

Elektrische Anlage
Electrical System
Installation électrique
Impianto elettrico

PORSCHE

Workshop-Manual

**914
914/6**

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This publication contains the essential removal, installation and adjustment procedures for the Porsche 914-914/6 vehicles sold in the USA and Canada.

Components and procedures described in this manual are identical for both types unless differences are pointed out in the text.

It is assumed that the reader is familiar with basic automotive repair procedures. Special tools required in performing certain service operations are identified in the manual and recommended for use. Use of tools or procedures other than those recommended in this repair manual may be detrimental to the vehicle's safe operation as well as the safety of the person servicing the vehicle.

The Porsche 914 - 914/6 Workshop Manual is divided into 8 volumes. The volumes are subdivided into 10 Main Groups as follows:

1st Volume	Engine and Clutch - 914	Main Group No. 1
2nd Volume	Fuel System - 914	Main Group No. 2
3rd Volume	Engine and Clutch - 914/6 Fuel System - 914/6	Main Group No. 1 Main Group No. 2
4th Volume	Transmission	Main Group No. 3
5th Volume	Front Axle Rear Axle	Main Group No. 4 Main Group No. 5
6th Volume	Brakes, Wheels, Tires Pedal System and Levers Maintenance, Specifications	Main Group No. 6 Main Group No. 7 Main Group No. 0
7th Volume	Body	Main Group No. 8
8th Volume	Electrical System	Main Group No. 9

The binders have a transparent plastic pocket on the spine into which the appropriate volume title can be inserted.

To find the individual repair operations, each main group is subdivided into "Chapters" and "Sections". Every main group is provided with a very detailed table of contents. Refer to example on next page.

The repair operations described in this Workshop Manual are based on the Type 914 vehicle. Repair operations which apply to Type 914/6 vehicles are described separately. The type vehicle to which the repair operation applies is given on the top left or right of the page.

When certain repair operations are similar for both type vehicles, the procedures are described together and the minor differences for the 914/6 emphasized by notes and remarks.

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984	Front Axle	984/6 4
Valid for Type		Valid for Type
Sub Group Chapter		Chapter
Printed in Germany - 1, 1968		1.1-5/8
		Page No.
		Section

Technical Information

The "Technical Information" pages which are published from time to time should be filed in chronological order at the beginning of the respective Main Groups of the Workshop Manuals.

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The operating voltage of the Type 914 and 914/6 is 12 volts.

Alternator

The alternator (driven by a V belt), supplies power for the electrical equipment and battery.

The alternator is provided with a regulator to keep the electrical voltage within a certain limit at all engine speeds and to protect the alternator from overloading.

The alternator does not require a cut-out relay, as the one-directional flow effect of its diodes prevents discharging through the windings.

Starter

The starter is a series-wound motor with an overrunning clutch. It has an output of 8 hp. A non-repeat latch in the ignition/starter switch prevents the starter from being operated more than once without first turning the engine off.

Battery

The lead-acid battery stores the electrical energy produced by the alternator. When starting the engine, the starter and ignition systems are supplied with the necessary current by the battery. Each of the battery cells has a set of positive lead oxide plates and a set of negative lead plates. The cells are in an acid proof container and are connected in series. The electrolyte has a specific gravity of 1.285. The positive terminal has a larger diameter than the negative terminal. In addition, the terminals are marked + and -.

Lights

The lighting system consists of: retractable headlights, stop lights, tail lights, parking lights, clearance lights, and fog lamps (optional 914). Back-up lights are incorporated in the tail light units. The rear license plate is also illuminated.

The interior light is operated by door contact switches and can be turned on or off with doors open or closed.

The turn signal lever is located on the left side of the steering column. The turn signals are self-canceling and can only be operated with the ignition switch "on". The turn signal indicator lights are located in the tachometer face.

A separate emergency flasher switch is located on the dash board. This system operates independently of the turn signal lever. The warning light for the emergency flasher is located in the switch knob.

Windshield Wipers and Washers

The windshield wiper motor and the wiper arm shafts together with its linkage is mounted on a common frame. Two wiper speeds can be selected in Type 914. Three wiper speeds are provided in Type 914/6. The electric windshield washer pump is switched on by pulling the control lever toward the steering wheel. The washer pump and reservoir are both located in the right part of the luggage compartment next to the fuel tank. Actuating the windshield washer in Type 914 is done by pressing the button in the windshield wiper switch. The wiper blades return automatically into the park position when the switch is turned off.

Instruments

The following instruments are located in the instrument panel (left to right):

- 914
 - . The fuel gauge dial contains the fuel gauge, alternator warning light, oil temperature warning light (sportomatic only) and the brake warning light.
 - . The transistorized tachometer with indicator lights for turn signals and high beam.
 - . The speedometer with resettable trip odometer and parking light warning light.
- 914/6
 - . The fuel/temperature gauge contains fuel gauge, engine oil temperature gauge, alternator warning light, oil temperature warning light (sportomatic only), and brake warning light.
 - . The tachometer with indicator lights for turn signals and high beam.
 - . The speedometer with resettable trip odometer and parking light warning light.

The operating voltage of Types 914 and 914/6 is 12 Volt.

Alternators

An alternator supplies the electric power for the consumers and for the vehicle battery. These alternators are driven by the engine via a V-belt.

Alternators are provided with a regulator to keep the electric voltage within constant limits at all engine speeds. The voltage regulator serves the purpose of keeping the voltage generated by the alternator at a constant level and also protects the alternator against overloads.

Alternators require no charging or reverse current switch like DC generators, since the locking effect of the diodes in the alternator prevents any discharging of the battery via the alternator windings.

Starting System

All VW engines are started by a screw-push starting motor running in counter-clockwise direction. The starting motor is a series wound electric motor and supplies the required high torque, particularly for a cold engine. The output of the starting motor is 0.8 HP. A start repeat lock in the ignition switch prevents the meshing of the starter pinion with the rim of the flywheel when the engine is running.

Battery

The battery is the electrochemical storage unit for the power generated by the alternator and supplies the required current to the starting motor and the ignition system for starting the battery itself consists of one set each of positive lead oxide plates and negative lead plates. The electrolyte is diluted sulphuric acid of a specific weight of $1,285 = 32^{\circ} \text{Be}$ (Baumé). The cells are installed in a common housing made of acid-resistant insulating material and connected to each other by sturdy lead bridges (connected in series). To eliminate confusion, the positive pole of the battery is thicker than the negative pole. In addition, the poles are identified by + and -.

Lighting System

The lighting system includes the blinker and clearance lights, the retractable headlamps as well as the halogen high beam headlamps.

The light source, the reflector and the diffusing lens are the optically effective components. For some export countries the light source, the reflector and the diffusing lens are combined into one unseparable unit. This system is called the sealed beam system and in contrast to headlamps with asymmetric dimmer there is no border line between bright and dark. The parking light bulb for these vehicles is generally housed in the front blinker lights.

In the 914 the lever of the blinker switch and the contact installed therein, in connection with combination relay, permit operation of the headlamp flasher when the headlamps are switched off and the parking lights are on. When the headlamps are switched on, the same unit controls the change from high beam to dimmer.

Brake-blinker-tail lights and two license plate lights serve as rear lights. The backup lights are installed in the tail lights as standard equipment.

The interior lights are switched on by means of the door contact switches when the door is opened. The switch in the interior light permits keeping the interior light on when the doors are closed, while also permitting switching the lights off.

The blinker switch with automatic cancellation is installed in the steering column switch. When, with the ignition switched on, the blinker switch is actuated, the electronic blinker relay controls the pulses for the blinker lamps. In combination with a special warning light switch, this relay permits the simultaneous switching on of all the blinker lights on the vehicle also while driving, independent of the position of other switches. The Indicator lights for the blinker system are in the revolution counter. The Indicator light for the warning light system is installed in the pull knob of the warning light switch.

Windscreen Wiper and Windscreen Washer Systems

The windshield wiper motor is mounted on a common frame together with the two wiper shafts and the wiper rods. The two-stage wiper switch permits two wiping speeds. The wiper blades return automatically to their starting positions when switched off. The windshield wiper switch holds the release button actuating the windshield washer. The container for the washer is mounted laterally in front of the fuel tank.

Instruments

The speedometer is driven by the lefthand front wheel via a flexible shaft.

The electric fuel gauge is installed in the lefthand cutout of the instrument insert and is connected to a pickup in the fuel tank which indicates the available quantity of fuel.

How to read current flow diagrams

In previous wiring diagrams electrical components were shown in the approximate position as you would find them on the car. However, to show the electrical connections between each component in the diagram became more and more difficult as the number of components increased. The result was that it was hard to trace electrical circuits.

To make reading wiring diagrams easier, we revised them completely. The result of intensive studies is a new diagram called "current flow diagram".

Current flow diagrams are laid out by placing circuits of related components one next to the other. The base of each circuit always starts with ground. The location of components on this diagram is no longer related to where the components would be in the car. The layout of the circuits, however, is such that each can be followed much easier to help in troubleshooting of electrical faults.

Looking at a current flow diagram you will find a yellow base line. The numbers in the yellow base line characterize the current tracks in the diagram and are to locate each component that is listed in the legend.

The colored lines in the diagram represent wires in the car, the colors correspond with the actual colors of the wires. The small numbers in the wiring runs indicate the wiring gauge in mm². The thin black lines are not actual wires but internal connections, such as the ground connection of a lamp housing. The base line for ground is the thin black line directly on top of the yellow base line.

Interrupted wires or connections end in a yellow square. Continuation of this interrupted circuit can be found in the current track using the number in the square.

Each component in the diagram is identified with a letter, sometimes with a letter and a number. Component definition can be found in the legend.

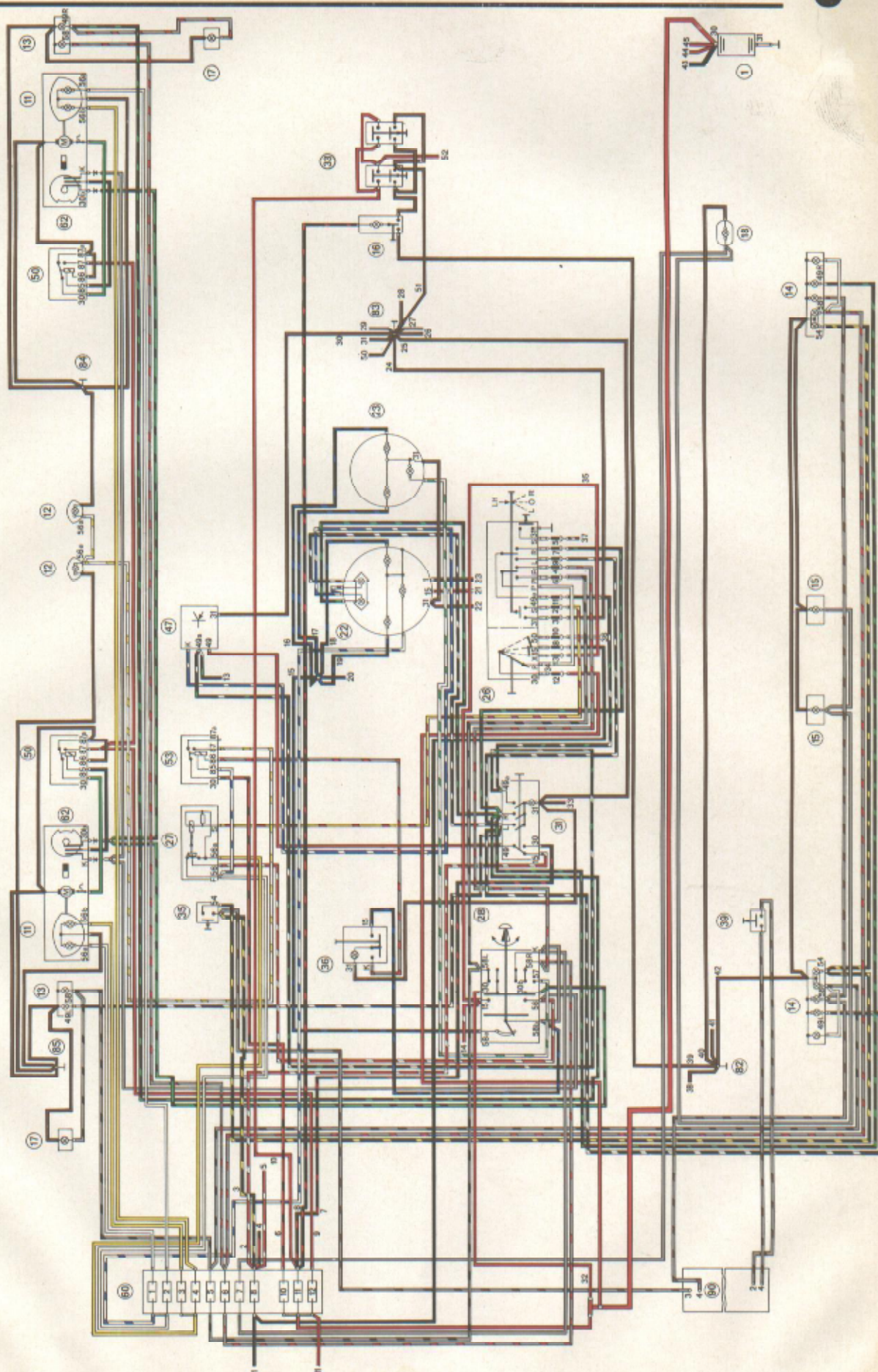
Most connectors or terminals are numbered. These numbers correspond with the numbers that are right next to most connectors on electrical components, such as switches and relays. This numbering system is used on most European cars. Listed below are the most commonly used terminals and their location.

Terminal No.	Location
B+	- on coil, input from ignition switch
D+	- on relay and generator
DF	- on relay and generator
1	- on coil, output to primary distributor lead
4	- on coil, high tension output and on distributor high tension lead
15	- on coil, input from ignition switch
30	- on starter solenoid, input from battery, ignition starter switch, light switch, dimmer relay, and twin horn relay
31	- ground
31 b	- windshield wiper switch and motor
49	- on turn signal bulbs
50	- on both terminals of starter solenoid - ignition starter switch
54	- on stoplight bulbs, steering ignition switch and windshield wiper switch
54 d	- windshield wiper switch and motor
56	- light switch and dimmer relay
56 a	- dimmer relay, headlight low beam
56 b	- headlight high beam
58	- on taillight bulbs, light switch and front parking lights
58 b	- light switch
85, 86, 87	- relay

Electrical Symbols

	Antenna		Heating resistor (element)
	Dipole antenna		Danger! High Voltage
	Direct current		Spark gap
	Alternating current		Condenser
	Three-phase current		Feedthrough (suppressor) condenser
	Generator		Coil, iron core
	Battery cell		Transformer, iron core
	Motor		Diode
	Measuring gauge		Zener diode
	Voltmeter		Transistor
	Ammeter		Thyristor
	Wiring		Mechanical connection of components
	Wire cross section in mm²		Mechanical connection, spring loaded contact
	Wire junction, fixed		Time switch
	Wire connector, separable		Manually operated switch
	Wire junction, separable		Mechanically operated switch
	Suppression wire		Motor operated switch
	Wire crossing		Relay coil
	Ground		Solenoid coil
	Switch position, open		Relay, electrothermal
	Switch position, closed		Relay, electromagnetic
	Multiple contact switch		Electromagnetic valve (jet)
	Fuse		Boundary line for an assembly
	Light bulb		Horn
	Glow lamp		Loudspeaker
	Resistor		
	Potentiometer		
	Tapped resistor		
	Thermal resistor, automatically regulating		

Electric wiring diagram (Part I) Type 914, Model 71 - USA



- 1 Battery
- 11 Headlamps
- 12 Fog lamps (optional)
- 13 Blinker-, clearance lamps
- 14 Tail-, brake-, blinker-, backup- and side marker lamps
- 15 License plate lamp
- 16 Interior lamp
- 17 Side marker lamps
- 18 Trunk light rear
- 22 Transistor revolution counter
- 23 Speedometer
- 26 Steering ignition starter switch, dimming switch with signal button in steering wheel
- 27 Combination relay
- 28 Light switch

- 31 Warning light switch
- 33 Door contact switch with buzzer contact
- 35 Brake light switch
- 36 Switch for fog lamps (optional)
- 39 Backup light switch
- 47 Direction warning blinker indicator
- 50 Relay for retractable headlights
- 53 Relay for fog lamps (optional)
- 60 Fuse box
- 62 Motor for actuating retractable headlights
- 82 Ground connection point A
- 83 Ground connection point B
- 84 Ground connection point C
- 85 Ground connection point D
- 90 Regulator plate

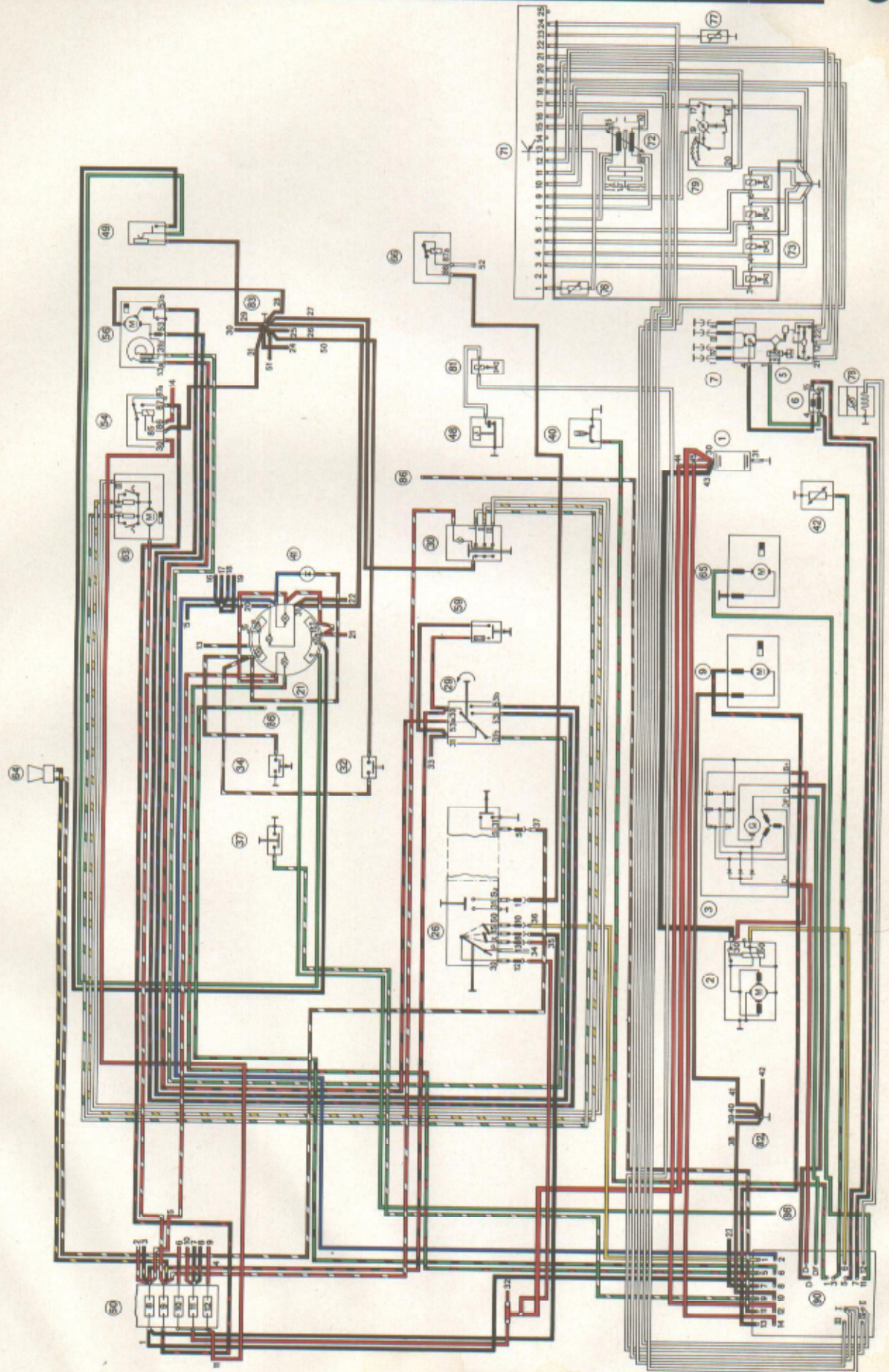
FUSES:

- 1 High beam left
- 2 High beam right
- 3 Dimmer left
- 4 Dimmer right
- 5 Clearance light left
- 6 Clearance light right
- 7 License plate light
- 8 Brake-, blinker-, backup light, windshield wiper, cigarette lighter
- 10 (Fog lamps)
- 11 Interior light, warning light, buzzer
- 12 Motor for actuating retractable headlights

CAUTION!

Disconnection of battery with the engine running will result in immediate destruction of alternator.

Electric wiring diagram (Part II) Type 914, Model 71 - USA



- | | | |
|--|---|---|
| 1 Battery | 66 Buzzer | 34 Hand brake contact |
| 2 Starter | 71 Electronic control unit for fuel injection | 37 Switch for heater blower |
| 3 Alternator | 72 Pressure sensor | 40 Oil pressure switch |
| 5 Ignition distributor | 73 Electric injection valve | 41 Diode |
| 6 Ignition coil | 76 Temperature sensor I | 42 Oil temperature indicator (optional) |
| 7 Spark plugs | 77 Temperature sensor II | 48 Thermostat |
| 9 Gasoline pump | 78 Supplementary air valve | 49 Indicator for fuel gauge |
| 21 Combination instrument | 79 Throttle valve switch | 54 Relay for fresh air blower |
| 26 Steering ignition starter switch, dimming switch with signal button in steering wheel | 81 Cold start valve | 56 Wiper motor |
| 29 Wiper-washer switch | 82 Ground connection point A | 59 Cigarette lighter |
| 30 Fan and separate heater switch | 83 Ground connection point B | 60 Fuse box |
| 32 Brake warning switch | 86 Sportomatic (optional) | 63 Fresh air blower |
| | 90 Regulator plate | 64 Horn |
| | | 65 Heater blower |

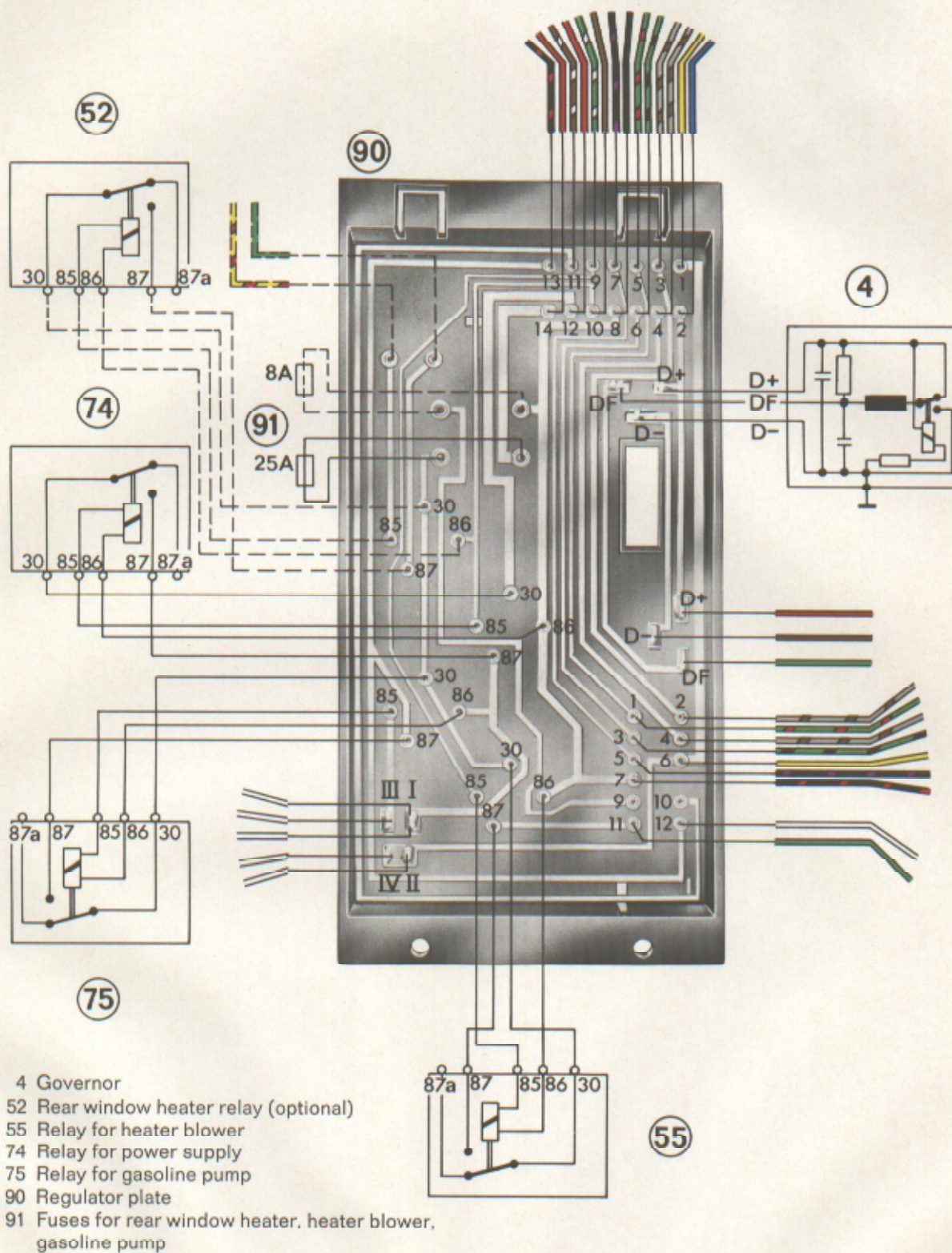
FUSES:

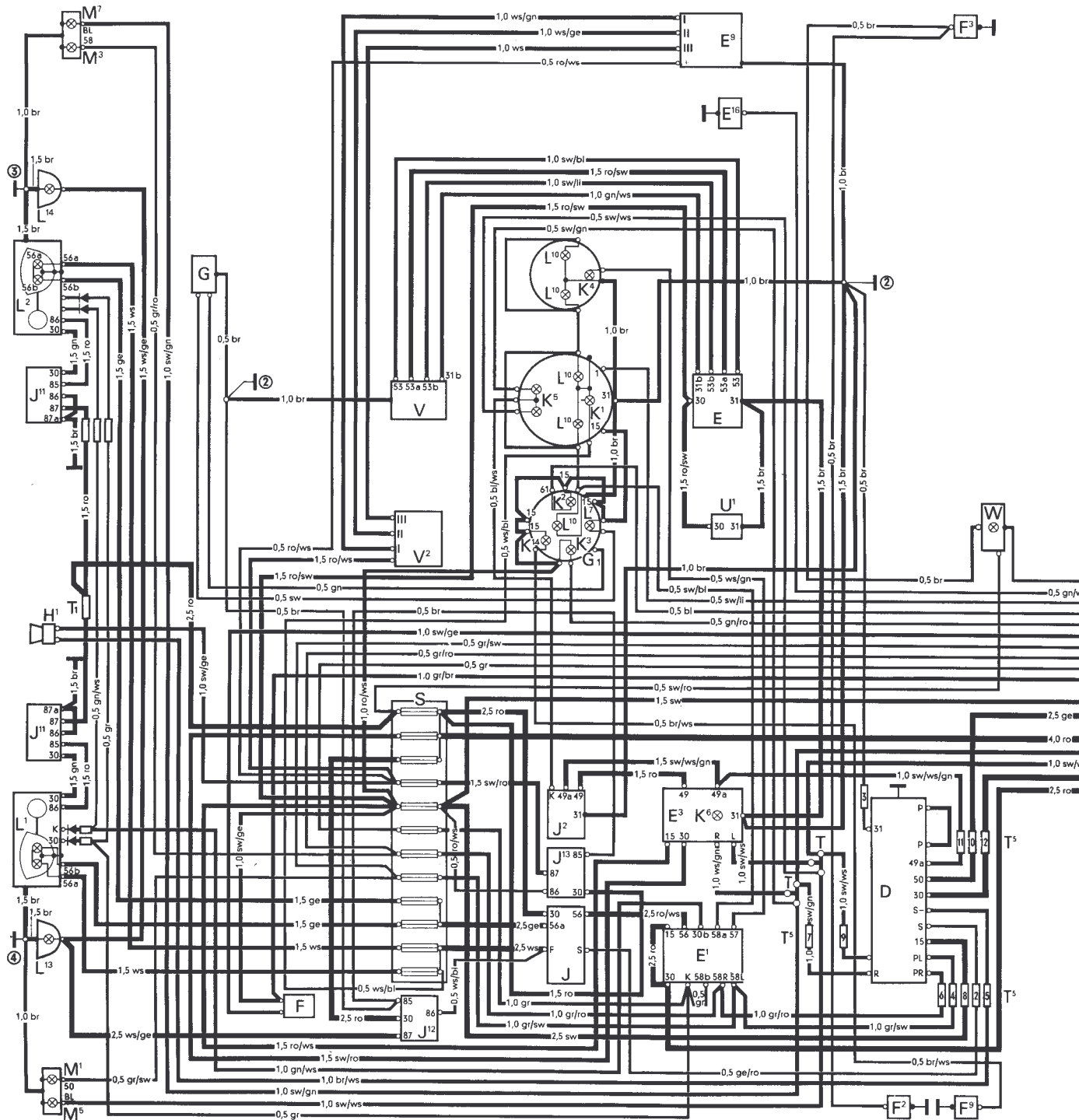
- 8 Brake-, blinker-, backup light, windshield wiper, cigarette lighter
- 9 Fresh air blower, horn
- 10 (Fog lamps)
- 11 Interior light, warning light, buzzer
- 12 Motor for actuating retractable headlights

CAUTION!

Disconnection of battery with the engine running will result in immediate destruction of alternator.

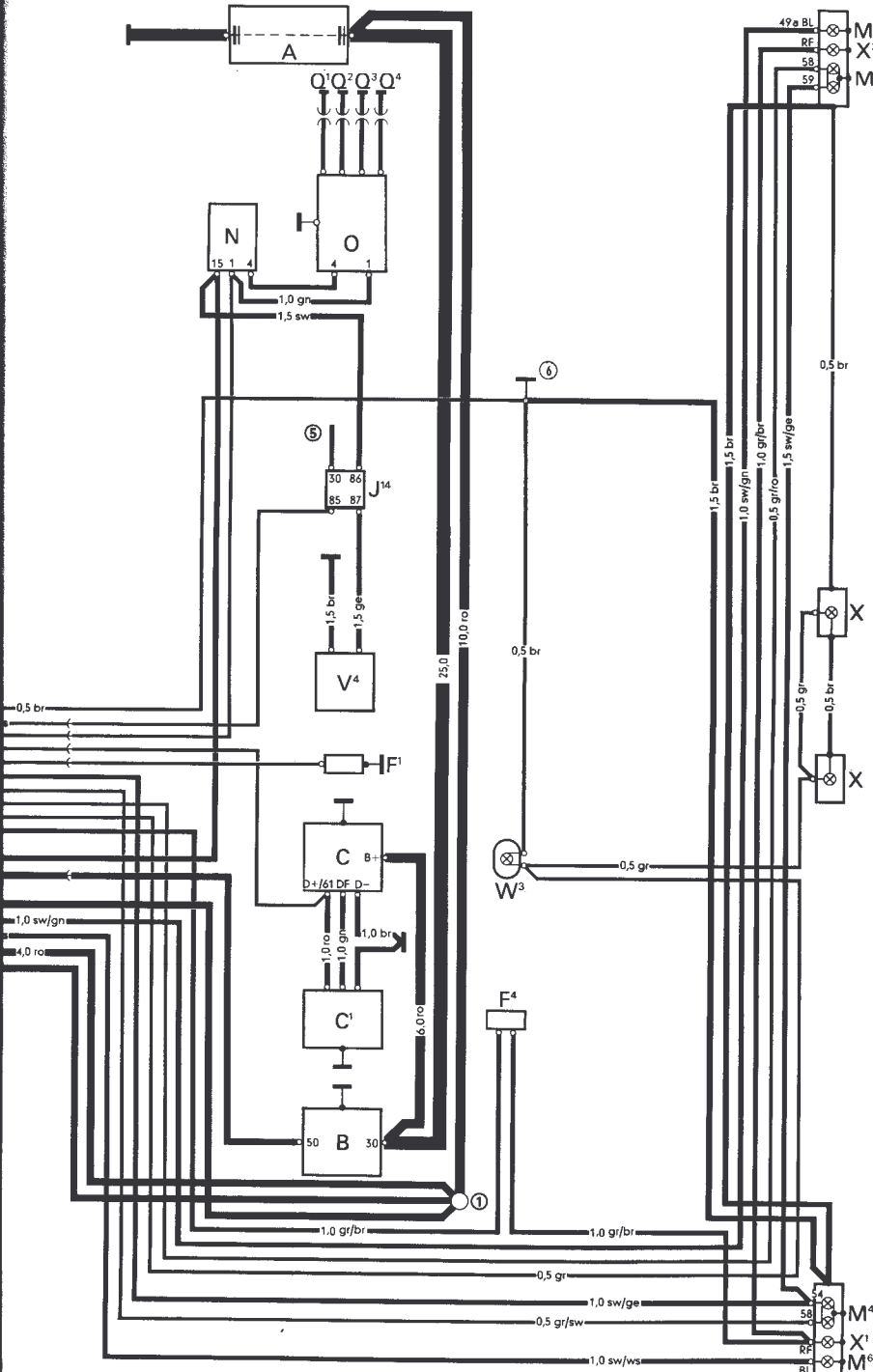
Electric wiring diagram (Part III) Type 914, Model 71



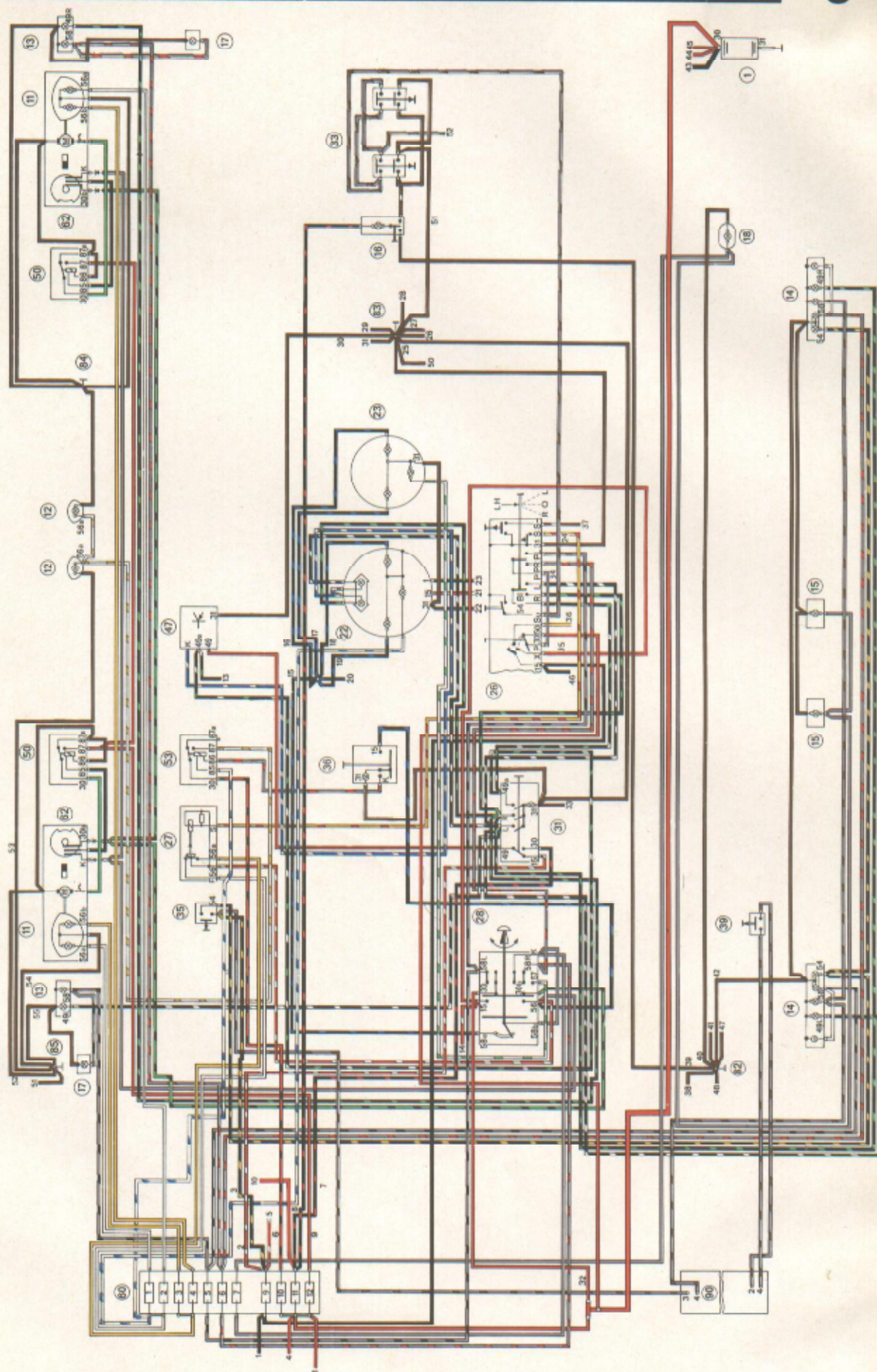


Designations for Wiring Diagram Symbols

- A - Battery
 B - Starter
 C - Generator
 C 1 - Regulator switch
 D - Ignition starter and blinker switch
 E - Windshield wiper switch
 E 1 - Light switch
 E 3 - Warning light switch
 E 9 - Fan motor switch
 E 16 - Hot air blower switch
 F - Brake light switch
 F 1 - Oil pressure switch
 F 2 - Door contact switch left
 F 3 - Door contact switch right
 F 4 - Backup light switch
 F 9 - Hand brake indicator light switch
 G - Fuel gauge transmitter
 G 1 - Fuel gauge indicator
 H 1 - Horn
 J - Hand dimmer and headlight flasher relay
 J 2 - Warning blinker relay
 J 11 - Retractable headlamp motor relay
 J 12 - High beam relay
 J 13 - Fan motor relay front
 J 14 - Warm air blower relay
 K 1 - High beam indicator light
 K 2 - Alternator indicator light
 K 3 - Oil pressure indicator light
 K 4 - Parking lamp indicator light
 K 5 - Blinker indicator light
 K 6 - Warning blinker system indicator light
 K 14 - Hand brake indicator light
 L 1 - Retractable headlamp with motor left
 L 2 - Retractable headlamp with motor right
 L 7 - Lamp for fuel gauge (reserve)
 L 10 - Instrument lights
 L 13 - Lamp for high beam left
 L 14 - Lamp for high beam right
 M 1 - Lamp for parking light left
 M 2 - Lamp for tail and brake light right
 M 3 - Lamp for parking light right
 M 4 - Lamp for tail and brake light left
 M 5 - Lamp for blinker light front left
 M 6 - Lamp for blinker light rear left
 M 7 - Lamp for blinker light front right
 M 8 - Lamp for blinker light rear right
 N - Ignition coil
 O - Ignition distributor
 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
 S - Fusebox
 T - Line connector
 T 1 - Line connector, single
 T 5 - Plug connection
 U 1 - Cigar lighter
 V - Windshield wiper motor
 V 2 - Fan motor front
 V 4 - Hot air blower
 W - Interior light
 W 3 - Trunk light
 X - Number plate light
 X 1 - Backup light left
 X 2 - Backup light right
 1 - Positive connection - fuse holder
 2 - Frame connection point - fuse holder
 3 - Frame connection point - retractable headlamp right
 4 - Frame connection point - retractable headlamp left
 5 - Relay plate in engine compartment fuse 30
 6 - Frame connection point - relay plate



Electric wiring diagram (Part I) Type 914, Model 72 - USA



- | | | |
|---|---------------------------------------|--|
| 1 Battery | 33 Door contact switch | 1 High beam, left |
| 11 Headlights | with buzzer contact | 2 High beam right |
| 12 Fog lights (optional) | 35 Stop light switch | 3 Low beam, left |
| 13 Turn signal and parking lights | 36 Fog light switch (optional) | 4 Low beam, right |
| 14 Tail, stop, turn, back-up and side marker lights | 39 Back-up light switch | 5 Parking light, left |
| 15 License plate light | 47 Turn signal/emergency flasher unit | 6 Parking light, right |
| 16 Interior light | 50 Retractable headlight relay | 7 License plate light |
| 17 Side marker lights | 53 Fog light relay (optional) | 9 Stop, turn and back-up lights |
| 18 Rear luggage compartment light | 60 Fuse box | 10 (Fog lights) |
| 22 Tachometer | 62 Retractable headlight motor | 11 Interior light, warning light, buzzer |
| 23 Speedometer | 82 Ground connection point A | 12 Retractable headlight motor |
| 26 Steering column switch | 83 Ground connection point B | |
| 27 Combination relay | 84 Ground connection point C | |
| 28 Light switch | 85 Ground connection point D | |
| 31 Emergency flasher switch | 90 Regulator plate | |

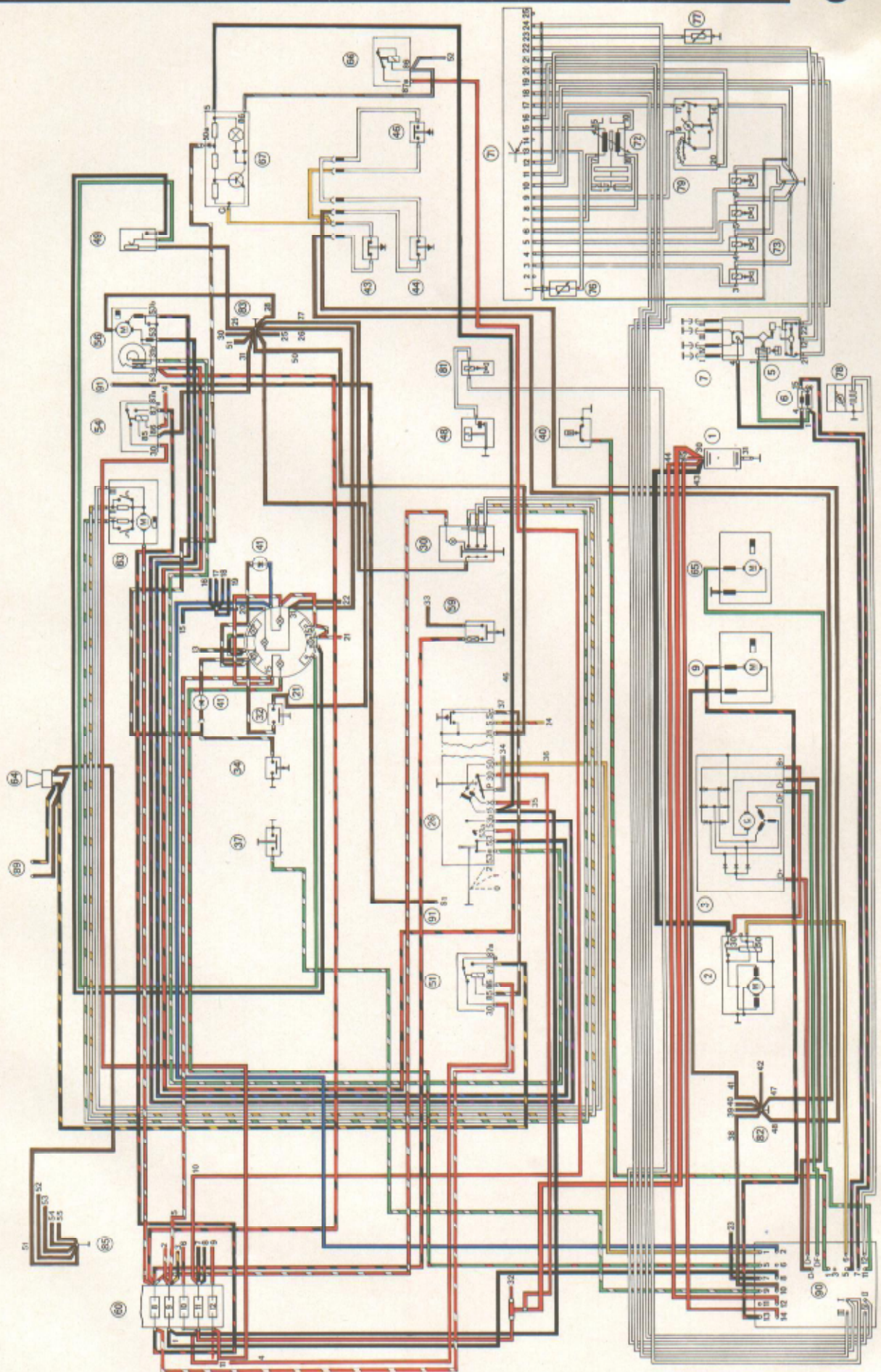
FUSES:

- 1 High beam, left
- 2 High beam right
- 3 Low beam, left
- 4 Low beam, right
- 5 Parking light, left
- 6 Parking light, right
- 7 License plate light
- 9 Stop, turn and back-up lights
- 10 (Fog lights)
- 11 Interior light, warning light, buzzer
- 12 Retractable headlight motor

CAUTION:

Do not disconnect battery while the engine is running as this will damage the alternator.

Electric wiring diagram (Part II) Type 914, Model 72 - USA



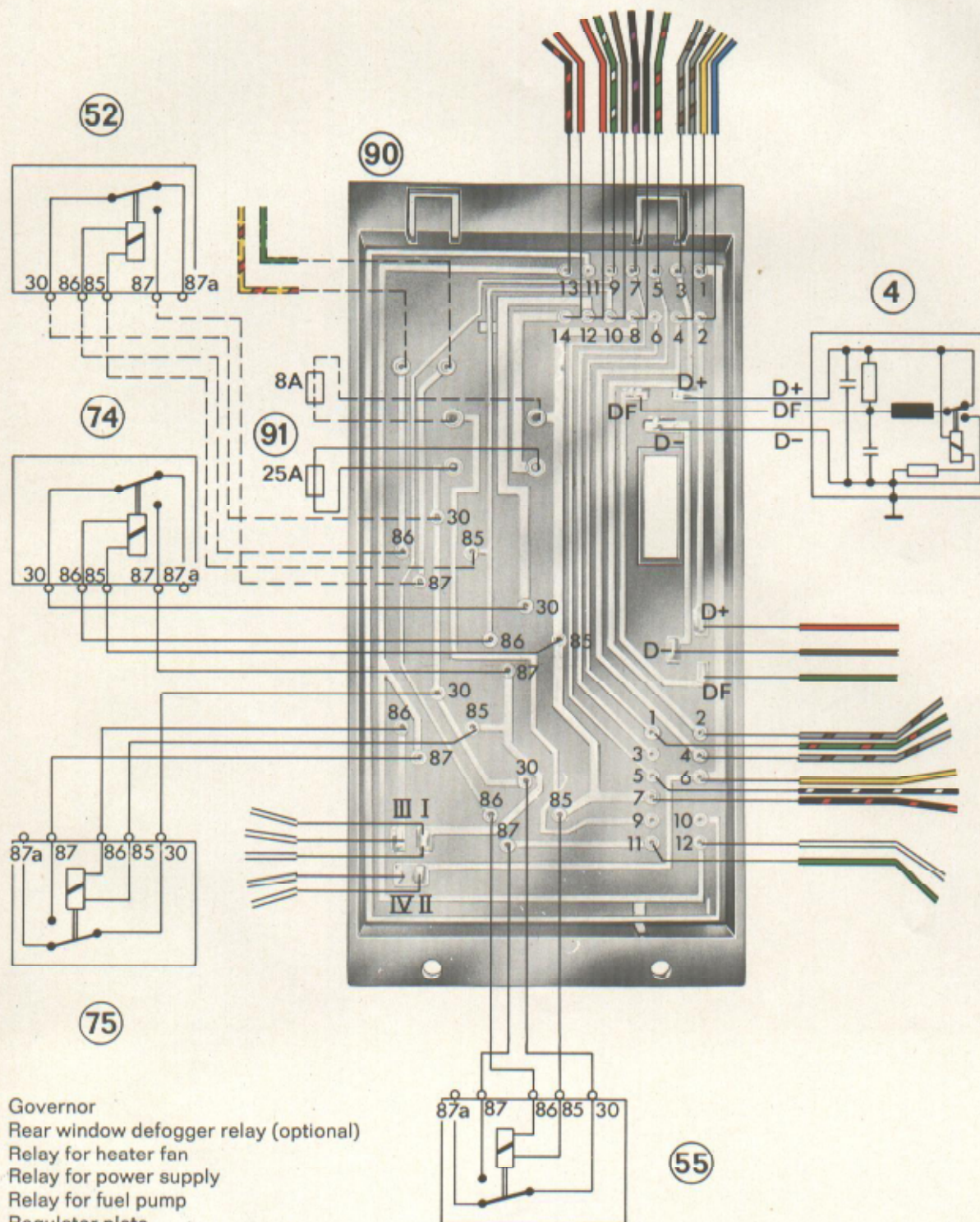
- | | | |
|--|---|---|
| 1 Battery | 49 Fuel level sending unit | 82 Ground connection point A |
| 2 Starter | 51 Horn relay | 83 Ground connection point B |
| 3 Alternator | 54 Relay for fresh air fan | 85 Ground connection point D |
| 5 Distributor | 56 Wiper motor | 89 Optional horn |
| 6 Ignition coil | 59 Cigarette lighter | 90 Regulator plate |
| 7 Spark plugs | 60 Fuse box | 91 Windshield wiper interval relay (optional) |
| 9 Fuel pump | 63 Fresh air fan | |
| 21 Fuel gauge | 64 Horn | |
| 26 Steering column switch | 65 Heater fan | |
| 30 Fan switch | 66 Buzzer | |
| 32 Brake warning light switch | 67 Safety belt warning light | |
| 34 Parking brake contact | 71 Electronic control unit (fuel injection) | |
| 37 Heater fan switch | 72 Pressure sensor | |
| 40 Oil pressure switch | 73 Injection valve (electric) | |
| 41 Diode | 76 Temperature sensor I | |
| 43 Safety belt contact, driver side | 77 Temperature sensor II | |
| 44 Safety belt contact, passenger side | 78 Supplementary air valve | |
| 46 Seat contact, passenger side | 79 Throttle valve switch | |
| 48 Thermo-switch | 81 Cold start valve | |
-
- | |
|---|
| 8 Fresh air fan, horn, windshield wipers, cigarette lighter |
| 9 Stop, turn and back-up lights |
| 10 (Fog lights) |
| 11 Interior light, warning light, buzzer |
| 12 Retractable headlight motor |

CAUTION!

Do not disconnect battery while the engine is running as this will damage the alternator.

FUSES:

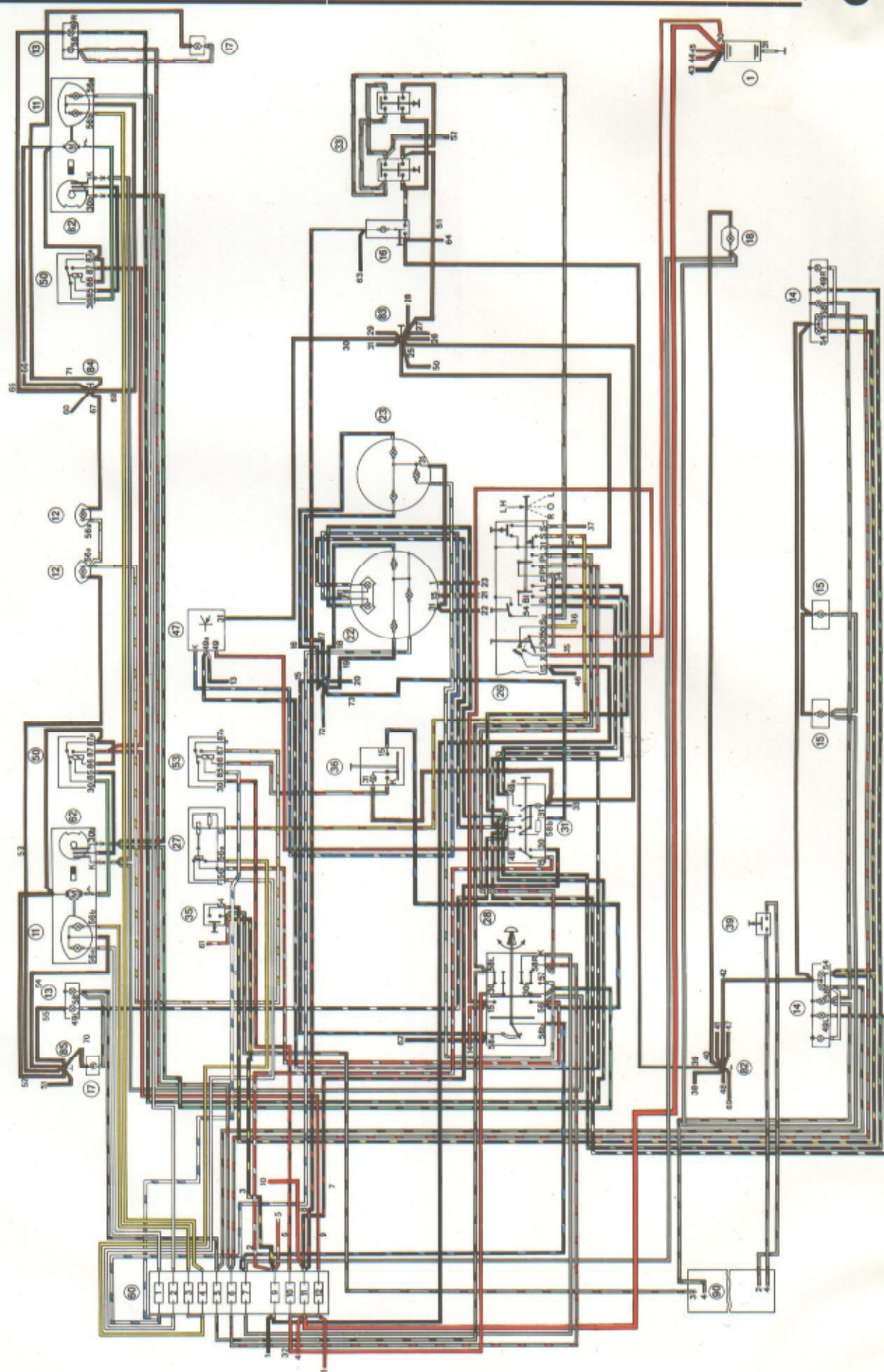
Electric wiring diagram (Part III) Type 914, Model 72



CAUTION!

Do not disconnect battery while the engine is running as this will damage the alternator.

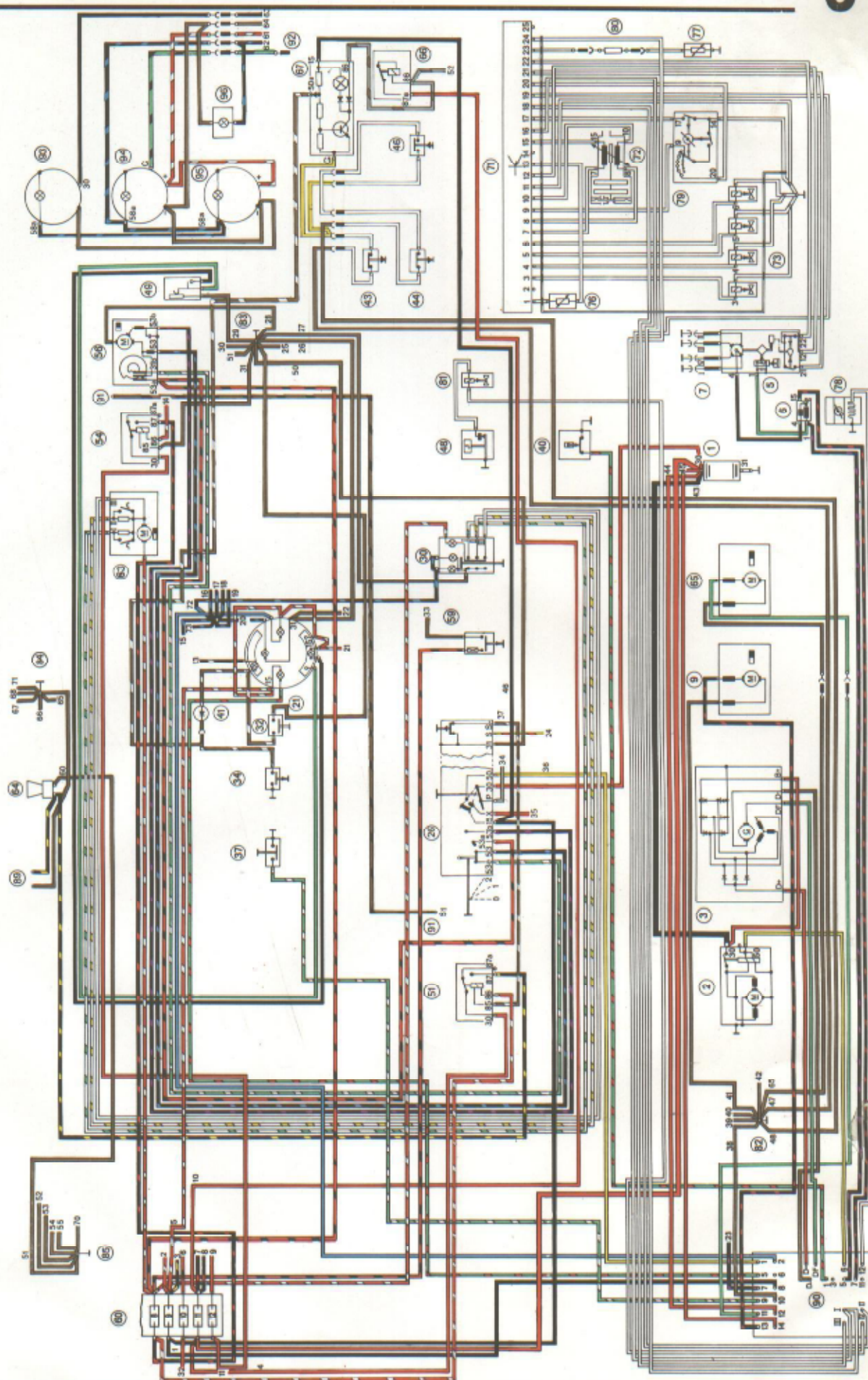
Electric wiring diagram (Part I) Type 914, Model 73 - USA



- | | | | |
|--|---|--|--|
| 1 Battery | 33 Door contact switch
with buzzer contact | 1 High beam, left | FUSES:

Do not disconnect battery while the engine is running as this will damage the alternator. |
| 11 Headlights | 35 Stop light switch | 2 High beam right | |
| 12 Fog lights (optional) | 36 Fog light switch (optional) | 3 Low beam, left | |
| 13 Turn signal and parking lights | 39 Back-up light switch | 4 Low beam, right | |
| 14 Tail, stop, turn, back-up and
side marker lights | 47 Turn signal/emergency flasher unit | 5 Parking light, left | |
| 15 License plate light | 50 Retractable headlight relay | 6 Parking light, right | |
| 16 Interior light | 53 Fog light relay (optional) | 7 License plate light | |
| 17 Side marker lights | 60 Fuse box | 9 Stop, turn and back-up lights | |
| 18 Rear luggage compartment light | 62 Retractable headlight motor | 10 (Fog lights) | |
| 22 Tachometer | 82 Ground connection point A | 11 Interior light, warning light, buzzer | |
| 23 Speedometer | 83 Ground connection point B | 12 Retractable headlight motor | |
| 26 Steering column switch | 84 Ground connection point C | | |
| 27 Combination relay | 85 Ground connection point D | | |
| 28 Light switch | 90 Regulator plate | | |
| 31 Emergency flasher switch | | | |

Electric wiring diagram (Part II) Type 914, Model 73 - USA



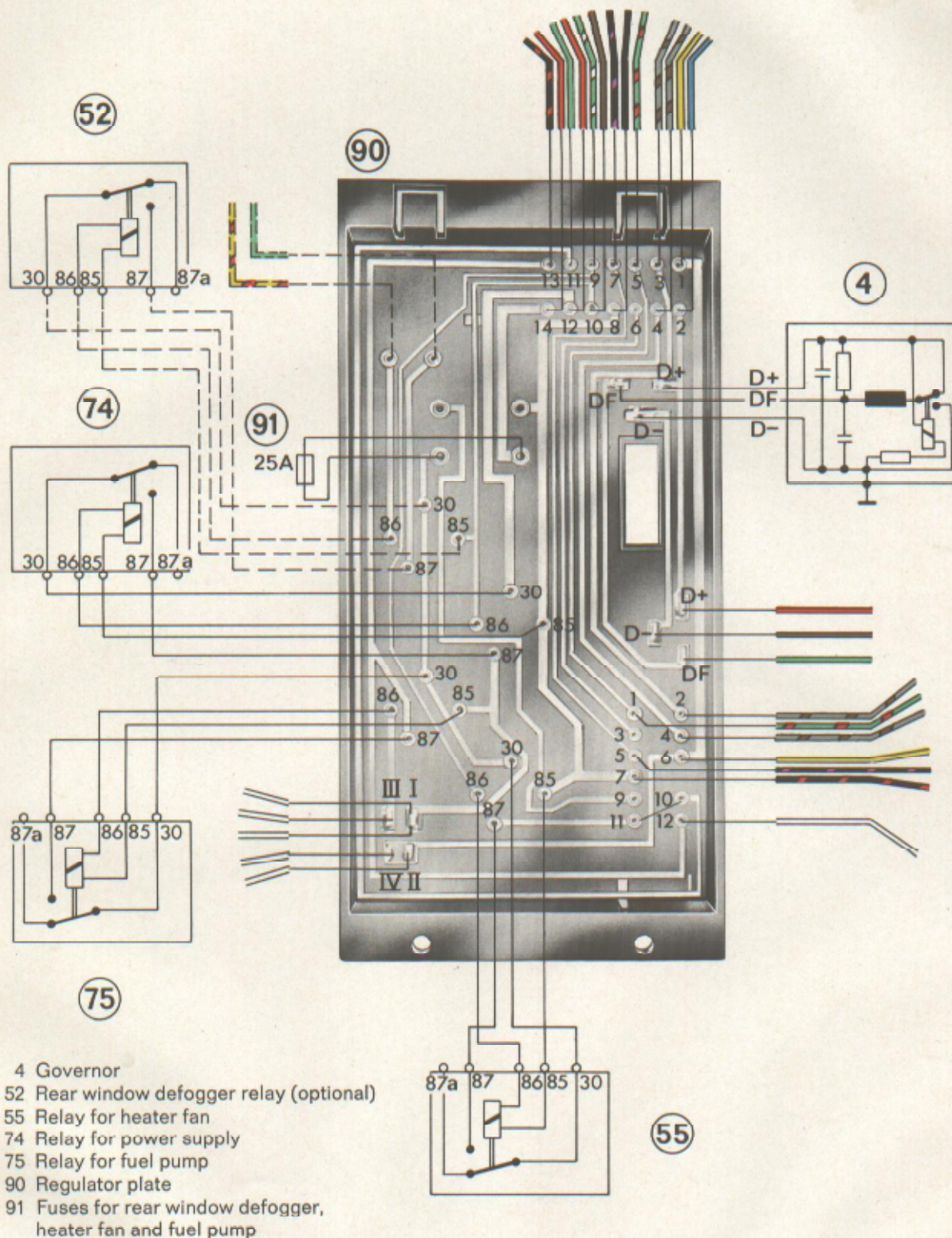
- 2 Battery
- 3 Starter
- 3 Alternator
- 5 Distributor
- 6 Ignition coil
- 7 Spark plugs
- 9 Fuel pump
- 21 Fuel gauge
- 26 Steering column switch
- 30 Fan switch
- 32 Brake warning light switch
- 34 Parking brake contact
- 37 Heater fan switch
- 40 Oil pressure switch
- 41 Diode
- 43 Safety belt contact, driver side
- 44 Safety belt contact, passenger side
- 46 Seat contact, passenger side
- 48 Thermo-switch
- 49 Fuel level sending unit
- 51 Horn relay
- 54 Relay for fresh air fan
- 56 Wiper motor
- 59 Cigarette lighter
- 60 Fuse box
- 63 Fresh air fan
- 64 Horn
- 65 Heater fan
- 66 Buzzer
- 67 Safety belt warning light
- 71 Electronic control unit (fuel injection)
- 72 Pressure sensor
- 73 Injection valve (electric)
- 76 Temperature sensor I
- 77 Temperature sensor II
- 78 Supplementary air valve
- 79 Throttle valve switch
- 80 Resistor
- 81 Cold start valve
- 82 Ground connection point A
- 83 Ground connection point B
- 84 Ground connection point C
- 85 Ground connection point D
- 89 Optional horn
- 90 Regulator plate
- 91 Windshield wiper interval relay (optional)
- 92 Oil temperature indicator (optional)
- 93 Electric clock (optional)
- 94 Oil temperature gauge dial (optional)
- 95 Voltmeter (optional)
- 96 Illumination for heating lever
- 8 Fresh air fan, horn, windshield wipers, cigarette lighter
- 9 Stop, turn and back-up lights
- 10 (Fog lights)
- 11 Interior light, warning light, buzzer
- 12 Retractable headlight motor

FUSES:

CAUTION!

Do not disconnect battery while the engine is running as this will damage the alternator.

Electric wiring diagram (Part III) Type 914, Model 73



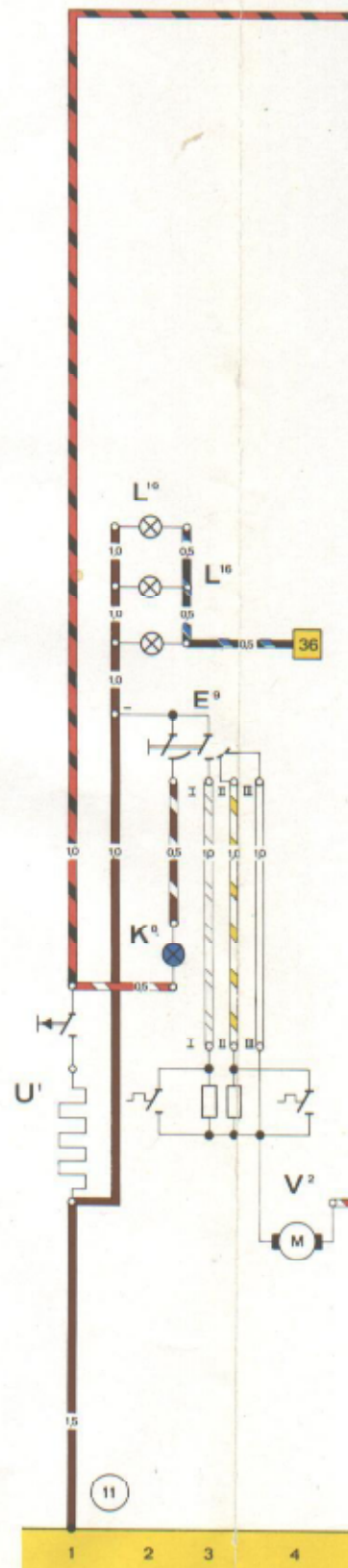
Current flow diagram, Type 914 USA, Model 74

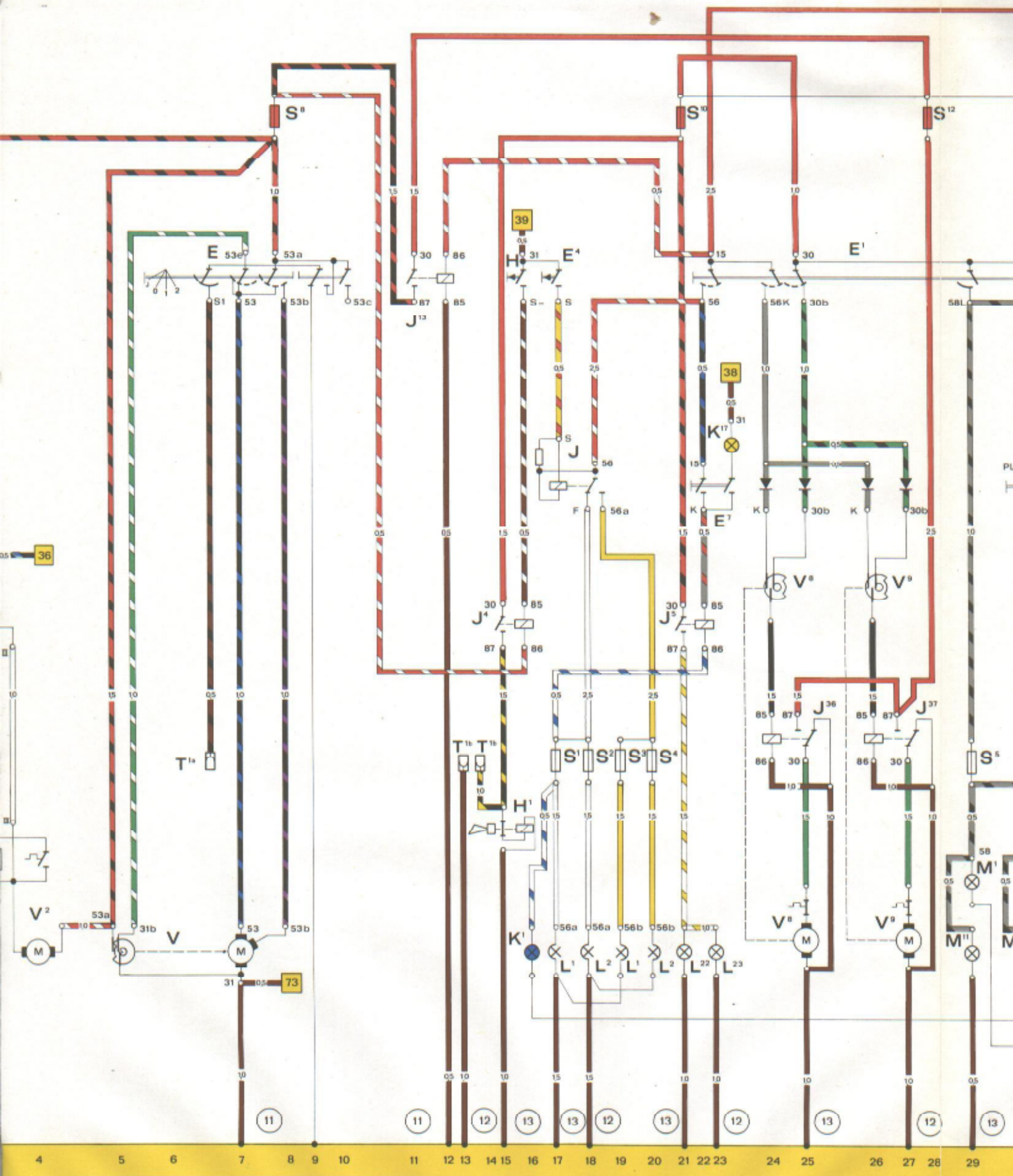
Description

- E — Windshield wiper switch
- E¹ — Headlight switch
- E² — Turn signal switch
- E³ — Emergency flasher switch
- E⁴ — Dimmer switch
- E⁷ — Fog light switch
- E⁹ — Fresh air blower switch
- E¹⁹ — Parking light switch
- E²⁰ — Instrument panel illumination potentiometer
- F⁶ — Brake warning switch
- H — Horn switch
- H¹ — Horn
- J — Dimmer relay
- J¹ — Hazard / turn signal flasher
- J⁴ — Horn relay
- J⁵ — Fog light relay
- J¹³ — Fresh air blower relay
- J³⁶ — Left retractable headlight relay
- J³⁷ — Right retractable headlight relay
- K¹ — High beam indicator light
- K⁴ — Parking lights indicator light
- K⁵ — Turn signal indicator light
- K⁶ — Hazard flasher indicator light
- K⁷ — Parking brake / brake warning indicator light
- K⁸ — Fresh air blower indicator light
- K¹⁷ — Fog lights indicator light
- L¹ — Sealed beam unit, left headlight
- L² — Sealed beam unit, right headlight
- L⁹ — Speedometer illumination light
- L⁷ — Fuel gauge illumination light
- L¹⁶ — Heater control assembly illumination lights
- L²¹ — Temperature control lever illumination light
- L²² — Left fog light
- L²³ — Right fog light
- L²⁶ — Tachometer illumination light
- M¹ — Left parking light
- M² — Right stop / rear light
- M³ — Right parking light
- M⁴ — Left stop / rear light
- M⁵ — Left front turn signal
- M⁶ — Left rear turn signal
- M⁷ — Right front turn signal
- M⁸ — Right rear turn signal
- M¹¹ — Front side marker light
- M¹² — Rear side marker light
- S¹ — Fuses
- to — Fuses
- S⁸ on the
- S¹⁰ — fuse box
- to — fuse box
- S¹² —
- T¹ — Cable connector, single
 - a — near fuel tank
 - b — near left horn
- U¹ — Cigar lighter
- V — Windshield wiper motor
- V² — Fresh air blower motor
- V⁸ — Left headlight operating motor
- V⁹ — Right headlight operating motor
- W³ — Luggage compartment light
- X — License plate light
- Ⓔ — Ground connection engine compartment
- Ⓕ — Ground connection instrument panel
- Ⓖ — Ground connection near right headlight
- Ⓗ — Ground connection near left headlight

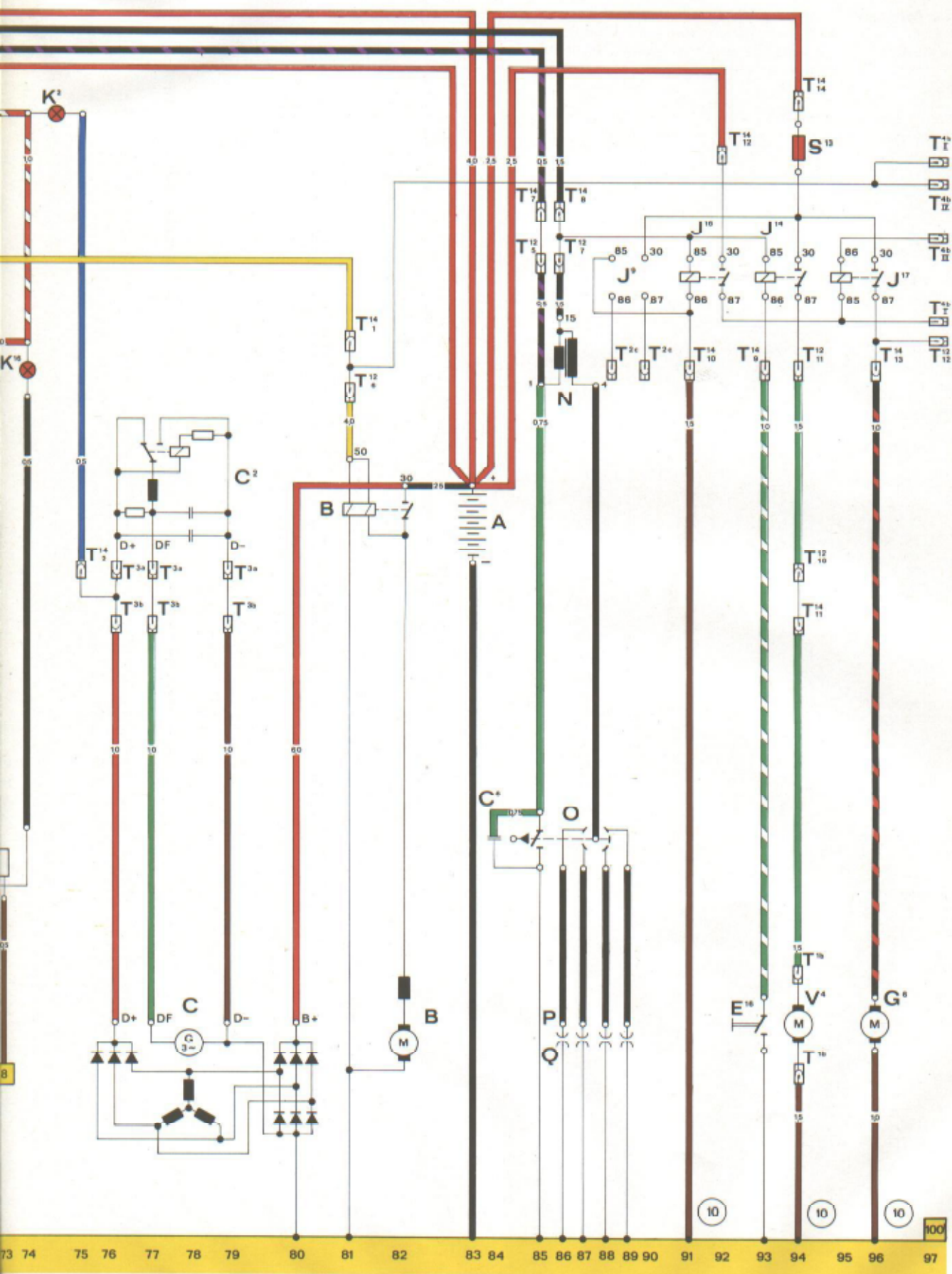
Current track

- 6, 7, 8, 9, 10
- 23, 24, 25, 29, 31, 33, 35
- 42
- 40, 41, 43, 44, 46
- 17
- 22, 23
- 3
- 30
- 34
- 44
- 16
- 15, 16
- 17, 18
- 45, 46, 47, 48
- 15, 16
- 21, 22
- 11, 12
- 24, 25
- 26, 27
- 16
- 35
- 45
- 40
- 44
- 2
- 23
- 17, 19
- 18, 20
- 37
- 37
- 2
- 36
- 21
- 23
- 37
- 29
- 32
- 31
- 30
- 41
- 41
- 43
- 43
- 29, 31
- 30, 32
- 17, 18, 19
- 20, 29, 31
- 33, 8
- 21, 46, 28
- 7
- 13, 14
- 1
- 5, 7, 8
- 3, 4
- 24, 25
- 26, 27
- 33
- 33
- 30, 34
- 1, 7, 12, 39, 44, 47
- 13, 18, 23, 27, 31, 43
- 15, 17, 21, 25, 29, 41





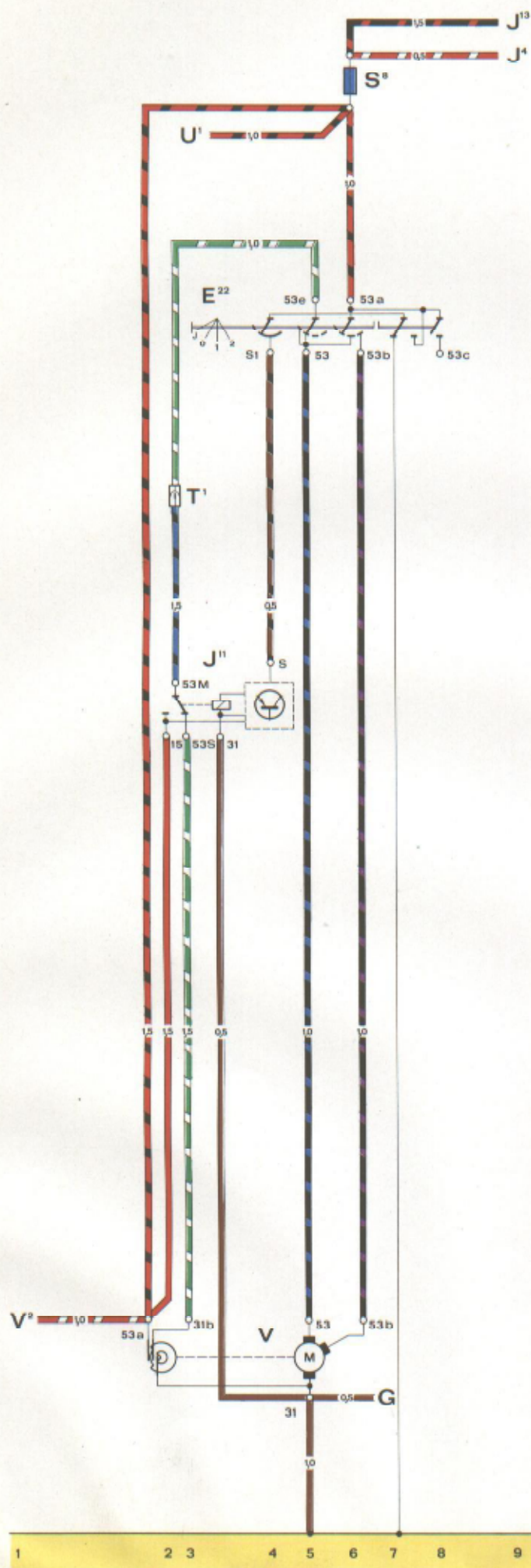




Current flow diagram, Type 914 USA, Model 74

9

Description	Current track
A — Battery	83
B — Starter	81, 82
C — Generator	76, 77, 78, 79, 80
C ² — Voltage regulator	76, 77, 79
C ⁶ — Ignition condenser	84
D — Ignition / starting switch	64, 65, 66, 67, 68, 69
E ¹⁴ — Heater blower switch	93
E ²⁴ — Left seat belt switch	64
E ²⁵ — Right seat belt switch	68
E ³¹ — Left seat sensor switch	66
E ³² — Right seat sensor switch	67
F — Stop light switch	51
F ¹ — Oil pressure switch	70
F ² — Left door switch	63
F ³ — Right door switch	63
F ⁴ — Back-up light switch	52
F ⁹ — Parking brake switch	61
G — Fuel sender unit	72, 73, 74
G ¹ — Fuel gauge	72
G ⁵ — Tachometer	71
G ⁶ — Fuel pump	96
G ⁸ — Oil temperature sender unit	53
G ⁹ — Oil temperature indicator	54
G ¹⁴ — Voltmeter	54
H ⁶ — Key warning buzzer contact	69
J ⁹ — Rear window defroster relay (optional)	88, 90
J ¹⁴ — Heater blower relay	93, 94
J ¹⁶ — Power supply relay	91, 92
J ¹⁷ — Fuel pump relay	95, 96
J ³⁴ — Seat belt warning system relay with integrated buzzer	64, 65, 66, 67, 68, 69
K ² — Generator charge indicator light	75
K ³ — Oil pressure indicator light	71
K ¹⁶ — Low fuel warning light	74
K ¹⁹ — Seat belt warning light	64
L ⁸ — Clock illumination light	59
L ²⁴ — Oil temperature indicator illumination light	59
L ²⁵ — Voltmeter illumination light	59
M ² — Right stop / rear light	51
M ⁴ — Left stop / rear light	51
M ¹⁶ — Left back-up light	52
M ¹⁷ — Right back-up light	52
N — Ignition coil	86
O — Distributor	87, 88
P — Spark plug connector	86, 87, 88, 89
Q — Spark plug	86, 87, 88, 89
S ⁹ — Fuse on the fuse panel	51
S ¹³ — Fuse on regulator panel	94
T ¹ — Cable connector, single	
a — below console	54, 55, 56, 58, 60
b — near heater blower	94
T ² — Cable connector, double	
a — below driver seat	66
b — below passenger seat	67
c — on regulator panel	88, 90
T ³ — Cable connector, triple	
a — on regulator panel, to regulator	76, 77, 79
b — on regulator panel, to generator	76, 77, 79
T ⁴ — Cable connector, quadruple	
a — near seat belt locks	64, 65, 68, 69
b — on regulator panel, to injection unit	97
T ¹² — Cable connector, twelvefold	
on regulator panel, lateral	52, 70, 81, 85, 86, 94, 97
T ¹⁴ — Cable connector, fourteenfold	
on regulator panel, front	52, 70, 75, 81, 85,
on regulator panel, front	86, 91, 92, 93, 94, 96
V ⁴ — Heater blower	94
W — Interior light	62
Y — Clock	54
⊕ — Ground connection engine compartment	62, 91, 94, 96



Description

E²² — Windshield wiper switch, interval type

G — to indicator for fuel gauge

J⁴ — to horn relay

J¹¹ — Interval relay

J¹³ — to relay for fresh air blower, front

S⁸ — Fuse in fuse-box

T¹ — Single connector (near fuel tank)

U¹ — to cigarette lighter

V — Windshield wiper motor

V² — to fresh air blower, front

current track

4, 5, 6, 7, 8

7

9

2, 3, 4

9

6

2

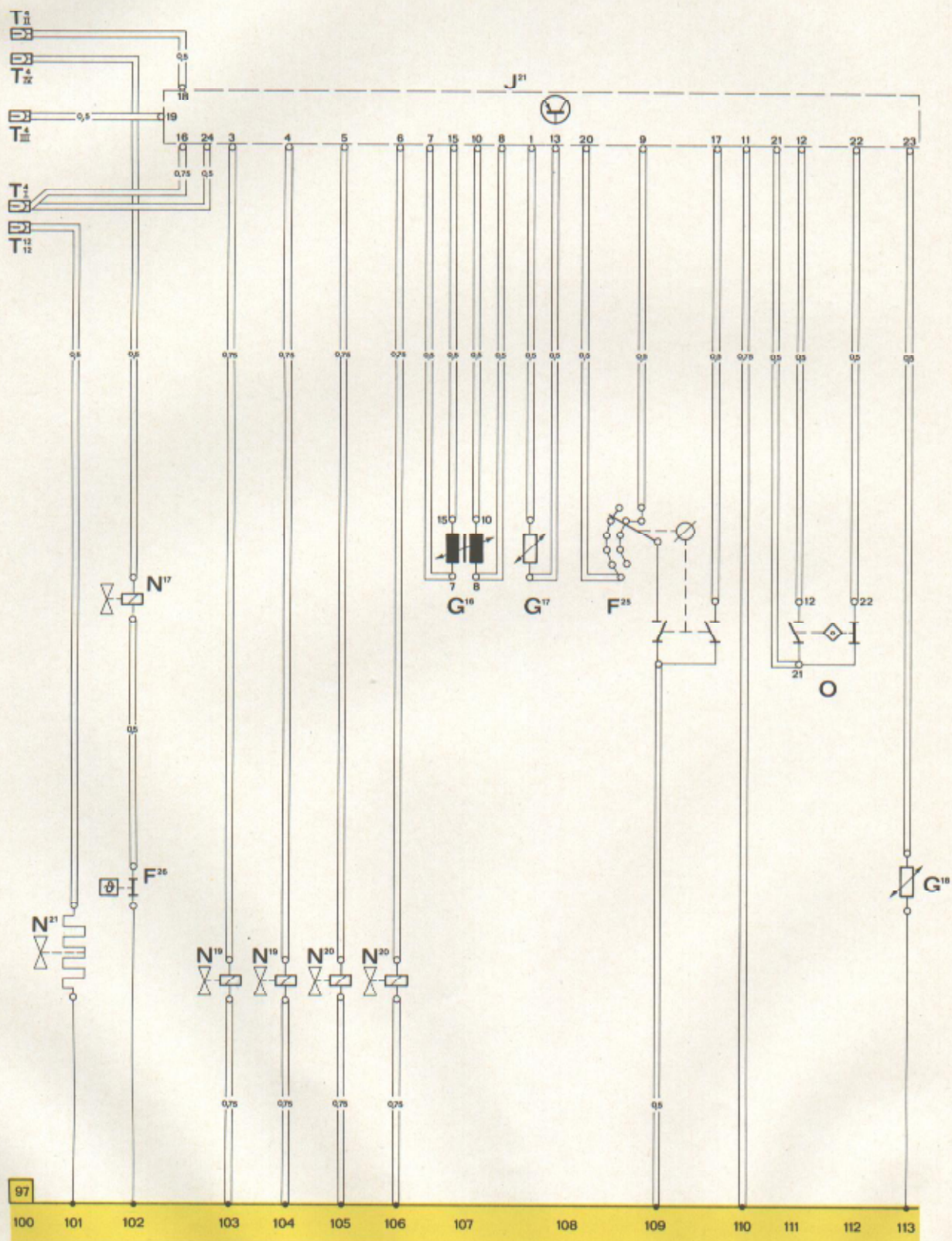
3

2, 5

1

Additional current flow diagram MPC-injection engine, Type 914, Model 74

Description	Current track
F ²⁵ — Throttle valve switch	109
F ²⁶ — Thermo-switch for cold start valve	102
G ¹⁶ — Pressure sensor	107
G ¹⁷ — Temperature sensor I	108
G ¹⁸ — Temperature sensor II	113
J ²¹ — Electronic fuel injection unit	103-113
N ¹⁷ — Cold start valve	102
N ¹⁹ — Injection valves cyl. 1 and 4	103, 104
N ²⁰ — Injection valves cyl. 2 and 3	105, 106
N ²¹ — Supplementary air valve	101
O — Distributor	111, 112
T ⁴ — Cable connector, quadruple on regulator panel	100
T ¹² — Cable connector, twelvefold on regulator panel	100



Additional current flow diagram AFC-injection engine, Type 914, Model 74

Description

A — To battery (+)
 F²³ — Throttle valve switch
 F²⁴ — Thermo-switch for cold start valve
 G¹⁸ — Temperature sensor II
 G¹⁹ — Air flow meter
 J²¹ — Electronic fuel injection unit
 J⁴⁰ — Double relay
 N — to ignition coil, terminals 1 and 15
 N⁶ — Resistor
 N¹⁷ — Cold start valve
 N¹⁹ — Injection valves cyl. 1 and 4
 N²⁰ — Injection valves cyl. 2 and 3
 N²¹ — Supplementary air valve
 T¹ — Cable connector, single
 T⁴ — Cable connector, quadruple, on regulator panel
 T⁵ — Cable connector, fivefold, below battery
 T¹² — Cable connector, twelvefold, on regulator panel

Current track

100
 112
 101
 113
 105, 106
 102-113
 101, 102, 103, 104
 100
 107, 108, 109, 110
 101
 107, 109
 108, 110
 103
 113
 100
 103, 107, 108, 109, 110
 100

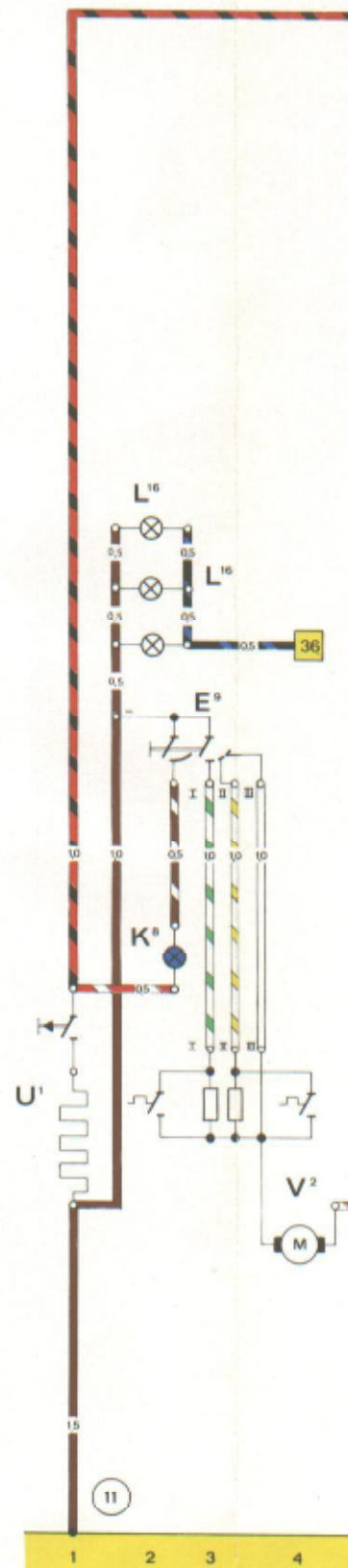
Current flow diagram, Type 914 USA, Model 75

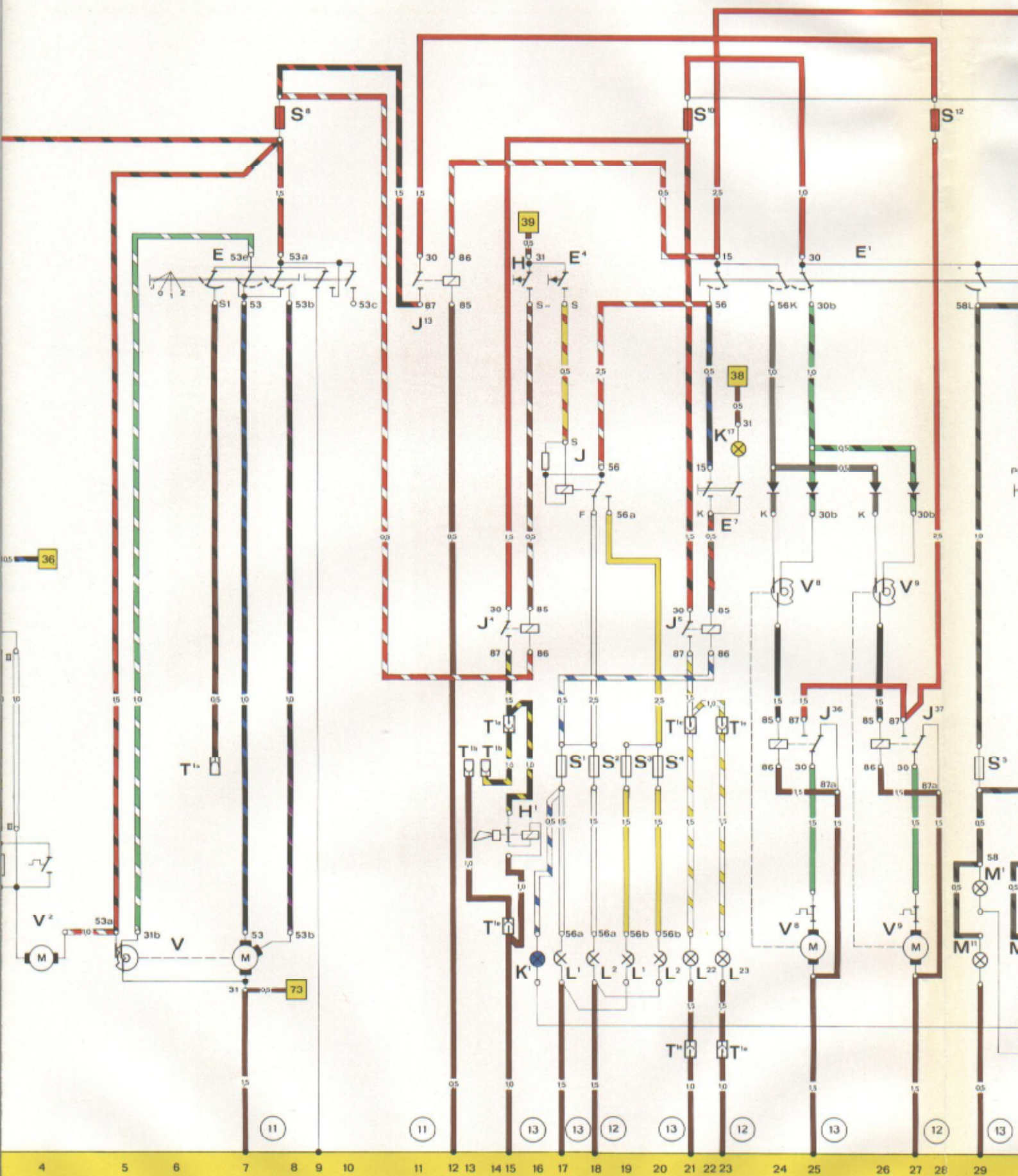
Description

E	— Windshield wiper switch
E ¹	— Headlight switch
E ²	— Turn signal switch
E ³	— Emergency flasher switch
E ⁴	— Dimmer switch
E ⁷	— Fog light switch
E ⁹	— Fresh air blower switch
E ¹⁹	— Parking light switch
E ²⁰	— Instrument panel illumination potentiometer
F ⁶	— Brake warning switch
H	— Horn switch
H ¹	— Horn
J	— Dimmer relay
J ¹	— Hazard / turn signal flasher
J ⁴	— Horn relay
J ⁵	— Fog light relay
J ¹³	— Fresh air blower relay
J ³⁶	— Left retractable headlight relay
J ³⁷	— Right retractable headlight relay
K ¹	— High beam indicator light
K ⁴	— Parking lights indicator light
K ⁵	— Turn signal indicator light
K ⁶	— Hazard flasher indicator light
K ⁷	— Parking brake / brake warning indicator light
K ⁸	— Fresh air blower indicator light
K ¹⁷	— Fog lights indicator light
L ¹	— Sealed beam unit, left headlight
L ²	— Sealed beam unit, right headlight
L ⁶	— Speedometer illumination light
L ⁷	— Fuel gauge illumination light
L ¹⁶	— Heater control assembly illumination lights
L ²¹	— Temperature control lever illumination light
L ²²	— Left fog light
L ²³	— Right fog light
L ²⁶	— Tachometer illumination light
M ¹	— Left parking light
M ²	— Right stop / rear light
M ³	— Right parking light
M ⁴	— Left stop / rear light
M ⁵	— Left front turn signal
M ⁶	— Left rear turn signal
M ⁷	— Right front turn signal
M ⁸	— Right rear turn signal
M ¹¹	— Front side marker light
M ¹²	— Rear side marker light
S ¹	
to	— Fuses
S ⁸	on the
S ¹⁰	
to	— fuse box
S ¹²	
T ¹	— Cable connector, single
a	— near fuel tank
b	— near left horn
d	— in luggage compartment, rear
e	— in luggage compartment, front
U ¹	— Cigar lighter
V	— Windshield wiper motor
V ²	— Fresh air blower motor
V ⁸	— Left headlight operating motor
V ⁹	— Right headlight operating motor
W ³	— Luggage compartment light
X	— License plate light
⓪	— Ground connection engine compartment
⑩	— Ground connection instrument panel
⑫	— Ground connection near right headlight
⑬	— Ground connection near left headlight

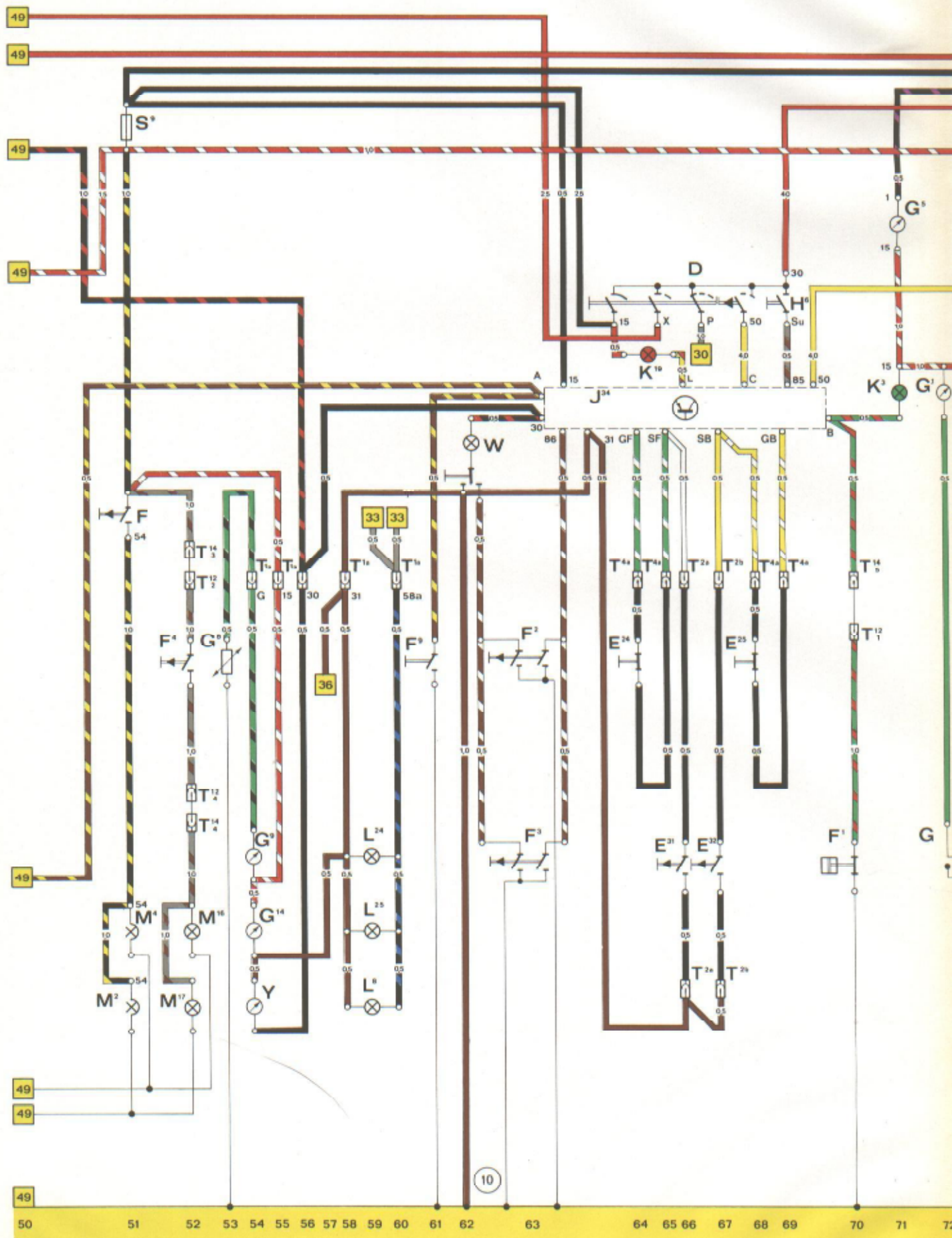
Current track

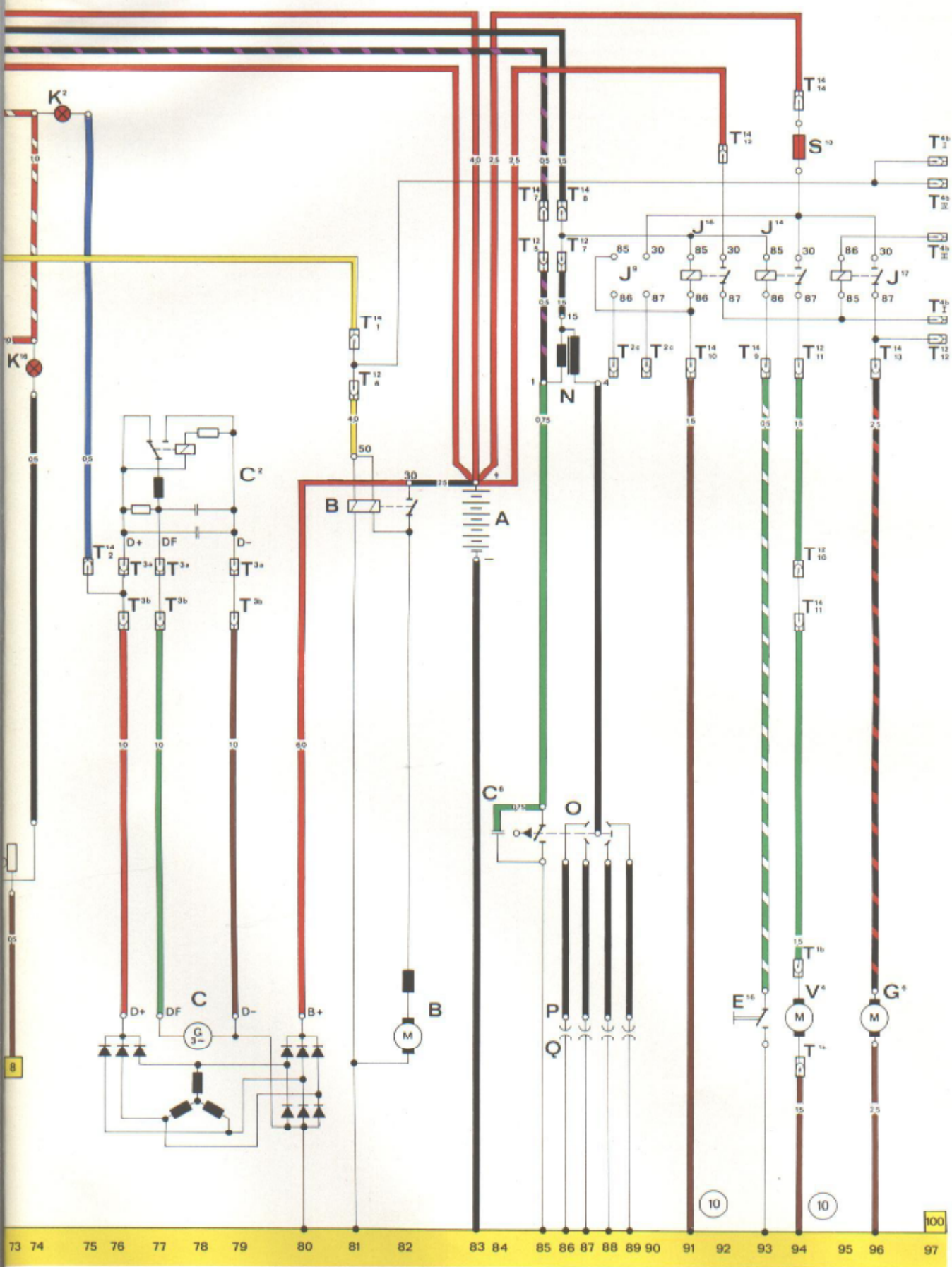
6, 7, 8, 9, 10
23, 24, 25, 29, 31, 33, 35
42
40, 41, 43, 44, 46
17
22, 23
3
30
34
44
16
15, 16
17, 18
45, 46, 47, 48
15, 16
21, 22
11, 12
24, 25
26, 27
16
35
45
40
44
2
23
17, 19
18, 20
37
37
2
36
21
23
37
29
32
31
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41
41
43
43
29, 31
30, 32
17, 18, 19
20, 29, 31
33, 8
21, 46, 28
7
13, 14
32, 33
15, 21, 23
1
5, 7, 8
3, 4
24, 25
26, 27
33
33
30, 34
1, 7, 12, 39, 44, 47
13, 18, 23, 27, 31, 43
15, 17, 21, 25, 29, 41











Current flow diagram, Type 914 USA, Model 75

9

Description	Current track
A — Battery	83
B — Starter	81, 82
C — Generator	76, 77, 78, 79, 80
C ² — Voltage regulator	76, 77, 79
C ⁶ — Ignition condenser	84
D — Ignition / starting switch	64, 65, 66, 67, 68, 69
E ¹⁶ — Heater blower switch	93
E ²⁴ — Left seat belt switch	64
E ²⁵ — Right seat belt switch	68
E ³¹ — Left seat sensor switch	66
E ³² — Right seat sensor switch	67
F — Stop light switch	51
F ¹ — Oil pressure switch	70
F ² — Left door switch	63
F ³ — Right door switch	63
F ⁴ — Back-up light switch	52
F ⁹ — Parking brake switch	61
G — Fuel sender unit	72, 73, 74
G ¹ — Fuel gauge	72
G ⁵ — Tachometer	71
G ⁶ — Fuel pump	96
G ⁸ — Oil temperature sender unit	53
G ⁹ — Oil temperature indicator	54
G ¹⁴ — Voltmeter	54
H ⁶ — Key warning buzzer contact	69
J ⁹ — Rear window defroster relay (optional)	88, 90
J ¹⁴ — Heater blower relay	93, 94
J ¹⁶ — Power supply relay	91, 92
J ¹⁷ — Fuel pump relay	95, 96
J ³⁴ — Seat belt warning system relay with integrated buzzer	64, 65, 66, 67, 68, 69
K ² — Generator charge indicator light	75
K ³ — Oil pressure indicator light	71
K ¹⁶ — Low fuel warning light	74
K ¹⁹ — Seat belt warning light	64
L ⁸ — Clock illumination light	59
L ²⁴ — Oil temperature indicator illumination light	59
L ²⁵ — Voltmeter illumination light	59
M ² — Right stop / rear light	51
M ⁴ — Left stop / rear light	51
M ¹⁶ — Left back-up light	52
M ¹⁷ — Right back-up light	52
N — Ignition coil	86
O — Distributor	87, 88
P — Spark plug connector	86, 87, 88, 89
Q — Spark plug	86, 87, 88, 89
S ⁹ — Fuse on the fuse panel	51
S ¹³ — Fuse on regulator panel	94
T ¹ — Cable connector, single	
a — below console	54, 55, 56, 58, 60
b — near heater blower	94
T ² — Cable connector, double	
a — below driver seat	66
b — below passenger seat	67
c — on regulator panel	88, 90
T ³ — Cable connector, triple	
a — on regulator panel, to regulator	76, 77, 79
b — on regulator panel, to generator	76, 77, 79
T ⁴ — Cable connector, quadruple	
a — near seat belt locks	64, 65, 68, 69
b — on regulator panel, to injection unit	97
T ¹² — Cable connector, twelvefold	
on regulator panel, lateral	52, 70, 81, 85, 86, 94, 97
T ¹⁴ — Cable connector, fourteenfold	
on regulator panel, front	52, 70, 75, 81, 85,
	86, 91, 92, 93, 94, 96
V ⁴ — Heater blower	94
W — Interior light	62
Y — Clock	54
Ⓢ — Ground connection engine compartment	62, 91, 94, 96

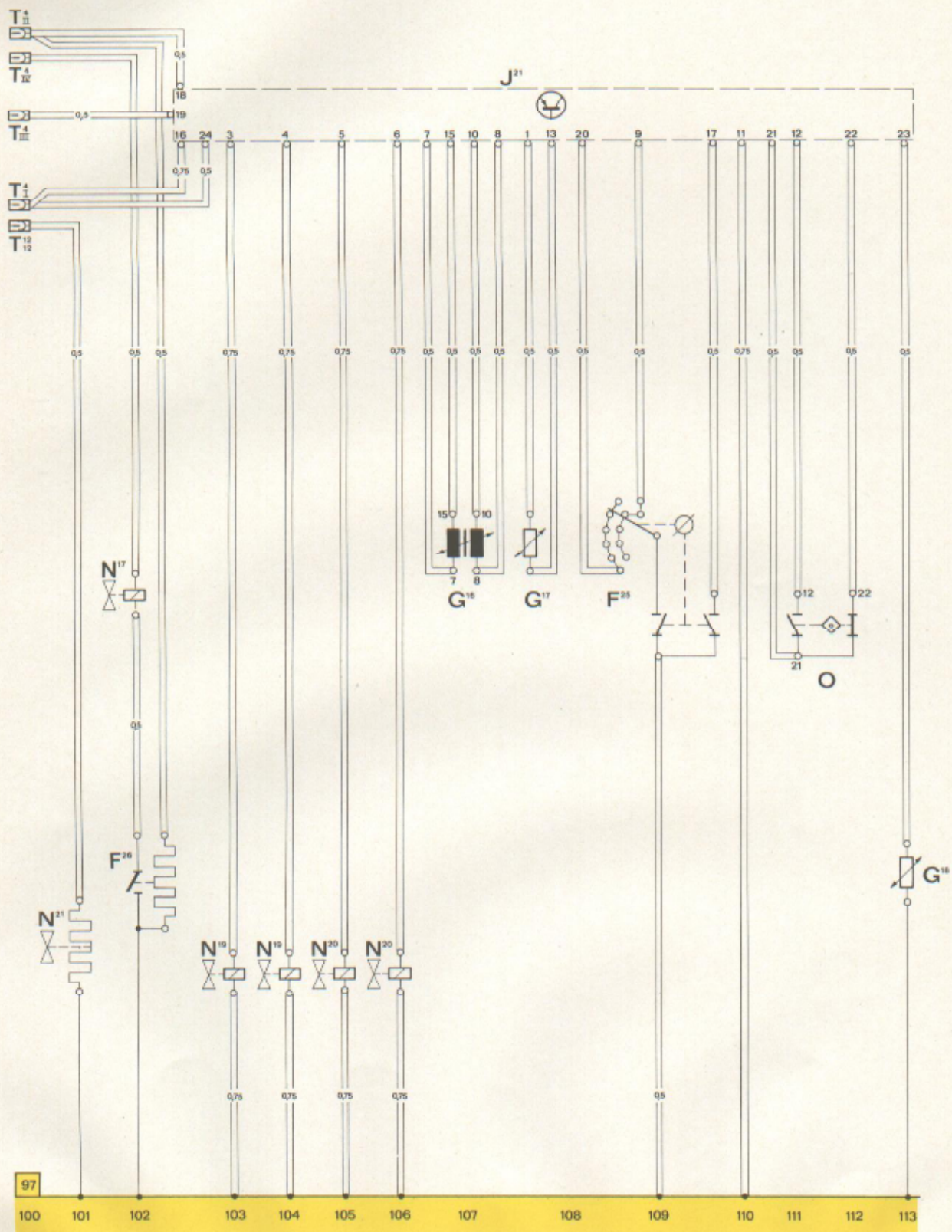
Additional current flow diagram MPC-injection engine, Type 914, Model 75

Description

F²³ — Throttle valve switch
F²⁴ — Thermo-switch for cold start valve
G¹⁶ — Pressure sensor
G¹⁷ — Temperature sensor I
G¹⁸ — Temperature sensor II
J²¹ — Electronic fuel injection unit
N¹⁷ — Cold start valve
N¹⁹ — Injection valves cyl. 1 and 4
N²⁰ — Injection valves cyl. 2 and 3
N²¹ — Supplementary air valve
O — Distributor
T⁴ — Cable connector, quadruple on regulator panel
T¹² — Cable connector, twelvefold on regulator panel

Current track

109
102
107
108
113
103-113
102
103, 104
105, 106
101
111, 112
100
100



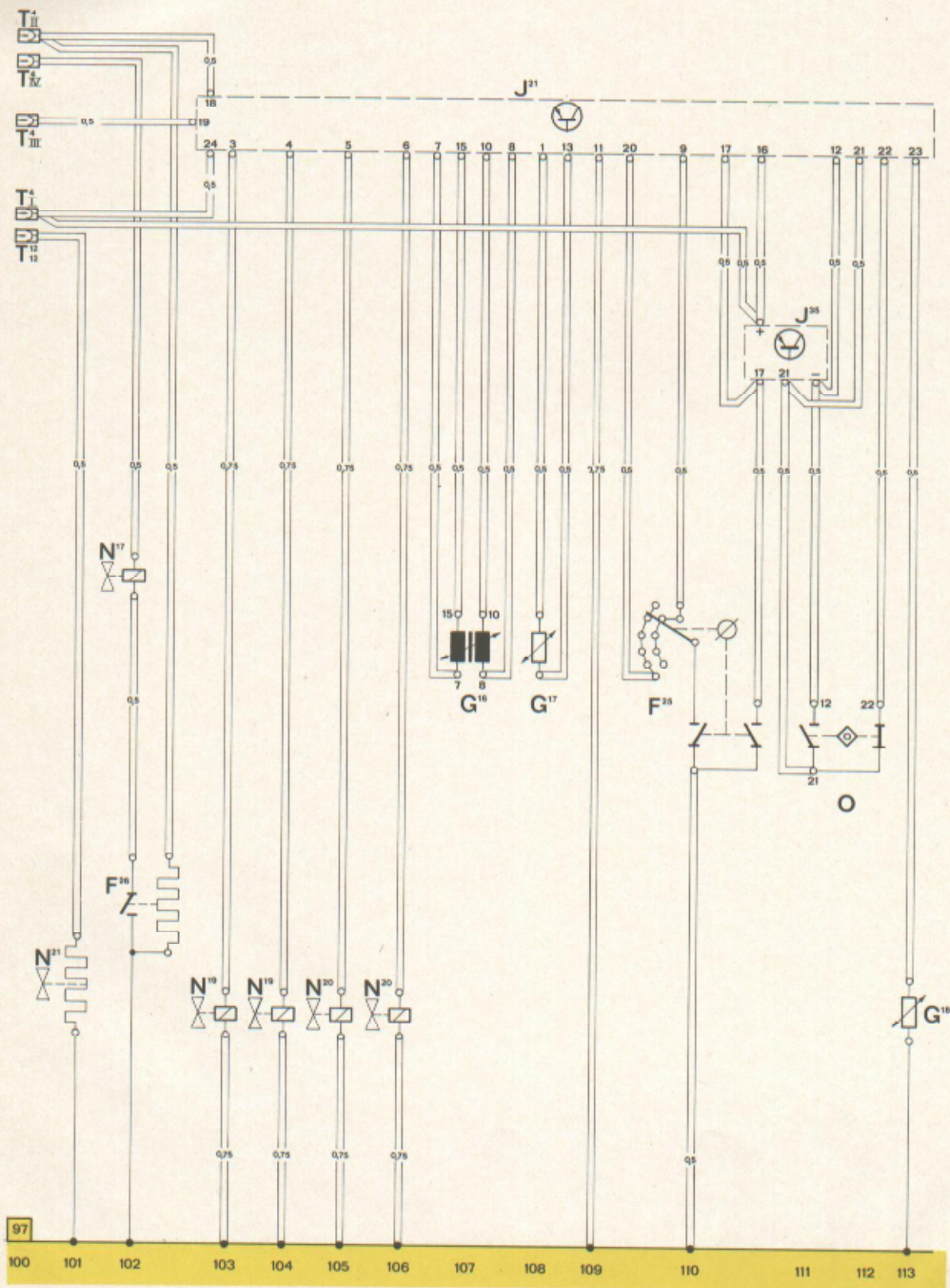
Additional current flow diagram MPC-injection engine, California, Type 914, Model 75

Description

F²⁵ — Throttle valve switch
 F²⁶ — Thermo-switch for cold start valve
 G¹⁶ — Pressure sensor
 G¹⁷ — Temperature sensor I
 G¹⁸ — Temperature sensor II
 J²¹ — Electronic fuel injection unit
 J³⁵ — Speed switch
 N¹⁷ — Cold start valve
 N¹⁹ — Injection valves cyl. 1 and 4
 N²⁰ — Injection valves cyl. 2 and 3
 N²¹ — Supplementary air valve
 O — Distributor
 T⁴ — Cable connector, quadruple on regulator panel
 T¹² — Cable connector, twelvefold on regulator panel

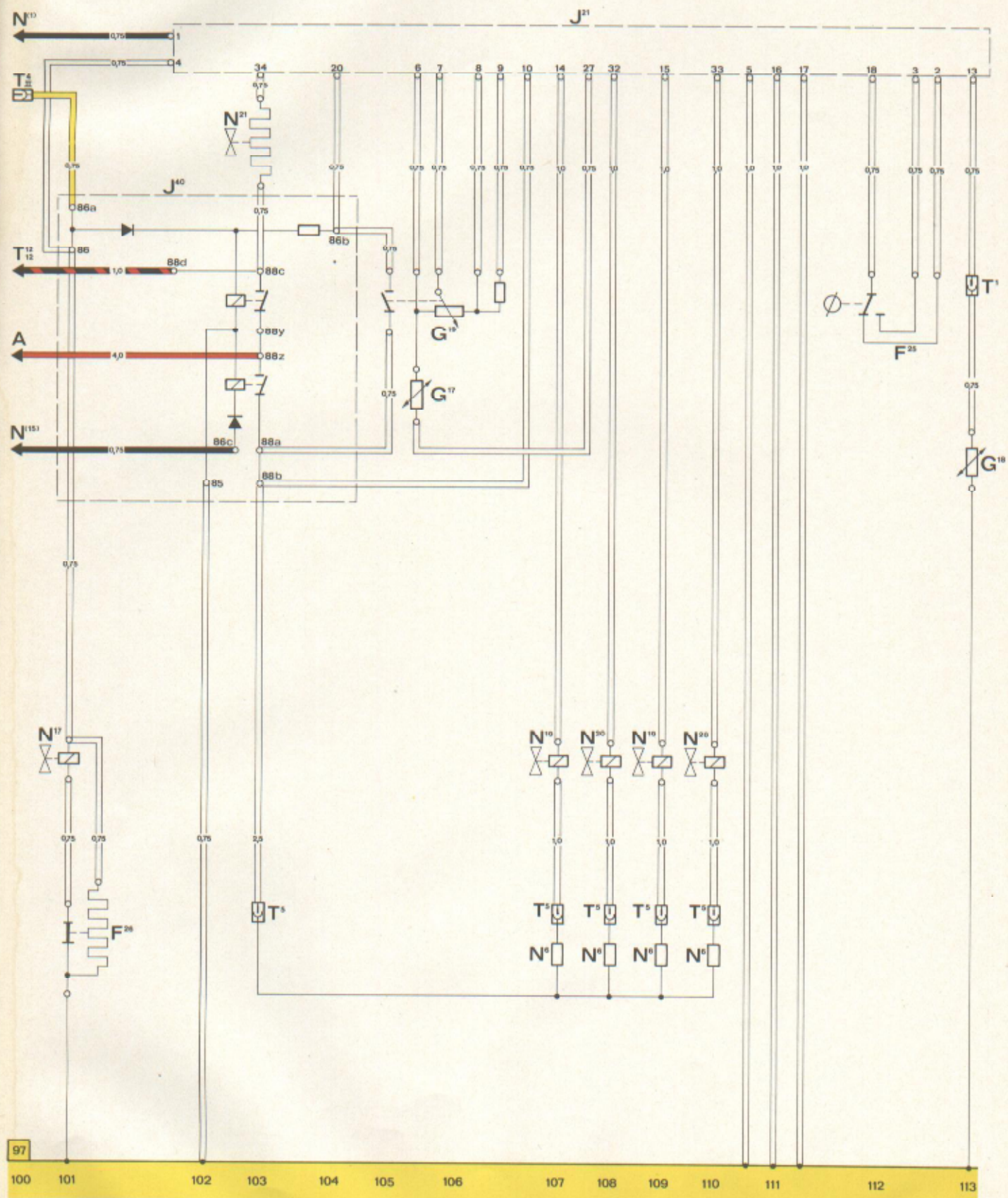
Current track

109
 102
 107
 108
 113
 103-113
 109, 110, 111
 102
 103, 104
 105, 106
 101
 111, 112
 100
 100



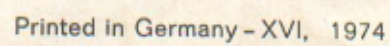
Additional current flow diagram AFC-injection engine, Type 914, Model 75

Description	Current track
A — To battery (+)	100
F ²⁵ — Throttle valve switch	112
F ²⁶ — Thermo-switch for cold start valve	101
G ¹⁷ — Temperature sensor I	105
G ¹⁸ — Temperature sensor II	113
G ¹⁹ — Air flow meter	105, 106
J ²¹ — Electronic fuel injection unit	102-113
J ⁴⁰ — Double relay	101, 102, 103, 104
N — to ignition coil, terminals 1 and 15	100
N ⁶ — Resistor	107, 108, 109, 110
N ¹⁷ — Cold start valve	101
N ¹⁹ — Injection valves cyl. 1 and 4	107, 109
N ²⁰ — Injection valves cyl. 2 and 3	108, 110
N ²¹ — Supplementary air valve	103
T ¹ — Cable connector, single	113
T ⁴ — Cable connector, quadruple, on regulator panel	100
T ⁵ — Cable connector, fivefold, below battery	103, 107, 108, 109, 110
T ¹² — Cable connector, twelvefold, on regulator panel	100



Additional current flow diagram California, Type 914, Model 75

Description	Current track
F - Stop light switch	6
F ²⁴ - Mileage counter switch (catalyst)	4
F ²⁷ - Mileage counter switch (EGR)	3
G ¹ - Fuel gauge	2
G ⁵ - Tachometer	4
G ²⁰ - Temperature sensor (catalyst)	7
J ⁴² - Relay for catalyst temperature control	7, 8
K ² - Generator charge indicator light	1
K ³ - Oil pressure indicator light	2
K ¹⁶ - Low fuel warning light	2
K ²¹ - Catalyst warning light	4
K ²² - EGR warning light	3
M ¹² - Rear side marker light	10
S ⁹ - Fuse on the fuse box	1
T ¹ - Cable connector, single	
a - below console	4, 6
d - in luggage compartment, rear	9
T ² - Cable connector, double	
in luggage compartment, rear	7, 8
T ⁴ - Cable connector, quadruple	
in luggage compartment, rear	7, 8
T ¹⁴ - Cable connector, fourteenfold	
on regulator panel, front	4
W - Interior light	5



Alternator Type Bosch K 1

The Bosch alternator is a claw pole machine with rectifier diodes installed in the bearing plate. The alternator is vented by the cooling air blower of the engine.

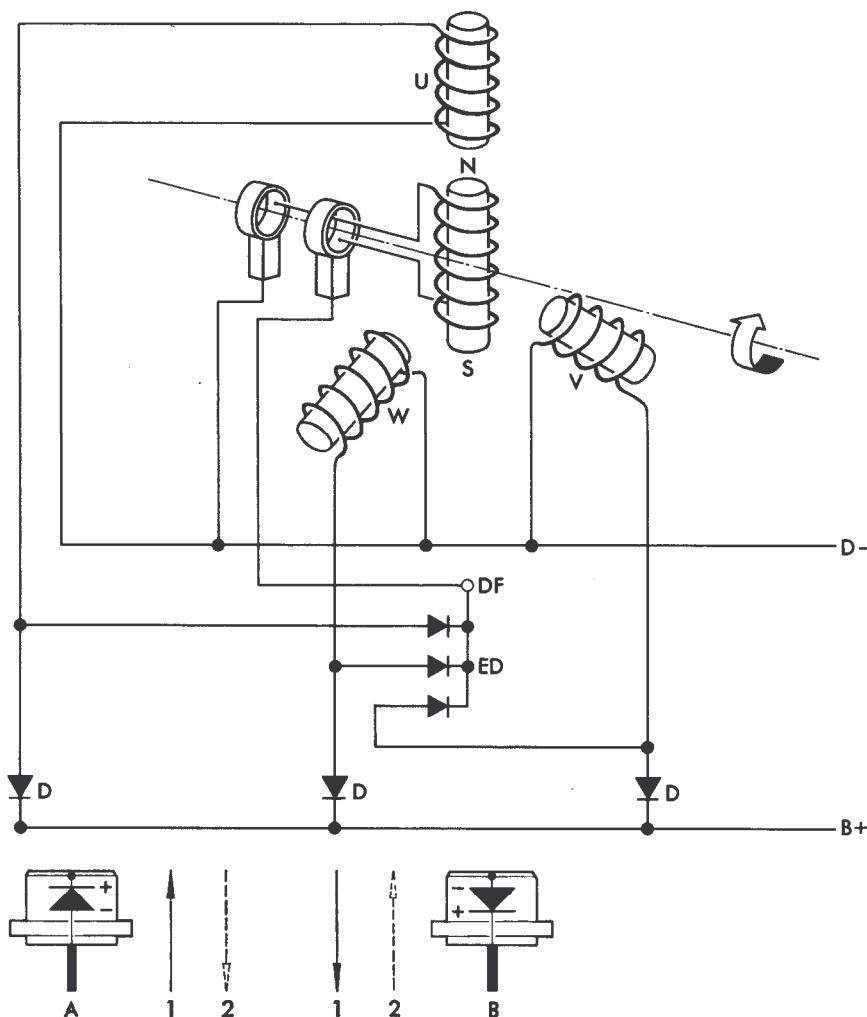
Each alternator generates current by a magnetic field moving past a coil and inducing a voltage in that coil (induction principle). It is immaterial whether the field (the exciting coil) is stationary and the generating coil is moving (DC generator) or vice versa.

The field coil (exciting coil) of alternators is mounted on the rotor as a ring coil. The exciting coil is enclosed by two iron poles designed as claw poles. It is supplied with direct current by two slip rings on the armature shaft and the pertinent carbon brushes. The direct current is generated by the alternator itself by means of three exciting diodes (self-excitation).

The claw pole rotor rotates in a coil arrangement which consists essentially of three coils. These three coils are installed in the stator and offset by 120° . The rotating magnetic field in the stator coils generates three partial voltages which are also offset by 120° with respect to time (three-phase current). The stator is therefore generating three-phase current, which explains the term three-phase generator sometimes used for alternator. Three-phase current is a special type of alternating current. However, the electric system of an automobile requires direct current, since only direct current can be stored in an accumulator (battery).

Therefore, the three-phase current induced in the stator coils must be rectified. This is done by means of silicon diodes (D). Silicon diodes are semiconductors which permit the current to flow in one direction only, locking it in the other direction. The result is a rectifier effect.

- D = Rectifier diodes
- ED = Exciting diodes
- U, V, W = Stator coils
- S, N = Magnetic field

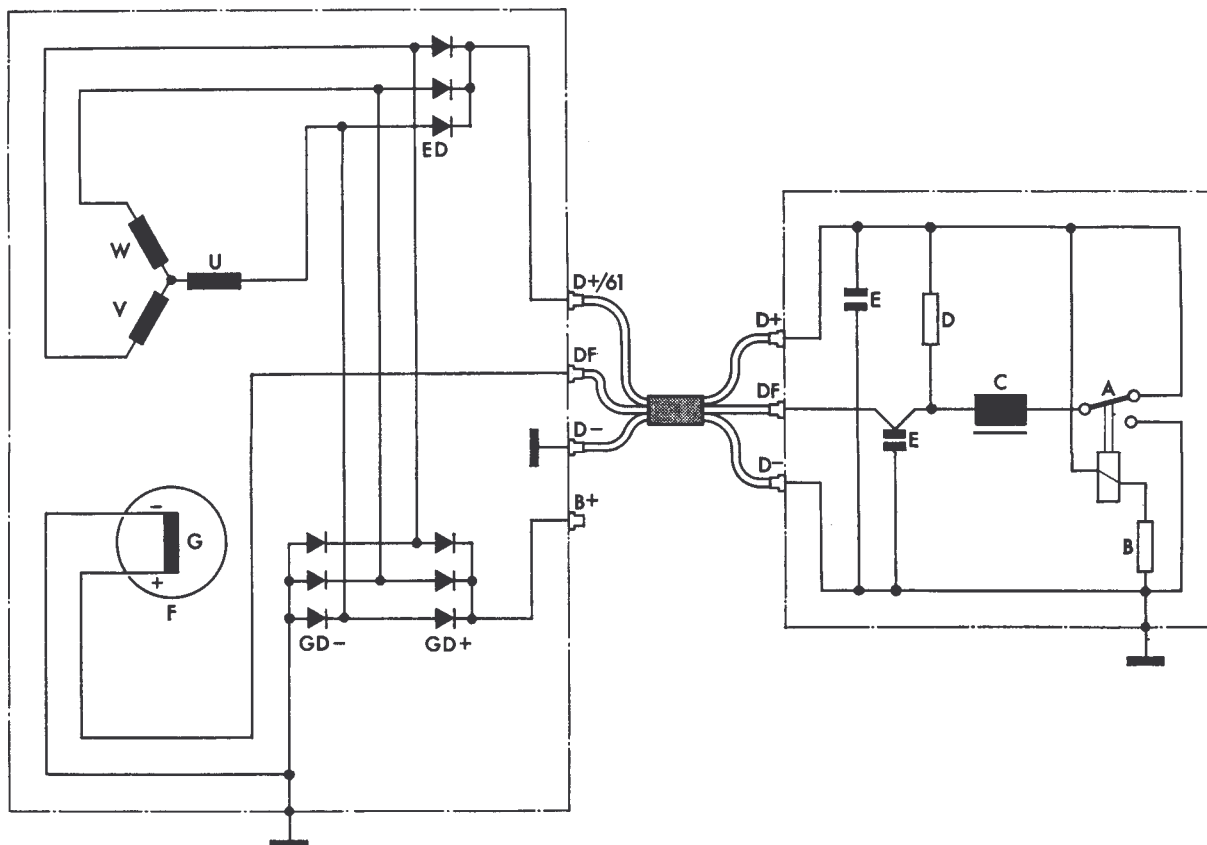


- A = + Diode
- B = - Diode
- 1 = Direction of flow
- 2 = Direction of lock

Symbol for diodes (the arrows indicate the direction of flow)

The circuit arrangement is as follows:

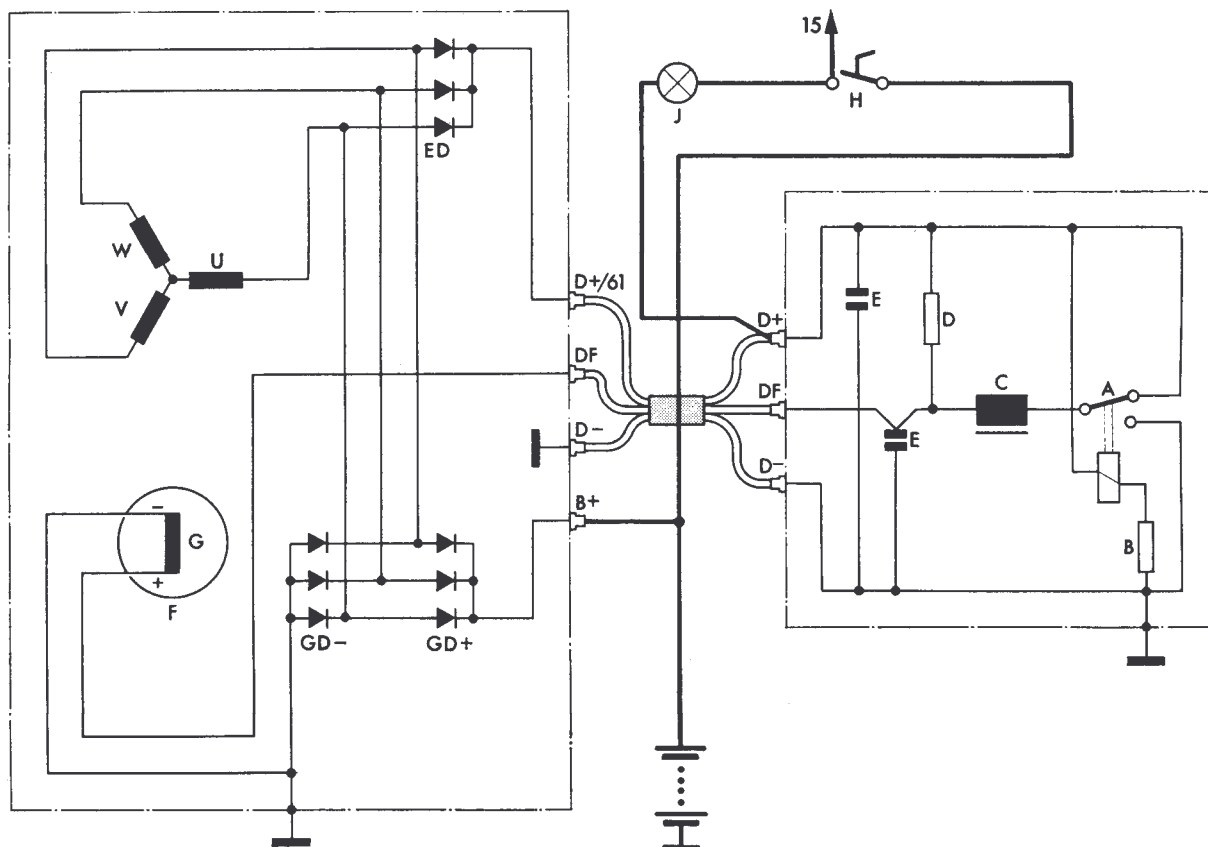
The beginnings of the three stator coils UVW join at a common point. The ends of the coils UVW are connected to two different diode arrangements. The diodes GD are the rectifier diodes. The symbol + and - behind GD in the drawing means that the pertinent diodes are connected to the housing either with their positive or negative pole. This is very important during repairs, since both types of diodes cannot be interchanged.



The three diodes ED (exciting diodes) rectify the three-phase current generated in the stator coils for the exciting coils. Their positive poles (housing) join on the connection D+/61 of the alternator, where the regulator switch is connected.

A Type ADN (Bosch) regulator is used. It is a mechanical single element voltage regulator. Alternators do not need the reverse current switch element required by regulator switches for DC generators, since the locking effect of the rectifier diodes prevents any discharge of the battery via the alternator coil.

A special characteristic of alternators must be explained: For reasons of weight, the rotor (field coil) contains less iron than the pole shoes of a comparable DC generator. The result is that the residual magnetism when the alternator is started is occasionally not enough to induce a starting voltage in the stator coil. A special circuit is therefore employed: the field coil is supplied with sufficient DC voltage for excitation from the battery positive pole via the ignition lock and the charging control light, as well as terminal D+/61, the regulator switch and terminal DF on the alternator. If with increasing speed of the alternator the voltage on terminal D+ rises to the magnitude of the battery voltage, the charging control light will extinguish again. The important point in this connection is that the charging control light must have a given input (at least 1.2 Watt).



A - Regulator contact
 B - Balancing resistance
 C - Choke
 D - Resistance
 E - Capacitors
 ED - Exciting diodes

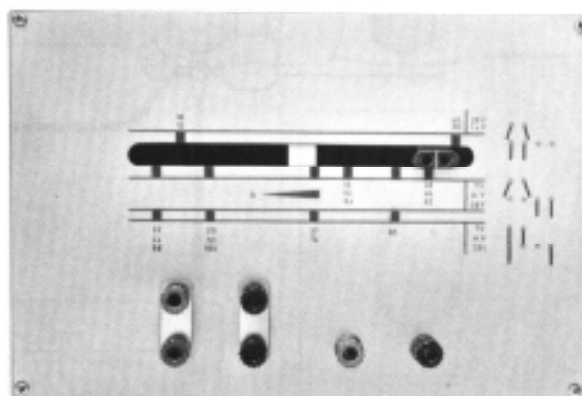
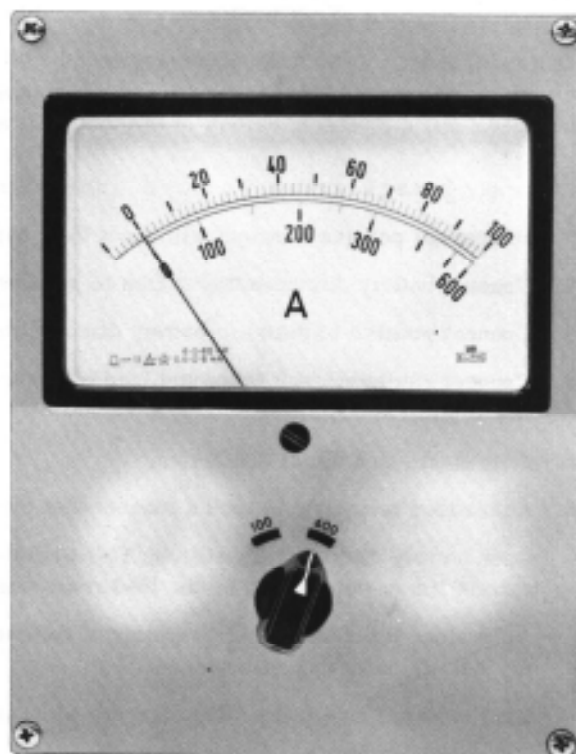
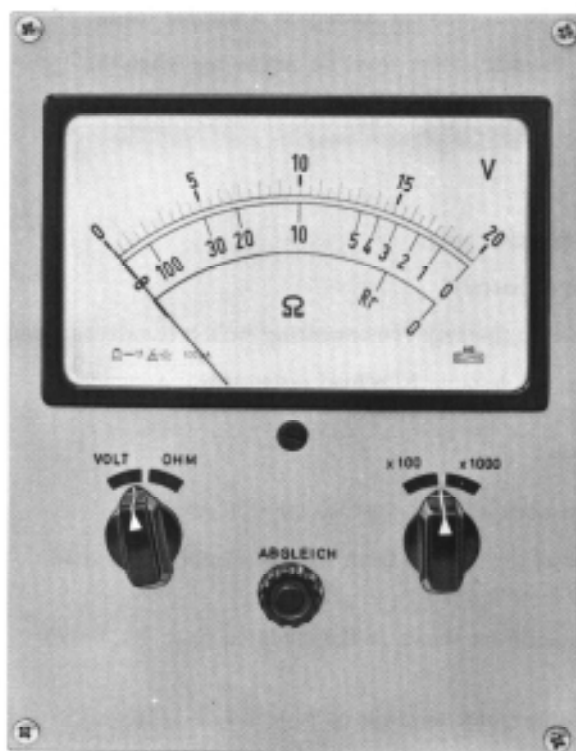
F - Rotor
 G - Exciting coil
 H - Ignition switch
 I - Charging control light
 K - Battery
 U, V, W - Stator coils

The terminals on the regulator and alternator are designed as non-interchangeable plug combinations.

Alternator and Voltage Regulator

Vehicle Type	Alternator Part Number	Regulator Part Number	Applies From To	Maximum Current A	Rated Mean Regulator Voltage V	Rated Output Speed RPM
914	022 903 023	021 903 803 A		50	14	2200
914/6	911 603 118 00			55		

Testing equipment



No.	Designation	Special Tool	Remarks
1	Voltmeter		0-18 Volt
2	Ammeter		at least 10-0-50 Amp.
3	Ohmmeter or Wheatstone Bridge		
4	Ignition oscillograph with alternator test cable		
5	Load resistance		max. 100 Amp.

Testing Procedure

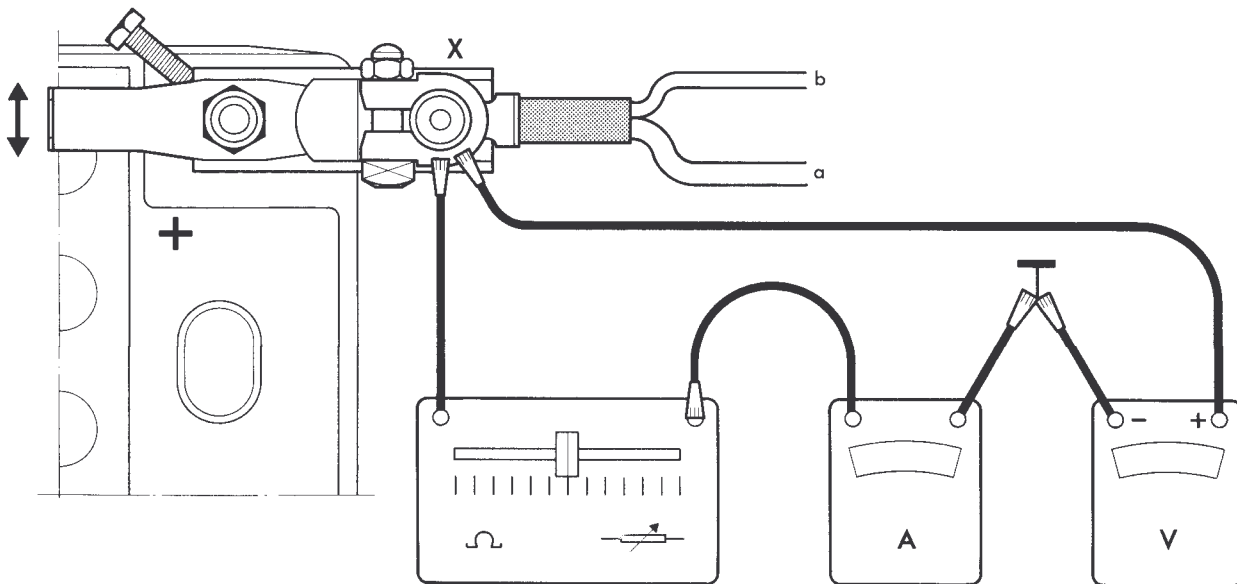
Caution!

Contrary to a DC generator an alternator may never be run without battery or a similar load.

During all tests, in which the alternator must be driven, the test cables must be connected when the alternator is stopped. When connecting the test cables, be sure that the connection between the alternator and the vehicle battery or the load resistance is maintained.

Checking Regulating Voltage under Load

- 1 - Disconnect positive terminal with lines from battery positive pole.
- 2 - Connect battery disconnecting switch to positive pole of battery.
- 3 - Connect positive terminal to battery disconnecting switch (battery disconnecting switch is switched on).
- 4 - Connect ammeter, voltmeter and load resistance acc. to drawing (the load resistance is connected to the positive terminal).
- 5 - Start engine and run at 2,000 rpm.
- 6 - Adjust load resistance in such a manner that the ammeter indicates approx. 20 - 30 Amp.
- 7 - Open battery disconnecting switch. This will disconnect the battery from the test circuit. The load current is now determined by the load resistance only.
- 8 - Adjust load resistance until the ammeter indicates the current shown in the table on page 9 1.5-1/1 for the alternator to be tested.
- 9 - Read voltage on voltmeter and compare with rated value (refer to table on page 9 1.5-1/1).



a - to starting motor

b - to light switch terminal 30

x - Battery disconnecting switch (SUN-Electric NO 7052-003 or similar equipment)

If values other than specified are indicated, replace regulator first and repeat measurements. If there are still deviations, test the alternator. This is done best by means of an ignition oscillograph. If no such instrument is available, remove the alternator and arrange for a checkup in accordance with instructions on page 9 1.4-1/1.

Alternator Test with an Ignition Oscilloscope

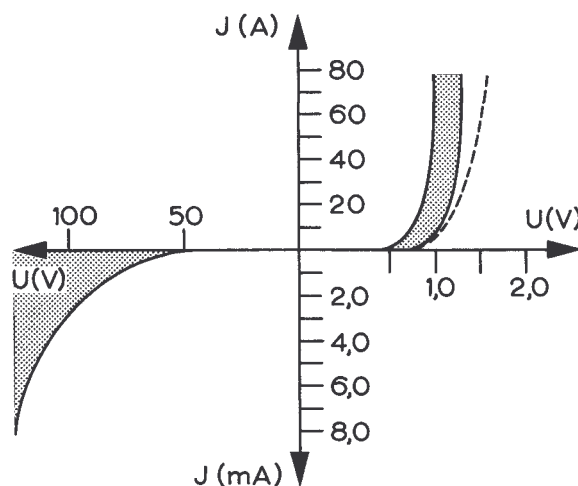
An installed alternator can be tested by means of an ignition oscilloscope and a coupling cable available from the oscilloscope manufacturer. If the oscillogram varies considerably from the basic pattern, remove alternator and repair.

The oscillograms shown in these instructions are basic patterns showing in each case only one fault in a characteristic pattern. If an alternator shows several faults at the same time, the resulting oscillogram will most of the time be different from the one shown here. In such a case it will be appropriate to remove and disassemble the alternator and check the electrical components individually.

To understand the test made here, it will be of advantage to know a few more details concerning the function and handling of diodes.

The rectifiers used in alternators are semi-conductor diodes which permit the current to flow in one direction, while blocking it in the opposite direction. The illustration shows a typical diode curve. At the right is the direction of flow and it is seen that this diode will become conductive when a voltage higher than 0.6-0.8 Volt (forward voltage) will be applied.

In the closed direction (at the left on diagram) the same diode can be loaded up to 100 Volt.

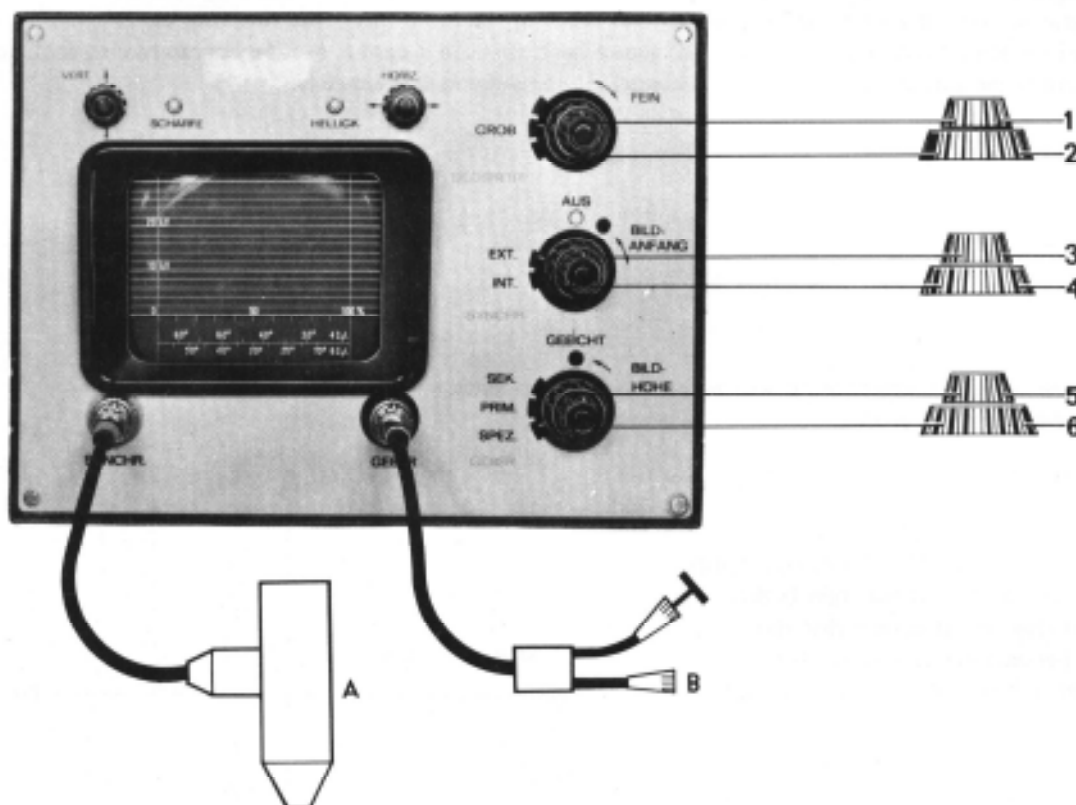


When the limits for the diodes (voltage, temperature) are exceeded, the diodes are either destroyed immediately (refer to oscillogram) or the characteristic curve of the diodes will change. In such a case, either the forward voltage will increase until the diode is interrupted or the inverse current may increase up to shorting the circuit.

If the change is still within permissible limits, the diode can still be used, if not, a new diode must be installed.

Testing the Alternator in Installed Condition

Connect coupling cable for alternator test to oscillograph. Positive connection (generally marked red) to terminal D+ of regulator, negative connection (generally marked black) to earth connection (engine). Connect synchronizing cable of oscillograph to an ignition cable of a given engine cylinder. Start engine. Adjust speed of engine to approx. 1,000 rpm.



Adjustment of Oscillograph

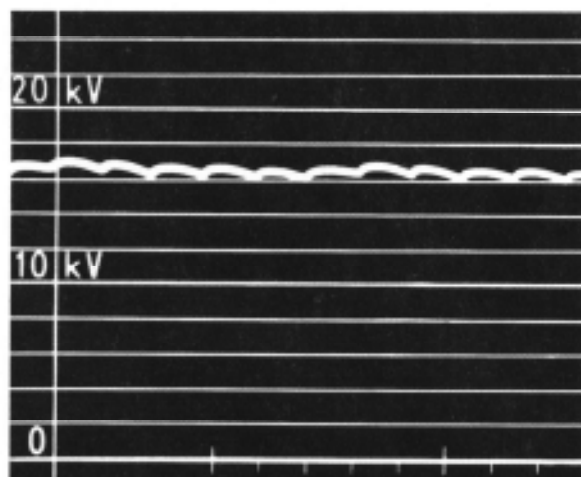
- 1 - Open fine control of picture width approx. half
- 2 - Coarse control in position "medium"
- 3 - Cutout switch and picture starting control
- 4 - Synchronizing switch to "intern"
- 5 - Picture height control to "small"
- 6 - Test type switch to "special"

- A - Connection for ignition line (any cylinder)
 B - to terminal D +/ regulator switch (line connection between alternator cable line and main cable line)

A perfect alternator will show the opposite pattern. The delivered direct voltage has a slight harmonic content and the picture may therefore not be quite stable. But its quality is good enough for a perfect diagnosis. When the picture shown opposite appears on the screen, it is an indication that the alternator is in order and need not be removed. The switch points of the regulator are showing up in the oscillogram in the shape of needles seen from the direction of the oscillograph either in upward or downward direction. Adding a load (switching on the headlamps) or reducing the engine speed permits stopping the regulator, that is, the needles can be erased from the oscillogram.

Note:

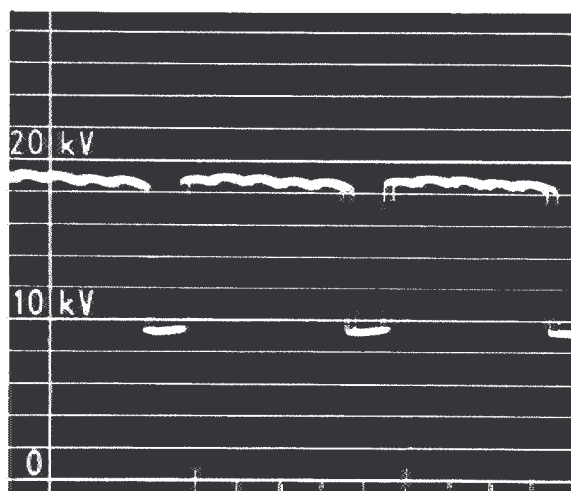
If the oscillogram undulates across the screen, a connecting line between the earth connection of the oscillograph (plug housing of pickup cable) and the earth connection of the engine to be tested must be changed.



Faults:

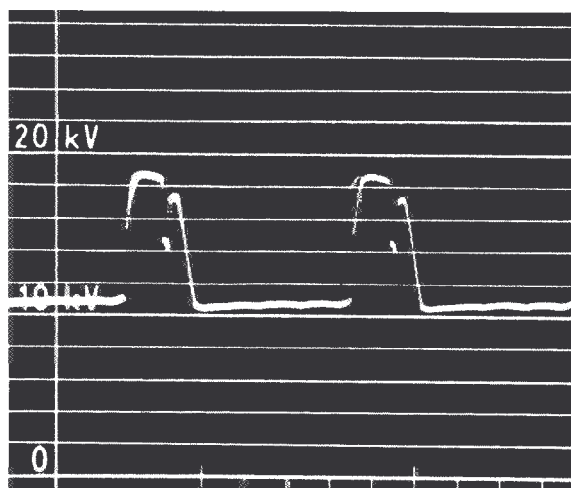
Interruption of an Exciting Diode

The opposite picture shows clearly the absence of a harmonic wave. To compare such pictures, the respective picture must be adjusted on the vertical controls of the oscillograph in such a manner that it fits approx. in between the 10 and 20 kV division. (Refer to illustration Adjustment of Oscillograph).



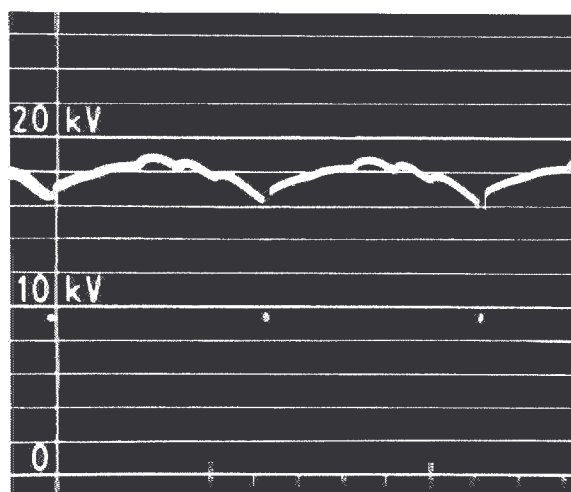
Interruption of a Positive Diode

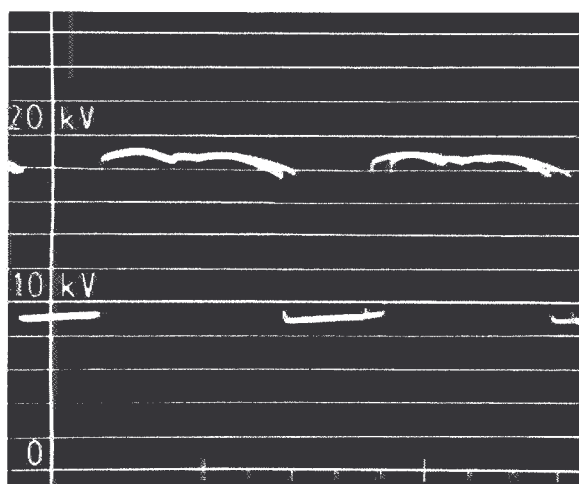
Since during the forward period no charging current but only the exciting current is taken from this diode, the damping effect of the battery is not available and upward induction voltage peaks will occur.



Interruption of a Negative Diode

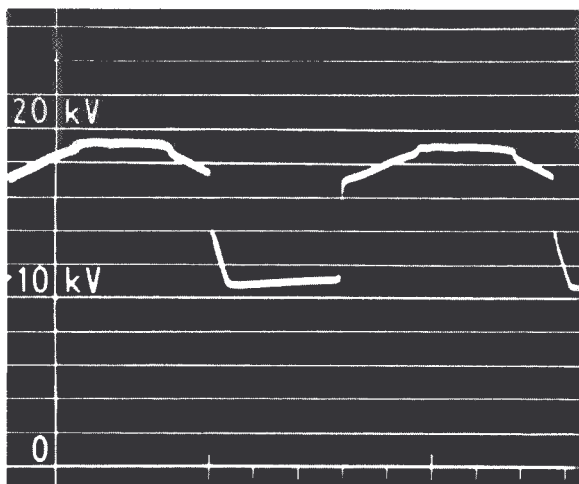
Negative diodes are under the influence of both, the charging current and the exciting current. The damping effect of the battery will therefore result only in a much more narrow disturbance in the oscillogram as the same faults would in an exciting diode.





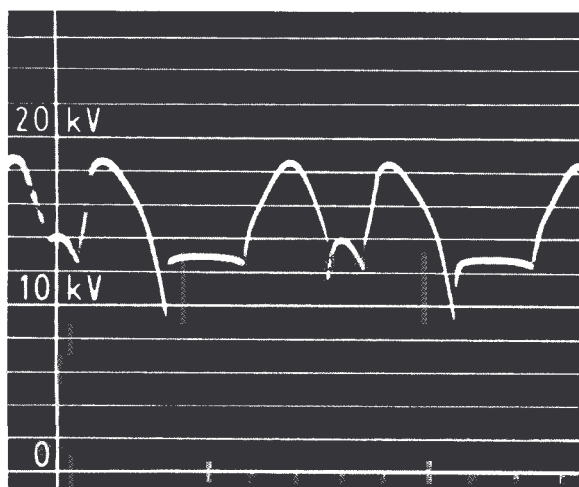
Short Circuit of a Negative Diode

A negative diode with a short circuit shows a similar oscillogram as an exciting diode having the same fault. But two decided harmonic waves are shown here.



Short Circuit of an Exciting Diode

The short circuit of an exciting diode will result in the loss of the alternator during an approximately complete half wave. The opposite picture shows a short circuit of an exciting diode. The heavily distorted harmonic waves are followed by a broad disturbance of the oscillogram by the short circuit.

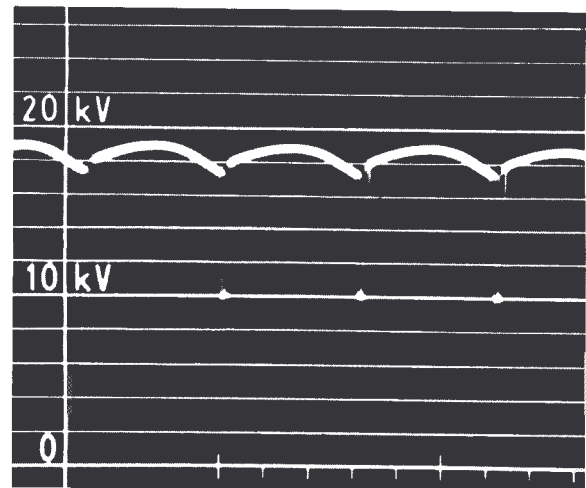


Short Circuit of a Positive Diode

In a shorted positive diode only two half waves will appear. The other half waves are shorted via the defective diode during the rest of the time.

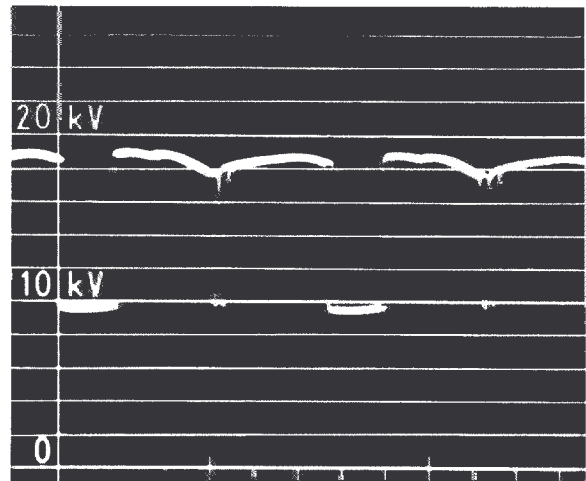
Phase Faults

If a phase (one winding group of the stator winding) is interrupted or if two phases are shorted in relation to each other, the opposite pattern will result. Each harmonic wave is followed by a narrow, but deep penetration.



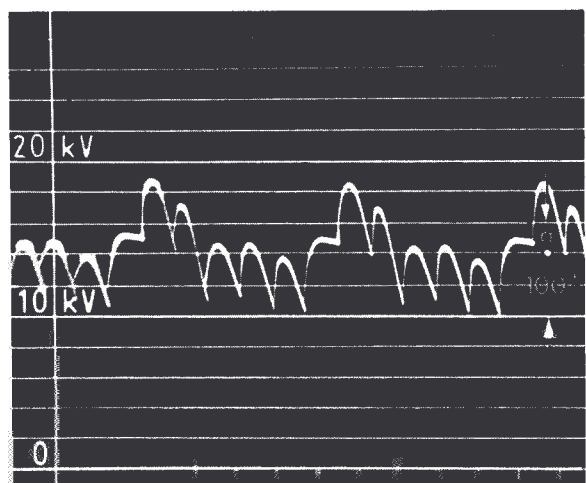
Several Faults at the same Time

In addition to the faults described up to now, an alternator may be afflicted with two or more faults at the same time. This will rarely happen, but here too certain characteristics are shown. The opposite picture shows a phase fault together with a shorted negative diode.



Faulty but not yet Failing Diodes

The opposite oscillogram shows diodes with changed characteristics. The changed curve results in an increase or a reduction of the harmonic waves (a). Deviations under 50 % of the harmonic wave condition are still permissible. The deviation in the opposite oscillogram is already too high. The afflicted diode must be replaced.

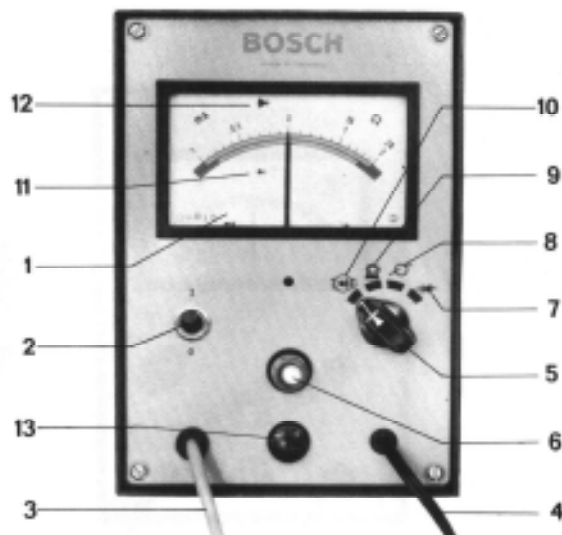


Testing of Removed Generator with an Alternator Tester

The alternator tester serves for testing installed and connected exciting and power diodes, as well as individual diodes, and for testing stator and rotor windings.

The example is shown with a German tester. Other testers known to us operate on a similar principle. Always refer to pertinent operating instructions.

Alternator Tester




- | | |
|---|--|
| 1 - Indicating instrument | 9 - Switch position
Check stator winding resistances |
| 2 - Mains switch | 10 - Test switch position of power and exciting
diodes when installed and connected |
| 3 - Cable | 11 - Symbol small diode |
| 4 - Test cable with two test points | 12 - Symbol large diode |
| 5 - Measuring type switch | 13 - Fuse |
| 6 - Mains control lamp (ready for operation) | |
| 7 - Switch position individual diodes | |
| 8 - Switch position
Test rotor winding resistances | |

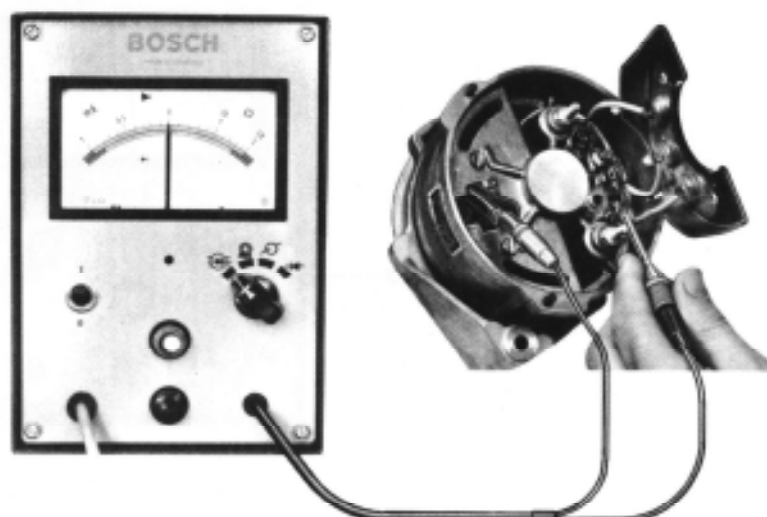
Important Note:

During the test, place test points of instrument securely but only momentarily against the measuring points. Be sure that with the alternator partially disassembled the tilted positive diode carrier is not becoming connected to the housing.

Testing the Exciting Diodes

Set test type switch to position . Hold test points against D+ and one after the other against the collecting points (arrow). The connection of the test points is at will. The needle will deflect to the left or to the right.

The diodes are in order, when the needle deflects during all three measurements up into the green range at the right or left at the end of the scale.



If the needle deflections are showing deviations, the following faults apply:

Needle deflections	Faults
2x in green range 1x in red range	Interruption of diode located in red range
2x in red range 1x no deflection	Short circuit of diode at which no deflection occurs Note: The diodes in the red range may be in order and should be checked after unsoldering the defective diode
1x red range 2x no deflection	Short circuit of diodes, at which no deflection occurs (check the third one)

Testing the Power Diodes

Test type switch remains in position 

Testing the Negative Diodes

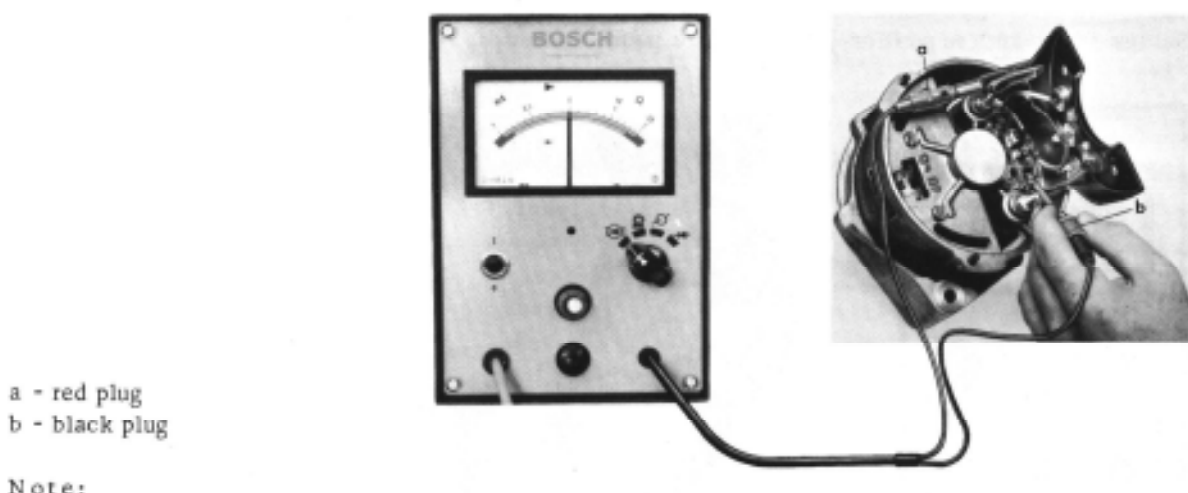
Place test points against D- and one after the other against the collecting points.



Negative diodes are the diodes which are in connection with connection D-. Needle deflections and faults similar to exciting diodes.

Testing the positive Diodes

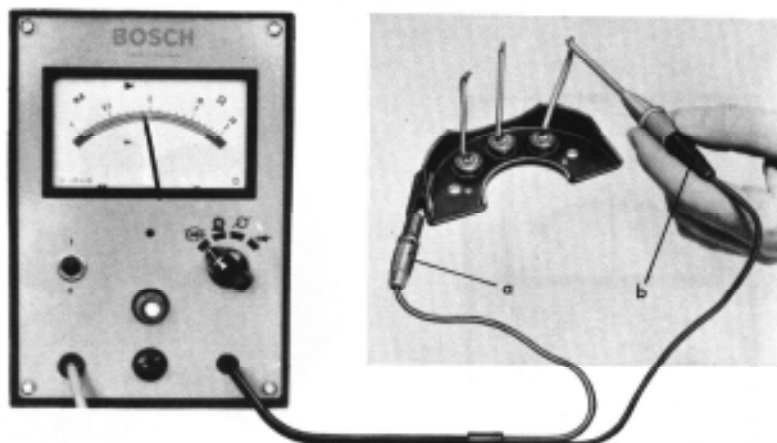
Place test points against B+ and one after the other against the collecting points.



Positive diodes are the diodes which are in connection with connection B+. Needle deflections and faults similar to exciting diodes.

Testing of Individual Diodes

Set test type switch to position $\rightarrow|$. The diodes are tested individually in unsoldered condition in both directions (forward and inverse direction). When the needle deflects completely toward the left, it is an indication that the diode has been connected in forward direction. When the needle deflection is less, the diode has been connected in inverse direction. The inverse current may be max. 0.8 mA at 25°C (77°F) housing temperature. If the needle remains at 0 during both measurements, the diode is interrupted.



a - red plug
b - black plug

If the needle deflects entirely to the left during both measurements, the diode is shorted.

The same switch position can be used to determine the polarity of an intact diode. A direct voltage between the test points amounts to approx. 40 Volt. The red point is the positive connection, the black point the negative connection.

Example for determining the polarity:

Place red point against connecting wire of diode, black point against diode housing. If a high current will then flow (approx. 1 mA) the diode has been connected in forward direction, that is, the negative pole of the diode is on the housing (negative diode).

If with the same connection there is no or only a low current, the diode has been connected in the inverse direction, that is, the positive pole of the diode is on the housing (positive diode).


Testing the Rotor Winding

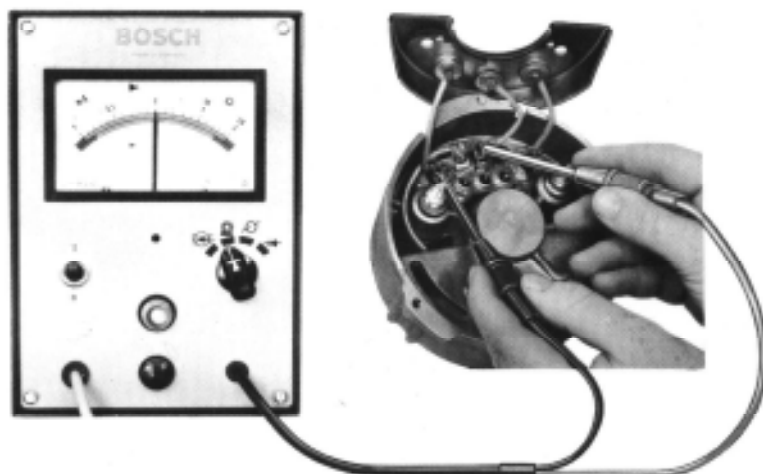
Set test type switch to position \circ . Place test points against slip rings.



If the slip rings are not readily accessible (for example in the assembled alternator), the connection can also be made to DF and earth. However, the transfer resistances between the carbon brushes and the slip rings will now be included in the measurements. The resistance rating will be higher and will fluctuate when the rotor is rotated.

Testing the Stator Windings


Set test type switch to position . Place test points against two collecting points. Make a total of three measurements. During the measurements, the resistances should be of uniform size.



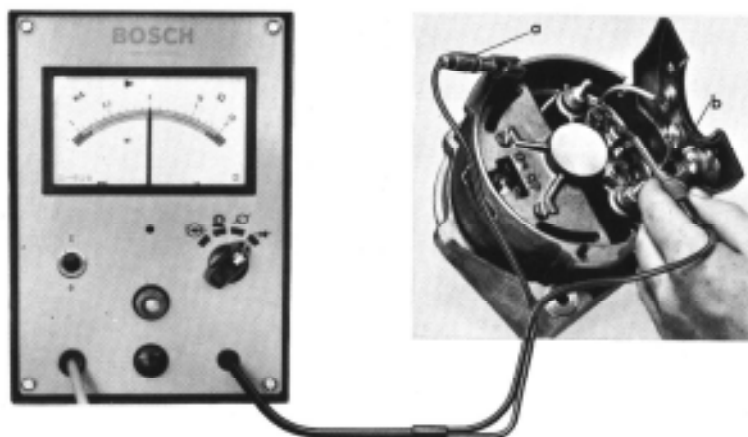
If there are differences in the resistance ratings between the individual measurements, the stator winding has a winding short.

When in doubt, unsolder stator assy and measure stator winding with a measuring bridge.

Testing the Alternator for body contact

A test for an earth short circuit can be completed only when the negative diodes are in order. Defective negative diodes may simulate body contact. Set test type switch to position . Place black test point against earth (housing), red test point in sequence against the collecting points on the soldering strip.

The alternator has body contact, if during all the three measurements the needle deflects against the stop toward the left.



a = black plug
b = red plug

Alternators

Alternator Part Number (stamped)	Regulator Part Part Number	Vehicle Type	Maximum Current	Mean Regulator Voltage	Rated Output Speed	Load Current	RPM
022 903 023	021 903 803 A or 901 603 206 02	914	50	14	2200	10 33 50	1400 2200 6000
911 603 118 00		914/6	55			10 36 55	1350 2200 6000

The most economic method of checking an alternator for function is a test with an ignition oscillograph (page 9 1.3-1/4).

The following chart shows only the most obvious faults:

Trouble	Cause	Remedy
Charging control lamp not lighting up with ignition switched on	a - Bulb burnt out b - Battery discharged c - Interruption in line from B+ (battery) via ignition switch to charging control lamp d - Plug connection between regulator and alternator not plugged or transfer resistance e - Exciting winding in alternator burnt f - Carbons are not resting on slip rings	a - Replace b - Charge c - Test with voltmeter acc. to Wiring Diagram d - Check and replace plug, if required e - Test with ohmmeter between terminal DF/alternator and earth (D-). If there is an indication, replace armature f - Check similar to e-, replace carbons
Charging control lamp does not extinguish when speed increases	a - Earth short circuit in line D+/61 between alternator and regulator b - Regulator defective c - Exciting diodes are interrupted	a - Test with ohmmeter and repair, if required b - Replace regulator c - Test with oscillograph or, with alternator removed, with tester. Replace diode carrier and diodes
Charging control lamp lights up at half its brightness when engine is stopped or operating	a - Voltage drop in line between DF alternator and DF regulator b - Alternator damaged	a - Check line b - Check: Connect 2-Watt test lamp directly to D+ and B+ of alternator. If it does not glow, the alternator is in order, otherwise: replace alternator
Control lamp lights up with ignition switched off	a - Positive diode has short circuit	a - Replace

Removing and Installing Alternator

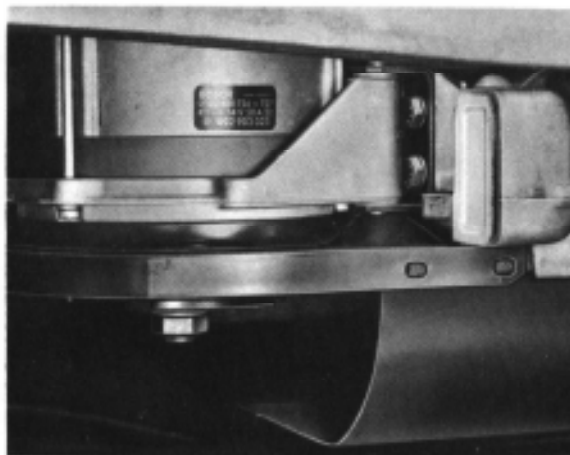
- 1 - Disconnect battery.
- 2 - Remove upper alternator mounting screw (don't lose square nut and washer). Remove drive belt.
- 3 - Remove slotted head screws on guard.

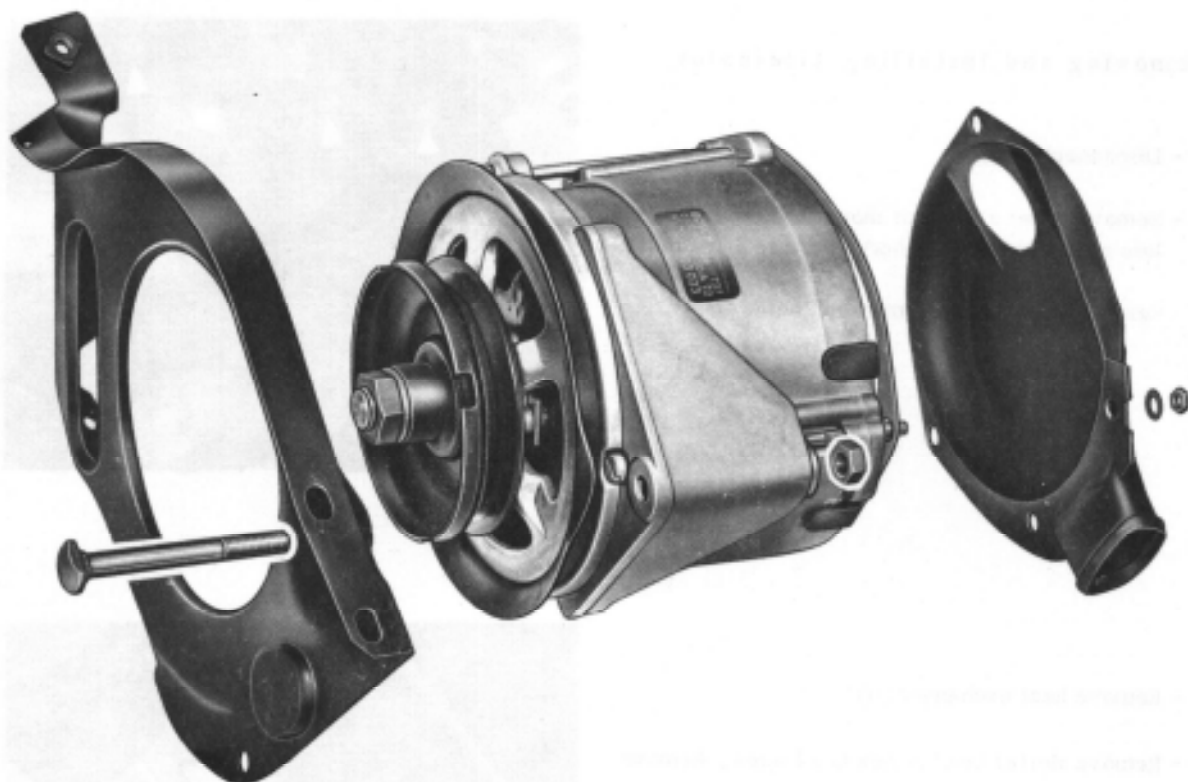


- 4 - Remove heat exchanger (left).
- 5 - Remove slotted head or hex head screw. Remove guard.



- 6 - Detach clamp and pull connecting elbow off intake cover.
- 7 - Loosen and remove lower alternator mounting screw.
- 8 - Remove alternator by lowering, being careful of connecting wires.
- 9 - Unscrew intake cover and disconnect wires.





Be careful not to damage the paper gasket between the intake cover and alternator housing during installation. Install the seal on the drive end of the alternator so that seal ear is located next to the lower mounting screw.

TOOLS

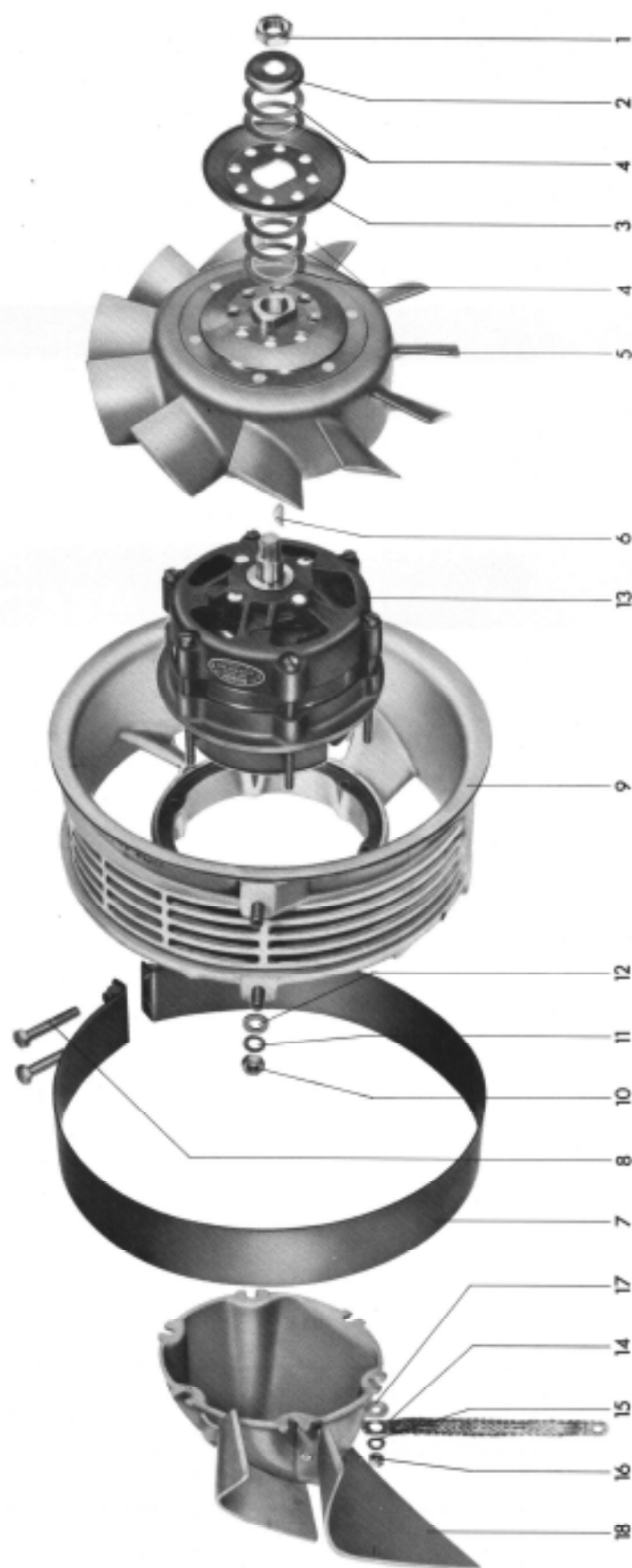


1



2

No.	Description	Special Tool No.	Remarks
1	Offset Open end Wrench, 22 mm		
2	Pulley wrench	P 208	



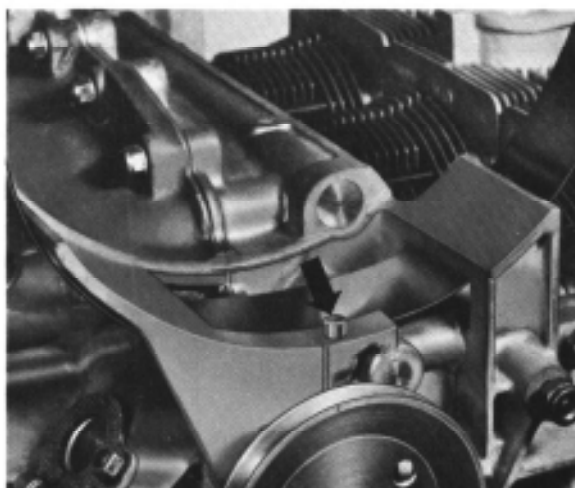
Nr.	Description	Qty	note when		Special instructions see
			Removing	Installing	
1	Nut	1	Use Special Tool P208 and offset box wrench	Torque to 4 mkp (29 ft lbs)	
2	Dished washer	1			
3	Belt pulley half	1	Hold with Special Tool P208		
4	Washer			Adjust belt tension by varying the number washers used. The V-belt tension is correct when the belt can be depressed 10 - 15 mm (0,4-0,6 in.) at the center.	
5		1			
6	Woodruff key	1			
7	Strap	1			
8	Bolt	2			
9	Fan housing	1		Align with dowel in crankcase and push fully against it. Marker notch in fan housing faces down.	1.7-2/4
10	Nut	2	Install wire terminals for ground connections between ignition coil bracket and washer.		
11	Washer	2			
12	Lock washer	2			
13	Alternator	1	Mark location of alternator in relation to fan housing. Align marks and assemble.		1.8-2/1
14	Ground strap	1	Ground strap is connected to crankcase.		
15	Washer	1			
16	Nut	6			
17	Washer	5			
18	Air duct	1	Mark installed location.	Install so that the upper blade faces studs for ignition coil mount (on fan housing).	



Alternator

Removing

1. Remove battery ground strap.
2. Remove carburetors with intake stacks, ignition coil, and engine shroud (see arrows).
3. Hold V-belt pulley with Special Tool P208 and loosen pulley retaining nut. Take pulley off.
4. Remove air duct.
5. Detach wires B+ and D+ from alternator, pull connector plug off DF and D.
6. Remove retaining strap.



Installing

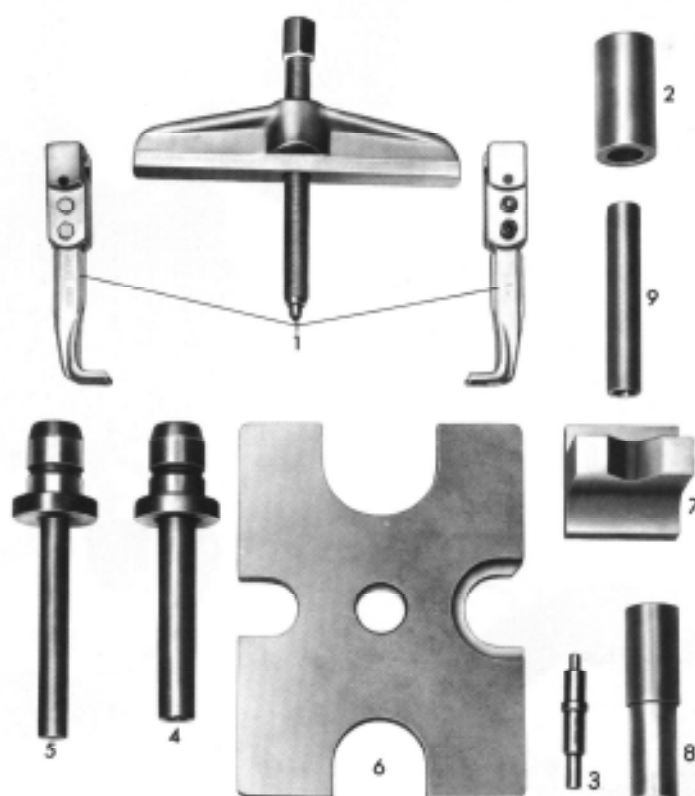
Align fan housing with dowel in crankcase and push fully against it (see arrow).

Caution

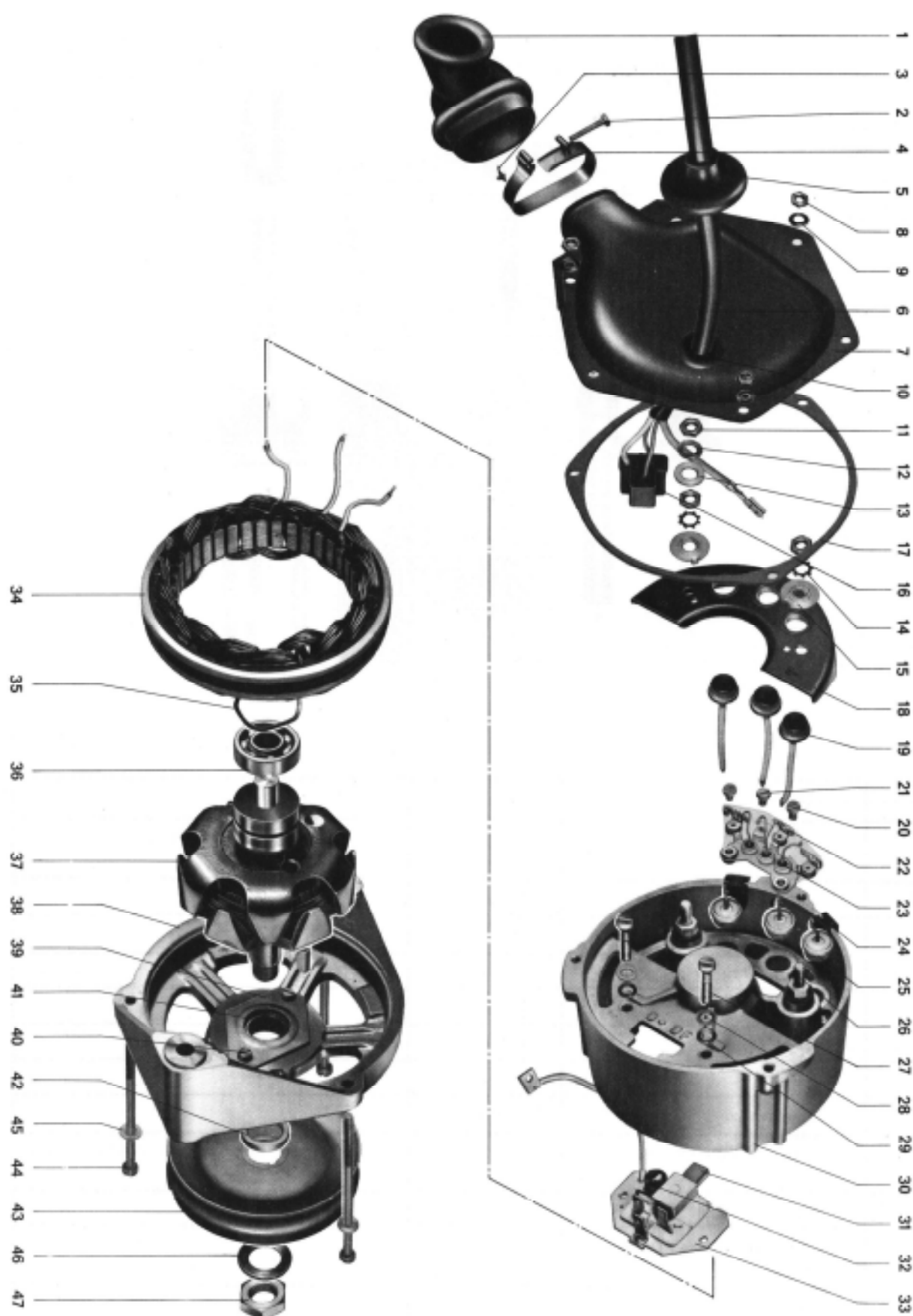
Make sure that **all** wires are correctly attached (according to wiring diagram). Make sure ground strap is connected between fan housing and crankcase.

Install and adjust V-belt.

Tools



No.	Designation	Special Tools	Explanation
1	Puller		Leg length 150-200 mm (5.9-7.9")
2	Tube	VW 422	-
3	Thrust piece	VW 438	-
4	Thrust piece	VW 410	-
5	Thrust piece	VW 411	-
6	Supporting plate	VW 402	-
7	V-Block		-
8	Pipe section	VW 421	-
9	Pressing-in matrix for diodes		Self-made acc. to drawing page 9 1.8-1/9
	Alternator tester		-
	Ohmmeter without measuring bridge		-
	Repair press	VW 400	-



No.	Designation	Each	Observe during		Spec. Instr.
			Removal	Installation	
1	Elbow connector	1			
2	Screw for hose clip	1			
3	Thread connection for hose clip	1			
4	Hose clip	1			
5	Rubber sleeve for line layout to engine sheeting	1		Seat well	
6	Wiring alternator	1			
7	Suction cover for alternator		Mark installation position		
8	Hex. nut	3			
9	Spring washer	3			
10	Rubber sleeve for suction cover	1		Seat well	
11	Hex. nut for B+ connection	3			
12	Washer	1			
13	Washer	1			
14	Serrated washer	2			
15	Contact washer	2		Locking nose must enter hole of positive diode carrier	
16	Plug housing, 3-pole	2		Watch out for correct position of plug in housing	
17	Seal for suction cover	1		Use new seal	
18	Positive diode carrier	1			
19	Positive diodes	3			
20	Cheesehead screw	2		Do not damage insulation in exciting diode carrier when tightening	
21	Connecting screw for stator winding	1			
22	Exciting diode carrier	1	Remove complete with diodes		

No.	Designation	Each	Observe during		Spec. Instr.
			Removal	Installation	
23	Exciting diodes	3	not removed		
24	Seal	2			
25	Negative diodes	3	Press out with punch	Press in with self-made tool	9 1.8-3/9
26	Fastening bolts for positive diode carrier	2			
27	Fastening screws for brush holder	2			
28	Washer	2			
29	Spring ring	2			
30	Alternator housing	1	Make note of position in relation to swivel arm		
31	Carbon brush	2	not available as a spare part		
32	Pressure spring for carbon brush	2			
33	Brush holder plate	1		Observe layout instructions for connecting cable	9 1.8-3/9
34	Stator	1	Caution! Do not damage windings	Test	9 1.8-3/7
35	Spring washer	1			
36	Ball bearing, slip ring	1	Watch instructions	Lubricate with Bosch grease F+1V34	
37	Claw pole rotor			Set carbon brushes back prior to installation	
38	Bearing plate	1	Mark position of swivel arm	Press on claw pole rotor prior to installation	
39	Ball bearing bearing plate	1		Depression should not point to ball bearing	
40	Cheesehead screw	2			
41	Ball bearing, drive end	1		Lubricate with Bosch grease F+1V34	
42	Intermediate ring	1			
43	Pulley	1	Remove with puller		
44	Housing screw	3			
45	Washer	2			
46	Washer	1			
47	Nut M 14x1.5	1		Tighten to 3.5-4.0 kp	

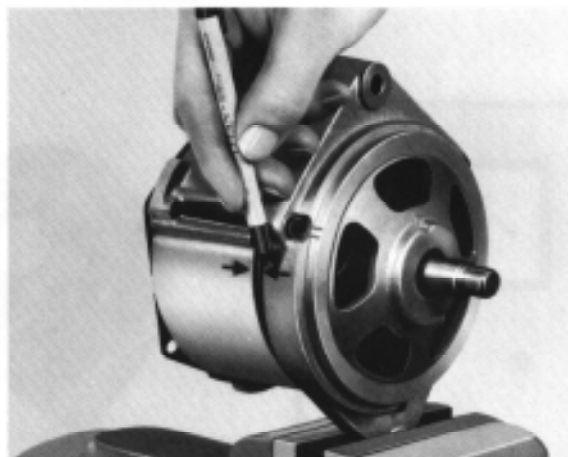
Disassembling the Alternator

1 - Test alternator with alternator tester EFAW 192 (Bosch) or Ohmmeter in accordance with test instructions on page 9 1.4-1/1.

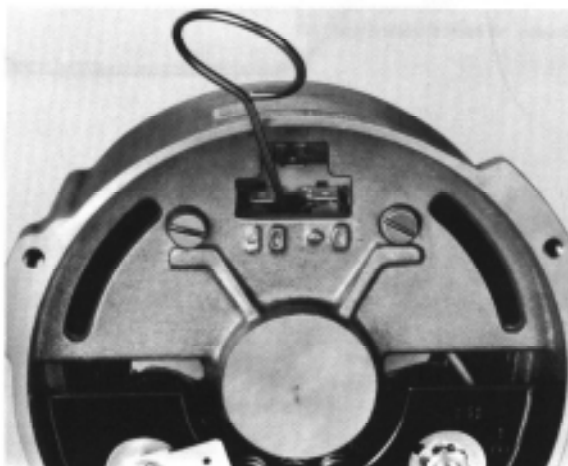
2 - Hold pulley in recesses provided and loosen fastening nuts. Remove pulley (use three-legged puller, if required).



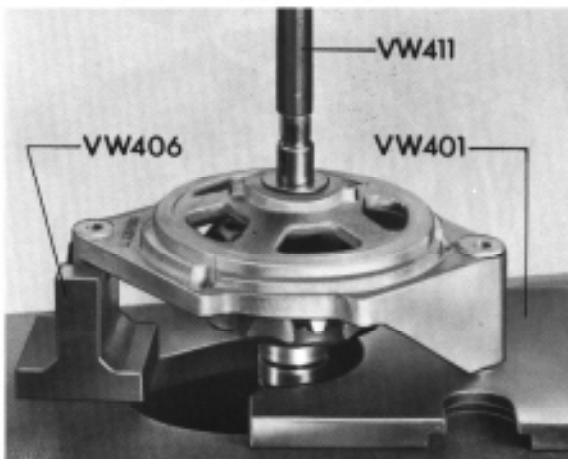
3 - Mark position of swivel arm in relation to housing.



4 - Prior to disassembling the alternator, pull back both carbons with a wire hook and arrest. The carbons can be held down with the aid of the pressure spring by pulling them wide enough out of brush holder.



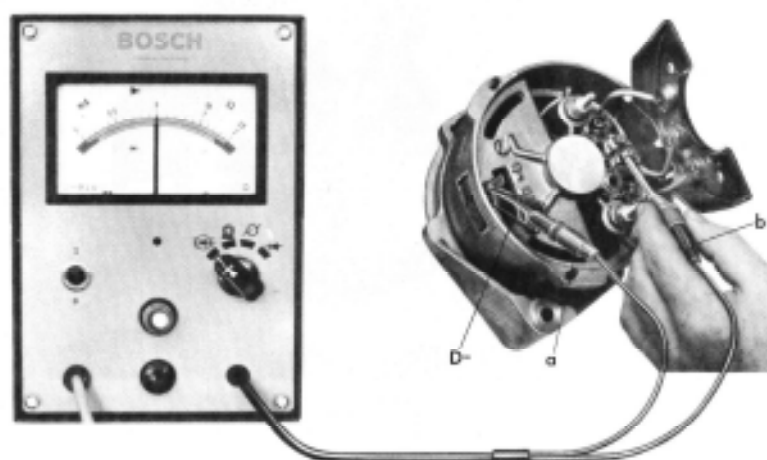
5 - Press claw pole rotor with repair press and suitable support out of drive bearing, holding rotor in position.



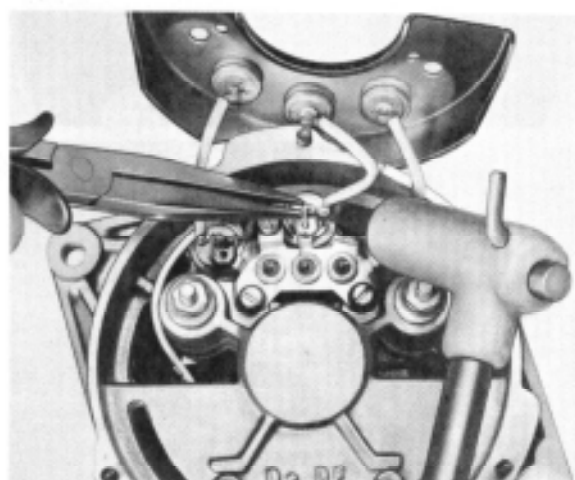
- 6 - Press off ball bearing at slip ring end on repair press using suitable fixture. The ball bearing can also be pulled off with a claw-type puller against inner race. When the ball bearing must be pulled off at the outer race, a new ball bearing must be installed.
- 7 - Prior to disassembling slip ring bearing still further, test diodes with diode tester EFAW 192 (Bosch) or with an ohmmeter.

Caution!

The diode carrier should not rest against housing, since this will falsify the measurements. Refer to testing instructions on page 1.4-1/1



a - red plug
b - black plug



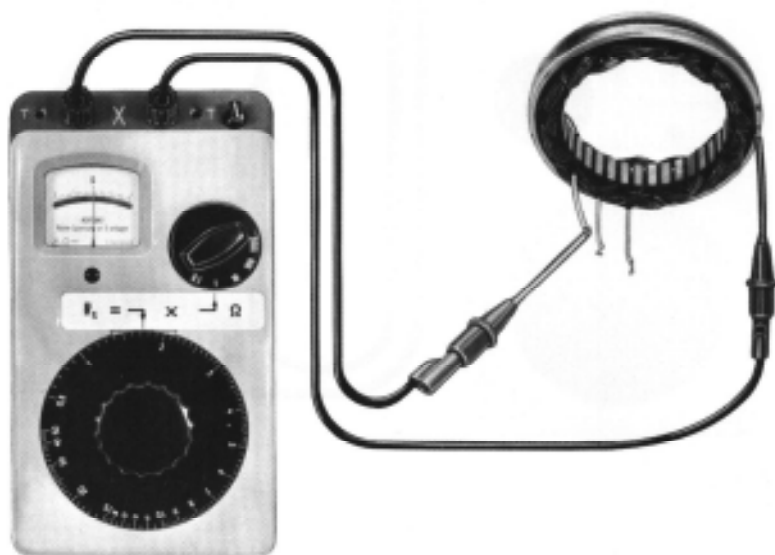
- 8 - Loosen connecting line from B+ to exciting diodes on exciting diode carrier. Unscrew fastening screws for brush holder. The brush holder can then be removed.
- 9 - Unsolder connections of positive diodes, of negative diodes and of stator winding from soldering strip of exciting diode carrier, using pointed pliers - as shown in illustration - for dispersing heat.

Cleaning

The individual parts of the alternator may be washed with gasoline or trichlorethylene (tri) for short periods only.

Inspecting and Repairing Individual Parts of Alternator

1 - Test stator with ohmmeter for earth short circuit.



2 - Test resistance of stator windings between phase outlets. Resistance rating: $0.2 \pm 0.02 \Omega$



- 3 - Test claw pole rotor for body contact (with ohmmeter).



- 4 - Measure exciting winding (field rotor) with resistance measuring switch. Resistance rating: $4,0 \pm 0,4 \Omega$



Note:

Slip rings should be machined in a special shop only. The minimum dia. is 31.5 mm, the max. permissible runout 0.03 mm and the max. permissible runout for field spider 0.05 mm.

Removing the Power Diodes

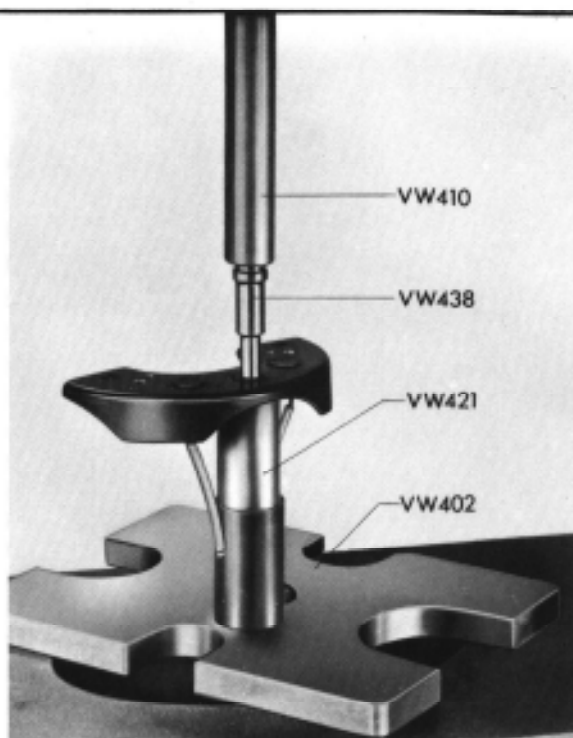
The required tools are shown in the illustration.

Assembling the Alternator

Only describing steps which must be given special attention.



- | | |
|------------|----------------|
| a - 100 mm | d - 13.5 mm |
| b - 5 mm | e - max. 18 mm |
| c - 12 mm | |

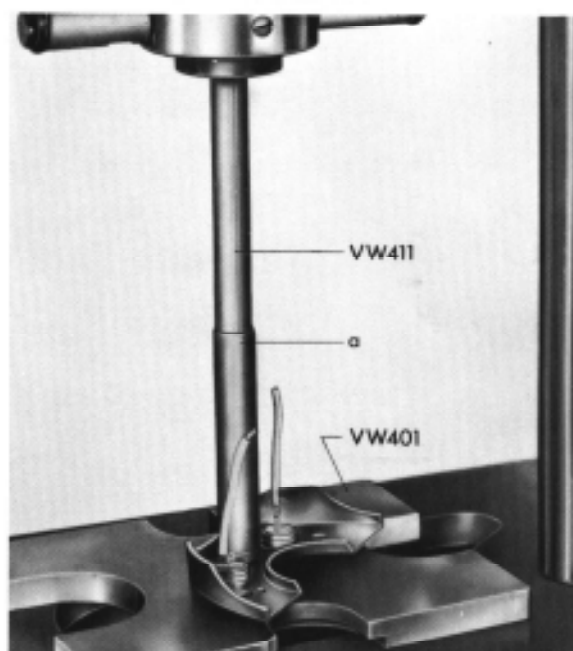


Installing the Diodes

Coat diode seat with silicon oil prior to installation. Use pressing-in punch (self-made) for installation.

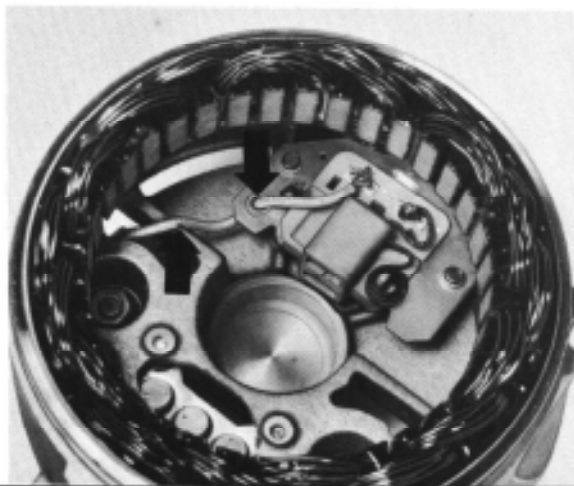
Following the installation of the diodes, measure all the diodes with tester EFAW 192 or with an ohmmeter. Prior to installing the exciting diode carriers, solder the three connecting lines of the positive diodes from below to the exciting diode carrier. Use radio solder (rosin-core solder) only!

Upon installation of exciting diode carrier, solder line outlets of stator winding, negative diodes as well as exciting diodes to soldering strip. Solder carefully so that the negative diodes are not overheated.

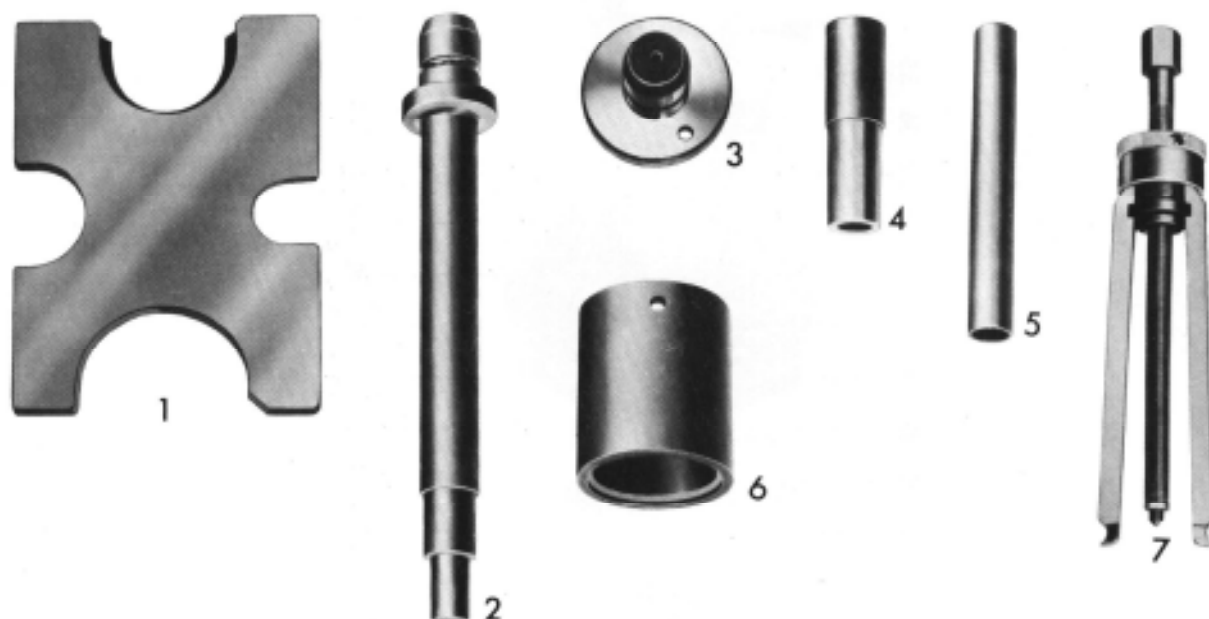


Installing the Brush Holder

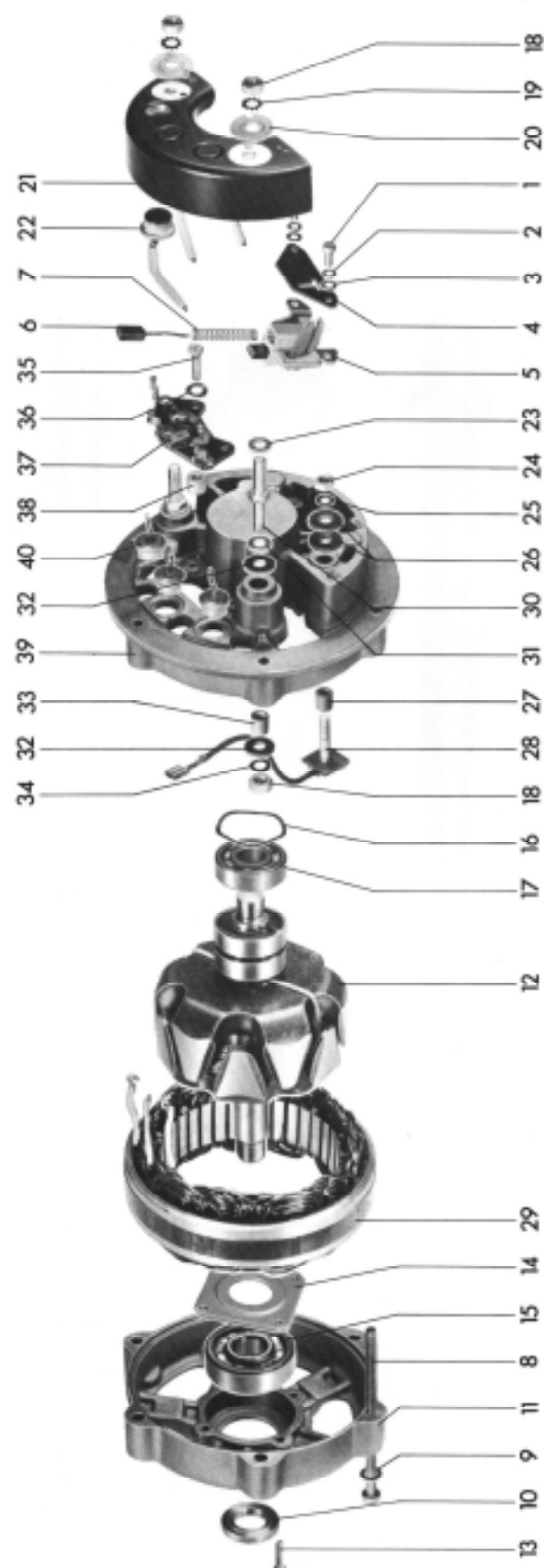
Pull up carbons prior to installation and arrest. Screw connecting line D+ to exciting diode carrier, watching out for correct layout of line (arrows).



TOOLS



Nr.	Description	Special Tool No.	Remarks
1	Plate	VW 402	
2	Block	VW 408 a	
3	Block	VW 412	
4	Pipe	VW 421	28 mm
5	Pipe	VW 423	21,5 mm
6	Thrust tube	VW 459/2	
7	Puller		Local purchase item



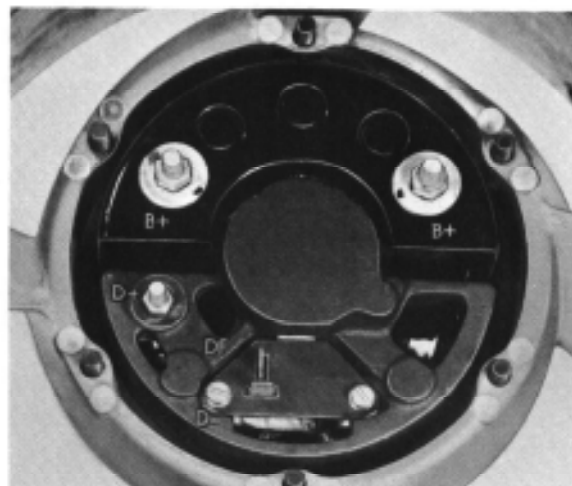
Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
1	Fillister head screw, M 4x10	2			
2	Lock washer	2			
3	Washer	2			
4	Fibre plate	1			
5	Brush holder plate	1		Replaceable only as complete unit with brushes.	
6	Brush	2		Not furnished as spare part.	
7	Spring	2			
8	Bolt, 6 x 110	6	Mark original location of drive bearing, housing and stator before disassembly.		
9	Lock washer	6			
10	Intermediate ring	1		Collar toward bearing.	
11	End plate	1	Press bearing out with VW 408 a.	Press in with VW 402, 412 and 423, making sure that no dirt enters the bearing on the slip ring side.	
12	Field rotor	1			9-1.8-1/8
13	Flat head screw M 4x15	4		Secure with paint after installation.	
14	Bearing cover	1		Depression faces field rotor.	
15	Ball bearing	1		Lubricate with BOSCH 1v33 or similar lubricant.	
16	Spring ring	1			
17	Ball bearing	1	Remove with puller	Use new bearing. Install with VW 402, 412 and 459/2.	
18	Nut, M6	4			
19	Spur washer				
20	Contact washer	2		Protrusion must rest in the hole of positive diode carrier.	

Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
21	Positive diode carrier	1			9-1.8-1/9
22	Positive diodes	3		Test after installation	9-1.4-1/3
23	Washer	2			
24	Nut M5	1			
25	Washer	1			
26	Insulating washer	2			
27	Insulating sleeve	1			
28	D+ terminal	1		Note location of wire in relation to exciter diode carrier.	
29	Stator	1	Do not damage windings.		9-1.8-1/7
30	B+ terminal stud M6	2			
31	Washer	2			
32	Insulating washer	4			
33	Insulating sleeve	2			
34	Lock washer	2			
35	Bolt M6	2			
36	Washer	2			
37	Exciter diode carrier	1	If one diode is faulty, replace complete carrier.		9-1.4-2/2
38	Spacer bushing	2			
39	Alternator housing	1	Before disassembling mark position in relation to end plate.		
40	Negative diodes	3	Mount alternator housing in vise. Drive diodes out with a punch.	Test after installation	9-1.8-1/9 9-1.4-1/3

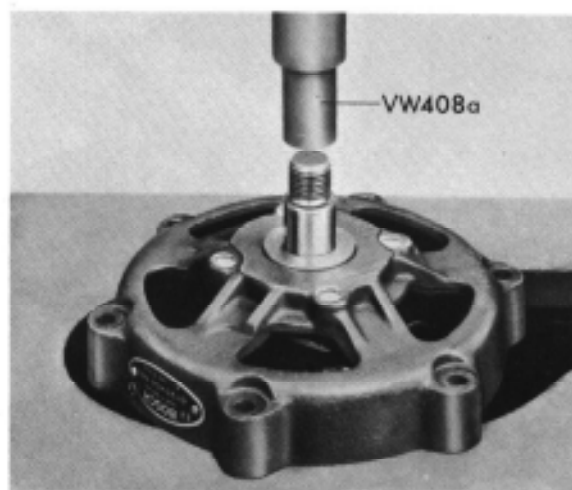
Alternator

Disassembling

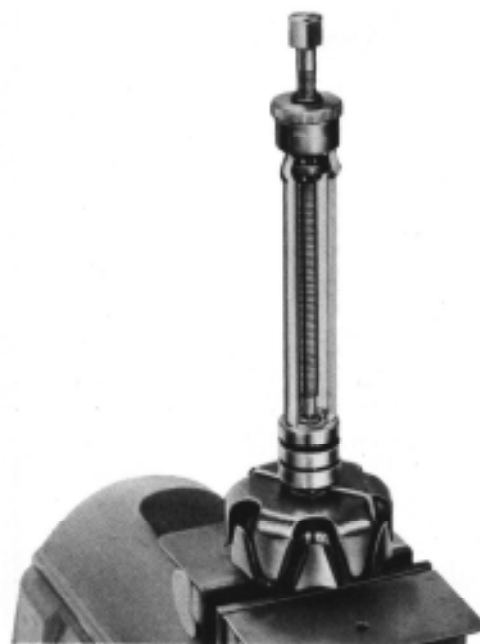
1. Mark the position of the end plate, housing and stator slip ring end to simplify reassembly. Remove retaining bolts.

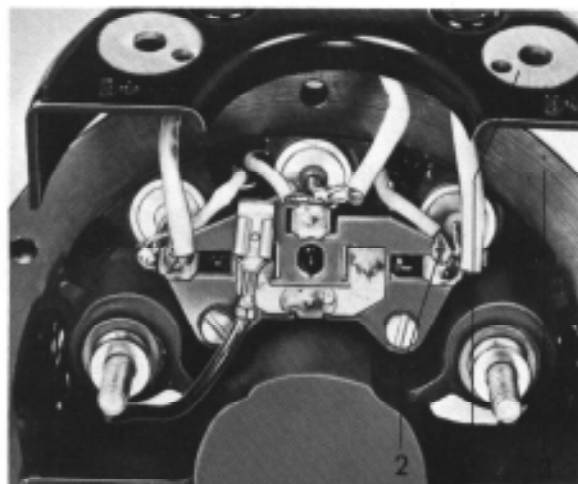


2. Press rotor out with VW 408 (hold rotor).



3. Remove slip ring end bearing with puller. Since pressure is applied to the outer race of the bearing during removal, the bearing cannot be reused.





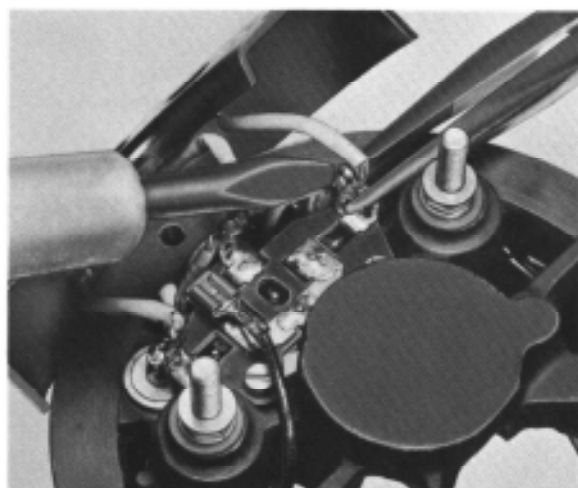
4. Test positive, negative and exciter diodes with diode tester before continuing disassembly (9-1.4-1/2, 1.4-1/3; D- matches the housing).

CAUTION

The positive diode carrier must not touch the housing since this will give incorrect readings.

Exciter diodes are not replaceable individually but only as a complete exciter diode carrier assembly.

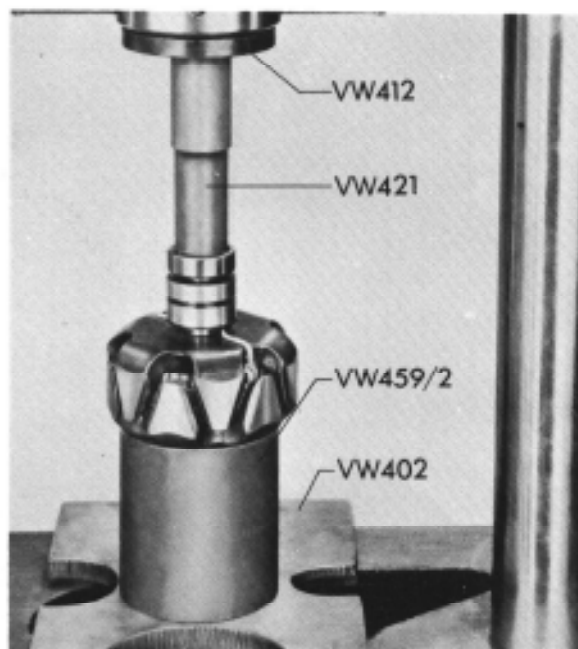
- 1 = B+
- 2 = Joining point
- 3 = D-



5. Loosen soldered terminal ends of positive diodes negative diodes, and stator from exciter diode carrier.

CAUTION

Use needle nose pliers as a heat sink to prevent heat damage (see illustration).

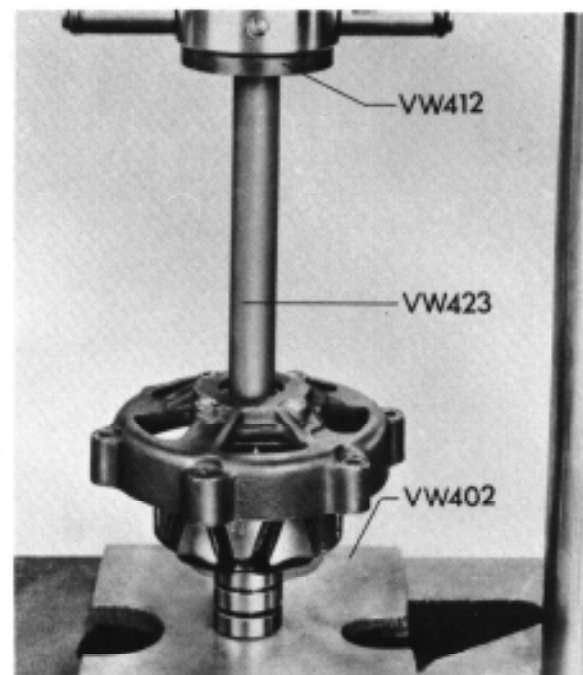


Assembling

See 9-1.8-1/7 to 9-1.8-1/9

1. Press the slip ring end bearing on.

2. Press the drive end bearing into place.



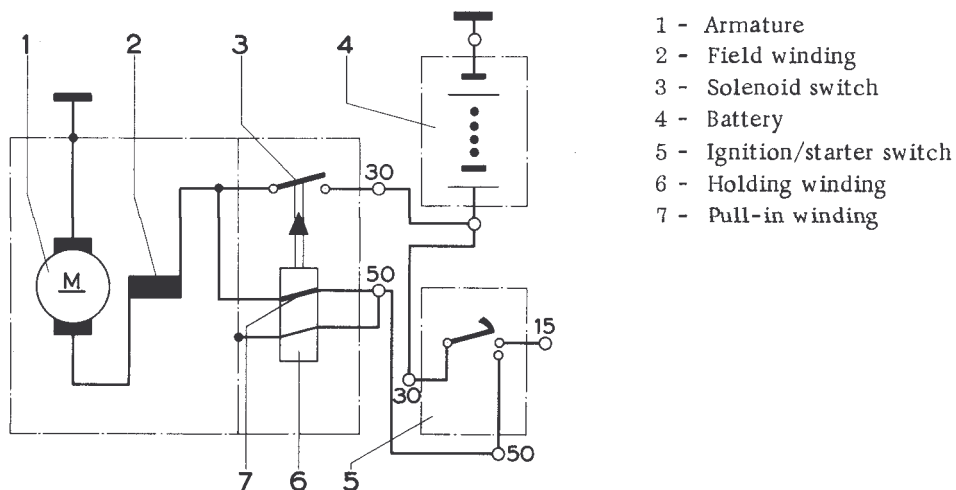
Starter Description

Engines have a starter with an overrunning clutch drive. This starter is a series-wound electric motor which draws a heavy current to deliver a high torque. It is secured to the transmission housing at the drive end.

When the ignition key is turned to the starting position, current is first supplied to the solenoid switch. The solenoid moves the shift fork which pushes the drive along spiral grooves on the armature shaft until the pinion engages the ring gear on the flywheel. At this time the circuit from the battery to the starter armature is closed and cranking begins.

When the engine has started, the ignition key is released and the starter circuit interrupted. The starter drive is disengaged from the ring gear by the return spring. If the key is not released immediately after the engine has started, the overrunning clutch in the drive will prevent damage to the starter.

When the engine is running, a non-repeat latch in the ignition switch prevents the starter from being operated. Before the starting operation can be repeated the ignition must be turned off.



Typ	From Chassis Number	Starter	Voltage u, Rated Power Output
914		003 911 023 A	12 V / 0,8 PS
914/6			

Testing Starter (in Installed Condition)

A faulty starter should first be tested at terminal 50 of the magnetic switch (control line) for the required voltage of at least 7 Volt for pulling. If the voltage is under that rating, the electric system, and in particular the lines of the starter circuit, must be checked.

Testing the starter for pull at full battery voltage can be done as follows:

- 1 - Lift vehicle
- 2 - Bridge terminals 30 and 50 on starter with a line (of at least 4 sq. mm section).

If the starter meshes perfectly, the fault is in the line to the starter. If the starter does not mesh, remove and check.

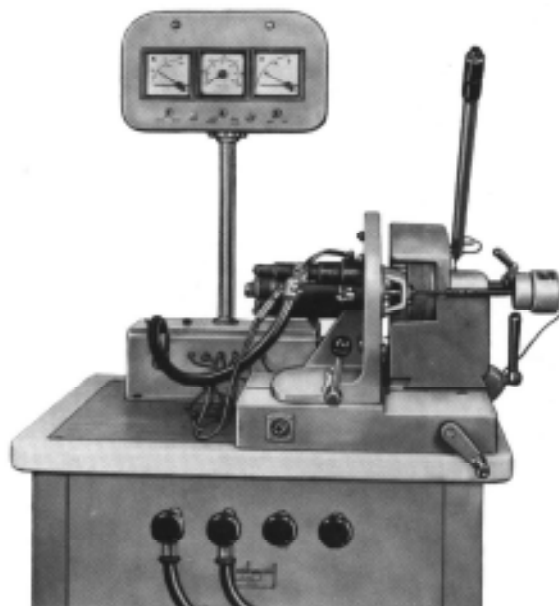
Testing the Starter (in removed Condition)

Function and output of the starter can be checked on a starter test stand. The following tests provide adequate information concerning the condition of the starter:

- 1 - Idling test
- 2 - Load test
- 3 - Short circuit test
- 4 - Meshing of pinion under load

The values of the test value chart refer to the use of 135 Ah battery. Be sure that no weaker battery is used on starter test stand.

The above test sequence should be maintained to prevent any faulty measurements by heating of the starter or battery discharge.



Idling Test

Place starter on test stand and adjust pinion for correct distance to ring gear of braking fixture. The meshed pinion should enter the flywheel teeth with its entire tooth width.

Connect starter - terminal 30 - to battery + and test stand control line to terminal 50 of magnetic switch.

During the idling test the starter is operated in such a manner that the pinion is in full mesh with the flywheel teeth and the flywheel is not braked. These measurements determine the speed, the power input and the battery voltage (refer to test values).

During idling operation, the starter speed should be high and the power input low. This will indicate that there is no winding or earth short circuit and that the armature rotates easily in its bearings.

Load Test

For the load test, the starter is braked from idling to a given speed (approx. 1,000 rpm) by means of the braking fixture of the test stand. During this test the power input and voltage are measured. The load test should not take longer than 10 seconds.

Insufficient battery voltage or an excessively heated starter will result in a lower speed.

This test also permits inspecting the pinion for proper meshing in and out. Under light braking the pinion should mesh in and out accurately when the starter is switched on or off.

Short Circuit Test

During the short circuit test the starter-driven flywheel is braked momentarily to a stop. The test should not take longer than 5 seconds.

The short circuit power input is a power rating for the break-away torque created by the starter. The torque depends on the power input.

Release brake immediately after reading the measured values. Switch off starter only then.

Testing the Magnetic Switch

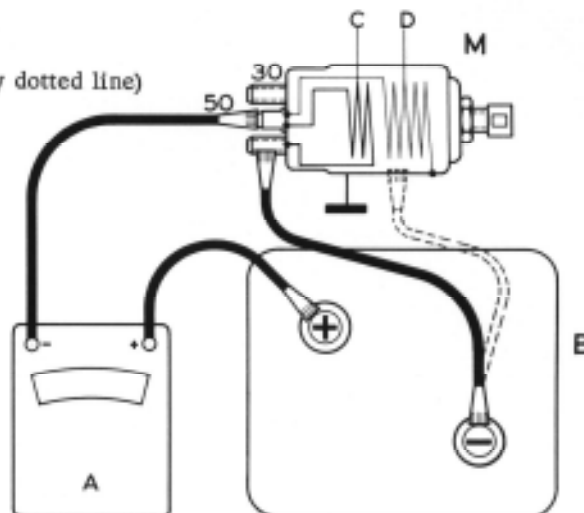
For judging the two coils of the magnetic switch only the power input need be measured. For this purpose, an ammeter and a battery are connected to the switch in accordance with the drawing.

The test values are listed in the test value chart E 2.4-1/1.

Magnetic switches with defective pulling or holding coil cannot be repaired.

- 1 - Testing the pulling coil
- 2 - Testing the holding coil, Battery negative pole is thereby placed against switch housing (shown by dotted line)

A - Ammeter
B - Battery
C - Draw-in winding
D - Holding winding
M - Magnetic switch



Starter Type	No Load Test		Load Test		Stall torque test		Solenoid pull-in Voltage volts
	Current amps	Voltage volts	Current amps	Voltage volts	Current amps	Voltage volts	
003 911 023 A	35 - 50	12	160 - 200	9	250 - 300	6	8

These values apply to a 12 Volt, 135 Ah battery (if necessary, connect batteries in parallel).
 All speeds pertain to the starter shaft.
 Testing temperature 20 °C (68 °F).

Test Data for Solenoid

Pull-in coil Hold-in coil	12 Volt Solenoid Current draw (amps)
	max. 35 amps max. 11 amps

Trouble	Cause	Remedy
Starter does not turn when starter switch is actuated	<p>Switch on light for test!</p> <p>a - Lamp does not light up. Cable or earth connection interrupted. Battery discharged</p> <p>b - Lamp lights up, but suddenly extinguishes when starter switch is actuated. Insufficient current flow as a result of loose or oxidized connections</p> <p>c - Lamp lights up, but is slowly getting darker when starter switch is actuated. Battery discharged</p> <p>d - Lamp lights up brightly. Bridge terminals 30 and 50 on starter; starter is running. Line 50 to starter switch is interrupted, starter switch defective</p> <p>e - Lamp lights up brightly. Magnetic switch pulls; Loosen battery cable from terminal 30 on starter and connect directly to contact screw for bridge connection. Starter begins to run. Contacts of magnetic switch worn or contaminated</p>	<p>a - Test battery cable and connections. Measure battery voltage and charge, if required</p> <p>b - Clean battery poles and terminals. Establish reliable connection between battery, starter and earth.</p> <p>c - Charge battery</p> <p>d - Repair brake, replace defective parts</p> <p>e - Replace magnetic switch</p>
Starter does not rotate when battery cable is placed directly against contact screw to bridge connection	<p>a - Carbons bind</p> <p>b - Carbons worn</p> <p>c - Springs slack, carbons suspended</p> <p>d - Collector contaminated</p> <p>e - Collector scored or burnt</p> <p>f - Armature or field coils defective</p>	<p>a - Clean carbons and guides of brush holders</p> <p>b - Replace carbons</p> <p>c - Replace springs</p> <p>d - Clean collector</p> <p>e - Recondition starter armature</p> <p>f - Recondition starter</p>
Starter rotates too slowly or does not crank engine	<p>a - Battery discharged</p> <p>b - Insufficient power flow as a result of loose or oxidized connections</p> <p>c - Carbons bind</p> <p>d - Carbons worn</p> <p>e - Collector contaminated</p> <p>f - Collector scored or burnt</p> <p>g - Armature or field coils defective</p>	<p>a - Charge battery</p> <p>b - Clean battery poles and terminals, tighten connections</p> <p>c - Clean carbons and guides of brush holders</p> <p>d - Replace carbons</p> <p>e - Clean collector</p> <p>f - Recondition starter armature</p> <p>g - Recondition starter</p>
Starter meshes and pulls, engine does not rotate or only in jerks	<p>a - Drive pinion defective</p> <p>b - Ring gear on flywheel defective</p>	<p>a - Replace drive pinion</p> <p>b - Refinish ring gear or replace flywheel, if required</p>
Drive pinion does not mesh out	<p>a - Drive pinion or threads contaminated or damaged</p> <p>b - Magnetic switch defective</p>	<p>a - Recondition starter</p> <p>b - Replace magnetic switch</p>

Removing and Installing Starter

Caution

Disconnect battery ground strap before removing and installing starter.

Type 914

The starter is fastened by two bolts. The upper bolt is accessible from the engine compartment (engine/transmission mounting bolt).

Note the following during installation:

1. Place the long mounting bolt into the mounting bracket hole and together with starter into the transmission housing.
2. After installation, seal the contact surface of the mounting bracket and transmission housing with VW D3 sealing compound or similar.
3. Make sure connections are clean and tight.

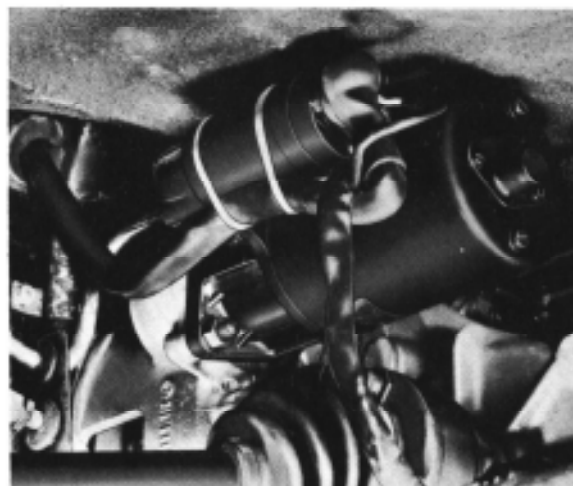
Type 914/6

1. Disconnect battery ground strap and remove cable from starter.
2. Remove upper retaining bolt of starter using Allen head socket drive adaptor, U-joint, and extension bar (upper bolt is an 8 mm Allen head type).

Note

It may be necessary to slightly lower the transmission/final drive assembly.

After installation, fasten starter cable to solenoid housing with a hose clamp.



Removing and Installing Solenoid (Starter removed)

Removing

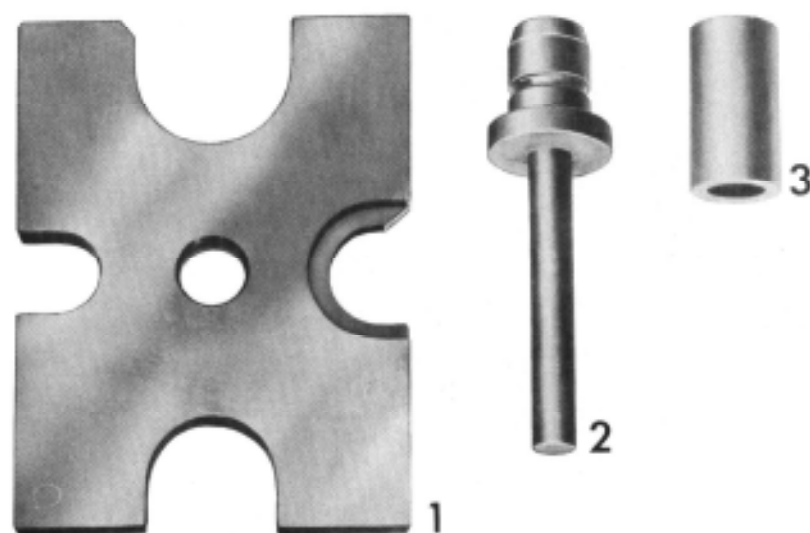
1. The solenoid switch pull rod can be pulled out of the operating lever easier if the pinion is pulled forward and to the right at the same time.
2. A faulty solenoid switch should be replaced.



Installing

1. Make sure rubber gasket on starter mounting bracket is properly seated.
2. Pull operating lever as far back as possible to allow installation of solenoid switch.
3. Seal joint between solenoid switch and mounting bracket with D 3 sealing compound.

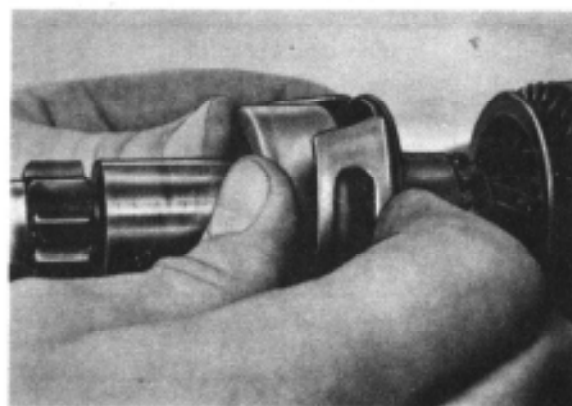
TOOLS



Nr.	Description	Special Tool Nr.	Remarks
1	Thrust plate	VW 401	
2	Punch	VW 411	
3	Tube	VW 418a	31,5 mm (1,24 in) dia.

No.	Description	Qty.	Note when		Special instructions see
			disassembling	assembling	
1	Nut	1			
2	Lock washer	1			
3	Screw	2			
4	Molded rubber	1		insert tongue of rubber into cutout in pole housing	
5	Disc	1			
6	Solenoid	1	pull pinion toward front	test current consumption of switch and check that core moves freely. Seal.	9-2.6-1/2 9-2.6-1/2
7	Solenoid return spring	1			
8	Fillister head screw	2			
9	Washer	2			
10	End cap	1		seal	9-2.7-1/6
11	Sealing ring	1	if damaged, replace		
12	C-washer	1			
13	Shim		note quantity of shims	adjust armature axial play to .004-.006 in. (0.1-.15 mm)	
14	Housing screws	2		seal with housing sealing compound D 3	
15	Washer	2			
16	End plate	1	check bushing, replace if necessary, use VW 401, 411 and 418a	ground connection to pole housing must be clean. Seal after installing.	
17	Brush holder	1		ensure correct position of retainer and good ground connection to end plate.	
18	Negative carbon brush	2	check for broken, dirty or unsoldered brushes.	brushes must be able to move slightly in holder. Replace only in sets.	
19	Positive carbon brush	2			
20	Retaining spring	4	lift with wire hook	brush pressure approx. 2.6 lb. (1200 grams)	
21	Rubber grommet	1		ensure good sealing	

No.	Description	Qty	Note when		Special instructions see
			disassembling	assembling	
22	Pole housing	1		ensure good ground connection between end plate and drive end plate.	
23	Field winding			test for open circuit, replace burnt winding	
24	Insulating washer	1		bears against brush holder	
25	Thrust washer	1		bears against commutator	
26	Armature	1	radial runout .002 in. (0.05 mm), minimum diameter 1.318 in. (33.5 mm), if necessary undercut segment insulation .031 in. (0.8 mm).	test for short circuit to ground, check soldered locations between segments and tabs. Install armature and engaging lever.	
27	Operating sleeve	1			
28	Engaging lever	1		if engaging lever bent, fit new one.	
29	Engaging spring	1			
30	Detend balls	10		Insert with lithium grease	
31	Drive pinion	1			
32	Pin	1			
33	Lock washer	1			
34	Nut	1			
35	Drive end plate	1		seal joint between solenoid switch and pole housing.	9-2.7-1/5



Removing Overrun Clutch

1 - Removing drive pinion:

Press operating sleeve against drive pinion and pull both off armature shaft by turning them slightly.

2 - Installing drive pinion:

Hold armature in vise, then push drive pinion and operating sleeve on armature shaft until the balls locate in the detent in the armature shaft. After releasing the drive pinion it must move freely on the armature shaft.

3 - Testing armature and field winding:

Damage to the armature and to the field windings is not often visible. The armature, commutator and field windings are tested as on the DC generator. The windings must not be turned or unsoldered and they must not project above the pole shoes. Check windings for breaks, particularly at the connections.

4 - Check brush holder for short circuit.

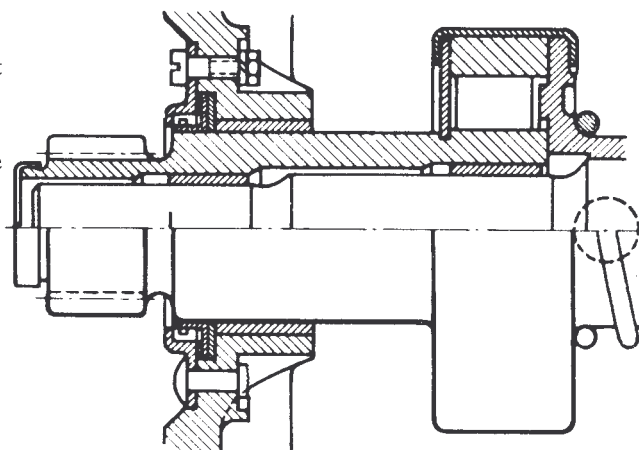
5 - Check armature for winding short circuit and/or short circuit to ground.

6 - Starter bushing:

Worn bushings must be replaced. The bushing must be flush on the inside. Use a suitable drift to press the bushing in and out.

When replacing the sintered metal bushing and the seal, the rivets in the mounting should be replaced by screws. Peen the screws.

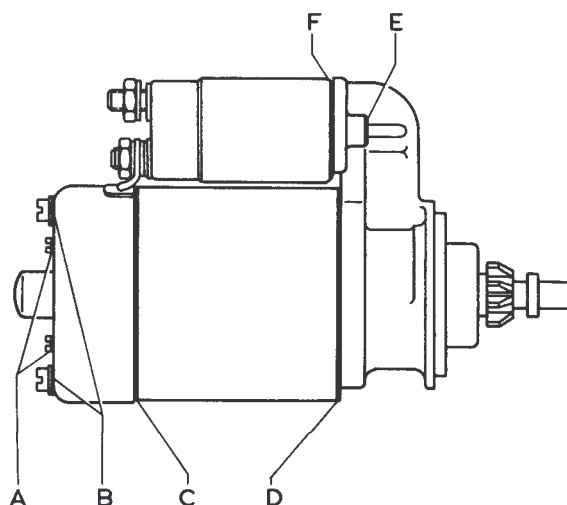
- 4 Fillister head screws M 4 x 10
- 4 Lock washers
- 4 Nuts



7 - Center the seal with a centering pilot.

8 - To prevent damage due to water, the following locations should be sealed with VW housing sealing compound D 3

- A - Holes for end cap screws.
- B - Holes for housing screws.
- C - Joint between pole housing and end plate.
- D - Joint between pole housing and mounting bracket.
- E - Holes for solenoid switch screws.
- F - The sealing surface between solenoid switch and mounting bracket should be sealed with VW plastic sealing compound D 14.



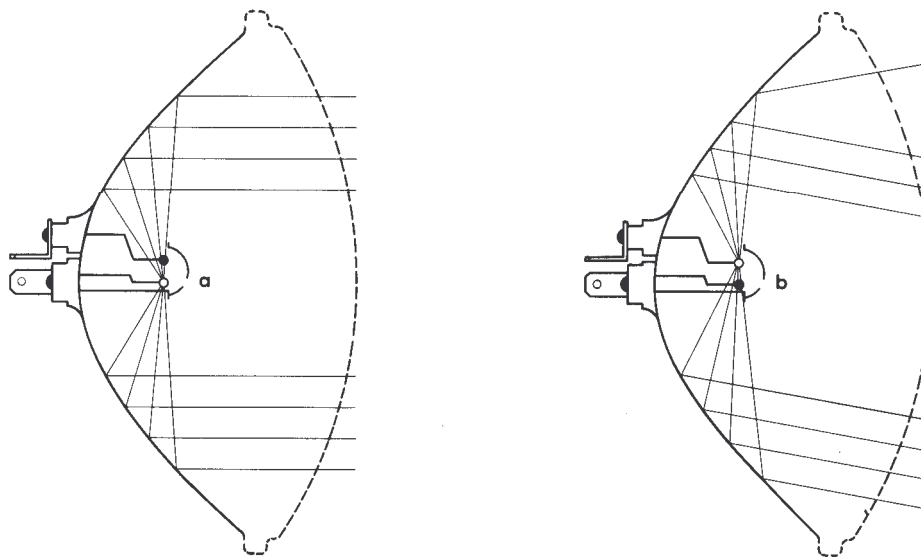
Sealed Beam Headlights

The reflector, filament, and lens are incorporated in a single unit.

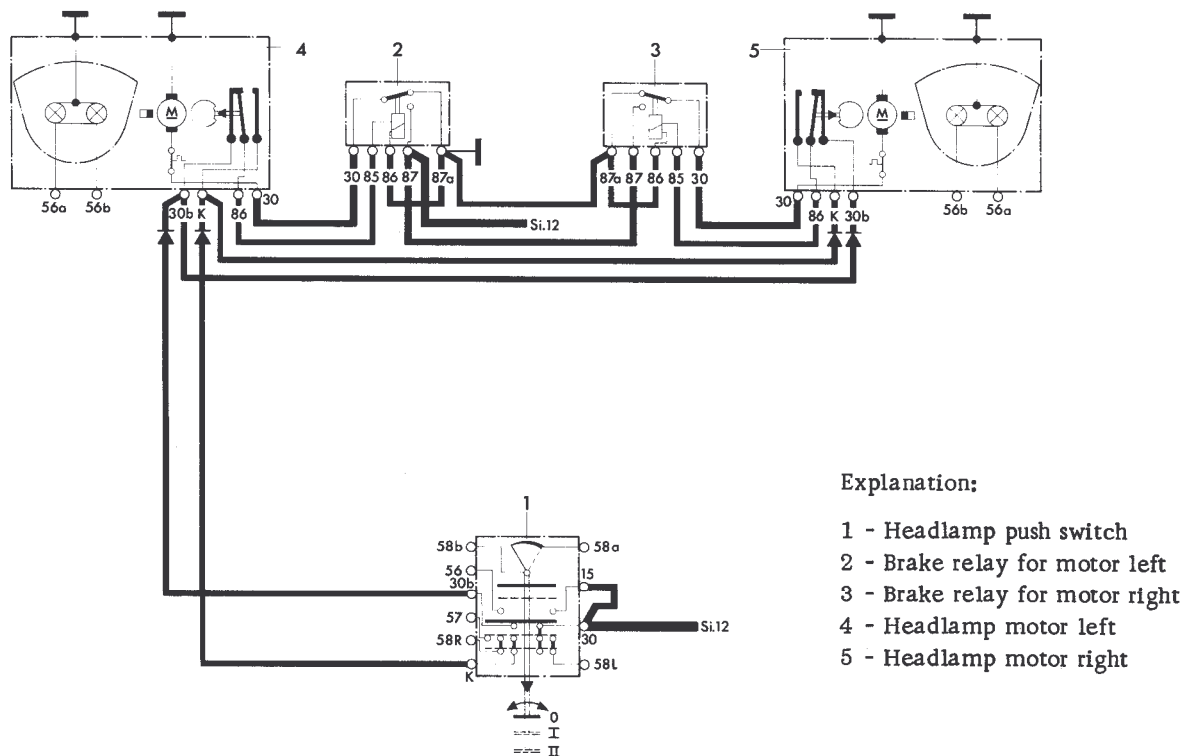
In the low beam, the filament is located above and to the right of the focal point. The reflecting zone located behind the focal plane directs the light upward. For this reason, only flat reflectors of greater focal length can be utilized. The sideward positioning of the filament has the effect of directing the light rays toward the right side of the road to increase its illumination.

a = High beam

b = Low beam



Headlamp Motor Circuit



Function

The headlamp push switch is provided with an additional changeover contact (terminals 30-30b and 30-K). When the headlamp switch is actuated (position I parking light or position II main beam) its terminal K is connected to terminal 30 and terminal K of both motors is therefore connected to positive voltage. The two slide contacts K and 86 of the motors then permit the two brake relays to attract.

Their contacts 87 and 30 will start the motors. They will run for half a rotation and will thereby open the headlamp flaps. The switch segments installed in the motors will thereby arrive at a position in which the slide contacts 86 can no longer receive voltage from contact K and the relays will drop out. The relays will then close their normally inoperative contacts 30-87 a and will thereby connect terminal 30 of the motors to earth. The motor armatures are now short-circuited. As long as the motor armatures are still in rotation, their short-circuited windings will induce a current, with its magnetic field opposing the field of the permanent magnet (field magnet of motor). This will result in a braking effect which will cause the armatures to stop immediately. When the headlamps are switched off, terminal 30b of the headlamp switch receives a positive voltage. As a result, the terminals 30b of the headlamp motors are also energized. Since the motors have rotated by half a revolution from their inoperative position into the position, in which the headlamps are exposed, the switch segment of the motors is in a position in which the sliding contacts 30b and 86 are bridged. The brake relays can now attract and the motors are energized for running half a revolution.

The switch segment will then be again in its inoperative position, this means, that there is no longer a connection between the slide contacts 30b and 86. The brake relays will drop out and will brake the motors by short-circuiting their armature windings as already explained above.

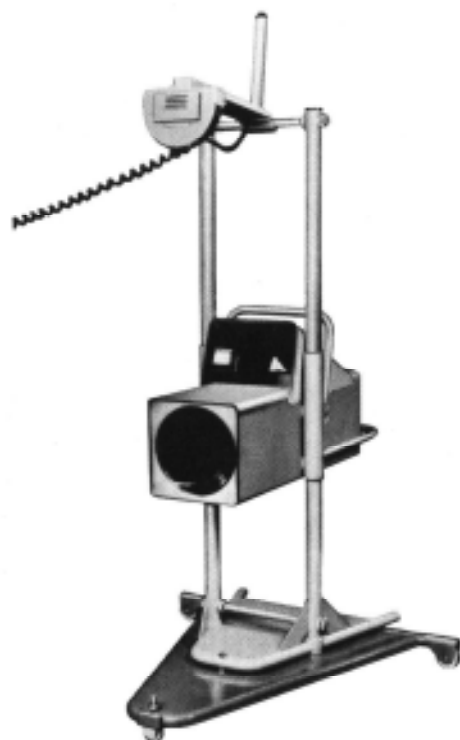
H 4 - Headlamps

Beginning with 1973 models, Type 914 vehicles are optionally equipped with the halogen H4 headlamps, providing that regulations do not prohibit their use in the given country of destination.

The H4 lamp is designed in the conventional way, that is, both filaments (high and low beam) are accommodated in a common bulb. The power rating is 60 watts for the high beam and 55 watts for the low beam. Halogen lamps have approximately twice the light density of the conventional automobile bulbs. This provides a much better illumination of the roadway, although the possibility of blinding oncoming vehicles is also considerably greater.

To keep the blinding aspect at a minimum, H4 headlamps must be equipped with more exactly designed lenses and reflectors. It is also not permissible to install the H4 bulbs into headlamps of conventional design. For this reason, the base of the H4 bulb has been so designed, that it can be used only in the H4 headlamp units.

Subsequent installation of the H4 headlamps in Type 914 and 914/6 vehicles is possible, providing that instructions given on page 3.2-2/3 are followed. Conversion is permissible in pairs only.



Nr.	Description	Special Tool No	Remarks
1	Aiming device		
2	Multiple cross wrench	VW 674/1	Local purchase item

Retractable Headlights

Removing

- 1 - Turn on the lights so that the headlights pop up.
- 2 - Disconnect battery ground strap.
- 3 - Remove three retaining screws from the fiber-glass shroud and lower shroud.
- 4 - Remove the three lamp retaining screws (see arrows), Do not remove the two adjusting screws. Remove plug and take out lamp.

Installing

Install in reverse order.



Retractable Headlight Motor

Removing

- 1 - Raise headlights by hand, using wheel in tool kit.
- 2 - Remove actuating lever from motor. Use a puller if necessary.
- 3 - Remove three headlight motor retaining screws and withdraw motor.
- 4 - Remove ground screw.
- 5 - Headlight motor wiring color code: red to red, blue to grey, black to green.

Note

The headlight motor cannot be repaired.



Installing

The headlight motor must be brought into the headlight raised position before installation.

Connect the brown wire (with connector) to ground. Connect hot (positive wire) to the red and blue wires at the same time. The motor will run to the "raised" position and stay in that position.

If the motor should not run, determine if it already was in the "raised" position. This can be done by connecting a hot wire to the black and red wires at the same time. This causes the motor to run to the "lower" position; reconnect wires to bring the motor back to the "raised" position.

The relay switch, Part Number 901.615.109.01, must be in its socket during this procedure. See illustration for position of the actuating lever.



Retractable Headlamps

Removal

- 1 - Running retractable headlamps up by actuating the headlamp switch.
- 2 - Disconnect battery earth connection cable.
- 3 - Loosen three screws of front panelling (plastics) and remove panelling.
- 4 - Loosen two screws of rear panelling and remove.
- 5 - Remove rubber cover on bulb socket and pull lines from contacts.
- 6 - Loosen three screws of headlamp (arrows) - not the two adjusting screws - and then remove headlamp.



Installation

Proceed vice versa for installation. Connect lines according to wiring diagram.

Retractable Headlamp Motor

Removal

- 1 - Run retractable headlamp completely up by means of hand wheel (arrow) (service tools).
- 2 - Pull crank from retractable headlamp motor, use Kuko puller, if required.
- 3 - Unscrew three fastening screws for headlamp motor and remove headlamp.
- 4 - Loosen earth connection screw.
- 5 - Connection of headlamp cables: red to red, blue to grey, black to green.



The headlamp motor cannot be repaired.

Installation

Put motor into "up" position of headlamps prior to installation - proceed as follows: Connect minus to brown line (cable shoe), plus simultaneously to red and to blue line. Motor will run into its end position and remain there automatically. If the motor does not start, see if it has been in its end position already. This is done by connecting plus to both, the black and the red line, which will cause the motor to run into the position "down". Then let engine run again into position "up". For this purpose, the standard relay, spare part No. 901 615 109 01, must be inserted into the relay holding bracket. For position of crank refer to illustration.

H4 - Headlamps

This headlamp does not differ from the formerly used type in outside dimensions, mounting, or adjustment specifications. The headlamps should always be adjusted with greatest care and with the aid of an optical headlamp adjuster.



Replacing H4 Headlamp Bulb

- 1 - Remove headlamp
- 2 - Withdraw 3-pole connector
- 3 - Push dust boot back
- 4 - Disengage retaining springs and take the bulb out.

Make sure that the bulb is properly seated upon reassembly. The glass sphere must be completely clean and free of grease; always hold the bulb by its base only.

Note the following points when converting vehicles to the H4 headlamp system:

The formerly used black rubber dust boot must be replaced with a red one (better heat resistance). Also, only the polyamide-colored 3-pole connector may be used. The formerly used, transparent connector must be replaced.



Halogen Driving Lamps

Removal

- 1 - Remove front bumper and grill (see Group 8).
- 2 - Remove lamp retaining screw and take lamp out
- 3 - Remove reflector retaining screw. Withdraw reflector from lamp housing and detach wires.

Installation

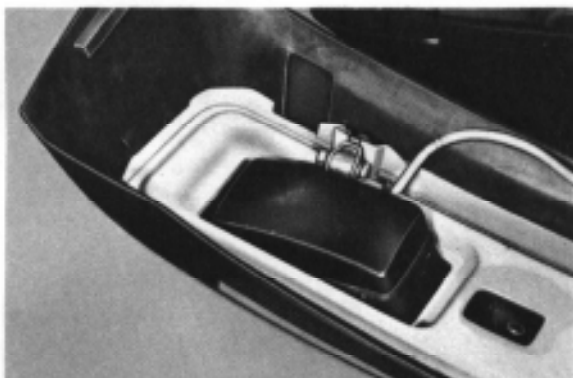
Install in reversed order of the above, subsequently adjusting the lamps (see page 3.2-10/1).

Removing and Installing Halogen Driving Lamp Bulbs

- 1 - Remove reflector retaining screw (accessible through depression in bumper, below lamp) and withdraw reflector from lamp.
- 2 - Unsnap bulb retainer and take bulb out.

When installing the bulb make sure that the locating pins come to rest in their seats in the bulb socket.





AUXILIARY DRIVING LIGHTS OR FOG LIGHTS - 1975 MODELS

Removing and Installing

- 1 - Remove bumper (see Group 8).
- 2 - Remove lights from bumper.



Loosen mounting screw at base of light to aim lights. It is accessible through the square opening underneath the bumper

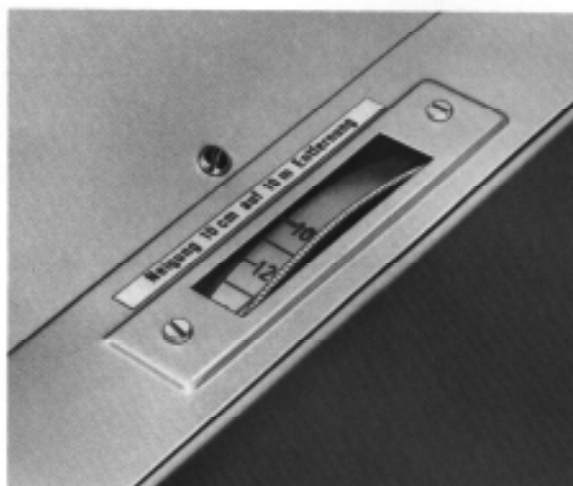
Aiming Headlamps with Headlamp Adjuster (Rail Type)

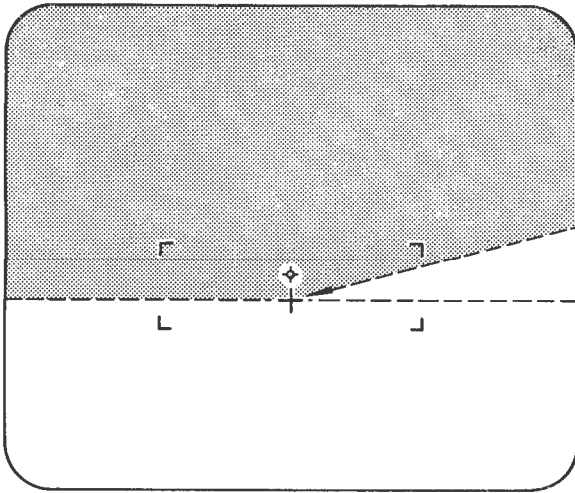
When using headlamp adjusters of other makes, the operating instructions of the manufacturer must be observed. Headlamp adjustments obtained with such equipment must meet legal regulations.

Headlamps with Asymmetric Dimmer:

Complete adjusting steps in the sequence below:

- 1 - Position vehicle as vertically as possible in relation to adjuster.
- 2 - Check specified tire pressure and correct, if required.
- 3 - Load vehicle with one person or 70 kg (154 lb) on driver's seat.
- 4 - Push vehicle back and forth several feet so that suspension conforms to load conditions.
- 5 - Move adjuster in front of the headlamps and set distance between the focusing lens in the optics carrier and the headlamp to approx. 250 mm (10 in.).
- 6 - Move adjuster in front of the vehicle center and switch on light beam projector.
- 7 - Direct light beam left and right to one prominent point of vehicle each (for example upper edges of retractable headlamps). The aiming is done by loosening the pedal lever on the column guide.
- 8 - Move adjuster in front of headlamp and align to headlamp center. The deviation of the optical axis (headlamp - optical carrier) may amount to max. 30 mm (1.18 in.) vertically or laterally. Set inclination of headlamp on scale of knurled disk to 10.
- 9 - Adjust headlamps with dimmer switched on. Corrections with high beam engaged are not permitted. Remove front plastic cover on headlamp.





A - Vertical Adjustment

Adjust headlamps vertically in such a manner that the border line between light and dark runs at the left of the adjusting cross horizontally on the adjusting line.

B - Lateral Adjustment

Adjust headlamps laterally in such a manner that the border line between light and dark runs along the sloping line (15°) and the break in the border between bright and dark is accurately in the center of the focusing cross.

Note:

With the border line between bright and dark of the dimmer accurately positioned, the center of the high beam should be on the focusing cross. The permissible deviation is 10 mm (0.4 in.) to the right and left, 7 mm (0.28 in.) toward the top and 5 mm (0.2 in.) to the bottom.

Halogen High Beam Headlamps

The high beam is adjusted with the retractable headlamps covered. In addition, the general instructions on page 9 3.2-10/1 apply.

Align adjuster to center of high beam. Set inclination scale to 10. The center line of the high beam should be against the upper focusing cross, that is, when the luxmeter indicates max. light intensity. The high beam radiates parallel to the lane.

Halogen headlamps can be adjusted vertically only, not laterally.

Measuring the Light Intensity

The adjuster is provided with a luxmeter to measure the light intensity. Measurements in lux light units must be made immediately after inspecting and aiming the headlamps, because the headlamp adjuster should not be readjusted for that purpose.

Light Intensity for Dimmer

- 1 - Push button on luxmeter. The dimmer range of the measuring unit is switched on. The needle of the luxmeter should remain in the green range. If it is in the red range of the scale, the light intensity is above the permissible rating for the dimmer.



- | | |
|-----------------|-------------------------|
| 1 - Push button | 3 - Scale for high beam |
| 2 - Luxmeter | 4 - Scale for dimmer |

Light Intensity for High Beam

(in Retracting Headlamps and in Halogen Headlamps)

- 1 - Adjust headlamp adjuster in such a manner that the center of the light beam strikes exactly against the photo-electric diode of the luxmeter (directly behind the upper focusing cross of the measuring screen). The unit is correctly adjusted when the luxmeter indicates the max. light intensity.
- 2 - The headlamps are in order when the needle of the luxmeter is in the green scale range when measuring.

When the green scale range is not attained, check headlamp system.

Faults in Headlamp System

a - Excessive Voltage Drop

If in spite of accurate aiming of the headlights, the light effect is insufficient, check the voltage on the headlamp connections. The reason for weak headlamps is often an excessive voltage drop caused by loose line connections, defective switch contacts or bad earth connection. The fusebox can also be the cause of excessive voltage drop as a result of corroding transition points between the fuse and the holder. At a voltage drop of only 10 % the light intensity will drop by approx. 30 %. The voltage drop in the headlamp lines should generally not exceed 0.6 Volt.

b - Bulb not in Order

Another cause of unsatisfactory light may be the position of the filament in the bulb. The bulb or the socket can also be badly inserted.

Aiming Headlamps without Adjuster

The headlamps can be aimed by using an adjustable, vertical surface. The test surface should be light in colour and must be provided with markings for the centers of the headlamps and a marking for the border line between light and dark.

Headlamps with Asymmetric Dimmer (in Retractable Headlamps)

Observe the following instructions prior to and while completing adjustments:

- 1 - Position vehicle 5 m (16.5 ft.) from test surface on level ground.
- 2 - The test surface should be vertical in relation to the direction of driving and the separating line should be parallel to the base of the vehicle.
- 3 - The tires should be inflated to the specified pressure.
- 4 - Move vehicle several feet back and forth to settle suspension.
- 5 - Check headlamps individually. Always cover the other.
- 6 - Aim headlamps vertically and laterally with the dimmer switched on.
- 7 - Load vehicle with one person or 70 kg (155 lb.) on driver's seat.

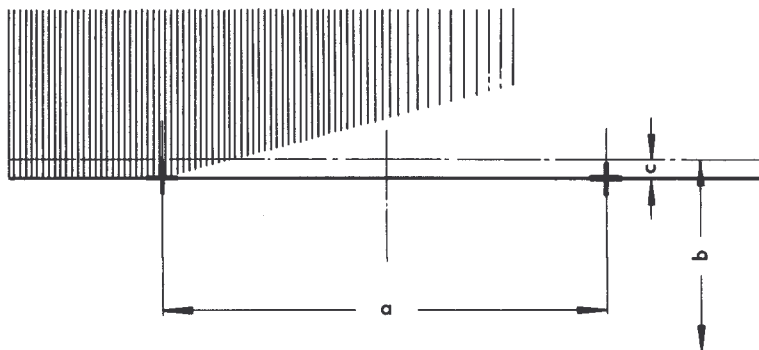
Aim headlamps with the dimmer installed.

a - Vertical Adjustment

Aim headlamps vertically in such a manner that the border line between light and dark to the left of the focusing cross proceeds horizontally along adjusting line.

b - Lateral Adjustment

Aim headlamps laterally in such a manner that the border line between light and dark proceeds alongside the sloping line (15°) and the break of the border line between light and dark is accurately in the center of the focusing cross.



- a - Distance from center to center of retractable headlamps = 1,070 mm (42 in.).
- b - Height of headlamp center from ground (separately determined for each vehicle).
- c - 1 % of distance, wall to vehicle, at 5 m (16.5 ft.) distance = 5 cm (2 in.).

Halogen High Beam Headlamps

The high beam is adjusted with the retractable headlamps covered. In addition, the general instructions 9 3.2-13/1 apply.

When adjusting the high beam, dimension c of the drawing on page 9 3.2-13/1 is not applicable. The center of the high beam is at the intersection of the height of the high beam center from the ground, dimension b (newly determined in each case) and the distance of the two high beam headlamps - 1130 mm (44.5 in.).

Note:

The high beam headlamps are adjustable only in height, but not laterally. Loosen fastening screw of headlamps for making adjustments.

Description

The front blinker and side marker lamps are installed in the front side members. The rear blinker lamps are in the brake-blinker-tail lamps. The blinker switch with automatic cancellation is installed in the steering column switch (914) or in the BAL-switch (914/6). When the blinker switch is actuated with the ignition switched on, the electronic blinker warning lamp relay controls the pulses for the blinker lamps. In combination with a special warning lamp switch this relay permits the simultaneous switching of all the blinker lamps on the vehicle, independent of the position of other switches and also while driving.

If the blinker switch is actuated with the ignition disengaged, either the lefthand or the righthand side marker lamps are on (parking lamp).

The two indicating lamps for the blinker system are installed in the time clock. They indicate, which directional blinker is switched on. With the warning lamp system switched on, one indicator lamp in the pull knob of the warning lamp switch indicates the function of the warning lamp system. When the warning lamp system is actuated with the ignition switched on, the indicator lamp for the blinker system in the speedometer will light up.

The separate turn signal lamps have been discontinued effective with the 1974 models.

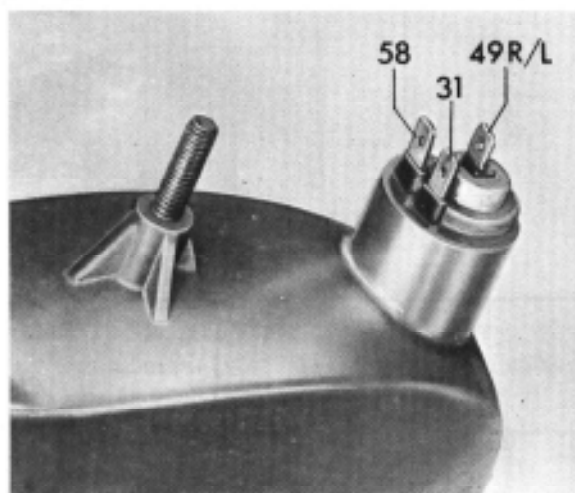
The turn signal indicator, located in the tachometer unit, lights up whenever the right or left turn signals are actuated.

Blinker and Side Marker Lamps Front



No.	Designation	Each	Observe during		Special Instructions refer to page
			Removal	Installation	
1	Cheesehead screw	2			
2	Window	1			
3	Rubber seal	1		Glue with original VW profiled rubber glue	
4	Bulb 12 V/21 W	1			
5	Bulb 12 V/5 W	1			

No.	Designation	Each	Observe during		Special Instructions refer to page
			Removal	Installation	
6	Lamp carrier	1			
7	Fastening clamp	1			
8	Spring washer	1			
9	Washer	1			
10	Hex. nut	1			3. 3-2/3



Earth contact (31)
Side marker lamp contact (58)
Blinker lamp contact (49 R/L)

Blinker and Side Marker Lamp Removal and Installation

- 1 - Loosen two screws of window and remove.
- 2 - Loosen screw nut (SW 10) inside fender. Pull off spring ring and washer.
- 3 - Remove fastening clamp.
- 4 - Pull out blinker and side marker lamp in forward direction. Pull rubber sleeve and line from socket.

Proceed vice versa for installation. Spray contact lugs with contact spray, if required. Lamp sockets are not exchangeable.

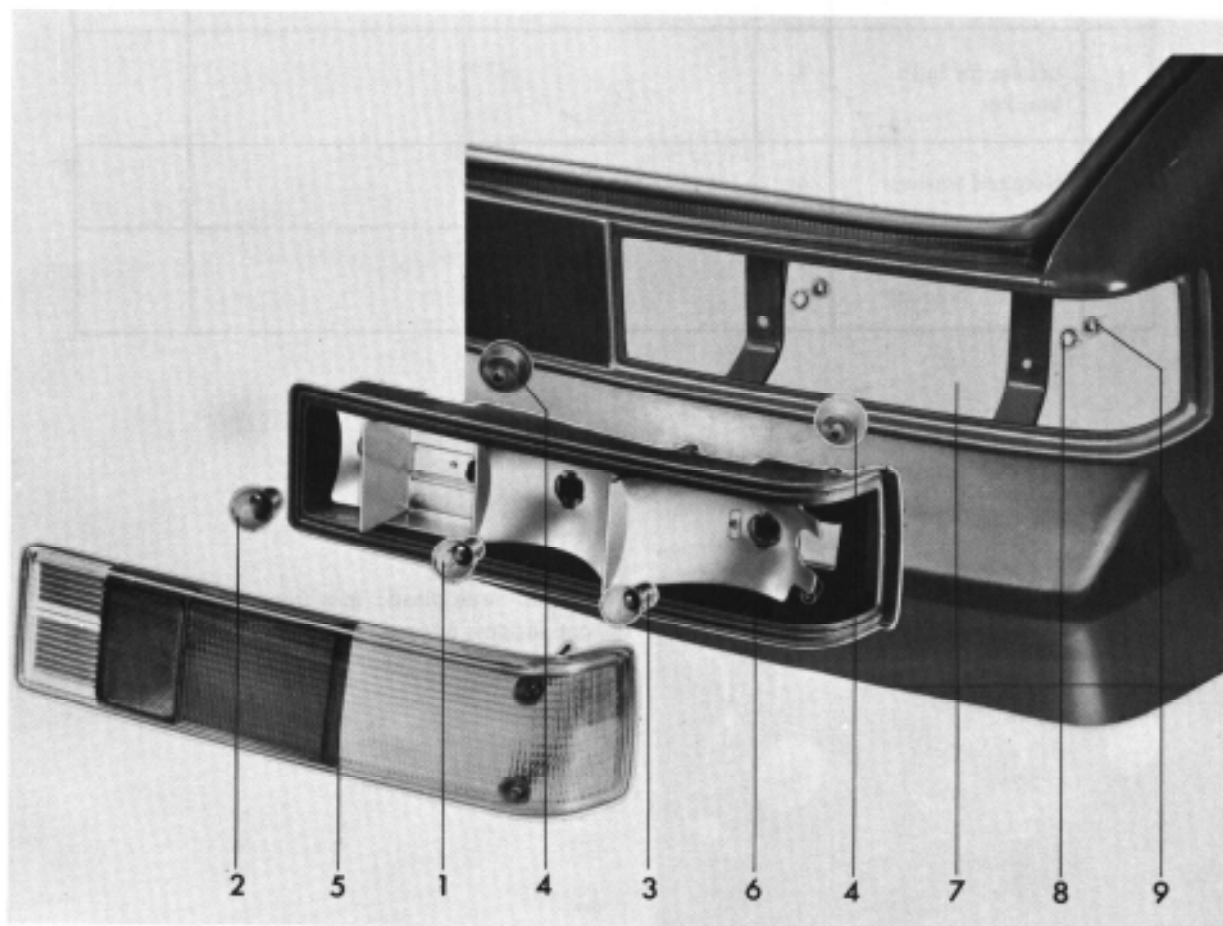
Brake, Blinker and Tail Lamps with Backup Lamps

The two triple chamber tail lamps (SBBR) with built-in backup lamps are installed in the rear side members and the rear end panel.

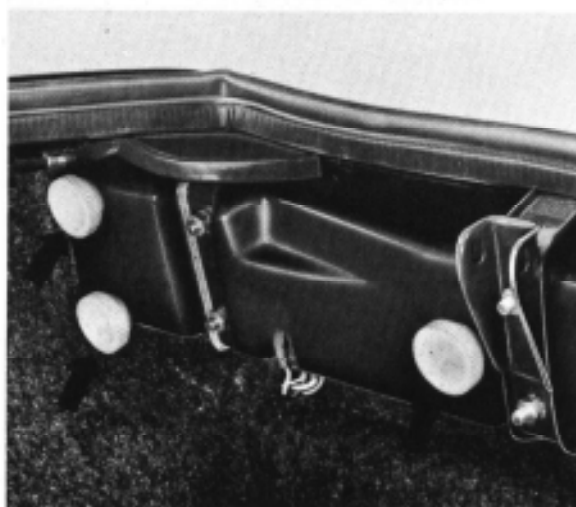
- 1 - Backup lamp
- 2 - Reflector
- 3 - Parking and brake lamp
- 4 - Blinker lamp



The illustration shows the righthand tail lamp, the lefthand tail lamp is a mirror image.



No.	Designation	Each	Observe during		Spec. Instr.
			Removal	Installation	
1	Bulb for brake and parking lamp SL 12 V/21/5 W	1	Do not touch reflectors	Watch out for good contact; install only bulbs as indicated by bulb bracket	3.4-1/3
2	Bulb for backup lamp RL 12 V/21 W	1			
3	Bulb for blinker lamp (yellow) E 12 V/25 W	1			
4	Plastic nuts for window attachment	3		Tighten carefully	
5	Window for SBRR lamps	1		Watch out for good seat of rubber seal	
6	Bulb bracket	1	Pull off lines, loosen 4 fastening nuts	Rubber seal for window should fit well	
7	Recess for bulb bracket	1			
8	Notched washers	4			
9	Fastening nuts for bulb bracket	4			



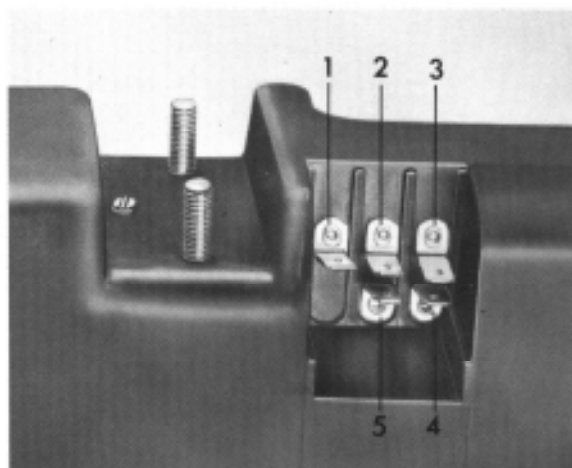
Replacing Bulbs

Loosen three plastic nuts from trunk end and pull out window toward the rear.

Installation of Bulb Bracket

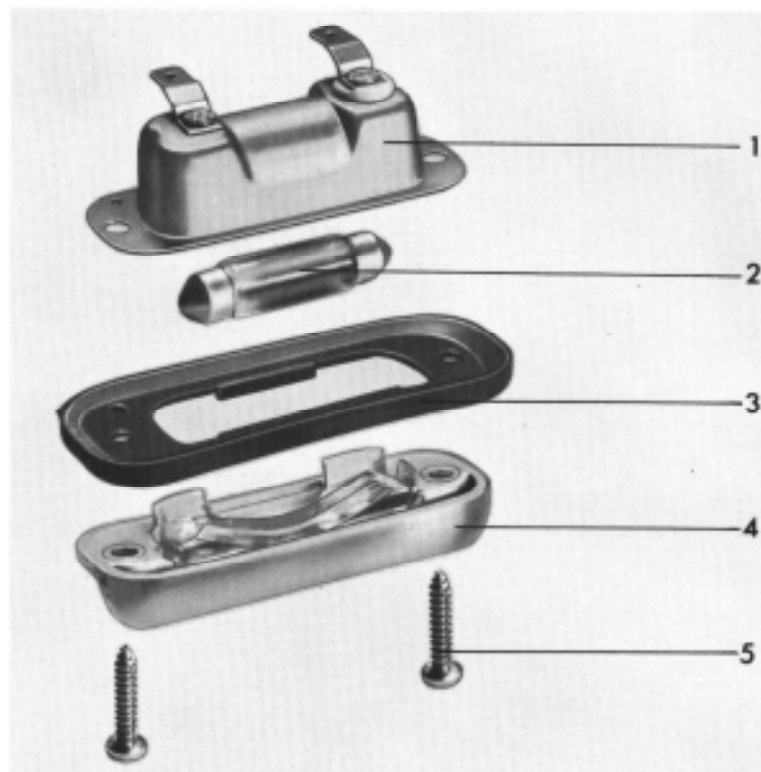
- 1 - Use original VW profiled rubber glue for glueing rubber seal.
- 2 - Spray contacts at central point with contact spray, if required.

- 1 - Tail light contact
- 2 - Brake light contact
- 3 - Backup light contact
- 4 - Earth contact
- 5 - Blinker light contact



The contacts of the lefthand tail light are arranged in mirror image.

License Plate Lamp



No.	Designation	Each	Observe during		Spec. Instr.
			Removal	Installation	
1	Bulb bracket	1	Loosen 2 screws, remove window, loosen felt lining inside trunk, push lines and bulb carrier outwards and pull lines from contacts	Connect lines and insert bulb bracket, while pulling up lines from inside trunk	
2	Bulb 12 V/10 W	1			
3	Rubber seal	1		Watch out for correct and tight seat	
4	Window	1		Insert correctly into rubber seal	
5	Cheesehead screw	2			

Interior Light

The interior light is located in the backrest assembly between the seats. It can be turned on or off by a switch in the light or, by the door contact switches (when the light switch is in the upper position).

Replacing Bulb

- 1 - Remove battery ground strap.
- 2 - Insert tip of screwdriver behind lamp housing, push retaining spring back, and pull the light assembly out of its seat in the backrest.
- 3 - Replace bulb. Make sure that it makes proper contact.

Install in reverse order. Insert the assembly into place with the spring side first. Make sure ground connections are secure.



Door Contact Switches

Both door contact switches in the door posts turn the interior lamp on automatically whenever either door is opened providing the light switch in the interior lamp is in the upper position.

Removing and Installing Door Contact Switch

Remove one screw and take out door contact switch. Remove the wire. When installing, make sure, that the switch has the proper ground connection.



Luggage Compartment Light

The luggage compartment lamp has no separate switch. The lamp is connected to the license plate lights and comes on with the parking lights and headlights.

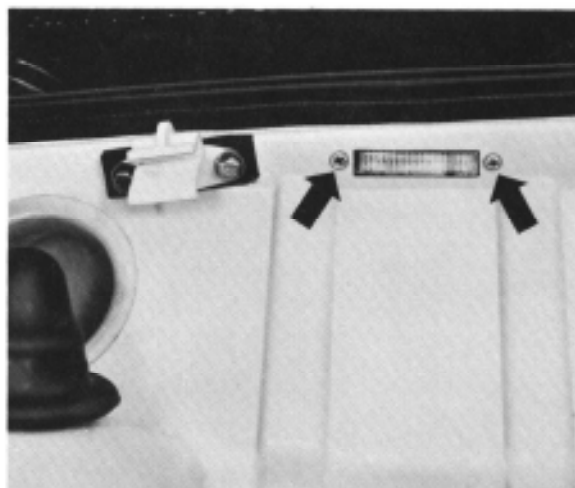


- 1 - Bulb carrier
- 2 - Bulb, 12V/4 W
- 3 - Lens
- 4 - Retaining screws

Removing and Installing Luggage Compartment Light

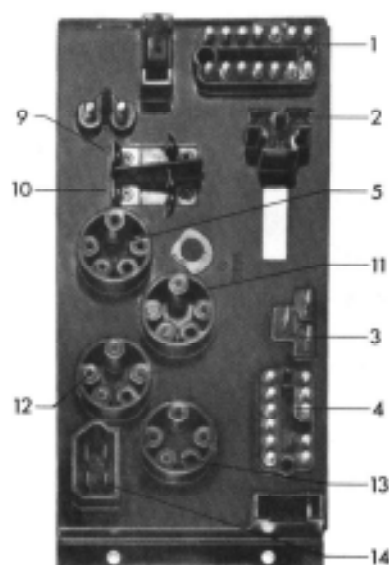
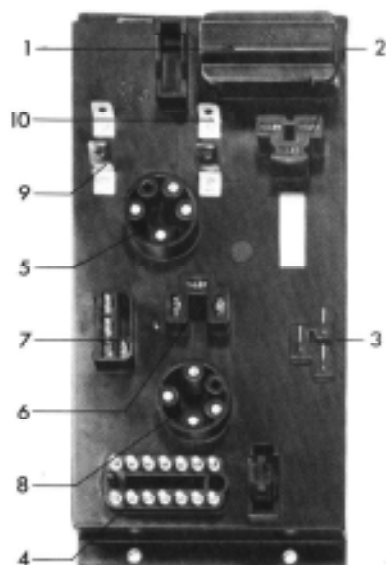
- 1 - Remove felt lining
- 2 - Remove both retaining screws
- 3 - Take out lamp carrier
- 4 - Pull lens off
- 5 - Detach wire

Install in reverse order.



Removing and Installing Relay Plate in Type 914 and 914/6

The relay plate is located on the left side of the engine compartment. It is attached by retaining clips in the front and sheetmetal screws in the rear. Type 914 and 914/6 relay plates are different.



- | | |
|---|--|
| 1 - Twelve-pole receptacle for main wiring harness. | 8 - Cold start enrichment relay |
| 2 - Voltage regulator | 9 - Fuse, 15 amps |
| 3 - Alternator wiring harness | 10 - Fuse, 30 amps |
| 4 - Twelve-pole receptacle for engine wiring harness. | 11 - Power supply relay (for fuel injection) |
| 5 - Electric rear window defogger relay (not yet available) | 12 - Fuel delivery pump relay (for fuel injection) |
| 6 - Rpm sensor for tachometer | 13 - Heater fan relay |
| 7 - Rpm transducer | 14 - Engine wiring harness injection |

The four-pole, engine wiring harness plug must be plugged into receptacle Nr. 14. The connection between the alternator and voltage regulator is provided for in the relay plate by means of conductor strips.

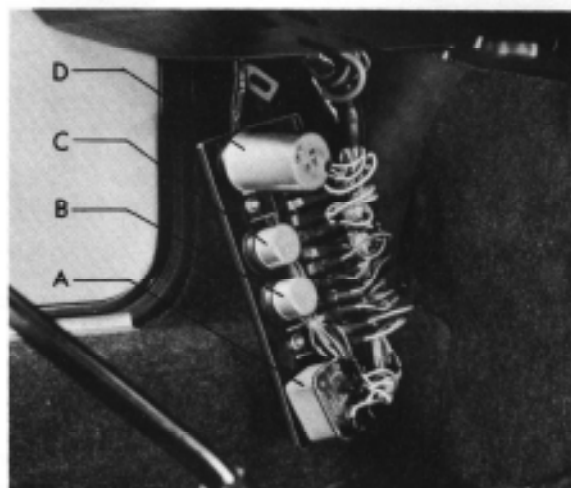
Removing and Installing Fuse Box with Relays

The fuse box is attached to the instrument panel, that is, to the left of the steering column switch in Type 914, or next to the BAL switch in Type 914/6 vehicles.

The following relays are mounted in the fuse box:

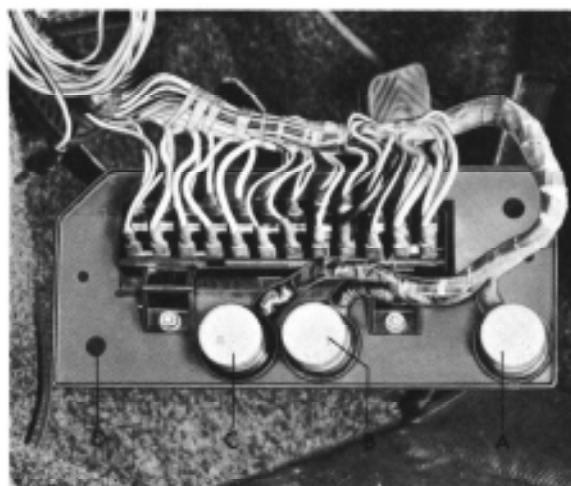
Type 914

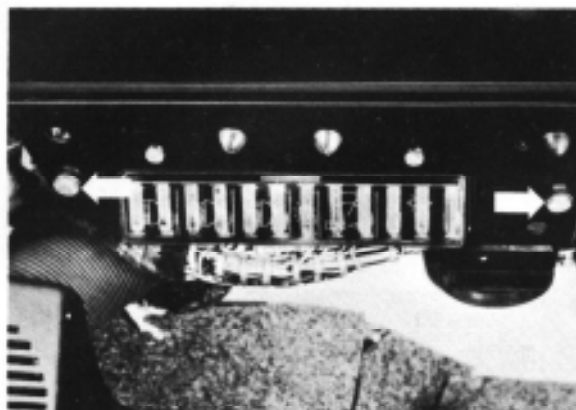
- A - Hand dimmer
- B - Fresh air fan
- C - Auxiliary driving lights
- D - Buzzer



Type 914/6

- A - Buzzer
- B - Fog lights
- C - Horn





Removing and Installing Fuse Box

- 1 - Remove battery ground strap.
- 2 - Remove fuse box mounting screws (see arrows).
- 3 - Pull relay out of socket (socket is snapped into fuse box).

Removing and Installing Turn Signal and Emergency Flasher Relay

When the turn signal switch is actuated with ignition on, the turn signal flasher relay causes the signal lights to blink. This relay, when connected to the emergency flasher switch, causes all turn signal lights in the vehicle to blink at the same time regardless of the positions of the key or turn signal lever.

The turn signal and emergency flasher relay is located behind the instrument panel near the fuse box. Disconnect the battery ground strap and remove the fuse box before removing the flasher. The flasher is located in a receptacle which is snapped into the instrument panel.

Note:

When installing, make sure all wires are properly connected (see wiring diagram). Detach battery ground strap to prevent shorting wires during assembly.

Note the following when trouble shooting the turn signal/emergency flasher system:

- 1 - When the ignition is turned on, the control relay in the turn signal/emergency flasher makes a "clicking" sound which is followed by another sound. The indicator light will not come on because the power relay is not energized.

This is due to the internal flasher design and has no effect on the operation of the system.

2 - Checking Directional Signal Operation:

When tracing malfunctions in the directional signal system, check the flasher first.

- a - Turn emergency flasher switch off.
- b - Detach wire from terminal 49 of emergency flasher switch.
- c - Using an ohmmeter, check continuity between terminal 49 in turn signal switch, and terminal R or L.
- d - If a resistance of more than zero is measured, replace turn signal switch.

3 - Checking Emergency Flasher Switch Operation:

Turn the emergency flasher switch on. If the relay does not function, proceed as follows:

- a - Remove battery ground strap.
- b - Remove emergency flasher switch.
- c - Using an ohmmeter, check continuity between terminal 30 in the switch and power (+).
- d - Also check continuity between terminal 49a and R and L in switch.
- e - Check fuse in circuit 30.
- f - If a resistance of more than zero is measured (Steps b + c), replace the emergency flasher switch.

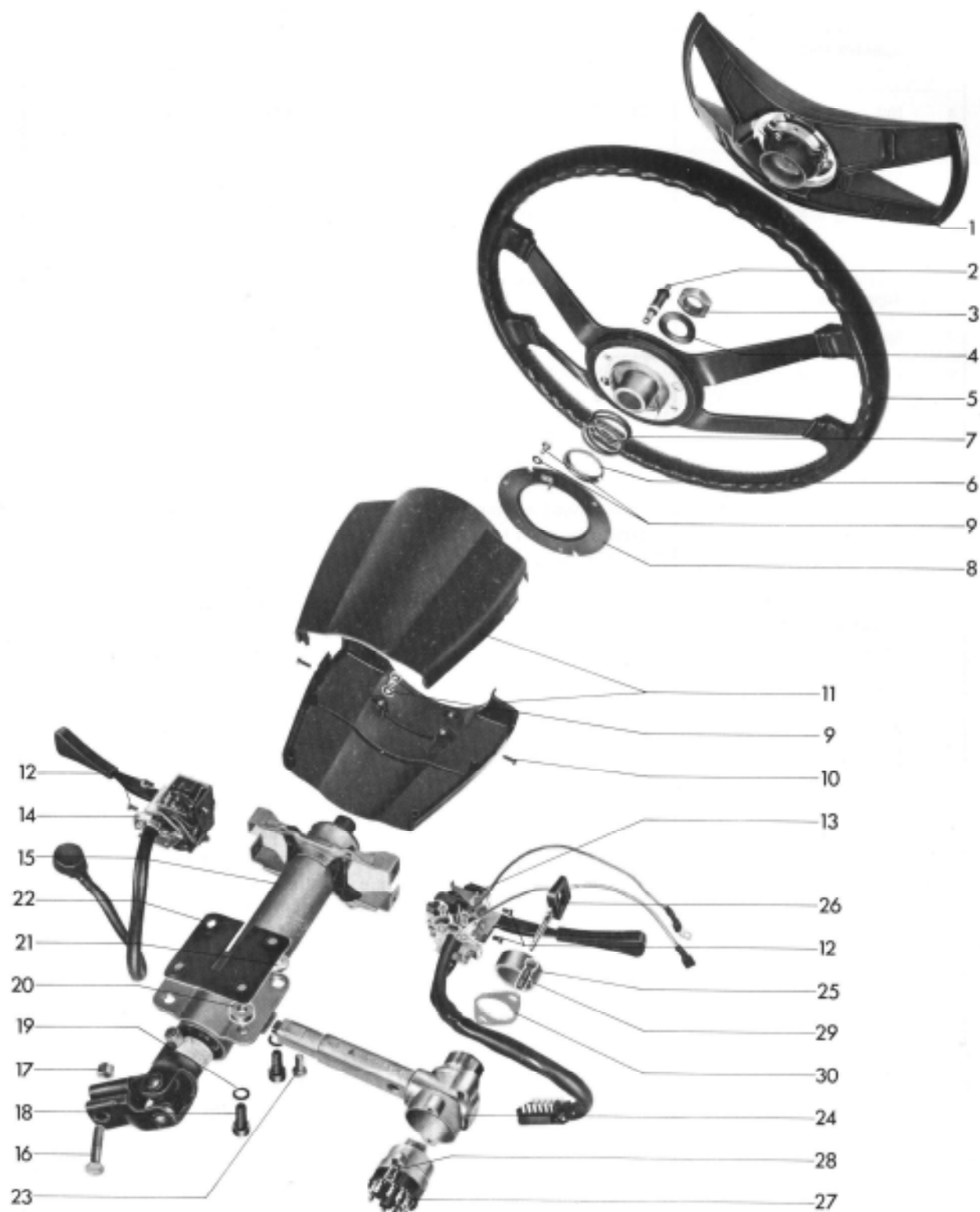
4 - Checking Control Light Operation:

If the turn signal control light in the tachometer is off when the turn signal lever is actuated and the signal lamps are blinking, the cause can be high resistance in the signal lights. The control relay within the turn signal and hazard warning flasher works as a power relay and is laid out for receiving the full current of two turn signal lights. A higher resistance (see above) reduces the signal lamp current flow so that the power relay can not function. Likewise, if one bulb is burned out, the relay can not function.

Remedy:

Check the contacts in the front turn signals. Remove corrosion from all components.

Removing and Installing Steering Column Components Type 914/6



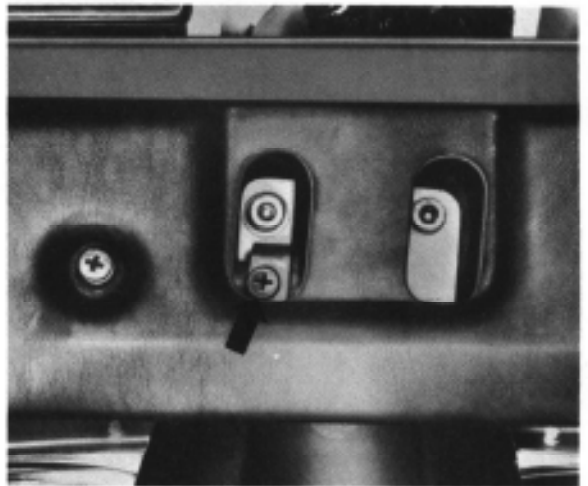
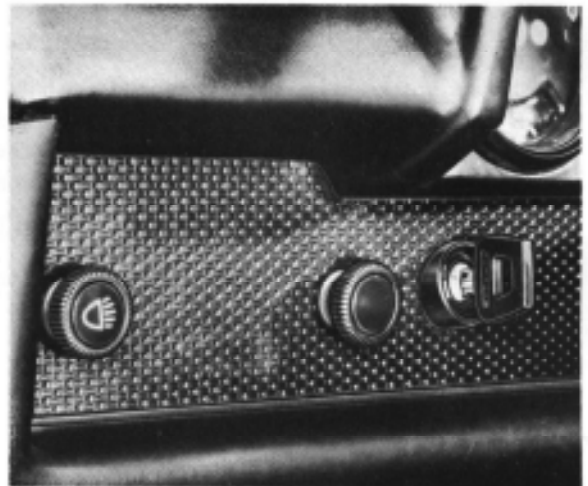
Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
1	Horn ring	1	Turn left to remove	Turn slightly left, press against steering wheel, turn right to snap into position.	
2	Contact finger			Copper contact faces the contact ring.	
3	Nut	1	Use 27 mm socket.	Torque to 8 mkg. (58 ft. lbs.)	
4	Spring washer	1			
5	Steering wheel	1	Mark position on steering shaft.	Tab of turn signal cancelling ring faces to left.	
6	Support ring	1			
7	Spring	1			
8	Contact ring	1	Tab of contact ring is on top right and points to instrument panel. Electrical side of ring faces steering wheel.		
9	Fillister head screw M 4 x 10, with washer	6	Horn ground connection fastens beneath top right screw which secures upper cover.		
10	Fillister screw M 3 x 10	6	Securing top and bottom halves of shroud.		
11	Upper and lower cover	2			
12	Fillister head screw M 3 x 6	10			
13	Turn signal/dimmer switch	1		Make sure during installation that lever is in middle position so that the cancelling cams are not damaged by the cancelling ring of steering wheel. The switch wires lead to a 12-pole plug and socket in the instrument panel. Socket snaps into panel. Place wire loom between steering shaft tube and steering support.	
14	Wiper/washer		Wires lead to a plug and socket in upper part of transverse panel.		
15	Steering shaft tube	1			

Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
16	Clamping bolt for steering intermediate shaft, M 8x35	1		Torque to 2.5 mkg (18 ft.lbs)	
17	Self-locking nut, M 8	1		Use new self-locking nut at installation.	Group V
18	Allen head bolt M 8 x 20	4		Torque to 2 mkg (14 ft lbs)	
19	Lock washer	4			
20	Washer	2		Use thick washers in front (toward ball joint end)	
21	Washer	2			
22	Rubber pad for steering shaft tube	1			
23	Phillips head screw, M5x10	1	Secures ignition/steering lock.		
24	Ignition/steering lock	1	Remove fuse box with connectors for buzzer.	Install so that lock bolt engages grooves in steering shaft freely when the key is removed. Secure ignition/steering lock with Phillips-head screw (No. 23, above).	
25	Cover ring	1	Remove instrument panel cover (first remove escutcheons from head-light and emergency flasher switches).		
26	Ignition key	1			
27	Ignition/starter switch	1	Remove multiple-prong plug from starter switch. Plug is attached to wire harness.		
28	Fillister head screw M 3,5 x 8	2			
29	Shear bolts	2	Drill the bolts out.	Ensure that part number is right. Tighten evenly until heads shear off.	
30	Support plate	1			

Ignition Steering Lock

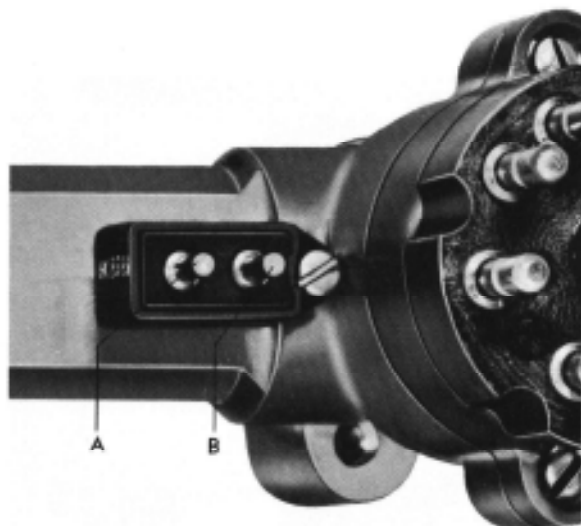
Removing:

- 1 - Remove fuse box
- 2 - Remove headlight and emergency flasher switches. Remove connector from ignition/steering lock and unscrew cover ring. Carefully remove instrument panel cover from the face of dash.
- 3 - Remove Phillips head screw which secures the starter/steering lock (see arrow).
- 4 - Drill out ignition/steering lock shear bolts from instrument panel. Take out ignition/steering lock and support plate.



Installing:

- 1 - Install ignition/steering lock and slightly fasten with the shear bolts. Insert ignition key and turn to the "ON" position. The lock pin must not touch the locking grooves in the steering shaft (turn steering wheel all the way right and left to check). The neck of the ignition/steering lock assembly must be secured with the Phillips head screw. Tighten shearing bolts until the bolt heads twist off.
- 2 - Unscrew cover ring and glue instrument panel lining on.
- 3 - Install headlight and emergency flasher switches.
- 4 - Reconnect multiple-prong plug to switch. Install fuse box.
- 5 - Check for proper operation.

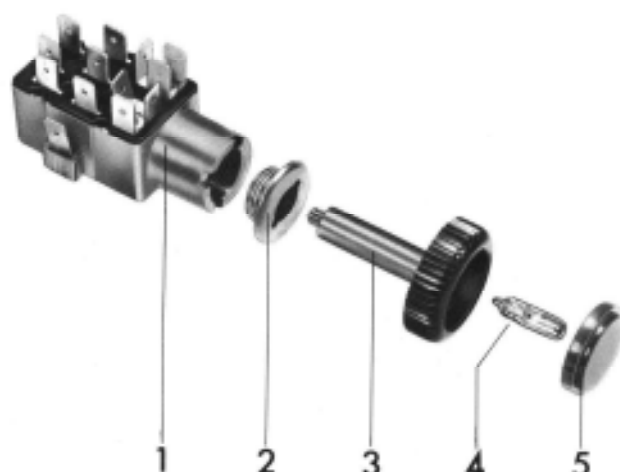
**Buzzer Alarm**

A = To door contact switch

B = To buzzer

When the key is inserted into ignition/steering lock a locking pin connects the circuit between the buzzer and door contact switch. When the door is opened (key still inserted) the door contact switch completes the circuit to ground; the buzzer sounds.

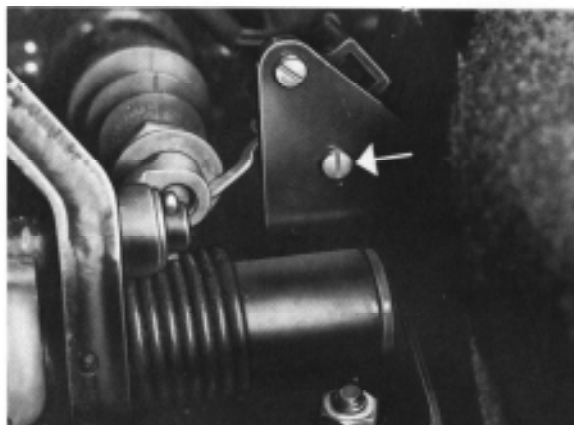
Removing and Installing Emergency Flasher Switch



Nr.	Description	Qty.	Note when		Special instructions see
			Removing	Installing	
1	Hazard warning light switch	1	Detach battery ground strap. Remove fuse box.	Contact plate must be firmly seated in switch.	
2	Escutcheon	1	Use special cross-slot wrench VW 674/1.		
3	Switch shaft with knob	1			
4	Bulb IG 12V/1.2 W	1	Push out from shaft with piece of wire.		
5	Switch knob lens	1			

Removal of Brake Light Switch

- 1 - Pull accelerator pedal out of thrust rod in rearward direction.
- 2 - Loosen two hex. nuts for floor board attachment and remove floor board.
- 3 - Loosen fastening screws for brake light switch, remove switch and pull off cable connections.



Installation of Brake Light Switch

Proceed vice versa for installation. The brake light switch must be adjusted.

Adjusting the Brake Light Switch

The brake light switch is adjusted in installed condition.

- 1 - Loosen counter nut and adjusting screw (arrow).
- 2 - Clamp a sheet metal strip 4 mm thick between the brake pedal lever and the brake pedal stop (corresponding to a path of approx. 21 mm (= 0.83 in.) at brake pedal plate center).
- 3 - Turn adjusting screw until brake lamp lights up.

Note: The cut-in point can also be checked with an ohmmeter.

- 4 - Remove brake light switch and lock adjusting screw.
- 5 - Reinstall brake light switch, connect cable and check switch for function.

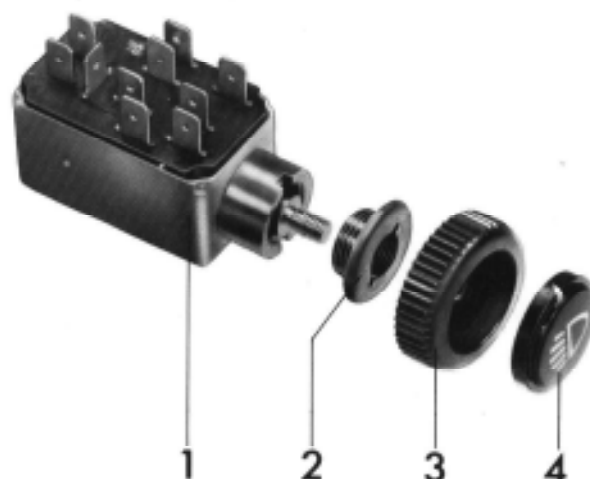


Light Switch

The light switch has the following positions:

- 0 - Pushed in = Off
- I - Pulled out half way = Headlamp units come into position; parking lights, tail lights, and license plate lights are on.
- II - Pulled fully out = Headlights are on.

Instrument light brightness can be regulated by turning the knob when the switch is in Position I or II.



Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
1	Light switch	1	Detach battery ground strap, remove fuse box. Unscrew escutcheon, take switch out through rear of panel, detach wires.	Connect wires according to wiring diagram.	
2	Escutcheon	1	Use special cross-rot wrench VW 674/1.		
3	Knob	1			
4	Cap	1			

Backup Light Switch

Vehicles with Standard Transmission

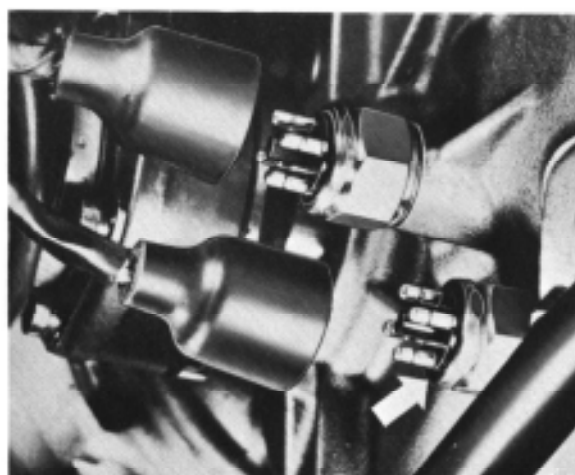
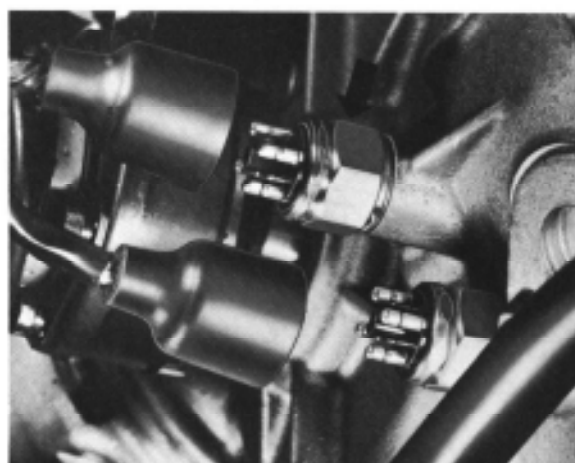
Removing:

The switch can be replaced with transmission installed.

- 1 - Pull off dust boot from switch and remove wires from terminals.
- 2 - Unscrew switch and pull out control plunger.

Installing:

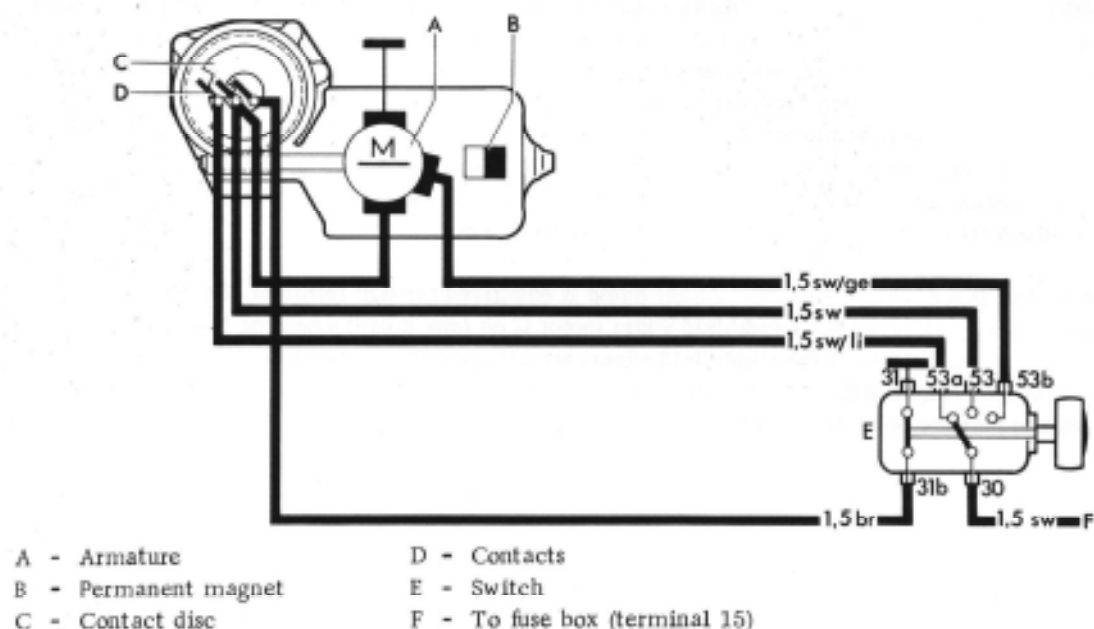
- 1 - Insert the control plunger into its seat in transmission housing, with retaining ring installed. Make sure the longer rounded end faces the shift rod.
- 2 - Screw the switch in, make sure that gasket ring is properly seated.
- 3 - Connect wires and install dust boot.



Windshield Wiper System

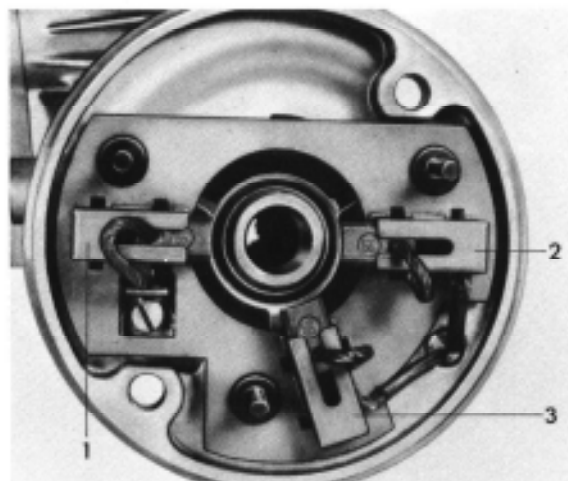
The windshield wiper motor, both wiper shafts, and the actuating rods are mounted on a common frame. The windshield wiper arms are secured to the splined wiper shafts by cap nuts.

Type 914 - Two wiper speeds



When the windshield wiper switch is turned to the first position, the motor and the contact plate on the worm gear are energized via terminal 53 of the switch. The wipers run at low speed. After switching off, the contact (53a) still supplies the motor with current via the contact plate until the wiper arms have reached their end position. The contact then switches the current off. At the same time, the armature winding is connected to ground via contact 31b of the switch and the small segment of the contact plate. By this means the armature brakes itself (induction brake). There are three carbon brushes in the brush holder, whereby one brush is installed offset to the ground brush. It is via this brush that the high speed is switched on directly with the switch (terminal 53b).

- 1 - Negative brush
- 2 - Low speed brush
- 3 - High speed brush



Type 914/6 Three Wiper Speeds and Electric Washer Pump

The windshield wiper/washer switch has four switching positions and is located on the steering column opposite the turn signal/headlight dimmer switch. By pulling the lever toward the driver, an additional switch actuates the windshield washer pump.

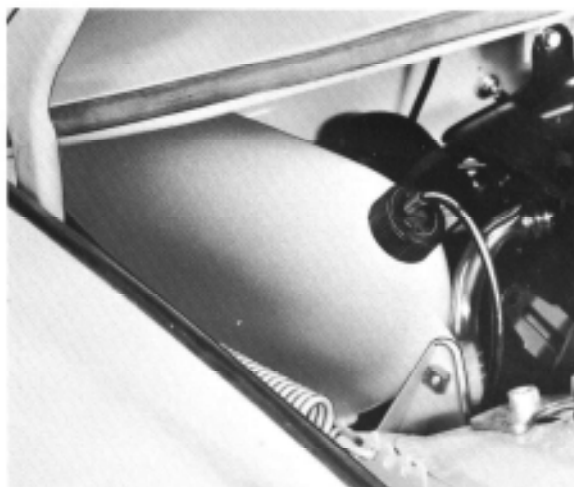
The windshield wiper motor is one with series windings and shunt windings. When the switch lever is moved to the first position, terminals 53 and 53b are energized; the wiper motor runs at low speed. In the second position, the shunt windings are energized through a resistor. This resistor reduces the voltage in the shunt windings which, in turn, reduces the field current in the shunt windings. As a result, the motor runs faster (medium speed). In the third position, the shunt windings are switched off. The motor then runs as a series motor, wiper motor runs at high speed. After the wiper switch is switched off, a sliding contact (53a) continues to provide the motor with current until the wipers have returned into their parked position at which time the flow of current is interrupted by contacts.

When the control lever is pulled up, the washer pump is energized through terminal 53a/53c of the windshield wiper/washer switch. If the windshield wiper motor is on (any speed) when the lever is pulled up, the washer motor is actuated. If the windshield wipers are off when the washer is activated (lever pulled back), position "0" (wipers off), two pressure points can be felt. The first pressure point actuates the washer, the second pressure point actuates the wipers. The wiper motor then runs at the high speed.

Windshield Washer System

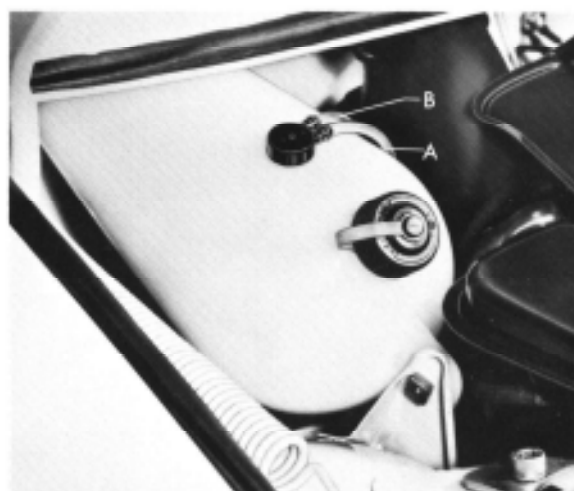
Type 914

The windshield washer reservoir is located in the rear of the front luggage compartment. It has a capacity of 1,5 liters (3,2 pints) of fluid. The reservoir is pressurized by the spare tire via a pressure line. A cut-off valve in the fluid reservoir cap prevents the pressure in the spare tire from dropping below 29 psi.



Type 914/6

The windshield washer reservoir is located in the right rear of the front luggage compartment. It has a capacity of 2,0 liters (4,2 pints) of fluid. The reservoir is pressurized by a gear-type pump which is activated when the windshield washer lever is pulled back. The operating pressure is approximately 1 atu (15 psi). A T-connector with a bypass bore is located between the pump and the discharge jets. This allows the washing solution to return to the reservoir in case the discharge jets become clogged.



- A - Hose from T-connector with bypass valve
- B - Hose to washer pump

Caution!

Prevent the washer solution from freezing during winter operation by adding appropriate amounts of windshield washer anti-freeze solution.

Checking Windshield Wiper Motor Installed

The operating condition of the system can be analyzed by measuring the current. Connect ammeter in line with the wire leading to terminal # 30 or 53a, respectively.

Current draw of the windshield wiper system is shown in the table below:

Windshield wiper motor	Type	Current draw (amps)		
		fast	medium	slow
	914	3.5	--	2.5
	914/6			

These values apply when the windshield wipers are turned on and the wiper arms and blades lifted off the windshield. Do not take current measurements.

If the current draw is higher than shown in the chart above, and if during slow operation, a squeaking noise is heard, the cause may be dry bearings. High current draw without noise usually means a shorted armature.

Checking Windshield Wiper Motor Disassembled

Checking armature

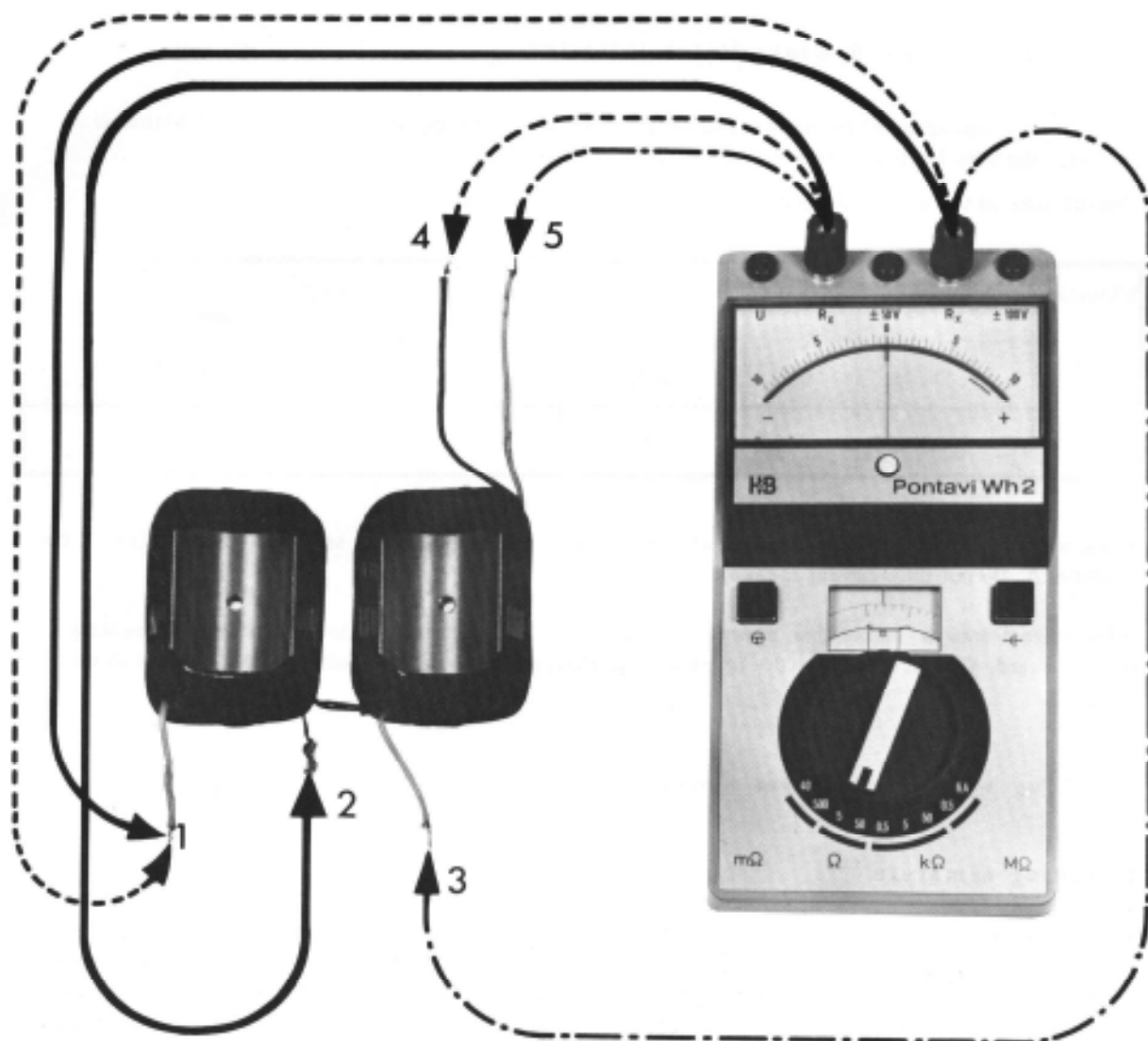
- 1 - If the commutator is oily or dirty it can be cleaned with a clean cloth moistened with cleaning solvent. If the commutator shows signs of wear or burning, it must be repaired. After turning down the commutator, the insulation between the segments must be reworked with a commutator saw. Make sure no chips remain between the segments as they may cause a short circuit between the armature windings. The permissible runout of the armature is 0.03 mm (0.001 in.).
- 2 - Often, armature damage can not be seen. The armature, commutator, and field windings are tested in the same way as a D.C. generator.

CHECKING

The windshield wiper motor used in the Type 914/6 does not have a permanent magnet. It uses two field coils with pole shoes.

It is necessary to remove the coils when checking for internal shorts.

To remove the coils, detach both ground coil ends which are soldered to the pole housing.



- 1 - Connection to brush # 1
- 2 - Ground
- 3 - Connection to brush # 2
- 4 - Connection to terminal # 53b
- 5 - Connection to terminal "b"

Resistance values between connections shown in the illustration are shown in the table below:

Resistance values	
between points	Ohms
1 and 2	0.12
1 and 4	4.4
3 and 5	0.12

Windshield Wiper Blades Type 914 and 914/6

Care

The good condition of windshield wiper blades is of decisive importance for the quality of the wiping pattern and the resulting safer driving.

During extended dry weather conditions, the wiper blades will be covered with spattered tar and insects. The elastic, wear-proof rubber lips of the wiper blades can no longer comply with their task of wiping the water film on the windshield uniformly and intensively.

For thorough cleaning, the wiper blades must be removed and cleaned with a rather hard nylon brush and fuel alcohol or with a strong detergent. Be sure that the rubber blade itself is not damaged. When the wiper lips of the wiper rubber show evidence of being brittle or when their edges are no longer sharp, be sure to replace.

Notes:

Often the quality of the wiper pattern cannot be improved by replacing the wiper rubber alone (refer to table "Faults on Wiper Pattern - Cause and Remedy"). In such cases, the windshield must be treated with a silicon remover. The following agents may be used for cleaning the windshield:

- 1 - Windshield cleaner
- 2 - A self-made paste consisting of two parts by weight of French chalk and three parts by volume of water. A few drops of ammonia solution will improve the effect, but result in a considerable smell. The mixture should not touch the paintwork. Rub on windshield, permit to dry and wipe off. Rinse carefully with clean water.
- 3 - Rub windshield with dry-cleaning gasoline and then treat with acidified water. Acidified water consists of one part by volume of muriatic acid and nine parts by volume of water. Then rinse carefully with clean water.

Note:


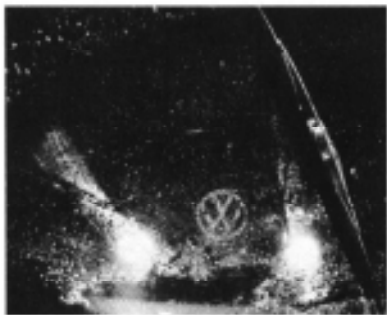

- 1 - If silicon-containing compounds are used for vehicle care, the brushes, sponges, chamois cloth and rags used for cleaning the paintwork may not be used for the windshields.
- 2 - The wiper rubber of the windshield wiper blades is of course subject to natural wear even when the pertinent instructions are closely followed. General safety requires that the rubber blades are replaced after approx. 12 months of service or earlier, if required.

Parking Position

The following instructions must be observed, so that the windshield wiper motor can always return to their starting position:

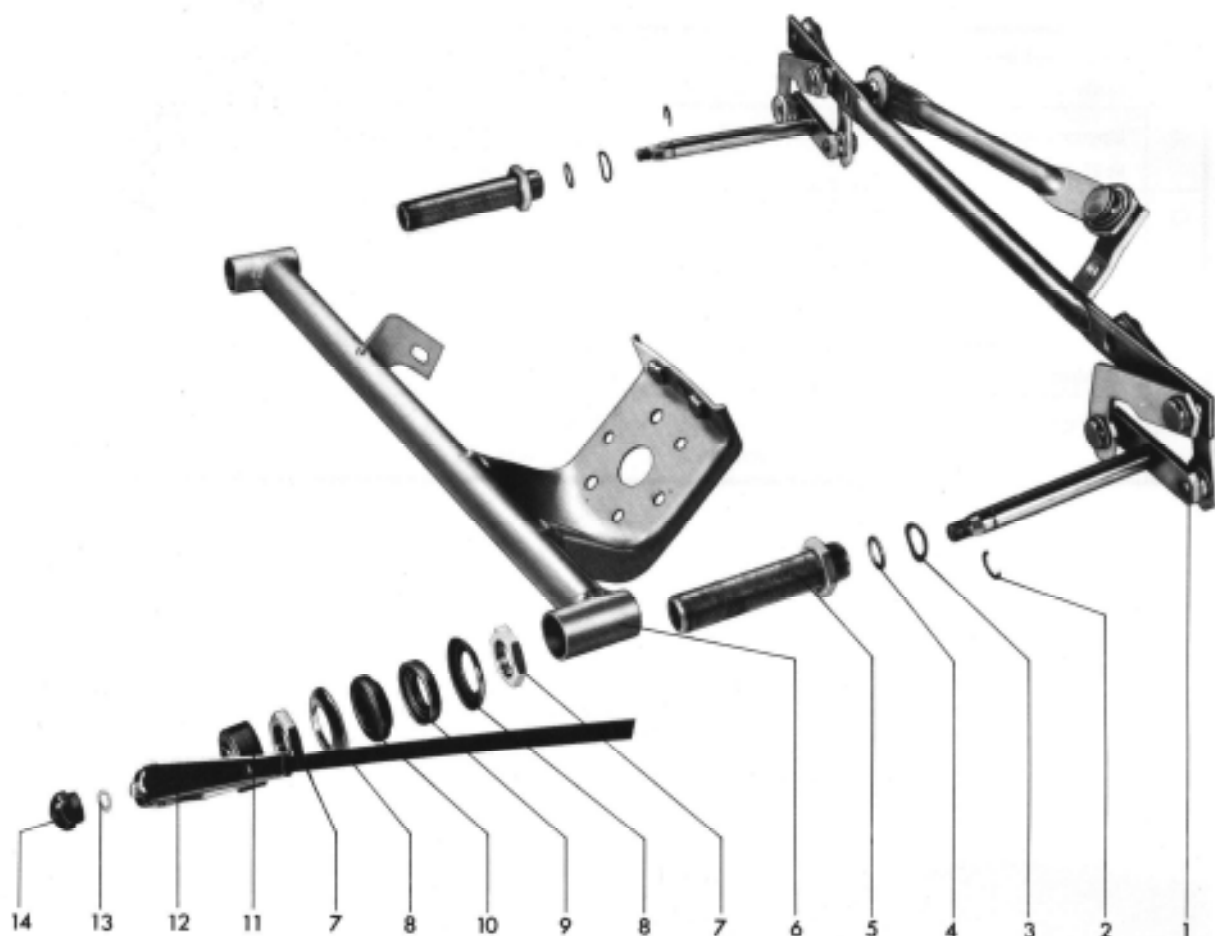
- 1 - Frozen down wiper blades must be released prior to actuating the windshield wiper switch. If this is not done, the wiper blades may move slightly when switched on and then become stuck again. They may thereby arrive at the switching-in position and in spite of the switch being in its Off position the motor will be energized. This in turn may cause the armature winding to burn out and make the wiper motor unfit for further use.
- 2 - Make sure that during heavy snowfalls, snow deposits on the windshield will not prevent the wiper blade from attaining its parking position.

The following chart lists faults on the windshield wiper blades, their cause and remedy.

Wiping pattern	Cause	Remedy
<p>1 - Streaks</p> 	<p>a - Wiper rubber contaminated</p> <p>b - Frayed wiper lips, torn or worn rubber</p> <p>c - Wiper rubber aged, cracked surface</p>	<p>a - Clean wiper rubber with hard nylon brush and a detergent solution or fuel alcohol</p> <p>b - Replace wiper rubber</p> <p>c - Replace wiper rubber</p>
<p>2 - Water remaining in wiper field will immediately collect in beads</p> 	<p>a - Windshield contaminated by paintwork polish, oil or diesel fuel residue</p>	<p>a - Wipe windshield with clean rag and a grease-oil-silicon remover (9 4.2-1/4)</p>
<p>3 - Wiper blade wipes well on one side and not so well on the other, blade rattles</p> 	<p>a - Wiper rubber deformed on one side, (does no longer tilt)</p> <p>b - Wiper arm twisted, blade is in slanted position on windshield</p>	<p>a - Clean wiper rubber with hard nylon brush and a detergent solution or fuel alcohol, or insert new wiper rubber</p> <p>b - Turn wiper arm carefully until correct, vertical position is attained</p>
<p>4 - Some areas not wiped clean</p>	<p>a - Wiper rubber torn from mounting</p> <p>b - Wiper blade does not rest uniformly against windshield, since spring strips or plates are bent</p> <p>c - Pressure of wiper arm too low</p>	<p>a - Insert wiper rubber carefully into mounting</p> <p>b - Replace wiper blade. This fault will come up particularly when a spare blade is inexpertly fitted</p> <p>c - Lubricate wiper arm joints and spring lightly, or install new arm</p>

Trouble	Cause	Remedy
Windshield wiper motor runs too slowly, runs intermittently or stops	a - Earth connection or lead have bad contact b - Carbon brushes worn or sluggish c - Insufficient tension of brush springs d - Collector contaminated e - Wiper bearings and joints of connecting rods without grease or binding f - Battery voltage too low	a - Establish perfect connection to earth or in supply line b - Replace carbon brushes or make operable c - Replace brush springs d - Clean collector e - Lubricate wiper bearings and joints thoroughly with universal grease f - Charge battery, check lines and connections
Windshield wiper motor does not stop accurately in its parking position after cutout	a - Sliding contacts in cover of wiper gears contaminated broken or bent b - Break in supply line to terminal 53a of wiper motor c - Drive crank on drive shaft offset d - Switch of terminal 31-31b not operating e - Slide contact 31b broken or bent	a - Clean sliding contacts or replace cover of wiper gear unit b - Check supply line for unbroken connections c - Run motor into parking position, loosen drive crank, place in parking position and tighten again d - Replace switch e - Straighten contacts or replace cover together with contacts
Windshield wiper motor continues to run after cutout	a - Sliding contacts in cover of wiper gears bent b - Contacts in switch burnt out	a - Check sliding contacts and replace cover together with contacts, if required b - Replace switch
Windshield wiper motor does not start or stops again	a - Armature burnt out by shorted winding or earthing short b - Contacts in switch burnt out c - Windshield wiper motor runs too slowly, intermittently or stops completely	a - Replace wiper motor or armature b - Replace switch
Squeaking noise while windshield wiper motor is running. Motor running slowly or armature burnt	a - Wiper shafts or drive bearings without grease b - Gear case not properly seated on case c - Armature or worm gear bearings sluggish	a - Lubricate or apply universal grease b - Correct seat of gear case c - Adjust end play and lubricate with molybdenum disulphide grease

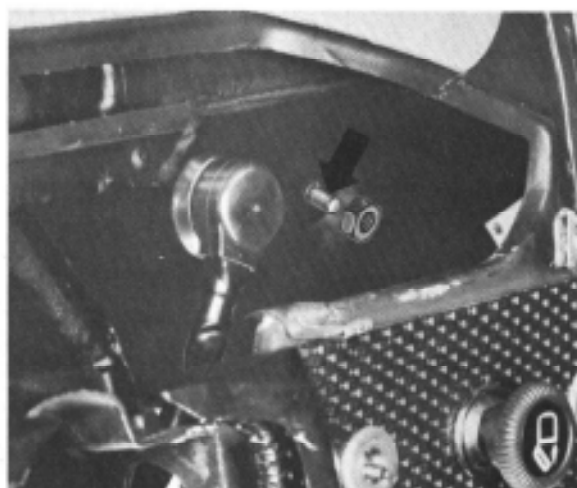
Windshield Wiper Frame with Motor



Nr.	Description	Qty.	Note when		Special instructions see
			Removing	Installing	
1	Wiper linkage	1	Cannot be dismantled		
2	Lock ring	2	Remove with needle nose pliers		4.4-3/1
3	Spring washer	2			
4	Washer	2			
5	Shaft support bushing	2			
6	Wiper frame assembly	1		Adjust position	4.4-3/1
7	Nut	4			
8	Cup washer	4		Note installed position	

Nr.	Description	Qty.	Note when		Special instructions see
			Disassembling	Assembling	
9	Lower rubber seal	2		Note installed position	
10	Upper rubber seal	2		Note installed position	
11	Shaft support cover (rubber)	2			
12	Wiper arm	2		Note parked position	4.4-2/1
13	Washer	2			
14	Cap nut	2	Remove with wiper arm raised		

Removing and Installing Type 914 and 914/6 Windshield Wiper Frame with Motor.

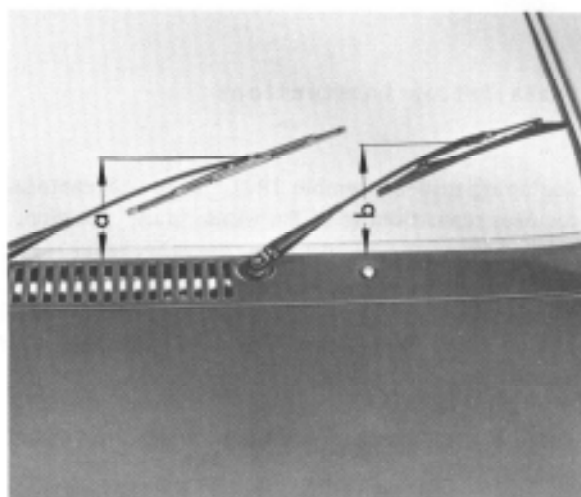


Removing:

- 1 - Remove battery ground strap
- 2 - Remove cap nuts at wiper arm pivot points and remove arms.
- 3 - Remove shaft support cover and nut. Take off cup washer and rubber seal on both sides.
- 4 - Remove the activated charcoal filter.
- 5 - Remove fuel tank.
- 6 - Remove fresh air fan housing (see BODY group).
- 7 - Remove nut from rubber/metal support, from passenger compartment side (under the instrument panel). Make sure that the rubber/metal support is not twisted.
- 8 - Pull the windshield wiper frame and motor assembly out through bottom of instrument panel.
- 9 - Disconnect wires.

Installation

- 1 - Connect lines according to wiring diagram.
- 2 - Insert windshield wiper frame with motor. Make sure that the anti-vibration bearing is in the bore provided.
- 3 - Screw hex. nut to anti-vibration bearing, holding bearing in position to prevent distortions.
- 4 - Position windshield wiper arms, observing parking position of arms.
- 5 - Connect battery and check windshield wiper system for function.
- 6 - Install fresh air blower housing and fuel tank.



Note:

When installing a new or repaired windshield wiper motor, be sure that the motor is in parking position. Refer to 9 4.4-2/1.

a = 135 mm (5.3 in.)

b = 170 mm (6.7 in.)

Installation Instructions

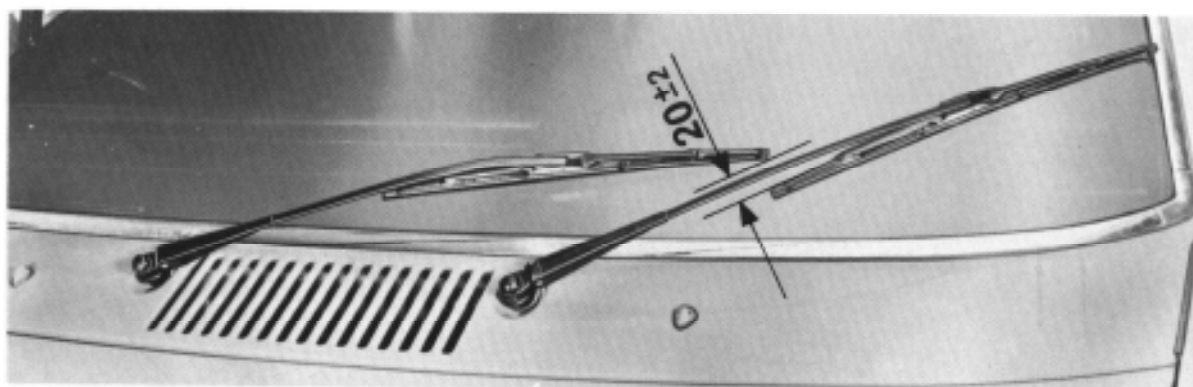
Beginning mid-September 1971, Type 914 vehicles are equipped with modified wiper arms which requires repositioning of the wiper "park" position.

During adjustment make sure that the outer wiper blade does not contact the windshield chrome trim when parked. The distance between both wiper blades must be 20 mm at the position shown in the illustration.

The specified park position of the wiper arms must be reached after a few wiper sweeps on a wet windshield.

This modification applies from chassis number

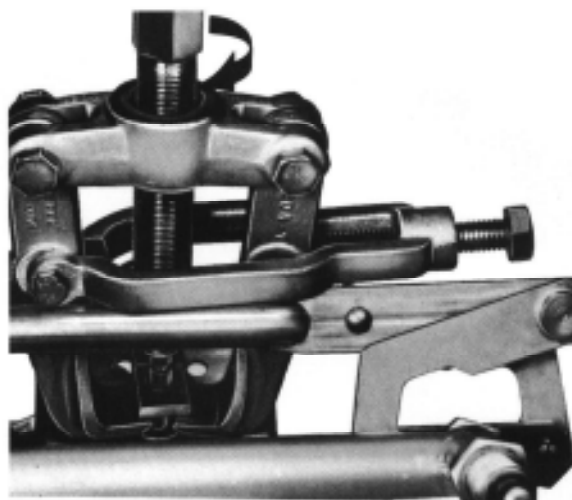
472 290 1073.



Windshield Wiper Motor Removal and Installation Type 914 and 914/6

Removal

- 1 - Remove wiper frame complete with motor. Refer to 9 4.4-1/1.
- 2 - Remove hex. nut and washer from windshield wiper motor shaft.
- 3 - Pull drive crank of linkage from shaft of windshield wiper motor with puller.
- 4 - Loosen three hex. bolts and remove motor.

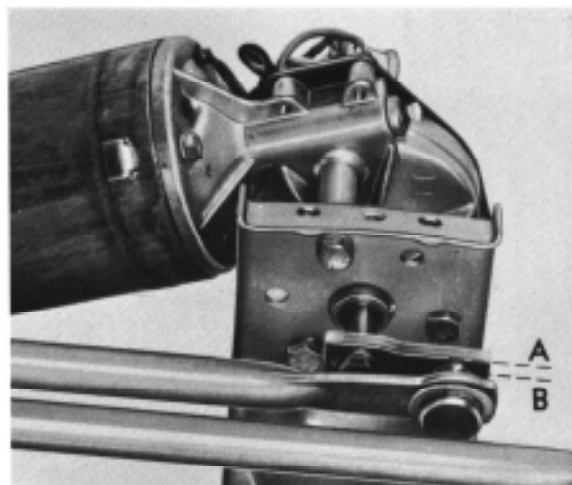


Installation

When installing the windshield wiper motor into the windshield wiper frame move windshield wiper motor into parking position prior to attaching drive crank:

- 1 - Connect earth wire from engine to earth pole of a battery. Connect line from terminal 53 and 53a to positive pole and run motor for a few minutes. When the line is then disconnected from terminal 53, the motor will stop in its parking position.
- 2 - Then place drive crank in parallel to drive rod on drive shaft of worm gear and attach by means of a lock washer and a hex. nut. The parking position of the crank may vary by $\pm 50^\circ$.

Proceed vice versa for further installation.



A and B = in parallel

Note:

The windshield wiper motor for the 914/6 is provided with an angular bracket on the bearing plate, by means of which the motor is additionally attached to the wiper frame.

Windshield Wiper Shaft Removal and Installation Type 914 and 914/6

Removal

For removing the wiper shaft, remove complete wiper frame together with motor. Refer to page 9 4.4-1/1.

Remove motor from windshield wiper frame. To pull the two wiper shafts from the wiper bearings, remove circlips from wiper shafts by means of pointed pliers and a rubber hammer.

Note:

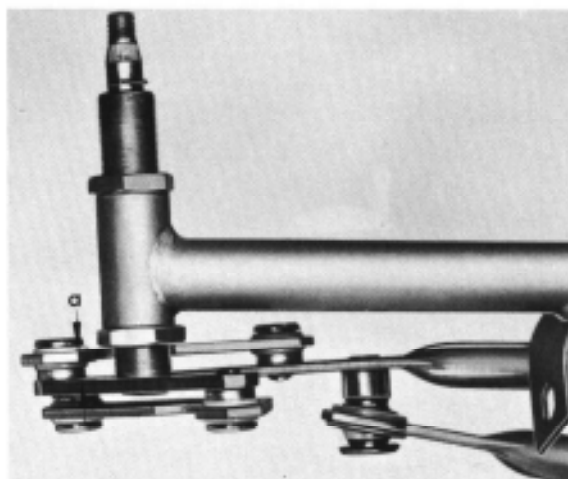
Apply only light blows against pointed pliers with rubber hammer.



A = Direction of blow

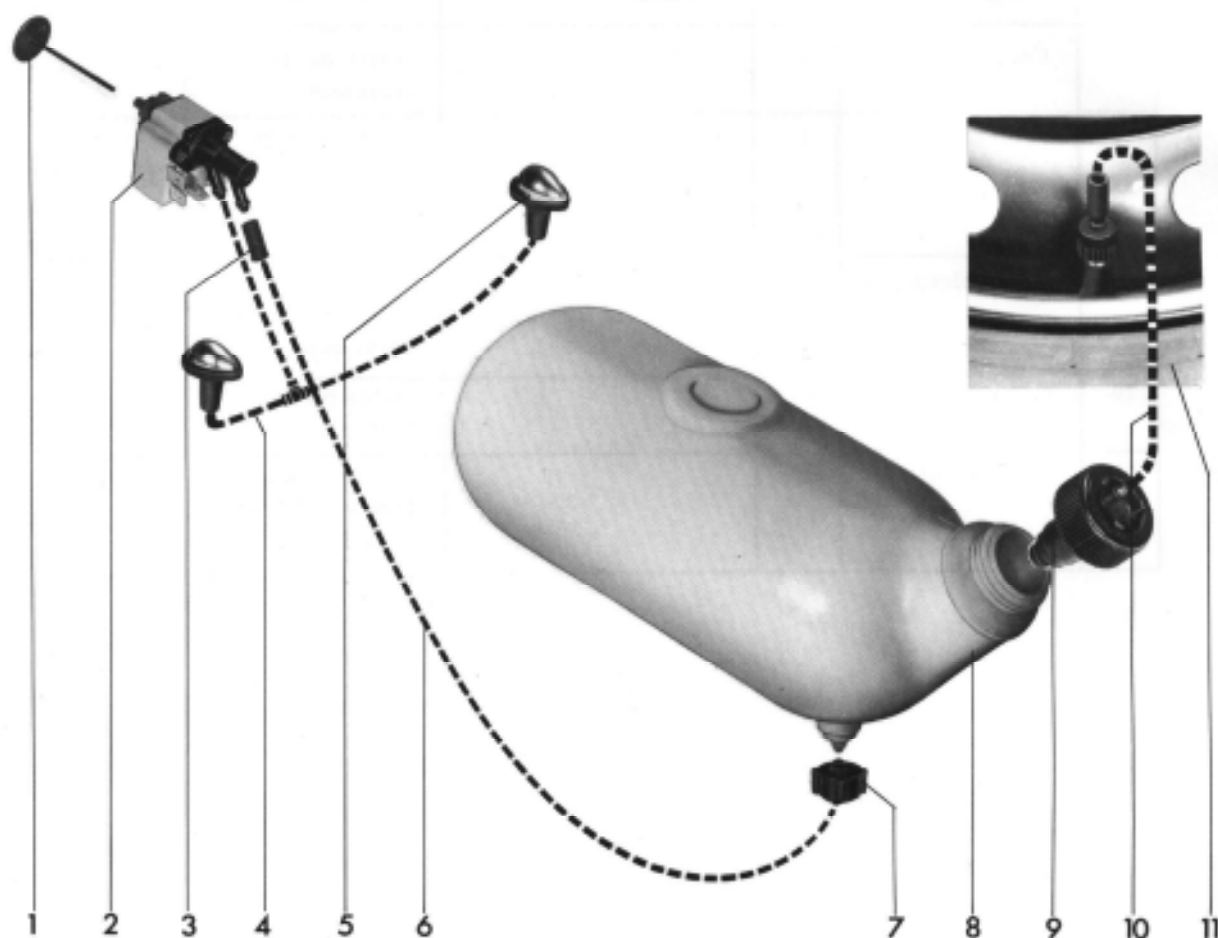
Installation

- 1 - Rub shafts prior to installation with molybdenum disulphide (MoS_2) paste.
- 2 - Watch out for correct and tight seat of circlips.
- 3 - The distance between the bottom hex. nut and the crank should be 8.5 mm (0.33 in.).



a = 8.5 mm (0.33 in.)

Windshield Washer System Removal and Installation



No.	Designation	Each	Observe during		Spec. Instr.
			Removal	Installation	
1	Releasing button	1		Check for easy operation	
2	Switch with valve insert	1	Replace compl. switch, if valve is damaged		
3	Rubber sleeve	1			
4	Hose with T-piece between switch and nozzle			Watch out for perfect layout	
5	Double spray nozzle	2	Push out from inside		
6	Hose between fluid container and switch			Watch out for perfect layout	

No.	Designation	Each	Observe during		Spec. Instr.
			Removal	Installation	
7	Coupling nut	1		Watch out for tight seat	
8	Fluid container	1	Loosen rotary locking cap, permit compressed air to escape. Loosen screw on clip	Check for leaks	
9	Rotary closing cap	1	Loosen carefully until compressed air has escaped	Watch out for tight seat. Attach hose up to stop	
10	Compressed air tapping hose	1		Watch out for perfect layout	
11	Spare wheel	1		Pump to max. pressure of 3 atü (43 psi)	

Removing and Installing Type 914/6 Windshield Washer System

The windshield washer reservoir and pump are located in right rear of the front luggage compartment.

Removing and Installing Windshield Washer Reservoir

- 1 - Remove hex nut using a U-joint adapter.
- 2 - Pull hoses connecting reservoir with pump and reservoir with T-joint off reservoir. Pull reservoir out of the rear attachment.

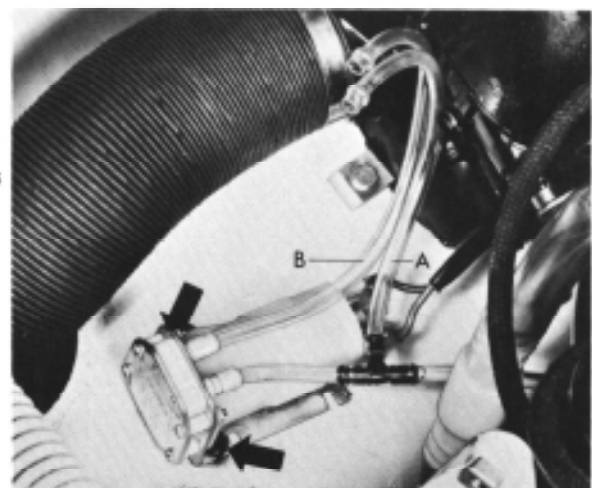


A - Hose from T-joint

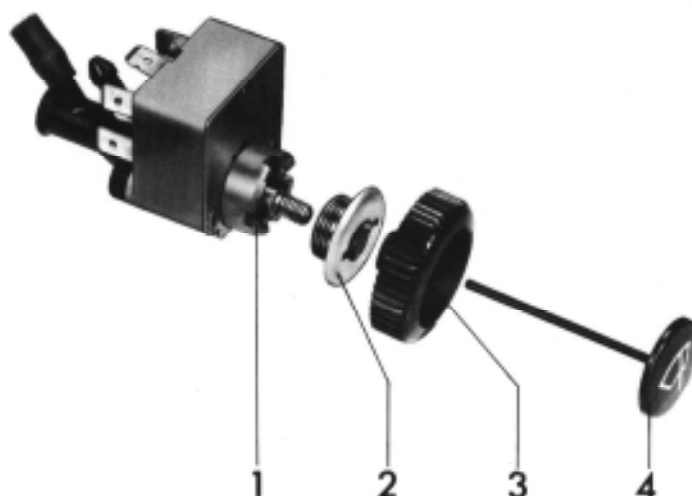
B - Hose to pump

Removing and Installing Washer Pump

- 1 - Remove windshield washer reservoir.
- 2 - Detach hoses and wires from pump.
- 3 - Pull pump out of the rubber retainers (see arrows). Make sure during installation that the pump is firmly seated in the rubber retainers and does not touch the body.
- 4 - Install windshield washer reservoir and check system for proper function.



Windshield Wiper Switch Type 914

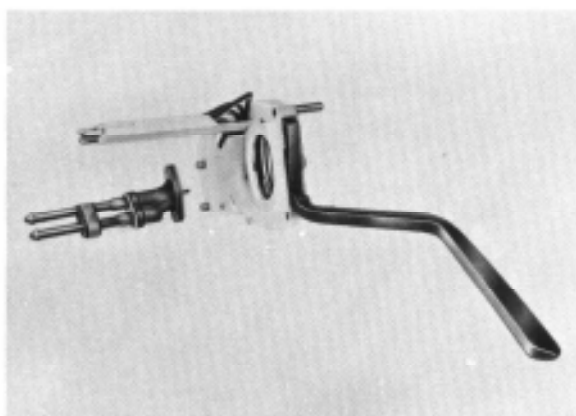


No.	Designation	Each	Observe during		Spec. Instr.
			Removal	Installation	
1	Windshield wiper switch	1	Disconnect battery earth connection cable. Vent windshield washer container. Loosen escutcheon. Remove switch in inward direction. Pull of lines, water hoses, and disconnect or close.	Connect lines acc. to wiring diagram. Attach air hoses for windshield washer container, watch out for leaks on hose connections.	
2	Escutcheon	1	Mount with special cross-slotted spanner VW 674/1		
3	Knob	1			
4	Releasing button	1			

Removing and Installing Windshield Wiper Switch with Interval Switch (as from Model 72)

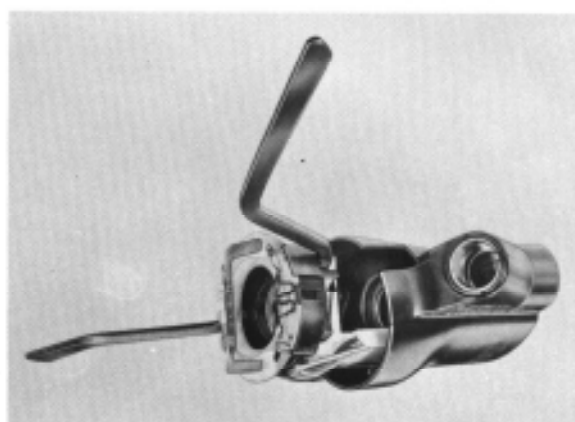
Removal

1. Remove steering column switch (refer to Workshop Manual Group 4, page 4.2-1/10, items 1 to 11).
2. Separate blinker switch from windshield wiper switch on removed steering column switch.
3. Remove valve for windshield washer from switch without valve.



Note:

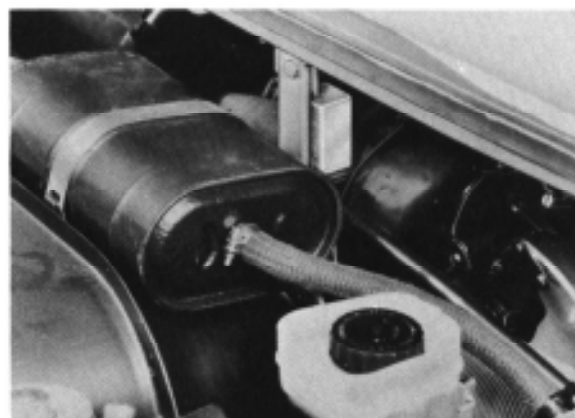
When a vehicle is subsequently provided with an interval switch, remove plastic nose in blinker switch housing so that the control step for interval switching can be actuated.



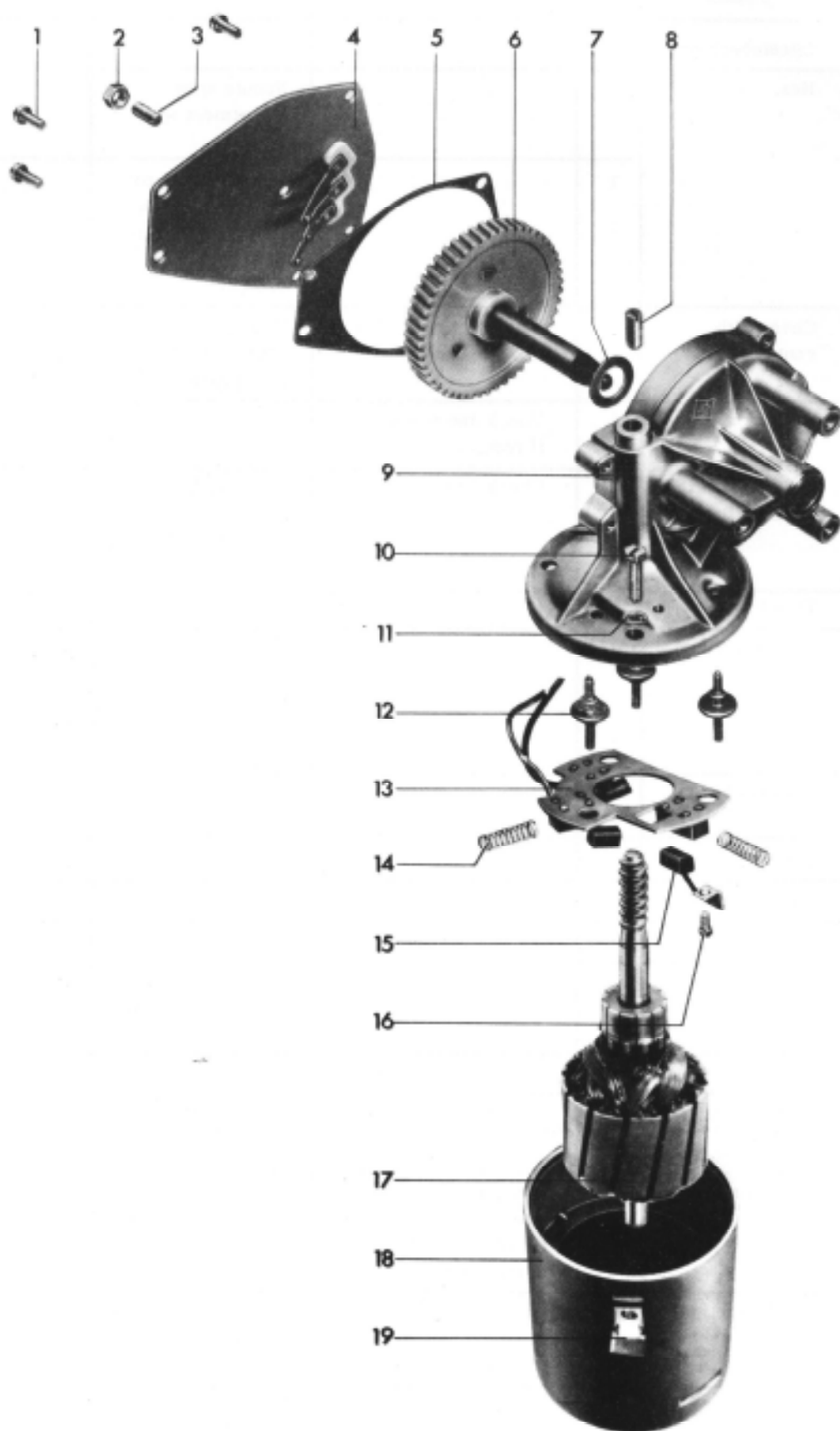
The pertinent interval relay is on the lefthand support between the trunk bottom and the windshield in the tank compartment. It is connected to the windshield wiper motor and the wiper switch by means of a cable.

Assembly

1. Assemble and install blinker switch and windshield wiper switch. Refer to assembly instructions in Workshop Manual Group 4, page 4.2-1/11.

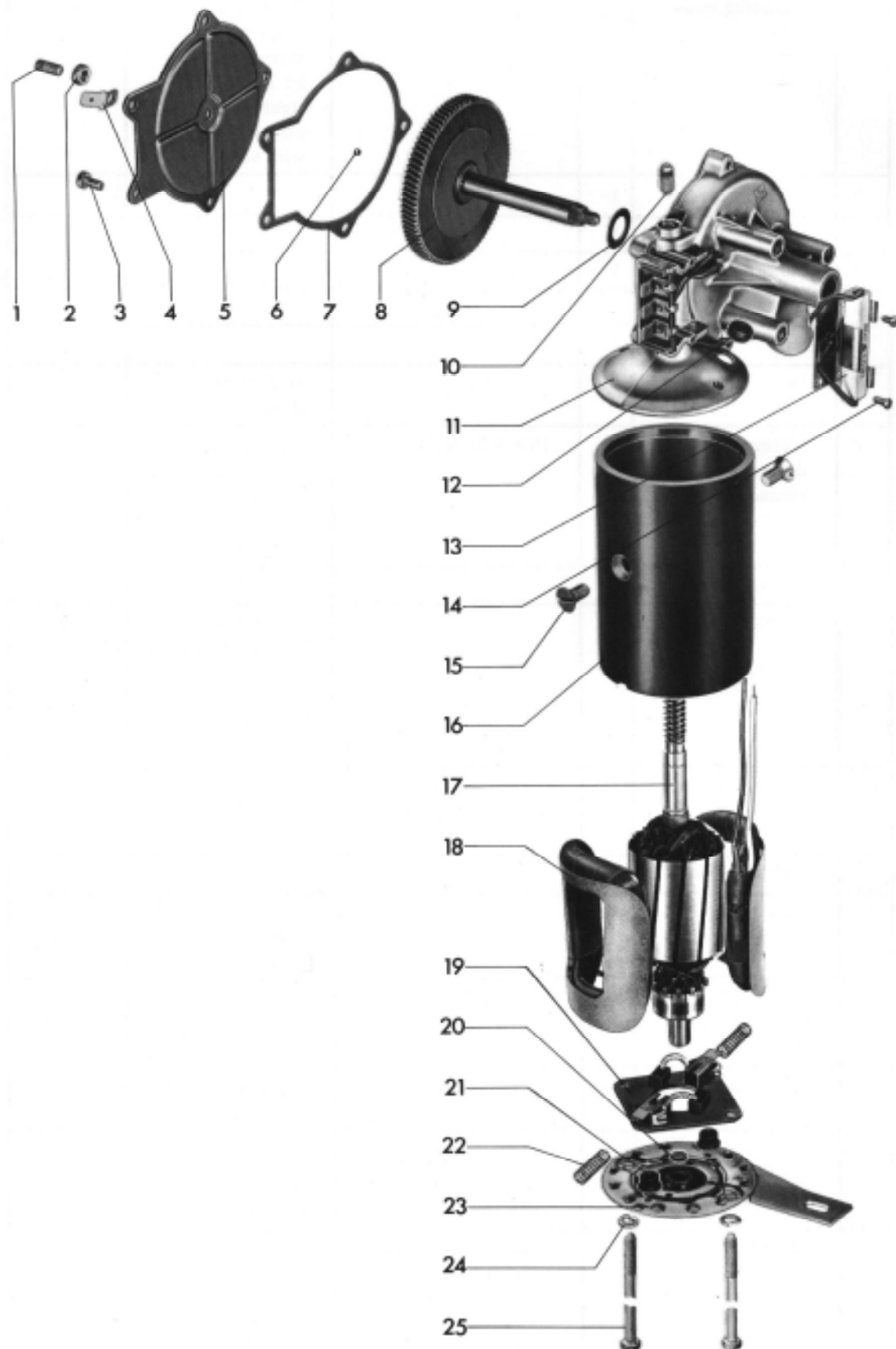


Windshield Wiper Motor Type 914



No.	Designation	Each	Observe during		Spec. Instr.
			Removal	Installation	
1	Cheesehead screw	5			
2	Hex. nut	1		Secure upon adjustment with varnish	
3	Adjusting screw	1		Turn down up to stop, then screw back by 1/4 turn and secure with varnish	
4	Cover with contacts	1	Watch out for broken or bent contacts	Straighten and clean, renew if required	
5	Seal	1	Check and renew, if requ.		
6	Worm gear with drive shaft	1	Check for wear	Insert with multi-purpose grease on lithium-basis and replace, if required	
7	Thrust washer	1			
8	Adjusting screw	1		Screw down against stop, then screw back by 1/4 turn and secure with varnish	
9	Bearing of gear unit	1			
10	Hex. screw	2			
11	Spring ring	2			
12	Rubber bearing	3			
13	Brush holder plate	1	Check positive carbons for wear	Replace complete brush holder plate if carbons are worn	
14	Spring				
15	Earth carbon	1	Check for wear	Replace, if required	
16	Cheesehead screw	1			
17	Armature	1	Check collector for wear and windings for breaks and earth connection		
18	Pole housing with permanent magnet	1	Clean	Exchange completely, if bearings are damaged	
19	Holding bracket	2		Insert w. outer leg facing magnet	

Windshield Wiper Motor Type 914/6



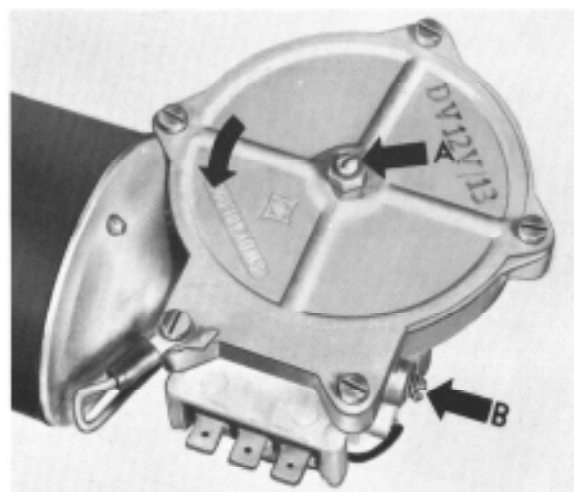
No.	Designation	Each	Observe during		Spec. Instr.
			Disassembly	Assembly	
1	Adjusting screw	1		Screw down against stop, then screw back by 1/4 turn, tighten counter nut and secure with varnish	4.5-2/3
2	Counter nut	1			
3	Cheesehead screw	5			
4	Earth plug	1			
5	Cover	1			
6	Ball	1			
7	Seal	1		Replace when damaged	
8	Worm gear with drive shaft and contact path	1	Check for wear	Insert with multi-purpose grease on lithium base, replace, if required	
9	Thrust washer	1			
10	Adjusting screw	1		Screw down against stop, then screw back by 1/4 turn, tighten counter nut and secure with varnish	4.5-2/3
11	Bearing of gear unit	1	Clean, watch out for good condition of sliding contacts		
12	Rubber sleeve	1			
13	Preresistance	1		Check for passage (rated value 12 Ohm)	
14	Oval head sheet screw for pre-resistance	2			
15	Cheesehead screw for pole shoes	2		Tighten well	
16	Pole housing	1	Clean		
	Pole shoes	2	Mark installation position	Observe installation position	
17	Armature	1	Check collector for wear and windings for breaks and earth connection		

No.	Designation	Each	Observe during		Spec. Instr.
			Disassembly	Assembly	
18	Field winding	2	Check for shorted winding	Outboard earth connection	4. 5-2/3
19	Brush holder plate	1		Completely exchange, if carbons are worn	
20	Thrust washer	1		Place into bearing plate	
21	Rubber bearing	2		Insert into bearing plate from pole housing end	
22	Spring for carbon brush	2			
23	Bearing plate	1			
24	Spring ring	2			
25	Oval head screw	2			

Adjusting End Play of Worm Gear

The end play should be approx. 0,2 mm (.008")

- 1 - Loosen counter nut (arrow A).
- 2 - Screw adjusting screw carefully up to stop, then screw back by 1/4 turn.
- 3 - Counterlock adjusting screw.



Adjusting End Play of Armature

The play should be approx. 0,2 mm (.008"). Adjustments are made similar to end play adjustment of worm gear. For adjusting screw, refer to arrow B.

Installing Windings 914/6

When installing the two windings, a new line is soldered to the two lining ends - earth - and an insulating hose is placed on top of this soldered spot. This line is then run outboard through the pole housing between the two field windings and through the cable rubber sleeve in gear housing.

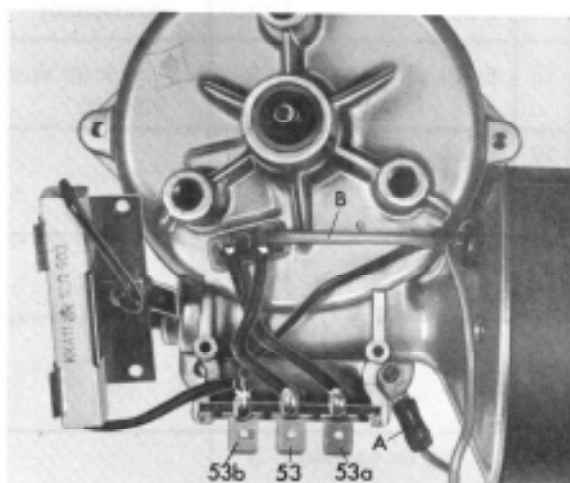


A = newly soldered earth line

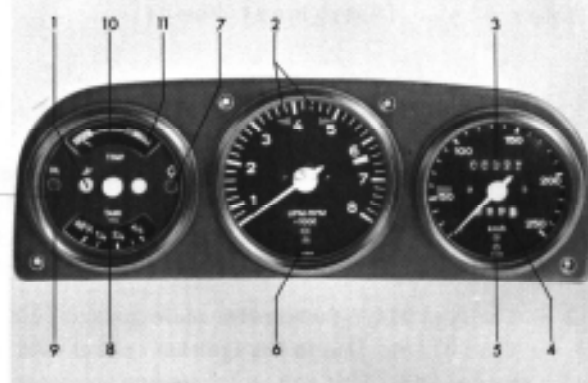
Clamp earth line by means of table shoe under the earth contacts to screw for gear housing cover.

A = Earth point of field winding following repairs

B = Yellow line of winding



Description



- 1 - Brake warning Light
- 2 - Turn signal indicator
- 3 - Odometer
- 4 - Trip mileage indicator
- 5 - Parking light indicator
- 6 - High beam indicator

- 7 - Generator warning light
- 8 - Fuel gauge
- 9 - Oil pressure indicator
- 10 - Oil temperature gauge
- 11 - Oil temperature warning light

Type 914 Instrument Panel

The electric fuel gauge is located on the left side of the instrument panel. The fuel gauge is connected to the sending unit in the tank. The indicator needle of the fuel gauge reacts to resistance changes in the sending unit, depending on the fuel level in the tank. Also located in the fuel gauge dial are the oil pressure, generator, and brake warning lights.

Located in the center of the instrument cluster is the transistorized tachometer. Ignition pulses are transformed by a transistorized circuit and fed to a calibrated gauge with an RPM scale. The tachometer range is 0-7000 rpm. Also located in this instrument are the high beam and turn signal lights.

The speedometer is located on the right side of the instrument cluster. It incorporates an odometer, a resettable trip mileage indicator, and parking light indicator. The speedometer is driven by a flexible cable connected to the transmission. The speedometer operates in the principle of the eddy current generator. A disc-shaped magnet is driven by the cable connected to the transmission. An aluminium "bell" surrounds the magnet. The bell, which is connected to the indicator needle, is suspended to turn very easily and yet not to touch the magnet. The spinning magnet creates eddy currents which drag the bell against the force of a spring (in direct relation to the speed of the vehicle) indicating the vehicle speed in miles per hour. The speedometer range is 0-120 mph.

Type 914/6 Instrument Panel

The Type 914/6 instrument panel differs from the Type 914 panel as shown below:

- 1 - The fuel gauge dial has an additional instrument to show oil temperature. If the oil temperature becomes excessively high, the needle moves into a red-shaped area, in addition, a red warning light comes on. The brake warning light is located to the left of the instrument center. Located to the right of the instrument center is a light for instrument illumination.
- 2 - The type 914/5 tachometer scale goes to 8000 rpm.
Type 914/6: Due to the ignition system used in Type 914/6 vehicles, it was necessary to install a ballast unit. This unit is located on the relay console in the engine compartment.
- 3 - The speedometer range is 0-150 mph.

Removing and Installing Instruments



Nr.	Description	Qty.	Note when		Special instructions see
			Removing	Installing	
1	Instrument panel	1	Detach speedometer cable. Detach reset shaft for trip mileage recorder by removing knob and lock nut from underneath dash.	Install panel with all instruments in place.	
2	Instrument panel retaining screws	4			
3	Instrument retaining rings	3	Remove retaining rings from panel when removing the instruments.	Place retaining rings in panel before inserting instruments.	
4	Fuel gauge retaining screws	4			
5	Fuel gauge	1	Remove instrument panel; detach wires.	Insert with care to avoid damaging the scale and indicator.	

Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
6	Reset shaft for trip mileage recorder	1	Remove knob and lock nut from underneath dash		
7	Speedometer	1		Connect cables and insert warning lights prior to installation	
8	Tachometer	1			
9	Combination instrument	1			

Removing

- 1 - Remove battery ground strap.
- 2 - Remove steering wheel by twisting horn bar slightly to the left. Remove nut from steering column.
- 5 - Take the complete instrument panel assembly out.
- 6 - Remove wires and pull out warning lights.
- 7 - Push individual instruments out toward front. Replace rubber retaining rings if necessary.

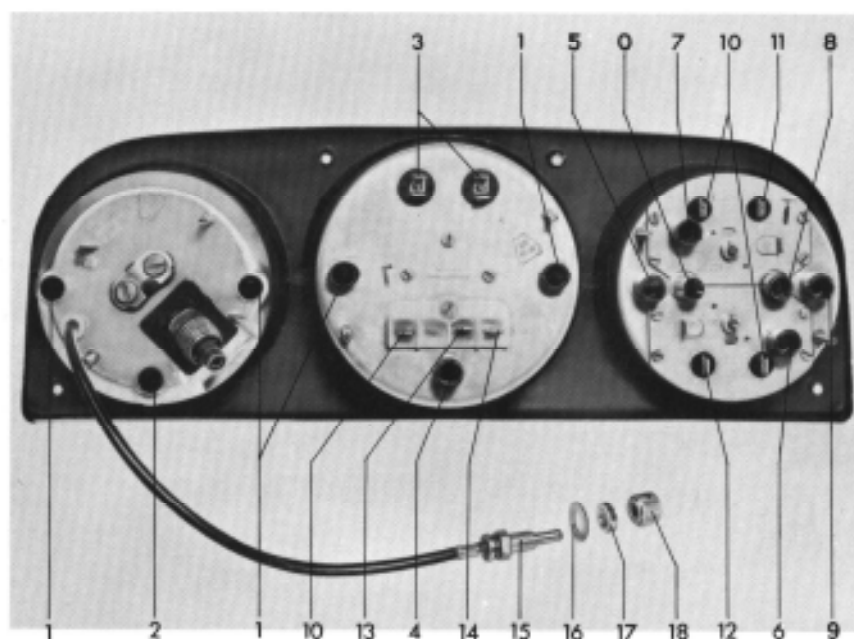
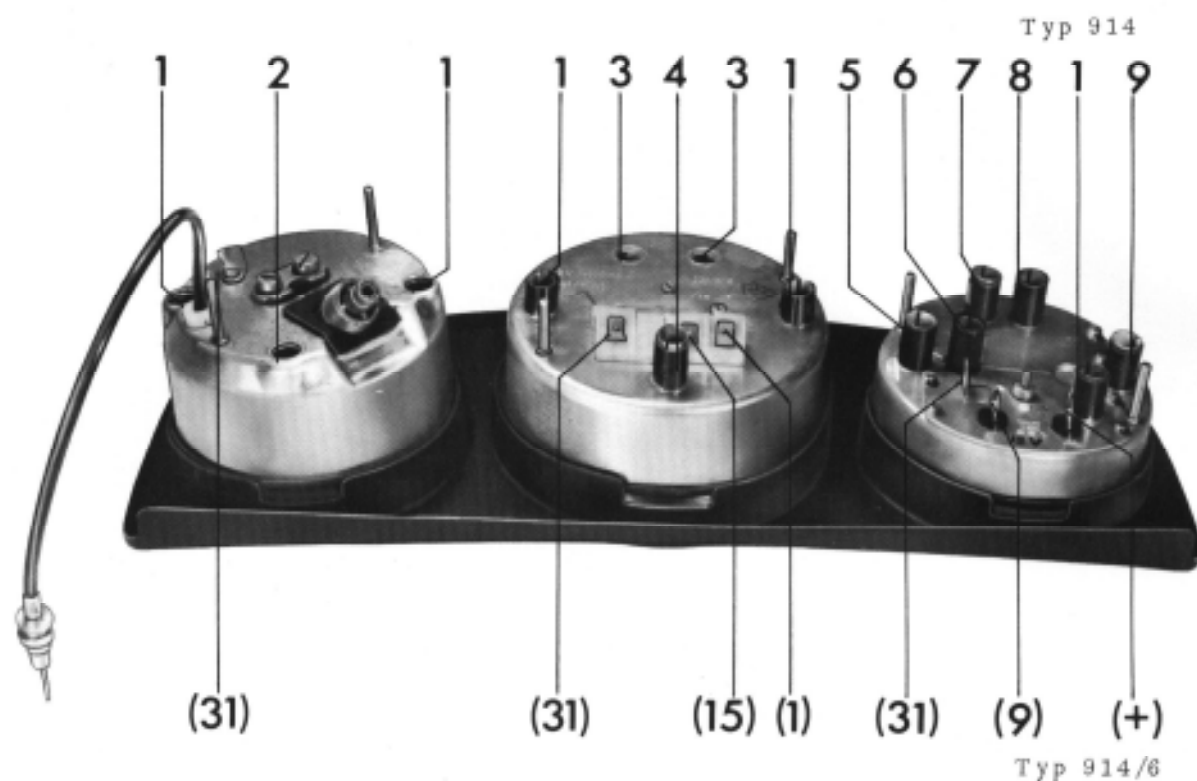


- 3 - Remove instrument panel retaining screws.
- 4 - Detach speedometer cable and reset shaft for trip mileage recorder.



Installing

Install in reverse order. Connect wires according to the wiring diagram.



Numbers in parentheses indicate actual terminal designations.

- | | |
|--|--|
| 0 - Not used | 10 - Terminal # 15 |
| 1 - Instrument illumination | 11 - To oil temperature sensor |
| 2 - Parking light indicator - green | 12 - To fuel level sensor |
| 3 - Turn signal indicator - green | 13 - To tachometer ballast unit |
| 4 - High beam indicator - blue | 14 - To ground |
| 5 - Generator warning light - red | 15 - Flex shaft for trip mileage reset |
| 6 - Low fuel indicator - red | 16 - Washer |
| 7 - Oil temperature indicator light | 17 - Round nut |
| 8 - Brake warning light - red | 18 - Knurled knob |
| 9 - Oil pressure warning light - green | |

Removing and Installing Speedometer Cable

- 1 - Remove battery ground strap. Remove retaining cable nut from speedometer head.
- 2 - Remove left floorboard and center tunnel covers.
- 3 - Remove speedometer drive retaining bolt.
- 4 - Remove rubber boot from speedometer drive unit on transmission and remove cable housing retaining nut. If necessary, remove retaining bolt (see arrow). (tightening torque is 1.5 mkg).



- 5 - Remove rubber boot from tunnel access hole in under carriage and pull speedometer cable assembly out to the rear.

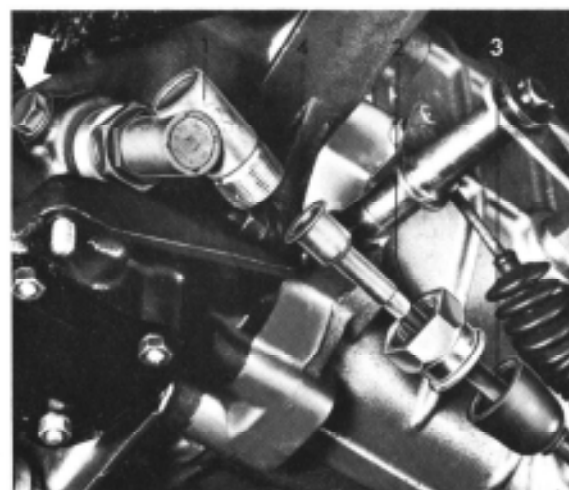


When installing:

Make sure that the rubber boots in tunnel access hole and the speedometer drive unit are correctly seated.

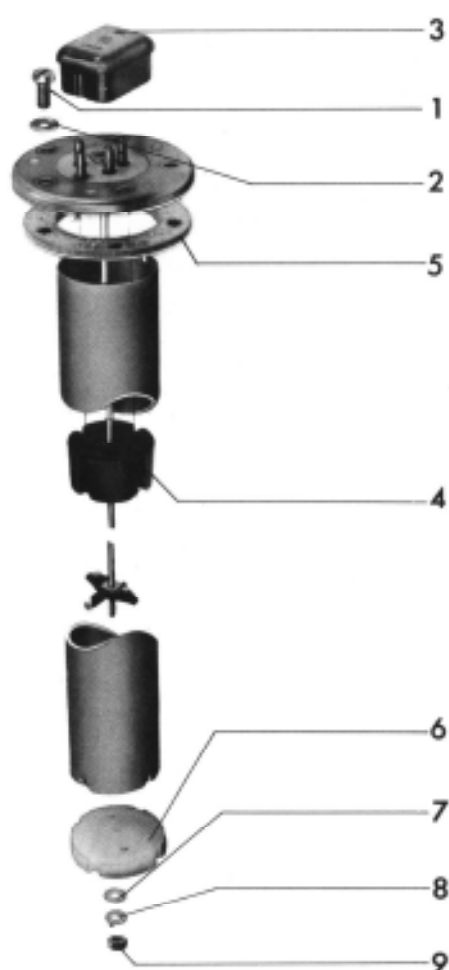
Fasten speedometer cable assembly to the crankcase, together with the hand throttle cable, with a clamp.

- 1 - Speedometer drive unit
- 2 - Cable housing retaining nut
- 3 - Rubber boot
- 4 - Speedometer cable



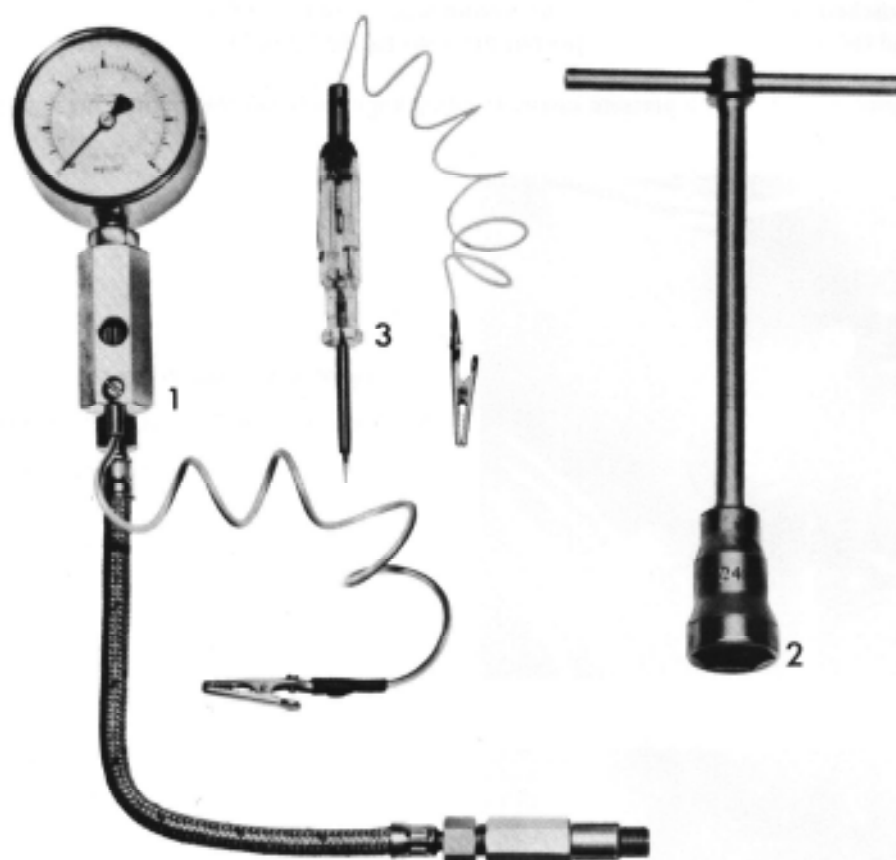
Removing and installing procedure for the speedometer drive unit is outlined in Group 3 - 4.1-5/1 of the workshop manual.

Pickup for Fuel Gauge



No.	Designation	Each	Removal	Observe during Installation	Special Instr.
1	Cheesehead screw	5			
2	Washer	5			
3	Plug	1			
4	Pickup for fuel gauge	1	Mark position		
5	Seal	1		Watch out for accurate seat of bores	
6	Base	1			
7	Pertinax washer	1			
8	Washer	1			
9	Hex, nut	1			

TOOLS

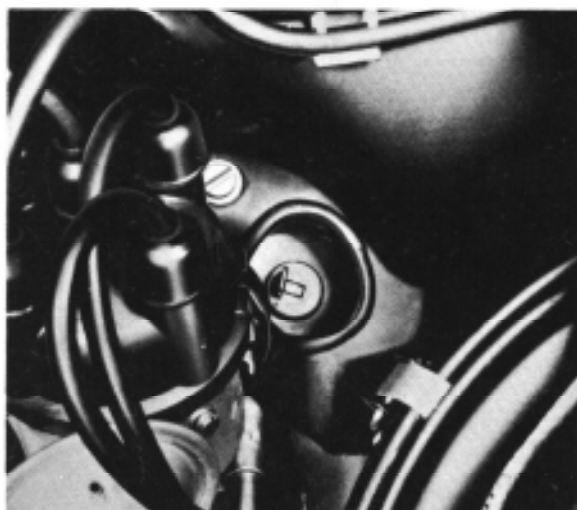


Nr.	Description	Special-Tool Nr.	Remarks
1	Pressure tester	VW 662/2	
2	Oil pressure switch wrench		
3	Test lamp		

Oil pressure switch

The oil pressure switch is installed in the oil pressure circuit between the oil pump and oil cooler. When the engine is not running, a diaphragm-connected contact is held in the closed position by a spring. When ignition is switched on, the current flows from terminal # 15 in the starter switch via the oil pressure warning light and the oil pressure switch to ground; the warning light goes on.

When the engine is running, oil pressure causes the diaphragm to break the circuit; the light goes off.



Removing

- 1 - Remove air cleaner housing.
- 2 - Remove wire from oil pressure switch.
- 3 - Remove switch cover plug and remove the switch.

Installing

The oil pressure switch has tapered which prevent oil leaks. Do not damage threads by overtightening when installing.



Testing Oil Pressure Switch

The oil pressure switch should be checked with the engine warm.

- 1 - Remove oil pressure switch and install in tester.
- 2 - Install tester in crankcase in place of oil pressure switch. Connect the test light between the switch and a source of power. The test light must come on. If not, replace the switch.
- 3 - Start the engine. While increasing the engine speed, observe at what oil pressure the test light goes out. The light should go off when reaching 0.15-0.45 atu (2.2-6.6 psi) at idle speed (or slightly higher if the engine is warm).
- 4 - Stop engine. The test light may come on again with a slight delay since the pressure drop takes place slowly.

The oil pressure switch can not be repaired.

Horn

A solenoid and an electrical breaker produce vibrations in the horn which are transmitted to a diaphragm where they are converted into sound. A integrated condenser, or shading ring, reduces arcing between the contacts of the breaker thereby preventing erosion of these contacts. The horn is activated by the horn ring on the steering wheel (completing the circuit).

914/6 models have two horns, they are located behind grills in the bumper. Type 914 vehicles have only one horn. It is located behind the left grill in the bumper.

Removing Horn

- 1 - Remove grill
- 2 - Remove horn support retaining nut with an offset open end wrench. Make sure that this will not move the driving light out of adjustment; readjust if necessary.



Installing

When installing make sure that the horn support is not damaged and the horn does not touch the body.

In general, when diagnosing a faulty horn, check the wire connections at the fuse box and horn. Check that the horn ring in the steering wheel makes a good ground connection when pressed. Corroded or loose connections frequently are responsible for horn malfunctions.

Horn Actuation

The Type 914 signal horn is connected directly to terminal # 15 in the fuse box (see wiring diagram). The twin horns in Type 914/6 vehicles are connected through a relay switch. Actuation is same in both vehicles. A wire is connected from the horn, or the relay, respectively, to the contact ring. The circuit is completed when the signal horn ring is pressed. The current then flows from the horn, through the contact ring, via a contact to the horn ring to the steering shaft which is grounded. The circuit is completed and the horn blows.



The horns of 1975 models are bolted to the floor plate, instead of the bumper.



CATALYTIC CONVERTER AND EXHAUST GAS RECIRCULATION CONTROLS

All 1975 California Version Models are equipped with a catalytic converter and exhaust gas recirculation (EGR) to help in the fight against air pollution.

The catalytic converter and EGR parts are subject to a certain amount of wear and must be replaced or inspected after a certain period of operation (see Group 2).

A counter is installed in the footwell of the front passenger's side to control this period of operation. It switches both indicator lamps in the instrument panel on after the car has covered a distance of 30,000 miles.

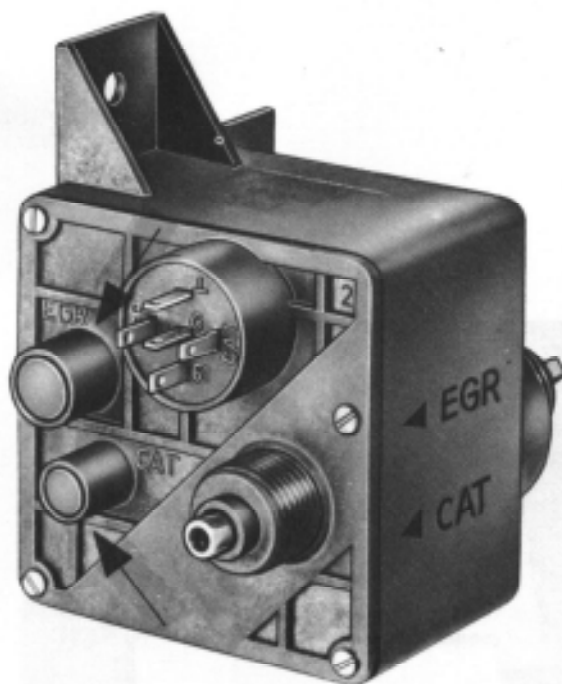
Overheating can cause immediate failure of the catalytic converter. The "CAT" indicator lamp flashes on and off to show excessively high temperatures in the catalytic converter. The indicator lamp goes out again when the temperature drops below the specified limit.

In this case, the catalytic converter must be inspected and, if necessary, replaced.

Note

Extremely high exhaust gas temperatures are usually not encountered during normal operating conditions. If the catalytic converter is too hot, the cause is usually found on the engine, e.g. incorrect ignition timing, failure of ignition circuit or too lean fuel/air mixture.





If the "CAT" indicator lamp remains on continuously, it means that it is necessary to replace the catalytic converter. Check the exhaust gas recirculation system, if the "EGR" indicator lamp lights up (see Group 2).

Press both pins (arrows) in to their stops to zero the counter. (To depress pins, make a right angle tool out of 6 mm 1/4 inch diameter wire approx 7 inches long. Bend 90° at one end approx. 3/4 inch).

"CAT" and "EGR" indicator lamps light up when switching on the ignition and go out when starting up the engine. This method provides a means of controlling the indicator lamps each time the engine is started.



The sensor which controls the catalytic converter temperature is bolted directly to the catalytic converter and is connected to a relay, which is located next to the left taillight housing.



Safety Belt Warning System

As of January 1, 1972, all vehicles are quipped with a safety belt warning system. This system consists of two three-point safety belts with automatic retractor, a warning light with inscription "Fasten Seat Belt" and a seat contact switch built into the passenger seat. The ignition key warning buzzer has been incorporated into this warning system.

Built into the safety belt buckles is an electric contact which is closed when the belts are not fastened; this provides ground for Terminal G of the warning lights. If ground is not simultaneously provided at Terminal 50a through the parking brake contact, the transistor incorporated in the warning light becomes conductive. Since current is always available at Terminal 87a of the buzzer, and at Terminal 15 of the warning light whenever ignition is switched on, the warning light comes on and the buzzer sounds. When the safety belt is fastened, the contact in the safety belt buckle opens and Terminal G is disconnected from the ground.

Built into the passenger seat is a seat contact which interrupts the ground connection between belt buckle on passenger side and Terminal C on the warning light side when not weighted.

The warning to fasten seat belts is given visually by the warning light with the inscription "Fasten Seat Belt" and, simultaneously, by the buzzer when:

- . ignition is switched on,
- . when driver (and passenger) have not fastened their (respective) belt,
- . and the parking brake is fully released.

Function of the ignition key warning buzzer remains unchanged.

Seat Belt Warning System

The seat belt warning system has been changed effective with the 1974 models.

The new system consists of 2 three-point seat belt assemblies with automatic locking retractors, a control lamp with the inscription FASTEN SEAT BELT, a seat contact in each seat, and the so-called logic relay switch with an integrated buzzer. The formerly used, separate buzzer is discontinued. In addition, the control lamp circuit has been changed so that the control lamp cannot be used in vehicles of pre-1974 vintage.

The following steps must be performed to start the engine:

1. The engine can be started at any time when no load is placed on the seats, such as starting from the outside.
2. Whenever a load is placed on a seat, the seat belt must be buckled. This applies to both the driver's and passenger's seats. It may also be necessary to buckle the seat belt when a heavier piece of luggage is placed upon it. Since the action sequence of "Occupy Seat - Fasten Seat Belt" is monitored by the logic relay switch, the engine will not start if either the driver or passenger fastens the seat belt prior to occupying the seat.
When the proper action sequence is not followed, the buzzer and the control lamp with the inscription FASTEN SEAT BELT are activated as soon as the ignition switch is turned on.
3. It is possible to restart the engine without fastening the seat belt if the restarting occurs within 2 ± 1 minutes of shutdown.

The acoustical and optical warning system will be activated whenever any of the following conditions occur when the engine is running:

1. When a load is placed on a seat without buckling the seat belt.
2. If the action sequence of "Occupy Seat - Fasten Seat Belt" was not followed in the order.
3. When a load is removed from a seat, in which the belt is buckled, for more than 10 seconds and then is placed back on it.

In all of the above cases, the warning system can be activated only when the parking brake is in the off position. The warning condition can be cancelled by refastening the seat belts in proper sequence.

The buzzer, integrated in the logic relay switch, also is part of the ignition key warning system.

Control Illumination

Beginning with 1973 models, all vehicles are equipped with illuminated controls.

This provision includes the following points:

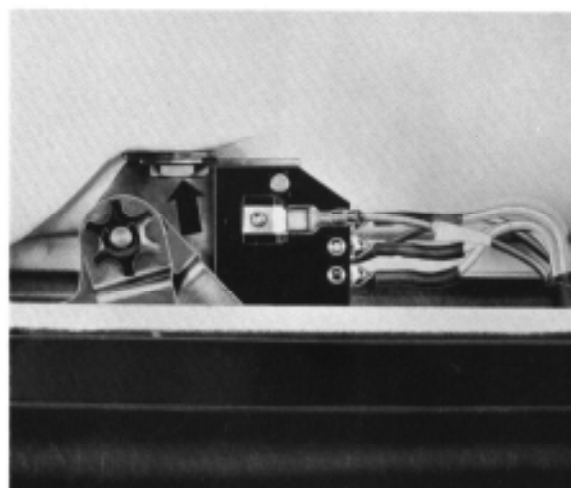
1. Illumination of the heater lever on the center tunnel
2. Illumination of the blower switch on the instrument panel
3. Illumination of the emergency flasher switch

All lamps are connected to the instrument lights and their lighting intensity can be progressively varied.

The upper fresh air ventilation control lever controls the fresh air gates and the fan. When the lever is moved into the left position, the gates are closed. When the lever is moved to the right, the gates open up. The three speed fan runs in the first, second, or third position. The center lever controls the distribution of fresh air. The lower lever controls the distribution of the engine heated air. When the fan is on, a blue light comes on in the right upper part of the fresh air control assembly.

Removing

- 1 - Remove battery ground strap
- 2 - Disconnect control cables from the fresh air control gates (see BODY group).
- 3 - Remove bolt (see arrow) and push the control assembly into the passenger compartment side.
- 4 - Remove wires and withdraw the control assembly with control cables.



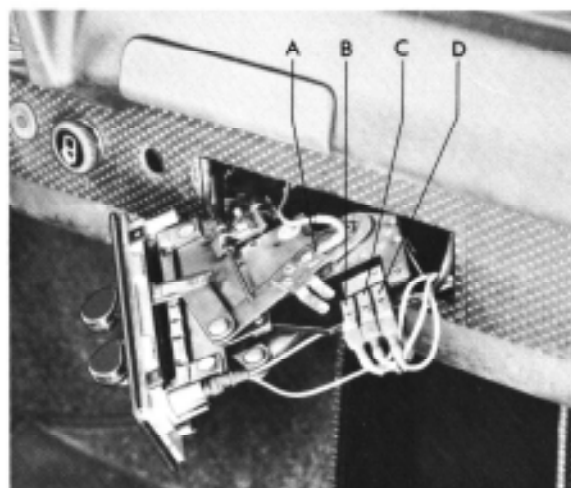
Installing

- 1 - Connect wires.

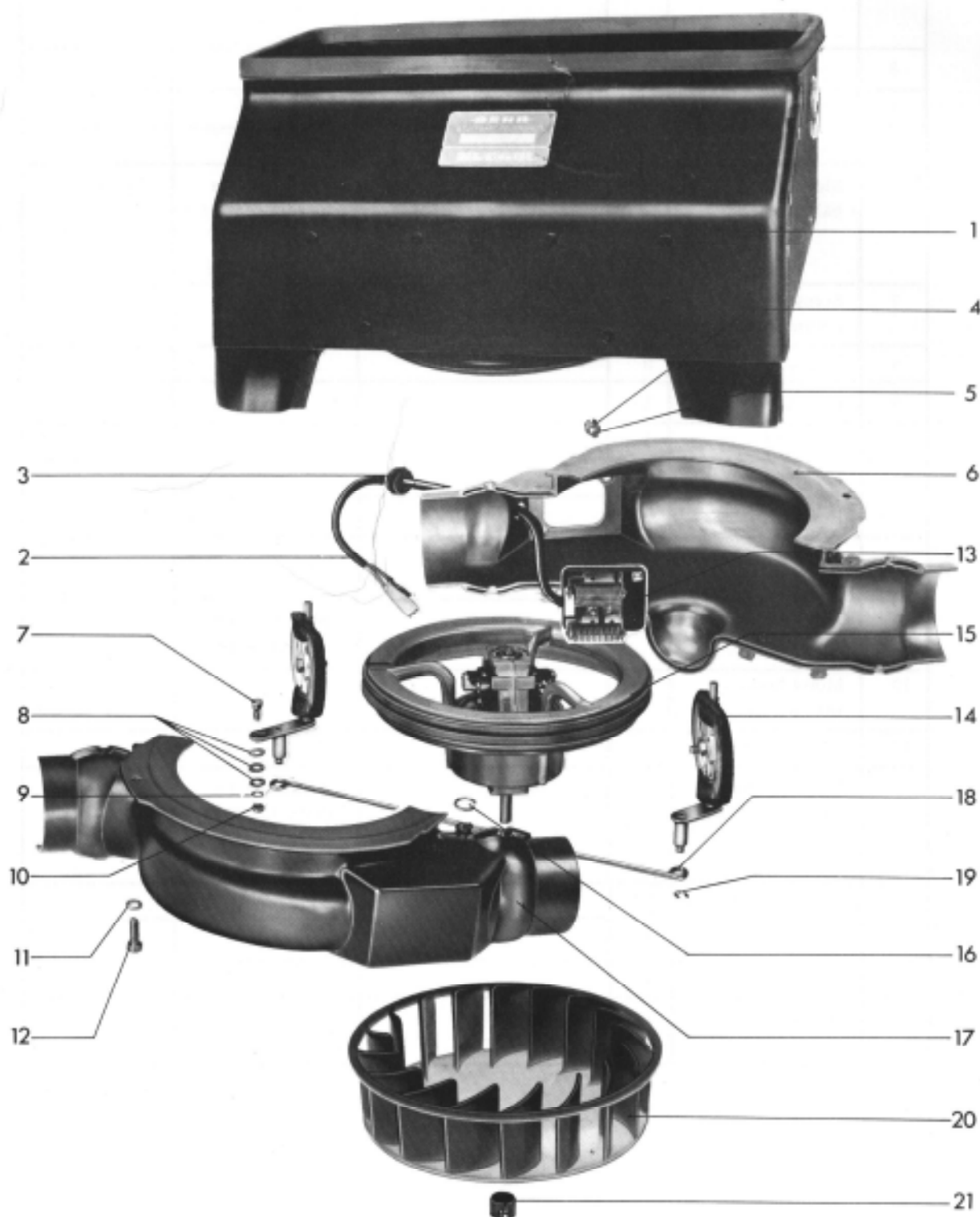
The brown/white wire for the indicator light is connected to the bottom of the control assembly. The "hot" (power supply) line is white/red.

- A = Ground
- B = Slow speed (white/green wire)
- C = Medium speed (white/yellow wire)
- D = Fast speed (white wire)

- 2 - Install control assembly and connect control cables to fresh air gates.

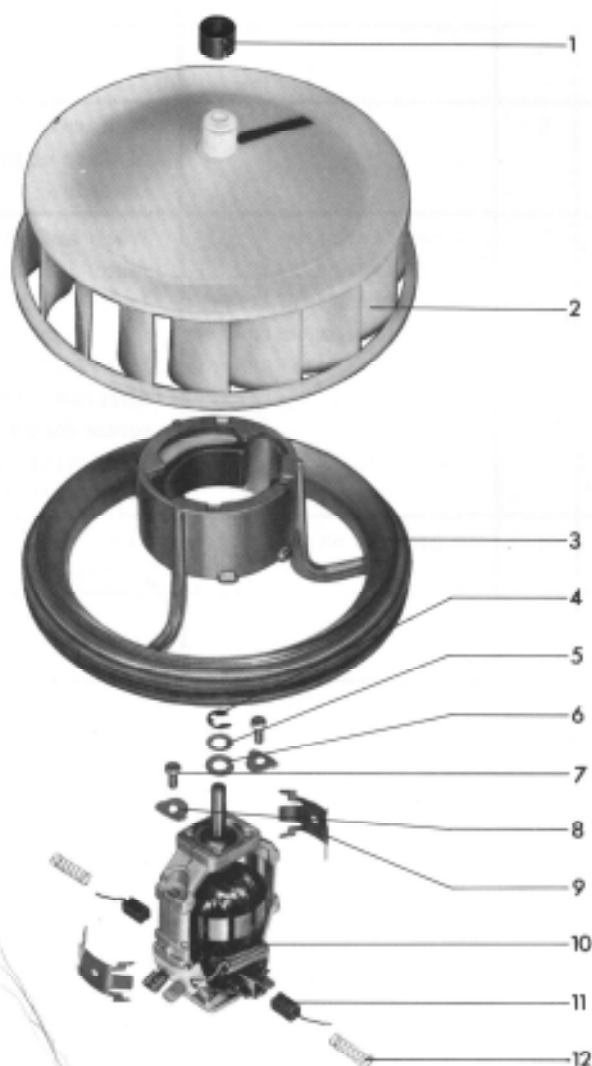


Fresh Air Blower Disassembly and Assembly Type 914 and 914/6



No.	Designation	Each	Observe during		Spec. Instr.
			Disassembly	Assembly	
1	Fresh air blower	1			
2	Line	1		Watch out for good seat of rubber sleeve	
3	Cable sleeve	1			
4	Cheesehead screw	2			
5	Washer	2			
6	Blower housing half rear	1		Watch out for correct seat of rubber seal of motor housing	
7	Screw for cable control attachment	1			
8	Washer	3			
9	Lock washer	1			
10	Hex. nut	1			
11	Lock washer	2			
12	Hex. screw	2			
13	Bimetallic switch with resistance	1			
14	Flap with seal	2		Watch out for correct position	
15	Motor housing with motor	1			
16	Clamping ring	6		Use new rings	
17	Blower housing half front	1		Watch out for correct seat in rubber seal of motor housing	
18	Connecting rod	1			
19	Circlip	2			
20	Impeller	1			
21	Spring clip	1	Push off with screw driver		

Fresh Air Motor Disassembly and Assembly Type 914 and 914/6



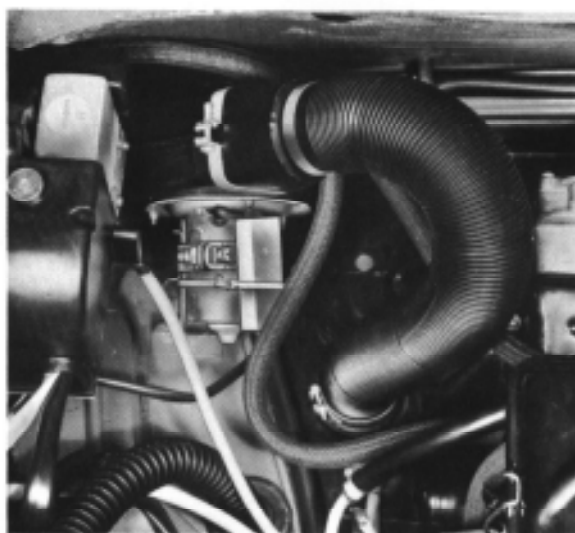
No.	Designation	Each	Observe during		Spec. Instr.
			Disassembly	Assembly	
1	Spring clip	1	Push off with screw driver		
2	Impeller	1		Do not cant while positioning	
3	Motor housing with frame	1			
4	Lock washer	1		Insert accurately into groove of motor shaft	
5	Washer	1			
6	Plastic washer	1			

No.	Designation	Each	Observe during		Spec. Instr.
			Disassembly	Assembly	
7	Cheesehead screw	2			
8	Holding disk for motor	2			
9	Holding clip for motor	2		Push outer ends of these clips inwards	
10	Motor	1	Check collector of armature for wear and windings for breaks and earth connection	When installing motor into blower frame be sure that the two contact lugs point in the direction of the recess for the line layout on blower frame	
11	Carbon brush	2	Check for wear	Replace, if required	
12	Spring for carbon brush	2			

Removing and Installing Heater Blower

Removal

- 1 - Remove hose clamp from duct junction and pull duct off the blower. The attachment of the duct junction will be changed during the 1973 model year. The hose clamp will be replaced with two plastic clamps which will have to be removed to facilitate removal of the junction.
- 2 - A suppressor is attached to the blower motor in vehicles equipped with a radio. Cut the plastic strap with side cutters, push the cover back over the suppressor, then detach the exposed wire, on the blower side, from the suppressor.
- 3 - Remove strap and take blower out.



Installation

- 1 - Make sure that the rubber piece is properly positioned on the console.
- 2 - Position blower in place and fasten with strap. Make sure that blower does not touch regulator plate.
- 3 - Connect wires. Watch polarity: both brown wires, as well as the green and yellow wires, are connected together. The suppressor, if installed, should be connected in same way to both cable ends. The plastic cover must be pushed back over the suppressor in such way that all connectors are covered. The suppressor should be reattached to the blower motor with a plastic hose clamp (at least 250 mm long).
- 4 - Attach duct junction to the blower. Use new plastic clamps, if necessary.



1 - Removing and Installing Passenger Seat

Before removing the passenger seat make sure that the two conductor wire leading from the seat contact to the plug-in connector is disconnected. When reinstalling the seat, don't forget to reconnect it.



2 - Removing and Installing Safety Belt Buckle

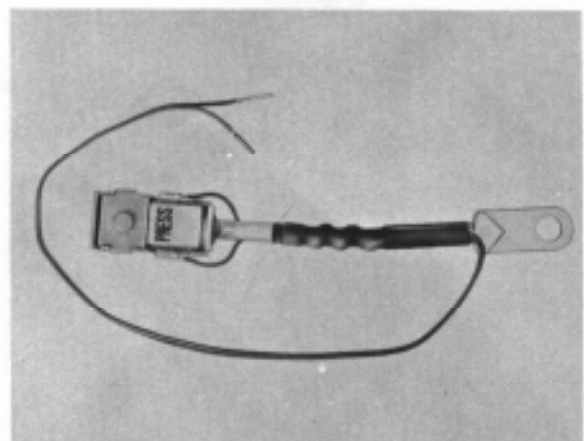
The safety belt buckles are fastened to the center tunnel by a M10 bolt each. The two conductor wire of each safety belt buckle should be detached at the round, four point connector.

When reconnecting the wires, make sure that the wire leading from the driver's side safety belt buckle is connected to brown and yellow, and that on the passenger side to brown and white. The respective color code for the wires is visible at the four point connector.



The M10 retaining bolts have a shoulder which rests against the center tunnel when they are tightened. This allows the belt buckle to swivel on its mounting point.

The contact incorporated into the safety belt buckle cannot be replaced. If repairs are necessary, the entire unit must be replaced.





3 - Removing and Installing "Fasten Seat Belt" Warning Light

The warning light is pressed into a rectangular opening above the heating and ventilating controls in the instrument panel. It is held in place by two plastic clips.

Before removing, detach the four point plug from the rear of the warning light. The light may then be withdrawn through the front end of the panel. The warning light can be easily removed with a screwdriver by carefully prying between the warning light frame and the instrument panel lining (do not damage the instrument panel lining).



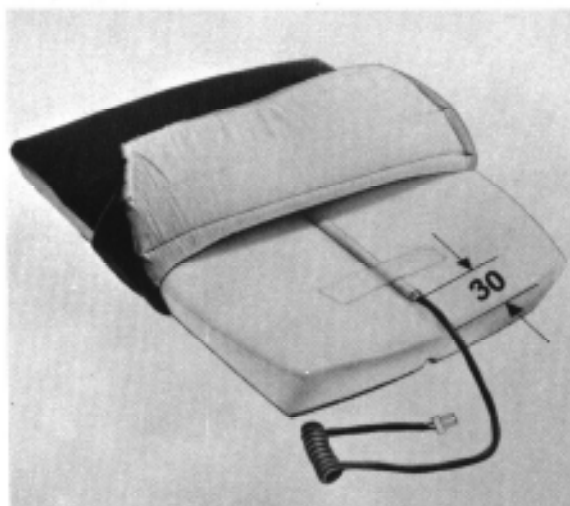
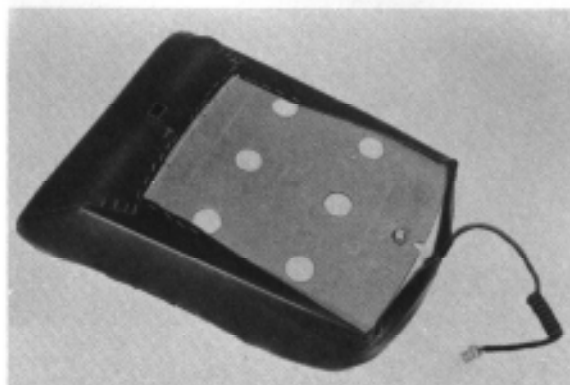
The warning light must be opened when replacing the bulb (12V, 1.2W).

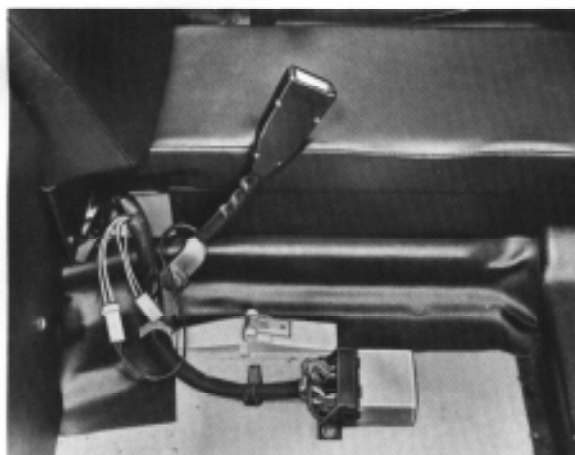
Before installing, it is necessary to position the connecting socket behind the cutout in such a way that light and socket can be reconnected and the light pushed into its seat.

4 - Removing and Installing Seat Contact in Passenger Seat

Detach the two point connector and remove seat cushion. To gain access to the seat contact, remove seat cover by taking out as many staples as necessary. Remove adhesive strips and take out seat contact. Note proper positioning of the seat contact during reassembly.

(Dimensions are 30 mm (1 3/16inch))





5 - Removing and Installing Logic Relay Switch

The logic relay switch is mounted in a socket attached to the floor pan, under the passenger seat, and is accessible upon removal of that seat. The asymmetric arrangement of the contact prongs prevents faulty installation of the relay switch. The written side of the logic relay switch faces the floor pan.

NOTE:

Two contact prongs in the logic relay switch are furnished with a rubber ring. These rings must not be removed from the switch during installation since it is possible to force the contact prongs out of the socket when the switch is pushed in too deep. However, beginning in October 1973, slightly modified logic relay switches are used in which the narrow contact prongs have been shortened. This eliminates the need for the rubber rings.

Troubleshooting Safety Belt Warning System

If the starter does not work despite properly attached safety belts, proceed as follows to eliminate the problem:

- 1 - Remove passenger seat and replace logic relay switch.

If this does not correct the problem, the malfunction may be in the following component areas:

- a - in the starter itself
- b - in the ignition/starter switch
- c - in the connecting wire between the two
- d - in the wires between belt and seat contacts, and logic relay switch.

- 2 - Remove logic relay and connect jumper wire between terminals C and 50 in the logic relay socket. The jumper wire must be provided with flat contact tabs to ensure good connection.

If starting is now possible, the defect will be found in the wires which connect the belt or seat contacts with the logic relay switch.

- 3 - Remove seats and check electrical connections according to the wiring diagram.

If the starter fails to work despite the jumper wire connection, check starter, starter/ignition switch, or wires connecting the two.

Other possible malfunction areas are:

- a - Malfunction in the optical and acoustic warning devices when belts are not buckled.
- b - Activation of the warning devices despite proper handling of the safety belts.

In either case, first replace the logic relay switch and then, if necessary, check the electrical connections and wires in the safety belt warning system by following the wiring diagram.

NOTE:

Upon rectification of the problem be sure to remove the jumper wire and replace the logic relay switch, otherwise the entire safety belt warning system will remain inoperative.



Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
1	Identification cap	1			
2	Knob	1			
3	Lighter body with heating coil	1			
4	Lighter housing	1	Remove battery ground strap. Do not mix up positive and negative wires.		
5	Retainer	1	Remove with a screwdriver from the compartment side through cut-outs in housing.	Replace if necessary.	

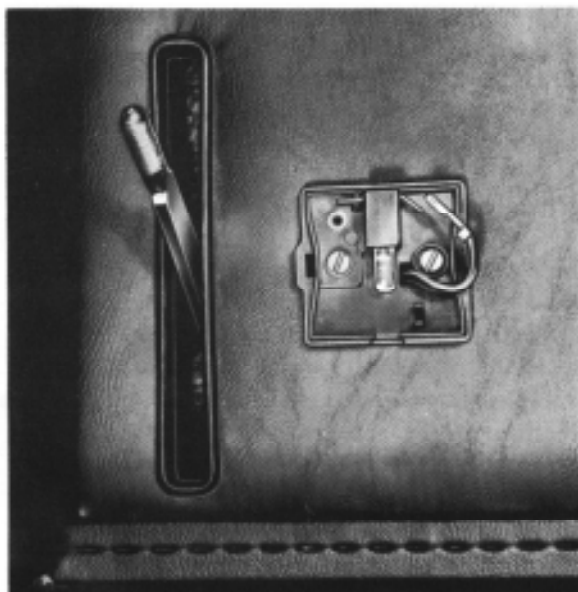
Illumination of the Heater Lever

A square-shaped lamp is located on the center tunnel, or tunnel console, respectively, near the heater lever.

Directions for the application of the heater lever are imprinted on the lamp cover.

Pull the lamp cover up to replace the wedge-base bulb (12V, 1,2W).

The console cover must be removed if the entire lamp assembly is to be removed.





Illumination of the Ventilation Blower Switch

A wedge-base bulb (12V, 1.2W) is located behind each of the positions "DEF.OFF" and "DEF.MAX." in the lower part of the blower switch.

The bulbs are mounted in sockets and are inserted in their appropriate receptacles from behind the switch assembly. They are accessible through the bottom of the instrument panel without removal of the knee protector.

Beginning with the 1974 models, an additional wedge-base bulb is located above the "DEF.OFF" position.



Illumination of the Emergency Flasher (Hazard Warning) Switch

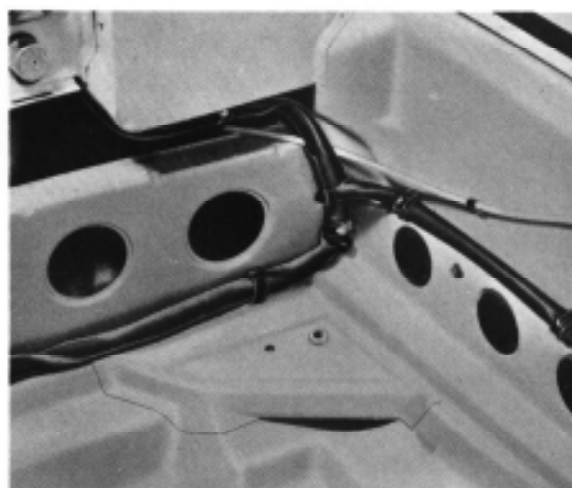
The control bulb located in the emergency flasher switch is connected to the light switch terminal 58b through a ballast resistor incorporated in the emergency flasher switch. The bulb simultaneously fulfills the purpose of illuminating the emergency flasher switch, although it burns with lesser intensity.

This new emergency flasher switch with the incorporated ballast resistor differs in appearance from the formerly used switch in that it has the added terminal 58b; it can be used as well in vehicles which are not required to be equipped with the illuminated emergency flasher switch, in which case terminal 58b will remain unused.

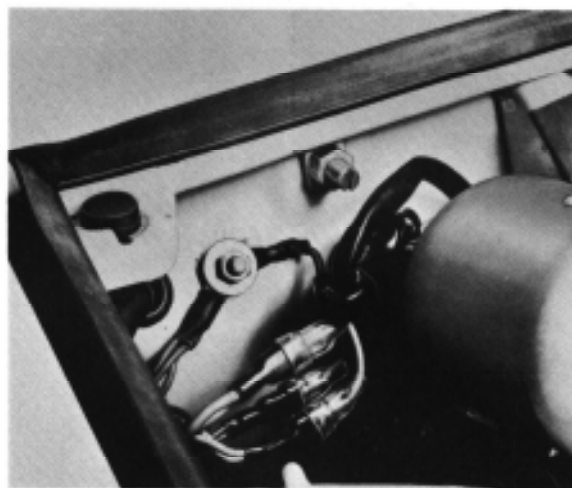
Main Wiring Harness

Removing

- 1 - Remove battery ground strap. Remove fuse box.

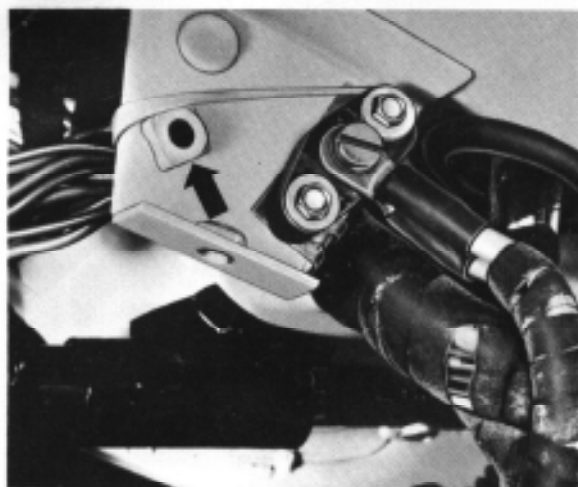


- 2 - Detach wires leading to the driving lights, headlamps, and horn(s). Remove wires from retractable headlight motors and turn signal light.



- 3 - Remove fuel tank, pry wire clips open, and pull wiring harness back into the fuel tank compartment.
- 4 - Disconnect wires from fuel level sending unit, fan and, in Type 914, the windshield wiper motor. Pull the harness into the car interior.

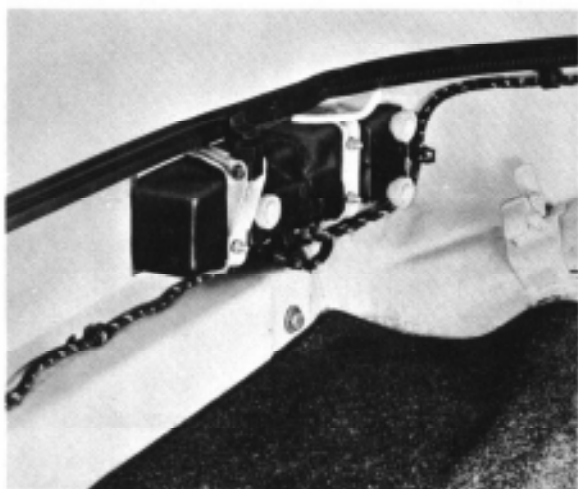




- 5 - Remove wires from the collective terminals which are located on the fuse box retaining bracket (ground wires see arrow).



- 6 - Remove instrument panel and detach all wires from the instruments and switches. Pull connector plug for turn signals from the control panel. Remove turn signal switch connector, as applicable.
- 7 - Remove left floorboard and center tunnel cover. Detach wires from stoplight switch. Remove driver's seat.



- 8 - Disconnect wires from the tail lights, license plate light, and luggage compartment light. Pry retaining clips open and pull wiring harness into the engine compartment.
- 9 - Disconnect positive wire from battery and disconnect plug from relay console in engine compartment.

- 10 - Pry retaining clips open in the engine compartment and pull the wiring harness into the car interior through the opening. Remove wires from interior compartment light and brake warning light.



Installing

Make sure during installation that all grommets make a good seal around the wiring harness. Connect wires according to the wiring diagram. To ensure that voltage drop throughout the entire wiring harness is kept at a minimum, make sure all terminals and ground connections make proper contact. Plug connectors should be sprayed with contact cleaner, if necessary.



Description of Battery

Electrical energy generated by the alternator is stored in the battery by an electro-chemical process. The battery provides the necessary current for the starter and ignition system when the engine is being started.

The battery cells consist of a set of positive lead proxide (PbO_2) and negative lead (Pb) plates each. Each cell of a battery produces approximately 2 volts. A 12-volt-battery therefore has 6 cells connected in series. The battery is filled with electrolyte. The electrolyte is a liquid mixture of diluted sulphuric acid ($\text{H}_2\text{SO}_4 + \text{H}_2\text{O}$) with a specific gravity of 1.285.

The cells are accommodated in a common housing made of acid-proof insulating material, and are connected in series by heavy lead bridges. To prevent mixups, the battery positive terminal is thicker than the negative terminal. In addition, the terminals are marked + and -.

Cell Voltage

Nominal cell voltage is 2 volts. During the charging process, the voltage in the cells rises to about 2.5-2.7 volts and drops down by itself shortly after the charging current is turned off to 2-2.1 volts (12-12.6 volts for the entire battery). When the battery voltage drops to 10.5 volts without electrical loads applied, the battery is fully discharged.

Battery Capacity

According to DIN 72311 standard, battery capacity is the energy which a battery can produce over a period of 20 hours at electrolyte temperature of 27°C (80°F). This value is given in terms of ampere-hours (Ah). This means that a battery with a capacity of 45 Ah can supply a current of 2.25 A, over a period of 20 hours, at a temperature of 27°C (80°F).

Discharge Process

During the discharge process, both plates absorb more and more parts of sulphuric acid and change into lead sulphate (PbSO_4). This reduces the specific gravity (1.12 at 20°C (68°F) in discharged condition).

Charging Process

Storage batteries can be charged only with direct current. (DC)

In the car, the alternator provides such direct current. It is important that the positive terminal of the DC source is connected to the positive terminal in the battery, and the negative DC source to negative battery terminal. Action of the DC current, which should be 2.7 volts per cell, converts the positive plates into lead proxide (PbO_2) and the negative plates into lead (Pb). The sulphuric acid particles absorbed by the plates during the discharge process are freed again, causing the specific gravity to rise to 1.285 (when fully charged at 20°C (68°F)). If the charging current remains connected, water contained in the electrolyte changes into oxygen and hydrogen, causing the battery to boil (gass).

Specific Gravity

Specific gravity, together with cell voltage, provides an exact indication of the state of charge of the battery. Specific gravity is tested with a hydrometer. The hydrometer consists of a glass cylinder with a suction ball, and a calibrated float with scale. The higher the specific gravity of the electrolyte, the higher the float. The following values must be attained:

State of Charge	Normal Climate Zones Specific Gravity	Tropics Specific Gravity
Discharged	1.12	1.08
Half loaded	1.20	1.14
Fully loaded	1.285	1.23

Winter Operation

Battery capacity is greatly affected in cold weather because conductivity and viscosity of the electrolyte varies considerably with temperature changes. The capacity drops considerably at low temperatures and, at an electrolyte temperature of -25°C (-13°F) provides only about 50% of the capacity available at $+20^{\circ}\text{C}$ ($+68^{\circ}\text{F}$). Also, the specific gravity of the electrolyte also drops in more or less discharged batteries so that possibilities of freezing are also increased. Frozen batteries supply no current. The battery will work again after deicing and recharging.

Specific Gravity	Electrolyte Freezing Point
1.285	-65°C (-55°F)
1.18	-22.5°C (-7°F)
1.14	-13°C ($+10^{\circ}\text{F}$)

Greater demands imposed upon the battery during the cold season, due to the considerably greater starter loads, require particular attention during service operations. It is recommended to fully charge the battery outside the car at four week intervals during the winter, at the same time checking specific gravity and level of electrolyte.

Battery Storage

Batteries stored for prolonged periods of time lose their charge. This discharge process depends upon the temperature at storage. The discharge rate increases with increasing temperatures. The loss at room temperature is about 1% of the capacity per day. Discharged batteries stored in warm rooms accumulate heavy coatings of lead sulphate on the plates (grey in color).

Batteries with heavily "sulphated" plates can not provide the high rate of current needed for starting the engine. They should be replaced.

The following points should be observed when a battery is to be stored in order to prevent self-discharging and "sulphating":

- 1 - Charge battery, check specific gravity and electrolyte level, add water if necessary.
- 2 - Store battery in a cool and dry place, discharge and recharge every 6 to 8 weeks.
- 3 - Prior to returning a stored battery to regular use, recharge it at low rate (max. 3 amps).

If batteries stored for prolonged time show considerable voltage variations from cell to cell, they may be "sulphated". Sulphated batteries gass excessively during the initial charging period. They should be charged at a slow rate (3 amps max.) to remove the lead sulphate from the plates.

In no case may "sulphated" batteries be quick-charged at high current rate.

Activation of Dry-Charged Batteries

When dry-charged batteries are activated for use, follow manufacturer's instructions. In general, the following applies:

- 1 - Store the batteries in a cool and dry place until used.
- 2 - Remove battery filler caps and fill cells with clean electrolyte with specific gravity of 1.285 at 20°C (68°F).
- 3 - After about 15 minutes, shake the battery lightly and refill with electrolyte to proper level.
- 4 - The battery is ready for use.

Maintenance Hints

The battery should be securely mounted in the vehicle. Battery terminals and cable clamps must be clean. They should be cleaned with a rag or with a terminal cleaner. After installation, the terminals and clamps should be lightly coated with battery terminal grease or petroleum jelly.

Caution!

Use a battery terminal puller if clamps cannot be easily removed.

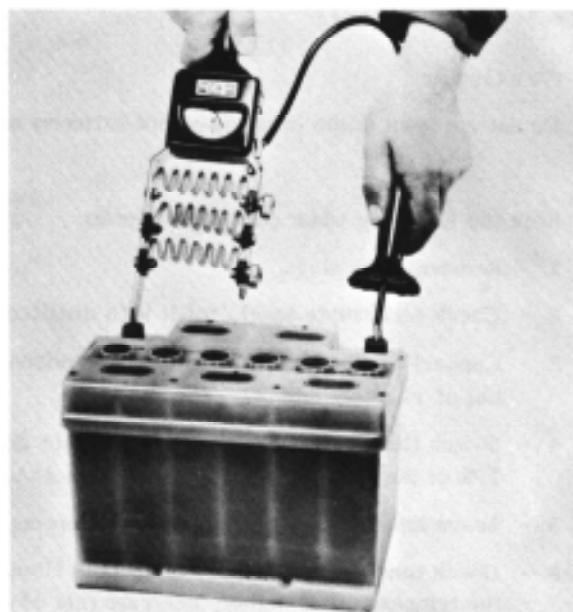
Note:

Grease, oil, and gasoline may discolor plastic battery cases.

Testing Voltage

The battery should always be tested under load. When a current load of about 110 amps is applied, the voltage must not drop to below the minimum value of 9.6 volts. Should the total voltage drop below the given value during this test (5-10 seconds duration), then the battery is either discharged or defective (sulphated).

Total voltage can be checked with a battery tester or a suitable quick-charge unit.



Note:

Discharged batteries should be charged at once! (See instructions under Battery Storage).

Checking Electrolyte Level

Electrolyte level will decrease with battery use due to the deterioration (gassing) of the water. Refill only with distilled water. Do not use rain water or tap water. Electrolyte level should be 5 mm (3/13 in.) above the plates, including separators. If a level indicator is incorporated in the battery, use it as a guide.

Overfilled batteries can boil over at high charge rate. Underfilled batteries have a shorter life.

Electrolyte

Electrolyte should be refilled only when the drop in level was due to a boiling-over or other leakage. Check specific gravity if electrolyte was added.

Charging Battery

Caution!

Do not use open flame in rooms where batteries are charged.

Note the following when charging batteries:

- 1 - Remove filler plugs.
- 2 - Check electrolyte level, refill with distilled water if necessary.
- 3 - Connect positive battery terminal to positive terminal of charging unit, and negative battery terminal of charging unit.
- 4 - Switch the charger on. The charging rate depends on the capacity of the battery. It should be about 10% of the battery capacity. (Charge a 45Ah battery at a rate of 4.5 amps).
- 5 - Leave the filler caps off during the charging procedure.
- 6 - Check temperature of electrolyte from time to time. Maximum temperature is 40° C (104° F). If the temperature is higher, decrease rate of charge and charge over a longer period of time.
- 7 - Charge the battery until all cells are gassing freely and no increase in specific gravity and voltage can be noted in three tests made each one hour apart. If so, the specific gravity must be 1.28 and total cell voltage 15.6 - 16.2 volts. Check voltage with load current on, specific gravity at prescribed electrolyte level.

Quick-Charging

Quick-charging should not become the rule.

The quick-charging process can be applied only to batteries in use which are in faultless electrical condition. Batteries which were in storage for prolonged periods of time should not be quick-charged. The same applies to brand new batteries.

Follow operating instructions furnished with the charging unit.

The charging current should be 80 - 90% of the battery capacity. (Charge a 45Ah battery at a rate of about 36 - 40 amps).

Removing and Installing Battery

The plastic-case battery is mounted on a support plate to the right of the engine, and is fastened with two clamps. The rearward clamp (on the body side) is welded on, the forward clamp is bolted on.

- 1 - Detach battery ground strap. Then detach the cable clamp from the positive terminal.
- 2 - Unscrew holddown clamp and take the battery out.

Make sure during installation that the battery is securely fastened. If necessary, clean battery terminals and cable clamps and coat with battery terminal grease or petroleum jelly after installation. Always attach the battery positive terminal first.

