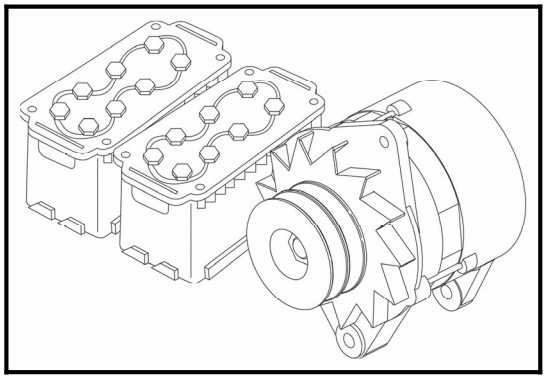


BEML - TATRA 815

26RR36 22 255 6x6.1R/50T, 51T

Workshop manual

Part 15 – ELECTRIC ACCESSORIES

Publication numer: 03-0254-ENG/00

TATRA, a.s. **1-st Edition 28-2-2007**

15 ELECTRIC ACCESSORIES

15.1 Description and Main Technical Specifications

The electric equipment of the vehicle BEML - TATRA **T 815 - 26RR36 22 255 6x6.1R/50T** and BEML - TATRA **T 815 - 26RR36 22 255 6x6.1R/51T** is of the so-called single-wire connection type when the positive lead is a cable and a reverse conductor at a time and the negative lead is a common one and it is a vehicle steel construction (ground). Some electric instruments are connected through a cable harness, which includes a grounding cable to assure a safe function. The two cables independent of the batteries cut-of switch connect only the independent heater and the infrascope.

Two lead **starting batteries** connected in series provide a source of the electric power to start the engine and to operate electric consumers with the engine not running. The source of the electric energy with the engine running is an **alternator** The alternator is driven from the engine crankshaft.
To start the vehicle engine, the **electric starter motor** is used.
The main specifications of the batteries, alternator and starter motor is listed in the next table.

Tab. 15.1 Main Specifications of the Electric Equipment

Data		Unit	Value
Type of the electric system			one-conductor
Nominal voltage		V	24
Grounding			negative pole
Accumulators	- number	pc	2
	- connection		in series
	- battery nominal voltage	V	12
	- nominal capacity C_{20}	Ahr	180 (177)
Alternator	- nominal voltage	V	24
	- operating voltage	V	28
	- maximum current	A	55
Starter	- nominal voltage	V	24
	- nominal output	kW	6.6

The circuit breaker of accumulators is located in the cabin, on the LH side behind the co-driver's seat. After terminating the driving or in case of a longer putting the vehicle out of operation, switch off the accumulators (thus interrupting the electric circuit). To switch off the accumulators, turn the circuit breaker handle to the left. **It is forbidden to disconnect the accumulators when the engine is running. This could lead to destruction of the semiconductors of the charging set.** Contrary to this, during repairs or replacing of some part of the electrical equipment it is always necessary to switch off the accumulators. Thus you prevent a contingent short circuit during assembly in the electrical system.

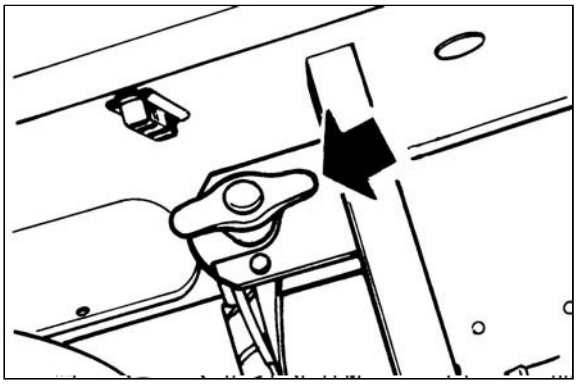


Fig. 15.1 Circuit breaker of accumulators

The instruments and switches (See Fig. **15.2**) and signal lamps (See Fig. **15.3**) are situated on the driver's instrument board.

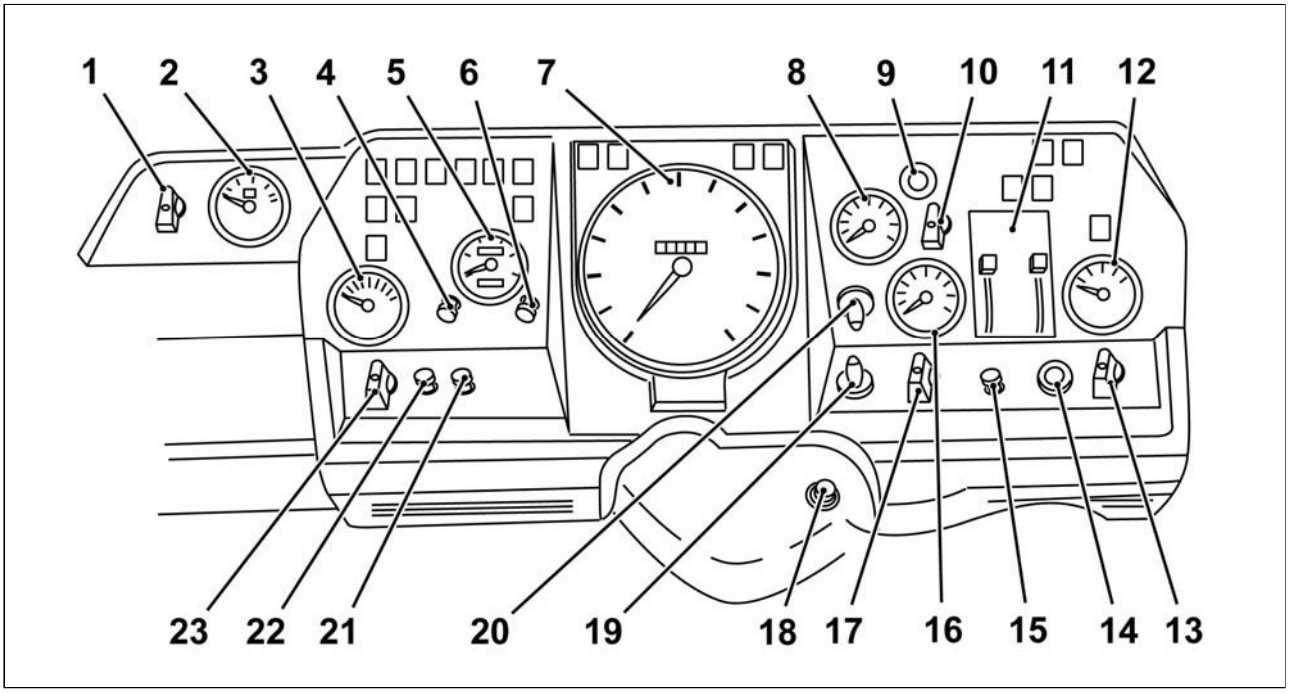


Fig. 15.2 Panel c/w instruments and switches

List of the instruments and switches on the panel:

1 – Winch controller (applicable for model RR36 6x6/50T)
2 – Voltmeter
3 – Fuel gauge with signal lamp of minimum fuel amount
4 – Switch of special warning lights - beacons
5 – Tachometer c/w eng. hrs counter
6 – Switch of lamp for illumination of towing hook
7 – Electronic speedometer c/w counter of km covered
8 – Double air pressure gauge in brake system
9 – Button switch to stop the engine
10 – Change-over switch to shift in auxiliary gears
11 – Control levers of heater and ventilation
12 – Air pressure gauge for tyres inflation
13 – Emergency flasher (hazard warning lights) switch
14 – Push-button switch of engine brake
15 – Switch of electric delivery pump
16 – Oil pressure gauge c/w signal lamp of the minimum oil pressure
17 – Fan switch
18 – Ignition box with starter
19 – Change-over switch of headlamps (upper – lower)
20 – Convoy light switch
21 – Switch of fog headlamps
22 – Dome light switch
23 – Rotary switch of outer illumination c/w TEST switch - push it to check a bulb function in the signal lamp of both circuits of service brake

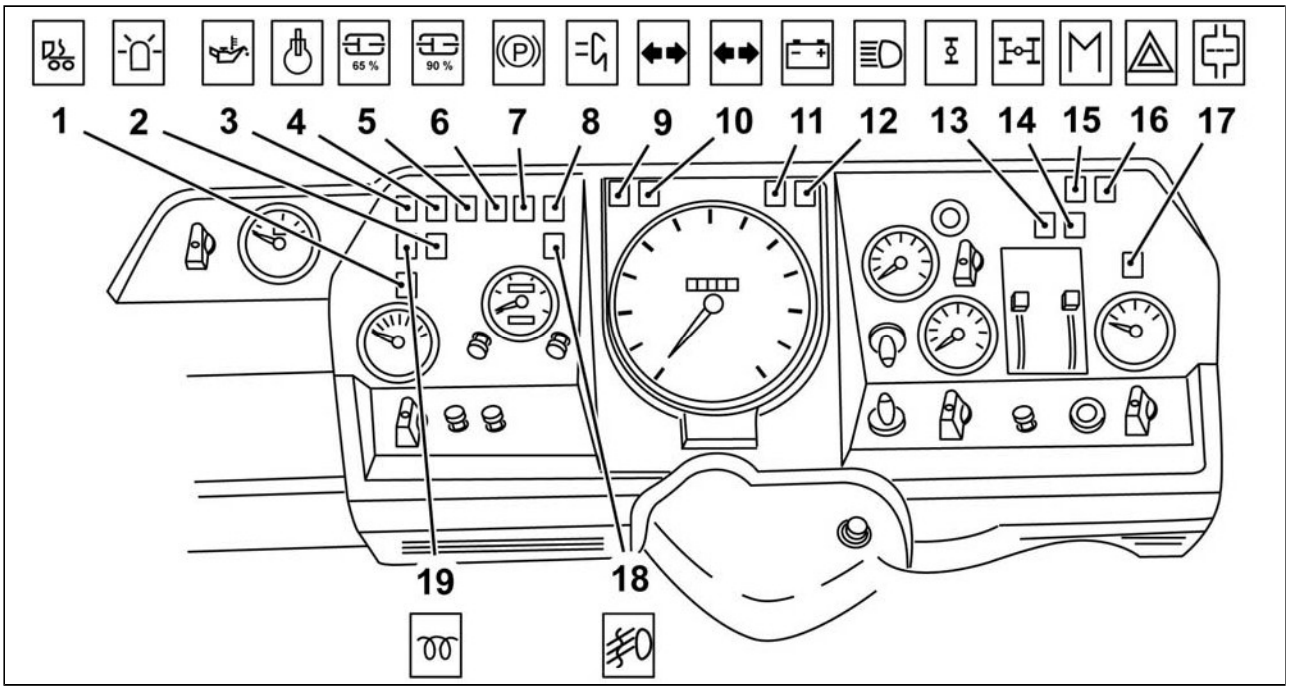


Fig. 15.3 Signal lamps of instrument panel

List of the signal lamps:

1 – Driver's cab signal lamp (red)
(If the driver's cab is not locked, the signal lamp comes on with the ignition on)
2 – Signal lamp of special warning lights (yellow)
3 – Signal lamp of engine electronic cooling malfunction (red)
4 – Signal lamp of engine overheating (red)
5 – Signal lamp of air overpressure in brake circuits (red)
(When it comes on during the driving, it signals an excessive pressure drop in any of the two brake circuits. If during further move or engine operation without air draining by braking it does not come to air boosting and going out of the signal lamp, it is necessary to stop the driving, and to ascertain and correct the cause of the air escape. The actual air storage in both the circuits must be incidentally watched on the double air pressure gauge on the instrument panel.)
6 – Signal lamp of air overpressure drop in spring cylinders of service brake (red)
(If it comes on during the driving, it signals an excessive pressure drop in circuit of spring cylinders. If during further move or engine operation without air draining by braking it does not come to air boosting and going out of the signal lamp, it is necessary to find out and correct the cause of the air escape. During this signalling, remember not to apply this brake very often.)
7 – Signal lamp of parking brake (red)
8 – Signal lamp of towing hook illumination (yellow)
9 – Signal lamp of vehicle turn signals (green)
10 – Signal lamp of trailer turn signals (green)
11 – Signal lamp of accumulators charging (red)
After starting the engine, the signal lamp goes out. If lights on the move permanently, it signals a defect in electric circuit of the charging set and/or the tensioning of alternator drive belts may be insufficient.)
12 – Signal lamp of high beams (blue)
13 – Signal lamp of front wheels drive and inter-axle differential lock engagement (green)
14 – Signal lamp of axle differentials locks engagement (green)
15 – Signal lamp of electric delivery pump operation (white)
16 – Signal lamp of emergency flasher (hazard warning lights) (red)
17 – Signal lamp of air cleaner (white)
(When main filter elements are polluted excessively, the signal lamp lights up on the move during the engine

running. In such a case, carry out its cleaning.)
18 – Signal lamp of fog lamps (green)
19 – Signal lamp of engine preheating (yellow)

ELECTRIC EQUIPMENT

Used for securing all electrical circuits are ceramic fuses which are located in the fuse boxes on the RH side under the upper cover of the instrument panel. The other current fuses, diodes and relays are located on the fuse panel on the RH side under the front vehicle bonnet.
If some fuse blows out, find out which electric part of the vehicle is connected to the pertaining fuse, check it for function, repair the faulty part and replace only with the fuse of the same ampere value.

Survey of Fuses Located under the Upper Cover of the Instrument Panel

1 P1 (5A) - Lower high beam, LH
2 P2 (5A) - Lower high beam, RH
3 P3 (5A) - Lower low beam, LH
4 P4 (5A) - Lower low beam, RH
5 P5 (5A) - Lower position lamp, LH, tail lamp, LH, upper contour lamps, width indicator lamps, spot lamp, instruments illumination, lamp for illumination of towing hook
6 P6 (8A) - Lower contour lamp, RH, tail lamp, RH, license plate lamp
7 P7 (16A) - Fog lamp, map reading lamp
8 P8 (5A) - Brake lights
9 P9 (5A) - Radio station socket

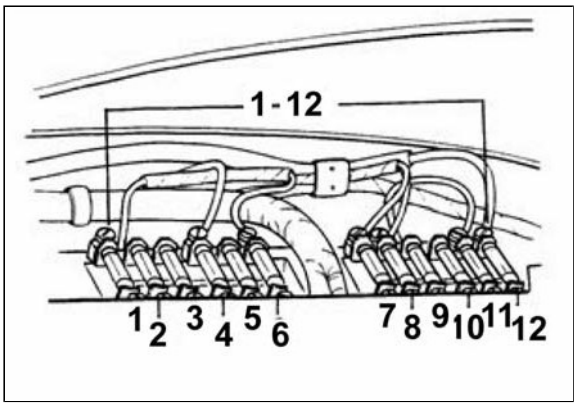


Fig. 15.4 Fuses located under the upper cover of the instrument panel

10 P10 (16A) - Hazard warning lights, conserver charging sockets, dome light, inspection lamp socket, voltmeter, speedometer, electronic cooling control
11 P11 (16A) - Engine start, engine start from external source, speedometer, oil pressure gauge, fuel gauge, tachometer, air drier, reverse lamp, independent heater, audible warning, electromagnetic air valves(to shift in low/high gears), crawl speed (turtle)/ quick speed (hare), relief (engine) brake, winch control (for the 50T model), electric delivery pump, signal lamps: charging, air overpressure in brake circuits, parking brake, axle differential locks, air cleaner, electronic cooling control, cab locking
12 P12 (8A) - Special warning lights

Fuses, Diodes and Relays Located under the Front Vehicle Bonnet

1 PSS - Turn signal lights interrupter
2 - Audible warning
3 P27 (10A) - Fuse of upper low beam
4 P28 (10A) - Fuse of upper high beam
5 P24 (10A) - Fuse of wiper, windshield washer and horn
6 P25 (15A) - Fuse of dependent heater
7 P19 (5A) - Fuse of high / low beam relay
8 P20 (10A) - Fuse of turn signal lights
9 D635 - Diode of instruments illumination
10 D549 - Diode of transfer case engagement
11 P22 (25A) - Fuse of starter motor
12 506 - Relay of starter motor
13 597 - Relay of start blocking
14 149 - Relay of fog lamps
15 525 - Relay of circuit ”15”
16 148 - Relay of low beam
17 89 - Relay of high beam
18 590 - Relay of air heating

The independent heater fuse (7.5 A) is placed above the heater body.

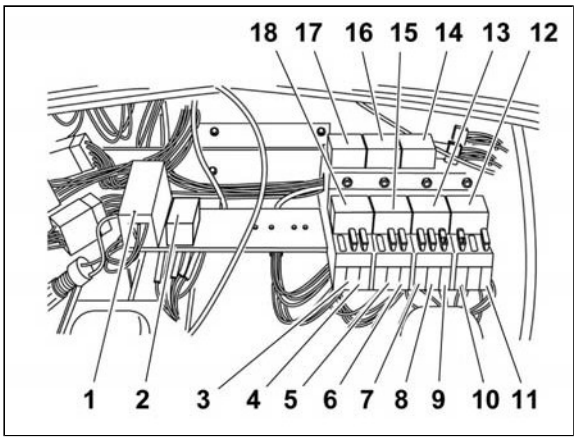


Fig. 15.5 Fuses, diodes and relays located under the front vehicle bonnet

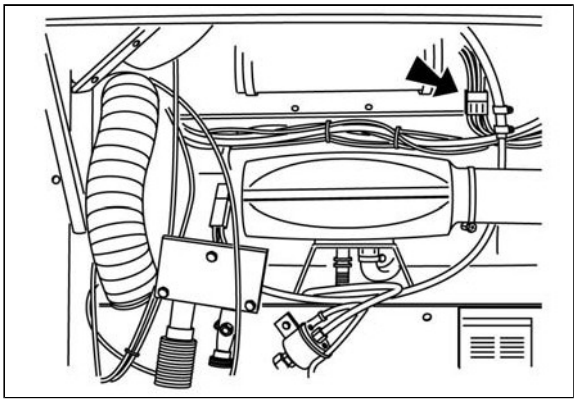
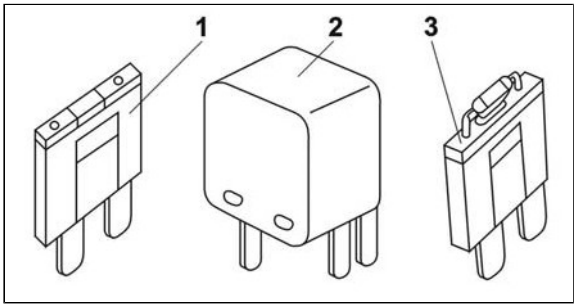


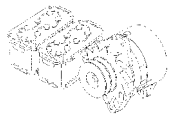
Fig. 15.6 Independent heater fuse

A proper performance of current fuses **1**, electromagnetic relays **2** and diodes **3** is illustrated in figure.



Legend: ***1*** *– current fuse,* ***2*** *– electromagnetic relay,* ***3*** *– diode*

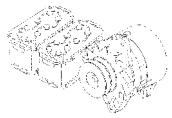
Fig. 15.7 Performance of elements on the fuse panel



The vehicle is equipped with a standard illumination, which is required for the road traffic. A list of the bulbs is in the next table.

Tab. 15.2 Survey of bulbs used (bulbs for the nominal voltage of 24 V)

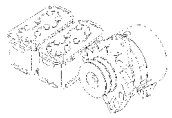
Equipment		Bulb, nominal voltage 24 V	
		Power input W	**Base**
Lower headlamps:	- high / low beam lights - contour lights	75/70 – H4 4	P 43t Ba 9s
Upper headlamps:	- high / low beam lights - contour lights	75/70 – H4 4	P 43t Ba 9s
Rear cluster lamps:	- turn signal and tail lamp - stop lamp	21/5 21	BAY 15d Ba 9s
Special warning lights		70 – H3	PK 22s
Fog headlamps		70 – H3	PK 22s
Turn signals		21	Ba 15s
Map-reading lamp		4	Ba 9s
Spot searchlight		35	Ba 20s
Dome lights		21	Ba 15s
Lamps for illumination of instruments		2	Ba 9s
Back-up light		70 – H3	PK 22s
Illumination of towing hook		35	Ba 20s
Width-indicating lamps		4	Ba 9s



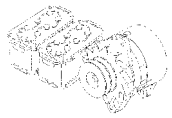
Marking of Electric Equipment Components in Diagrams

Regarding the fact that the vehicle manufacturer uses a fixed method of marking the principal components, this marking (list of parts) does not form a continuous numerical sequence.

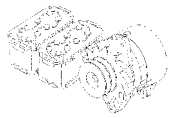
Item	N a m e
P	Fuses
1	Main headlamp, LH (a - high beam, b - low beam, c - contour lights)
2	Main headlamp, RH (a - high beam, b - low beam, c - contour lights)
3	Rear cluster lamp, LH (a - stop light, b - turn signal, c - tail light, d - reversing lamp, e - fog light, f - license plate light)
4	Rear cluster lamp, RH (a - stop light, b - turn signal, c - tail light, d - reversing lamp, e - fog light)
5	7-pole socket, rear
6	Fog headlamp, LH front
7	Fog headlamp, RH front
8	High beam signal lamp
9	Front fog headlamp signal lamp
10	Low / high beam changeover switch + check push button
11	Front fog headlamp switch
12	Instruments illumination bulbs
13	24N socket
14	Stop lights switch
15	Turn signals interrupter
16	Turn signal, LH front
17	Turn signal, RH front
18	Turn signal, LH side
19	Turn signal, RH side
20	Combined changeover switch a) low / high beam b) wipers
21	Turn signals signal lamp, vehicle
22	Turn signals signal lamp, trailer
23	Dome light
24	Dome light switch
27	Inspection lamp socket
28	Wiper
30	Fuel gauge
31	Windshield washer
32	Signal lamp switch of pneumatic circuit I
33	Signal lamp switch of pneumatic circuit II
34	Pneumatic circuits signal lamp
38	Signal lamp switch of differential lockI



Item	N a m e
39	Signal lamp switch of differential lock II
40	Signal lamp switch of differential lock III
42	Axle differentials locks signal lamp
43	Front drive signal lamp switch
44	Inter-axle differential lock + front drive signal lamp
49	Air pressure watcher
50	Push button at clutch release lever
51	Pre-selector of reduced or normal constant mesh
52	Electromagnetic pneumatic valve of reduced constant mesh
53	Electromagnetic pneumatic valve of normal constant mesh
54	Electromagnetic pneumatic valve of gearshift booster
55	Fuel gauge float
57	Reversing lamp switch
58	Reversing lamp
59	Signal lamp switch of pressure drop in spring brake cylinder
60	Signal lamp of pressure drop in spring brake cylinder
65	Engine brake push button
66	Engine brake relay
67	Electromagnetic pneumatic valve of engine brake
69	Ignition box
70	Charging signal lamp
71	Noise suppressing filter
72	Alternator c/w regulator
73	Accumulator battery
74	Batterycircuit breaker
75	Auxiliary start socket
76	Starter motor
80	Independent heater
86	Air filter signal lamp
89	Electromagnetic relay of high beam
90	Accelerator pedal switch
91	Hazard warning lights signal lamp
92	Hazard warning lights switch
93	Air filter signal lamp switch
95	Fuel pump signal lamp
96	Fuel pump switch
97	Fuel pump
99	Signalling of reversing



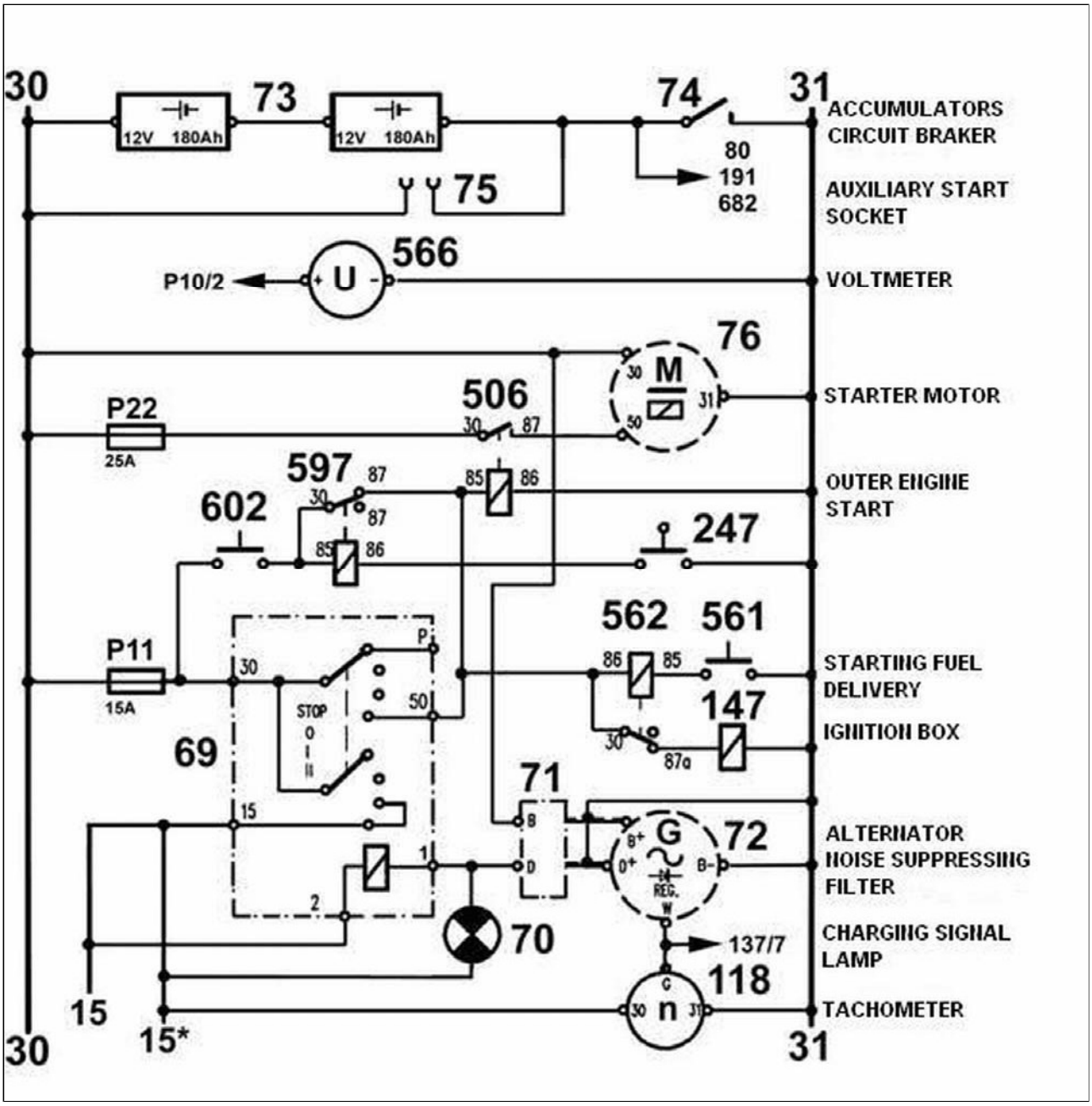
Item	N a m e
111	Hazard warning lights, LH + RH
112	Hazard warning lights switch
113	Hazard warning lights signal lamp
114	Oil pressure gauge
115	7-pole socket, front
117	Oil pressure gauge sensor
118	Speedometer
121	Changeover switch of auxiliary transmissions shifting
124	Search spot lamp
127	Width indicator light, LH
128	Width indicator light, RH
129	Signalling push button
133	Cylinder head temperature sensor (a, b)
134	Oil temperature sensor
135	Electromagnetic valve of cooling control
136	Electronic cooling control signal lamp
137	Electronic cooling control regulator
138	Electromagnetic pneumatic valve of auxiliary transmission shifting - hare
139	Electromagnetic pneumatic valve of auxiliary transmission shifting - turtle
143	Auxiliary headlamp switch
144	Auxiliary headlamp signal lamp
145	Auxiliary headlamp
147	Electromagnetic valve of starting fuel delivery
148	Low beam relay
149	Fog lamps relay
150	24S socket
151	Rear fog lamp switch
152	Rear fog lamp signal lamp
153	Rear fog lamp
155	Preheat signal lamp
156	Cylinder heads temperature signal lamp
159	Electric motor of dependent heater
160	Dependent heater changeover switch
161	Electric speedometer
162	Speedometer sensor
163	Heater regulating resistances
174	Signal lamp switch of inter-axle differential lock4
180	Electromagnetic valve of output limiter



Item	N a m e
191	Front preservative source socket
245	Air drier
247	Gearshift booster neutral switch
262	Lamp switch, RH
263	Engine stop push button
268	Dome light rear
277	Upper / lower headlamps changeover switch
278	Headlamp, RH upper
279	Headlamp, LH upper
418	Parking brake signal lamp
419	Parking brake signal lamp break switch
444	Radio post socket
447	Horn (horn valve)
448	Cab locking signal lamp switch
450	Cab locking signal lamp
506	Starter motor relay
525	“15” circuit switching-on relay
534	Dependent heater noise-suppressing condenser
549	Diode of auxiliary transmission shifting
561	Regulating rod stop switch
562	Fuel start delivery relay
563	Map reading lamp
566	Voltmeter
585	ISO diagnostics socket
590	Relay of air electric heating
591	Air heating bodies, LH + RH
597	Start blocking relay
602	Starter motor push button
635	Masking illumination diode
638	Instruments illumination switch
647	Audible signalling
682	Preservative source socket, rear
689	Engine speed sensor (inductive)
715	Fillter-ventilation
744	Winch switch
745	Electromagnetic pneumatic valve of winch - brake
746	Electromagnetic pneumatic valve of winch - drive

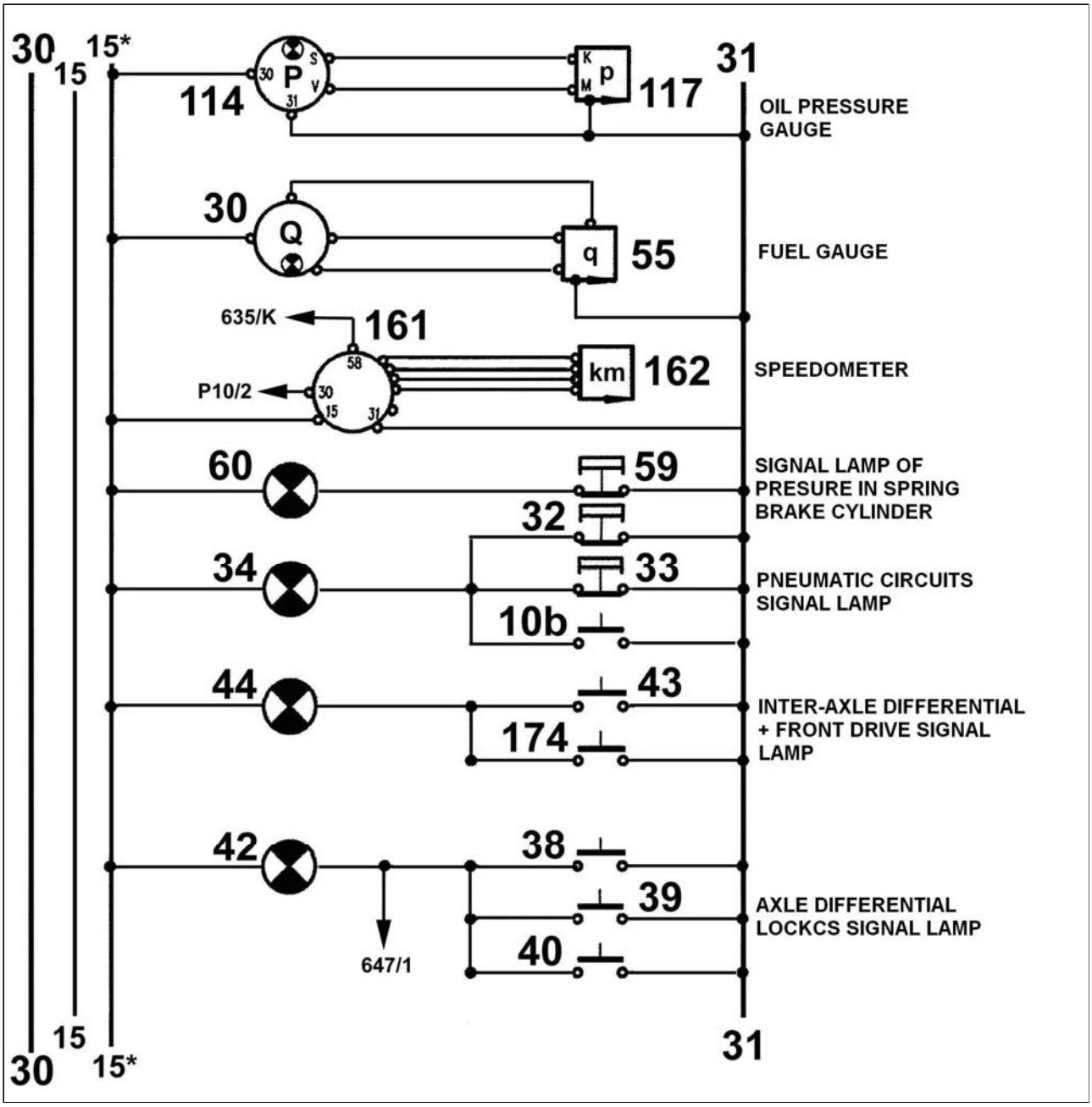
Another part contains the single wiring diagrams of the electric equipment installed on the vehicle BEML -

TATRA **T 815 - 26RR36 22 255 6x6.1R/50T** and BEML - TATRA **T 815 - 26RR36 22 255 6x6.1R/51T**. Individual particular diagrams are completed with a legend of items used and/or a linkup (arrow) to further items.



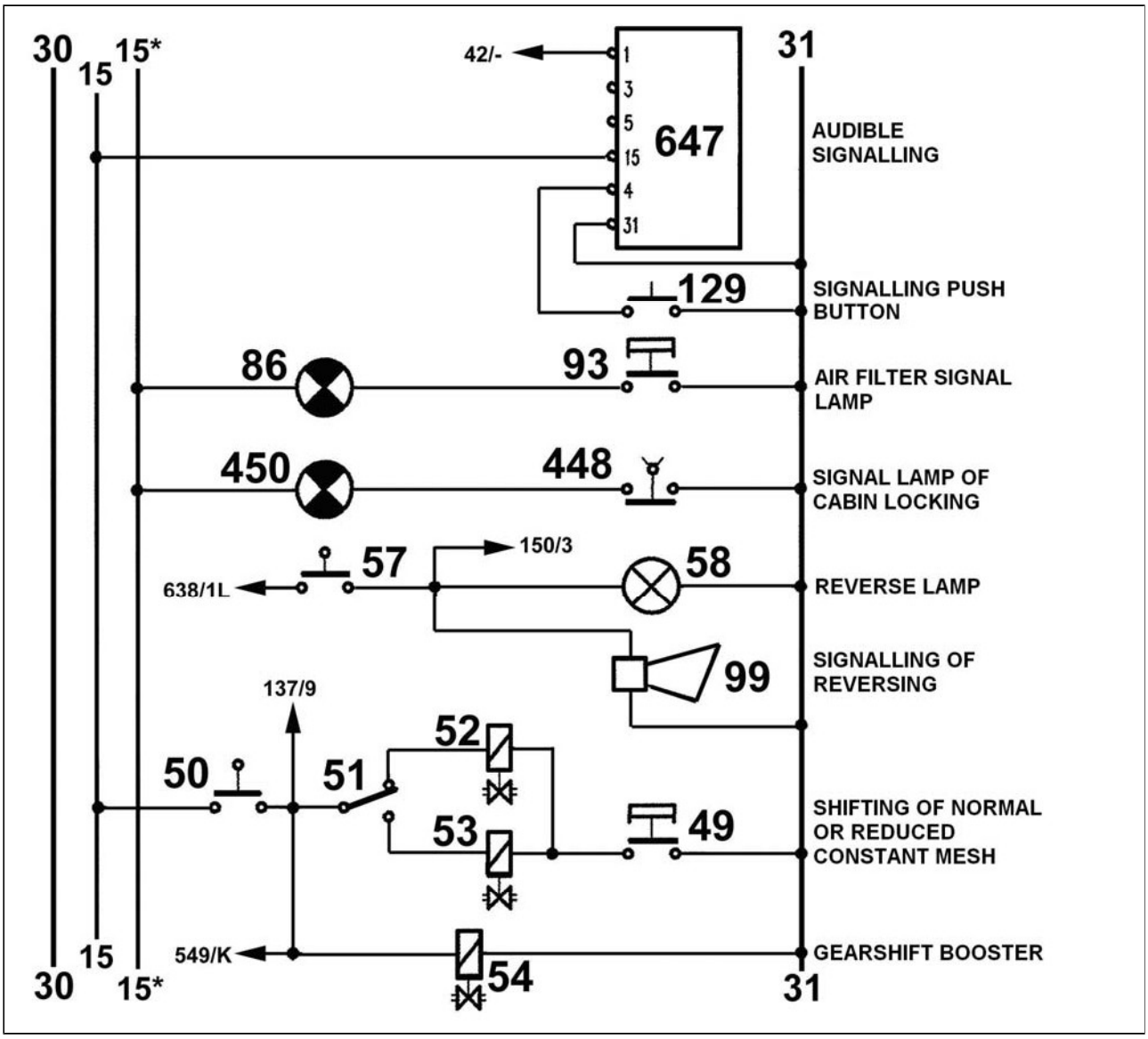
Legend: ***69*** *– ignition box,* ***70*** *– charging signal lamp,* ***71*** *– noise suppressing filter,* ***72*** *– alternator c/w regulator,* ***73*** *– accumulator battery,* ***74*** *– accumulator circuit breaker,* ***75*** *– auxiliary start socket,* ***76*** *– starter motor,* ***80*** *– independent heater,* ***118*** *– tachometer,* ***137*** *– electronic cooling control regulator,* ***147*** *– electromagnetic valve of starting fuel delivery,* ***191*** *– front preservative source socket,* ***247*** *– neutral switch of gearshift booster,* ***506*** *– starter motor relay,* ***561*** *– regulating rod stop switch,* ***562*** *– starting delivery relay,* ***566*** *– voltmeter,* ***597*** *– start blocking relay, 602 – starter motor push button,* ***682*** *– rear preservative source socket.*

Fig. 15.8 Wiring diagram – 1st part



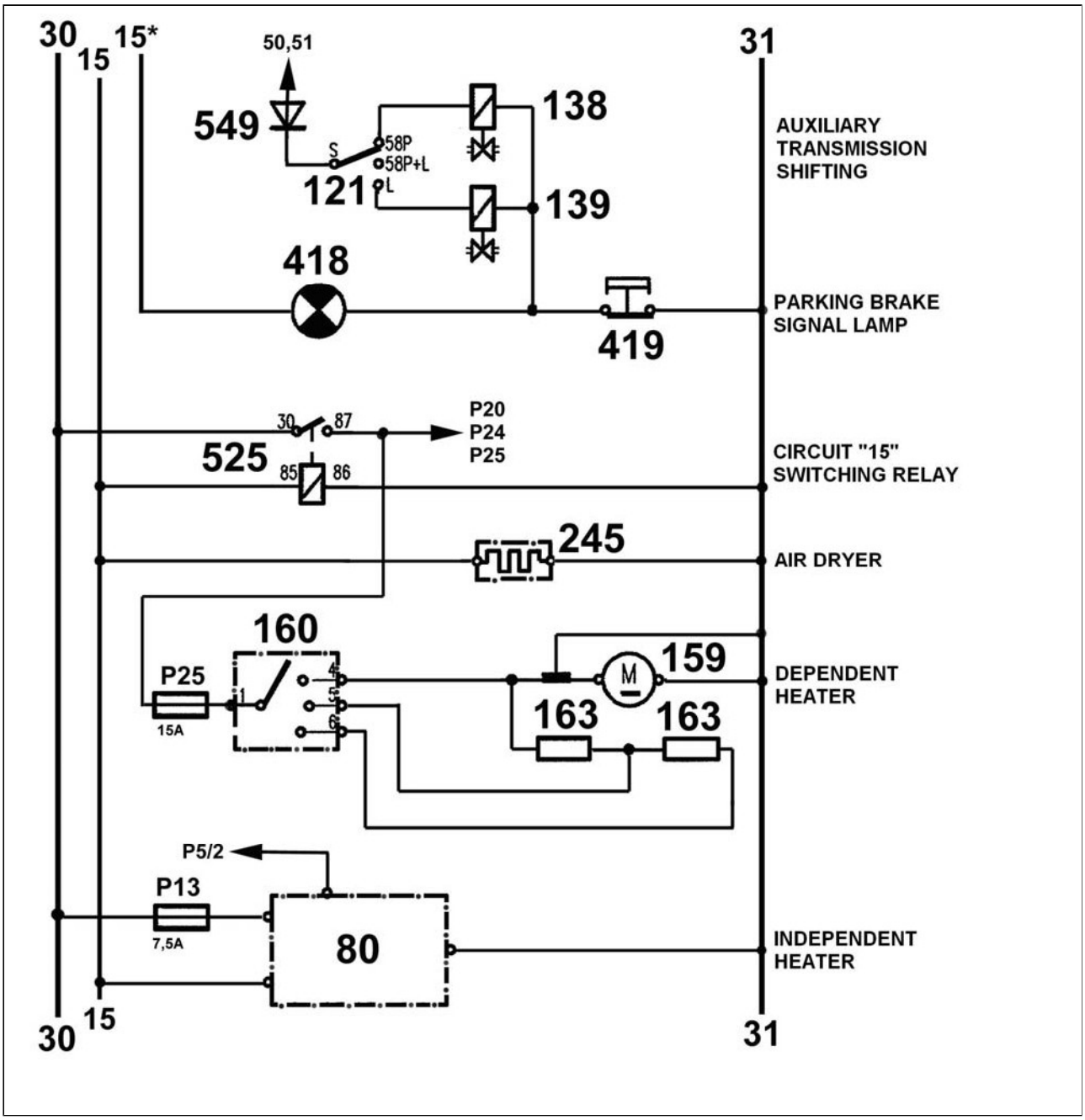
Legend: ***10*** *– low/high beam changeover switch + check push button,* ***30*** *– fuel gauge,* ***32*** *– signal lamp switch of pneumatic circuit I,* ***34*** *– pneumatic circuits signal lamp,* ***38*** *– signal lamp switch of differential lock I,* ***39*** *– signal lamp switch of differential lock II,* ***40*** *– signal lamp switch of differential lock III,* ***42*** *– signal lamp of axle differential locks,* ***43*** *– signal lamp switch of front drive,* ***44*** *– inter-axle differential lock + front drive signal lamp,* ***55*** *– fuel gauge float,* ***59*** *– signal lamp switch of pressure drop in spring brake cylinder,* ***60*** *– signal lamp of pressure drop in spring brake cylinder,* ***114*** *– oil pressure gauge,* ***117*** *– oil pressure gauge sensor,* ***161*** *– electric speedometer,* ***162*** *– speedometer sensor,* ***174*** *– signal lamp switch of inter-axle differential lock, 635 – masking illumination diode,* ***647*** *– audible signalling.*

Fig. 15.9 Wiring diagram – 2nd part



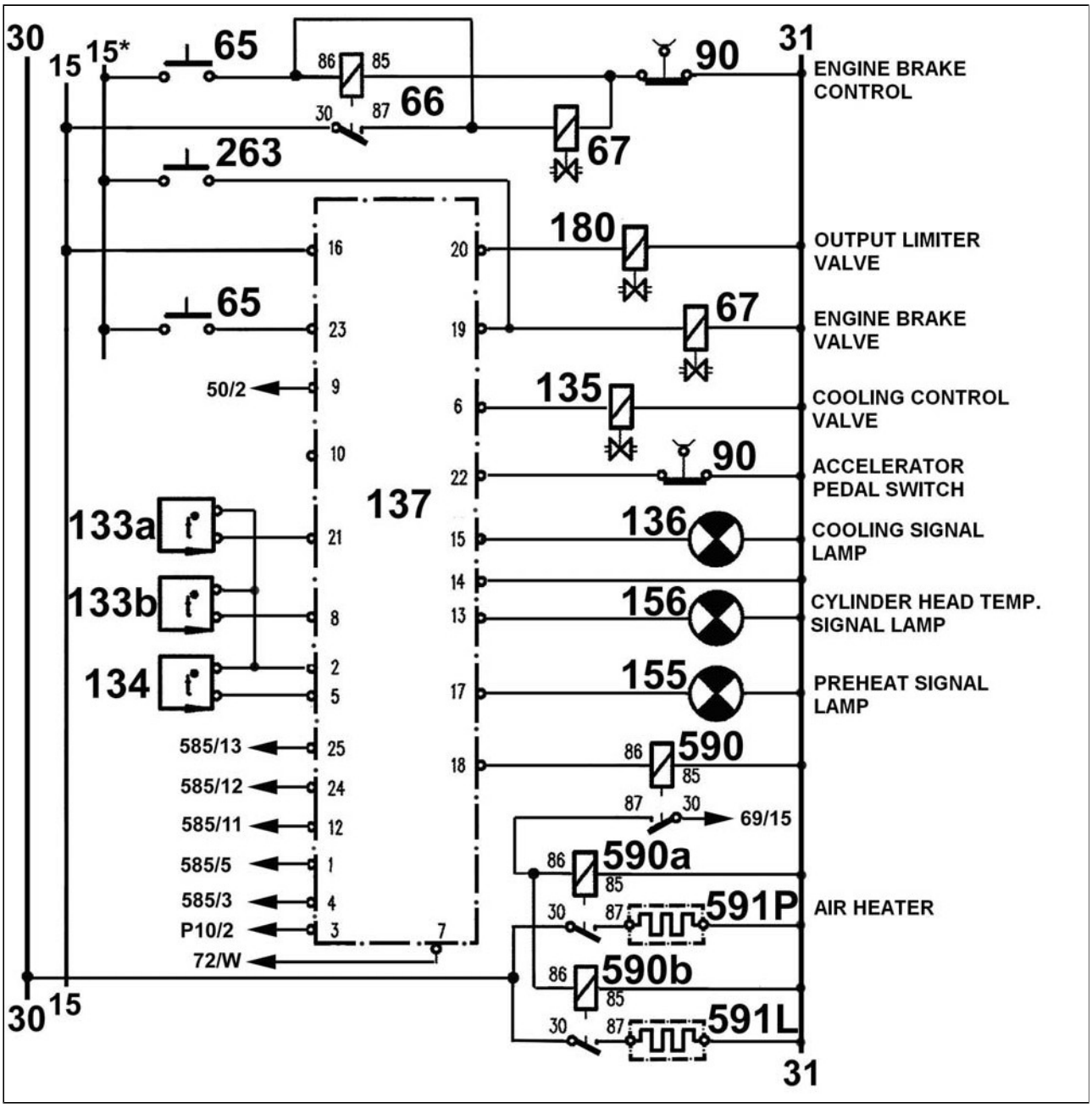
Legend: ***49*** *– air pressure watcher,* ***50*** *– push button at clutch release lever,* ***51*** *– reduced or normal constant mesh pre-selector,* ***52*** *– electromagnetic pneumatic valve of reduced constant mesh,* ***53*** *– electromagnetic pneumatic valve of normal constant mesh,* ***54*** *– electromagnetic pneumatic valve of gearshift booster,* ***57*** *– reverse lamp switch,* ***58*** *– reverse lamp,* ***86*** *– air filter signal lamp,* ***93*** *– signal lamp switch of air filter,* ***99*** *– signalling of reversing,* ***129*** *– signalling push button,* ***137*** *– electronic cooling control regulator,* ***150*** *–24S socket,* ***448*** *– signal lamp switch of cab locking,* ***450*** *– signal lamp of cab locking,* ***549*** *– diode of auxiliary transmissions shifting,* ***638*** *– switch of instruments illumination,* ***647*** *– audible signalling.*

Fig. 15.10 Wiring diagram – 3rd part



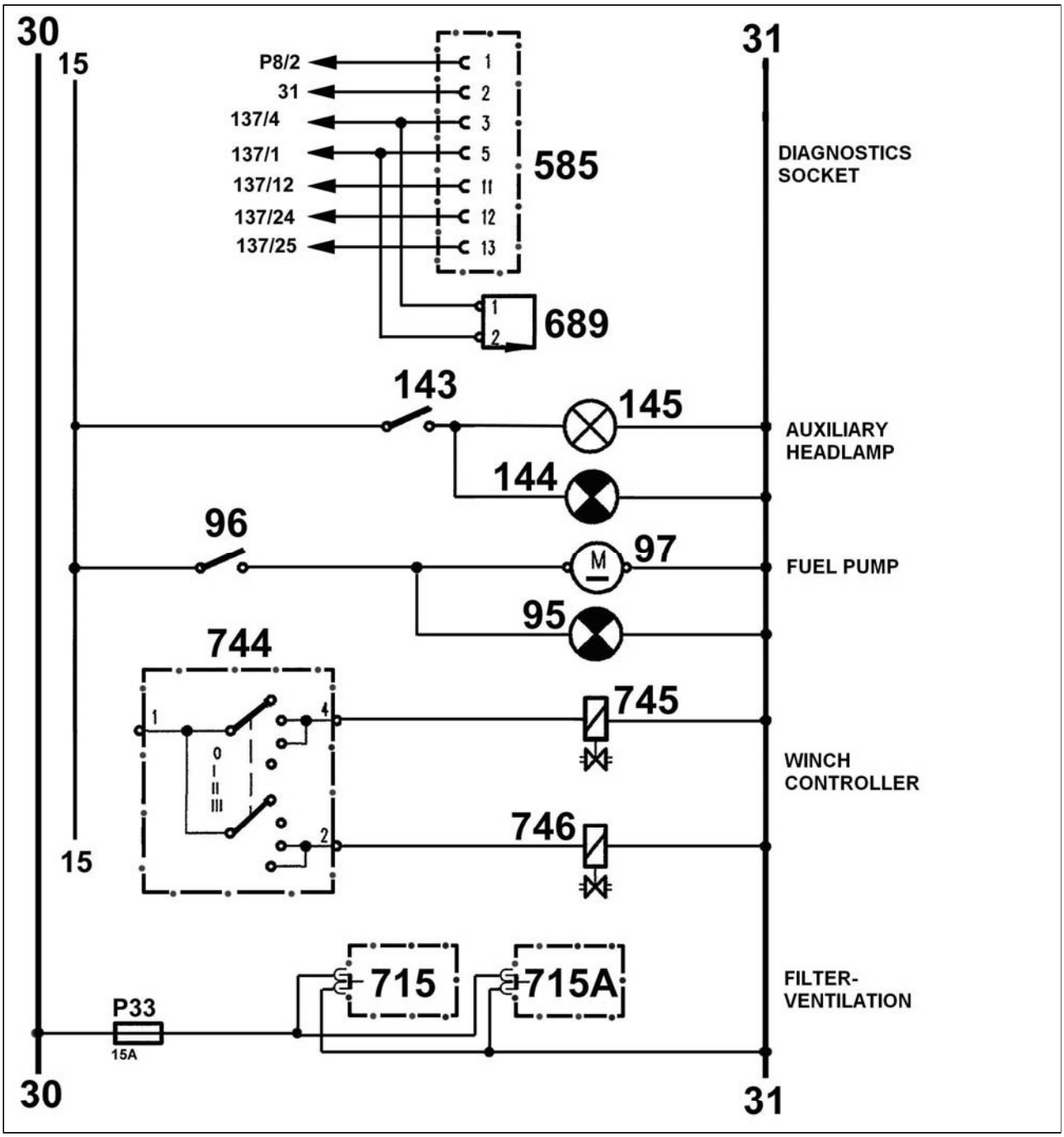
Legend: ***50*** *– push button at clutch release lever,* ***51*** *– reduced or normal constant mesh pre-selector,* ***80*** *– independent heater,* ***121*** *– switch of auxiliary transmissions shifting,* ***138*** *– electromagnetic pneumatic valve of auxiliary transmissions shifting - hare,* ***139*** *– electromagnetic pneumatic valve of auxiliary transmissions shifting - turtle,* ***159*** *– electric motor of dependent heater,* ***160*** *– dependent heater changeover switch,* ***163*** *– heater regulating resistances,* ***245*** *– air drier,* ***418*** *– parking brake signal lamp,* ***419*** *– break switch of parking brake,* ***525*** *– circuit “15” switching relay,* ***549*** *– diode of auxiliary transmissions shifting.*

Fig. 15.11 Wiring diagram – 4th part



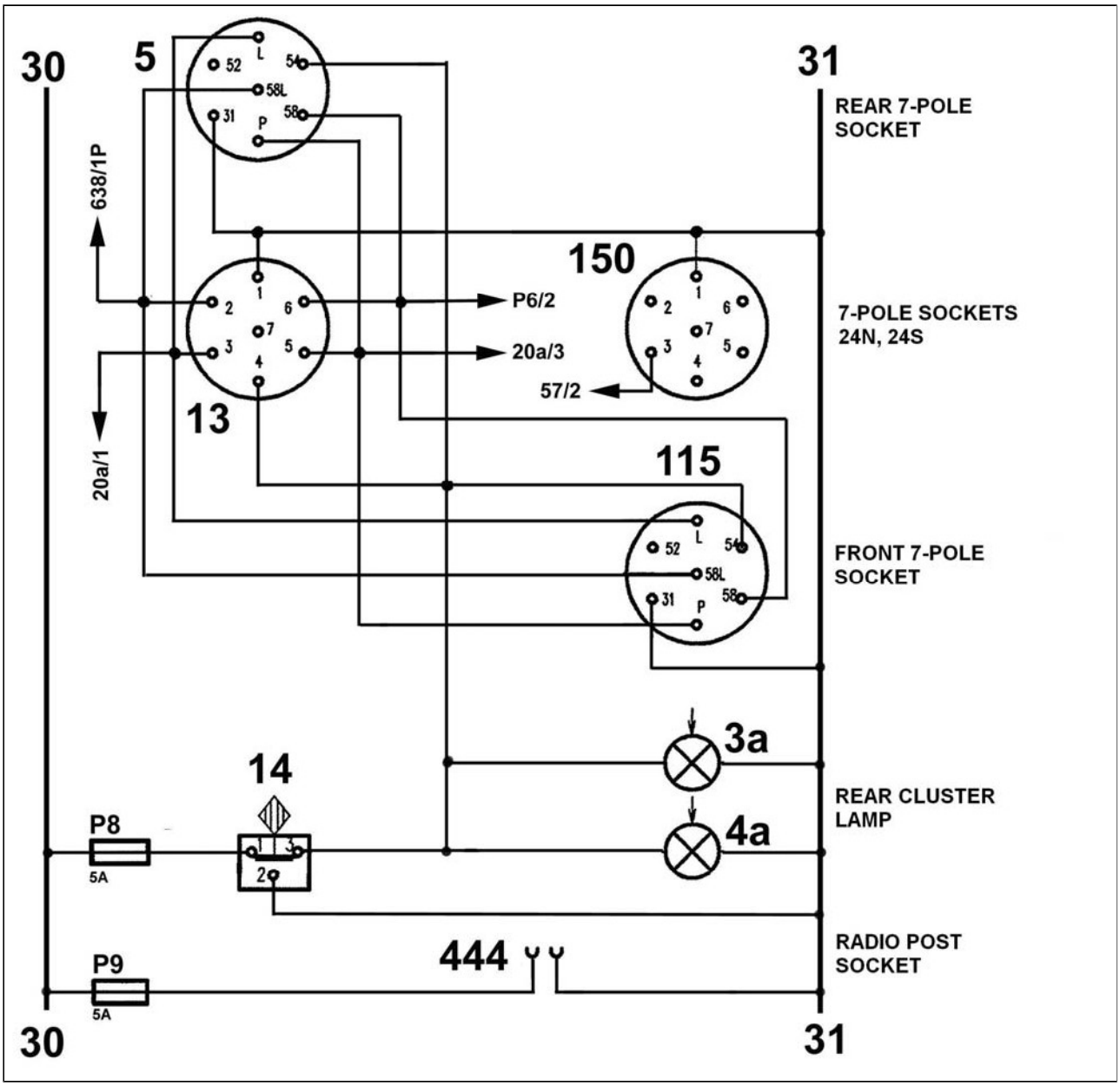
Legend: ***65*** *– engine brake push button,* ***66*** *– engine brake relay,* ***67*** *– electromagnetic pneumatic valve of engine brake,* ***69*** *– ignition box, 72 – alternator c/w regulator,* ***90*** *– accelerator pedal switch,* ***133*** *– temperature sensor of cylinder head (a, b),* ***134*** *– oil temperature sensor,* ***135*** *– electromagnetic valve of cooling control,* ***136*** *– electronic cooling control signal lamp,* ***137*** *– electronic cooling control regulator,* ***155*** *– preheat signal lamp,* ***156*** *– cylinder heads temperature signal lamp,* ***180*** *– output limiter electromagnetic valve,* ***263*** *– engine stop push button,* ***585*** *– ISO diagnostics socket,* ***590*** *– relay of air electric heater,* ***591*** *– air heater bodies, LH + RH.*

Fig. 15.12 Wiring diagram – 5th part



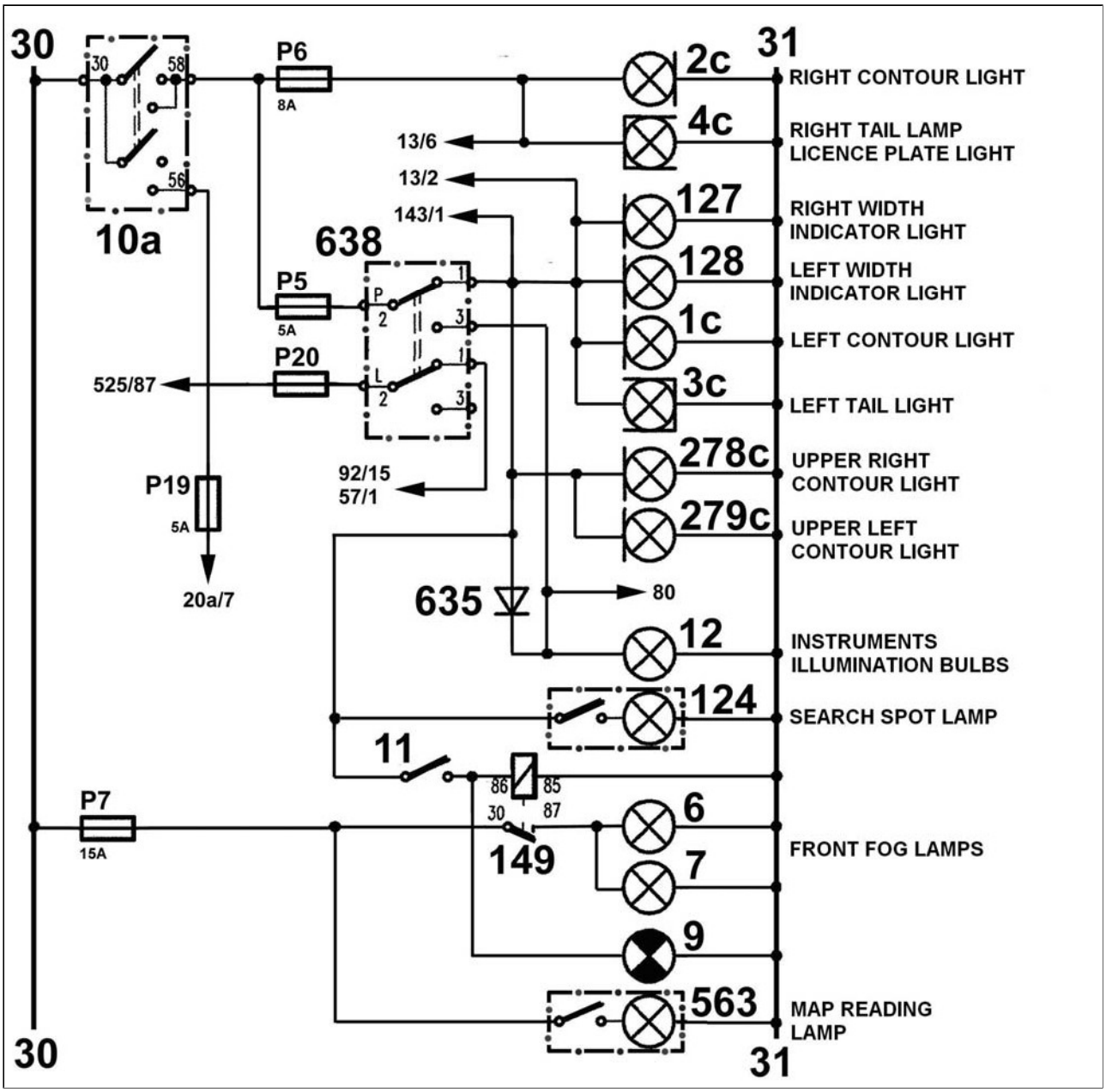
Legend: ***95*** *– fuel pump signal lamp,* ***96*** *– fuel pump switch,* ***97*** *– fuel pump,* ***137*** *– electronic cooling control regulator,* ***143*** *– auxiliary headlamp switch,* ***144*** *– auxiliary headlamp signal lamp,* ***145*** *– auxiliary headlamp,* ***585*** *– ISO diagnostics socket,* ***689*** *– engine speed sensor (inductive),* ***715*** *– filter-ventilation,* ***744*** *– winch switch,* ***745*** *– electromagnetic pneumatic valve of winch - brake,* ***746*** *– electromagnetic pneumatic valve of winch - drive.*

Fig. 15.13 Wiring diagram – 6th part



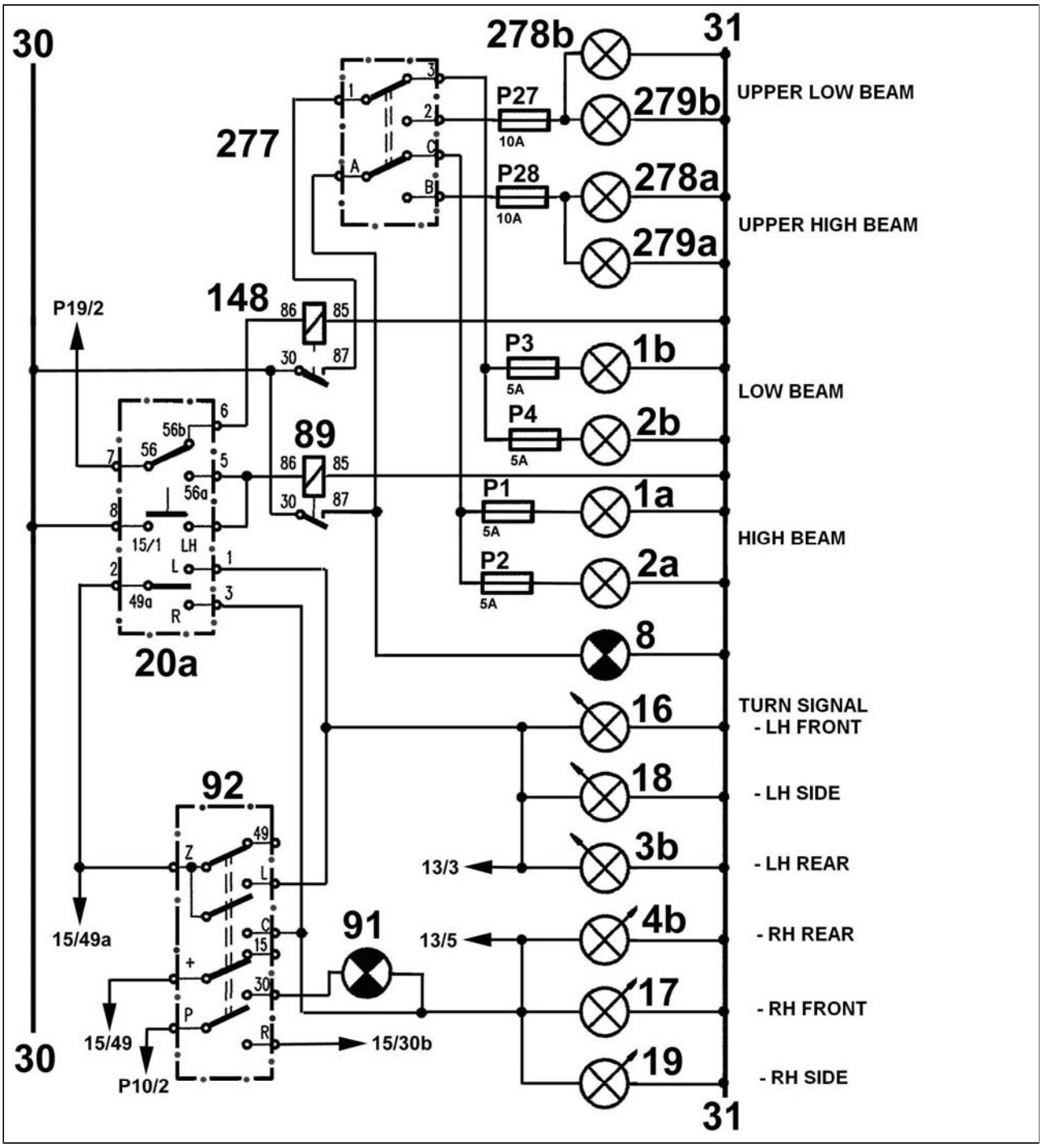
Legend: ***3*** *– rear cluster lamp, LH (a - stop light, b - turn signal, c - tail light, d - reversing lamp, e - fog light, f -license plate light),* ***4*** *– rear cluster lamp, RH (a - stop light, b - turn signal, c - tail light, d - reversing lamp, e - fog light),* ***5*** *– rear 7-pole socket,* ***13*** *– 24N socket,* ***14*** *– stop lights switch,* ***20*** *– combined changeover switch a) low / high beam b) wipers,* ***57*** *– reversing lamp switch,* ***115*** *– front 7-pole socket,* ***150*** *– 24S socket,* ***444*** *– radio post socket,* ***638*** *– instruments illumination switch.*

Fig. 15.14 Wiring diagram – 7th part



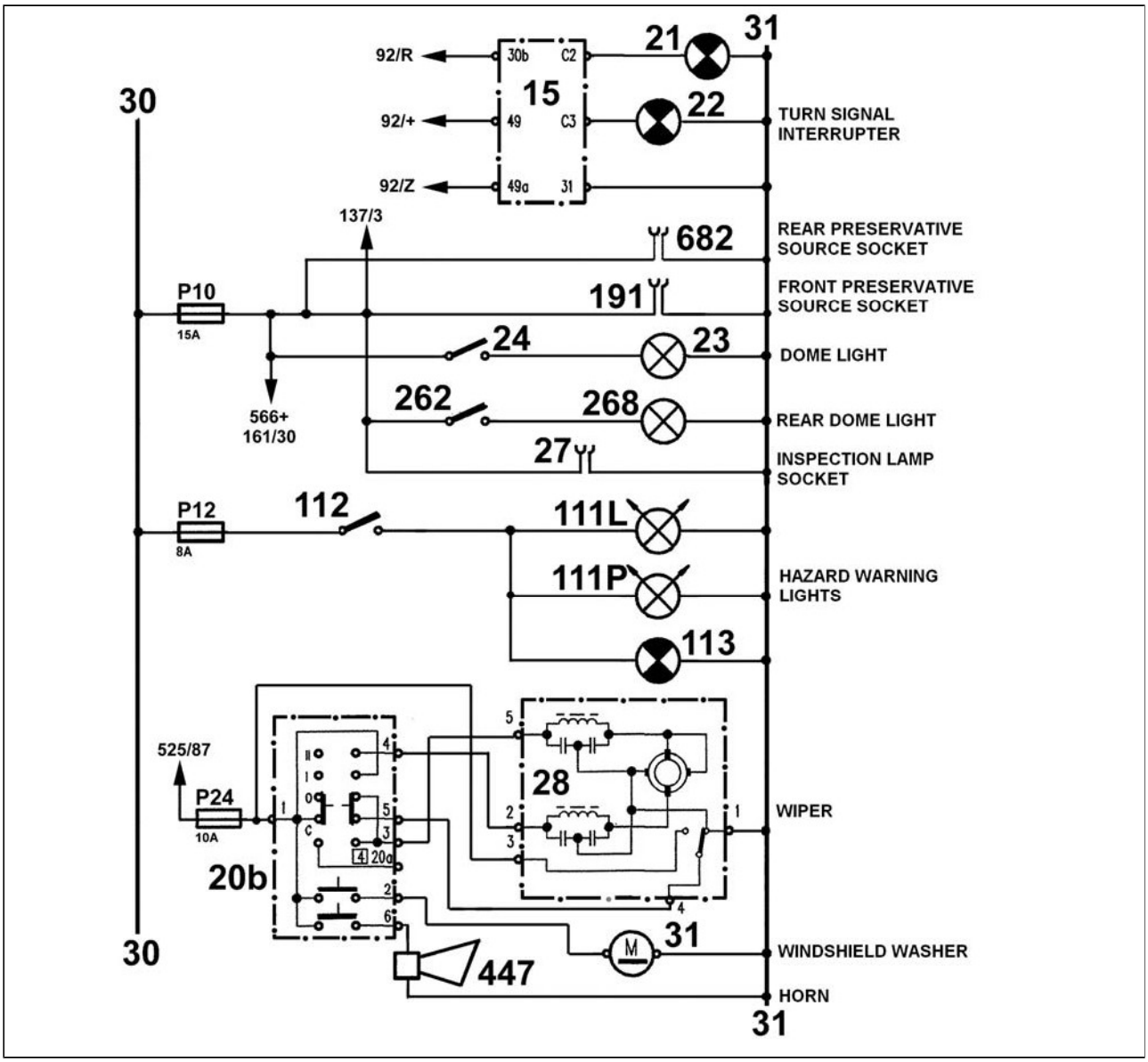
Legend: ***1*** *– main headlamp, LH (a - high beam, b - low beam, c - contour lights),* ***2*** *– main headlamp, RH (a - high beam, b - low beam, c - contour lights),* ***3*** *– rear cluster lamp, LH (a - stop light, b - turn signal, c - tail light, d - reversing lamp, e - fog light, f - license plate light),* ***4*** *– rear cluster lamp, RH (a - stop light, b - turn signal, c - tail light, d - reversing lamp, e - fog light),* ***6*** *– fog lamp, LH front,* ***7*** *– fog lamp, RH front,* ***9*** *– front fog lamps signal lamp,* ***10*** *– low / high beam changeover switch + signal lamp bulb push button,* ***11*** *– front fog lamps switch,* ***12*** *– instrument illumination bulbs,* ***13*** *– 24N socket,* ***20*** *– combined changeover switch a) low / high beam b) wipers,* ***57*** *– reversing lamp switch,* ***80*** *– independent heater,* ***92*** *– hazard warning lights switch,* ***124*** *– search spot lamp,* ***127*** *– width indicator light, LH,* ***128*** *– width indicator light, RH,* ***143*** *– auxiliary lamp switch,* ***149*** *– fog lamps relay,* ***278*** *– upper headlamp, RH,* ***279*** *– upper headlamp, LH,* ***525*** *– "15" circuit switching-on relay,* ***563*** *– map reading lamp,* ***635*** *– masking illumination diode,* ***638*** *– instruments illumination switch.*

Fig. 15.15 Wiring diagram – 8th part



Legend: ***1*** *– main headlamp, LH (a - high beam, b - low beam, c - contour lights),* ***2*** *– main headlamp, RH,* ***3*** *– rear cluster lamp, LH (a - stop light, b - turn signal, c - tail light, d - reversing lamp, e - fog light, f - license plate light),* ***4*** *– rear cluster lamp, RH ,* ***8*** *– high beam signal lamp,* ***13*** *– 24N socket,* ***15*** *– turn signals interrupter,* ***16*** *– turn signal, LH front,* ***17*** *– turn signal, RH front, 18 – turn signal, LH side,* ***19*** *– turn signal, RH side,* ***20*** *– combined changeover switch a) low / high beam b) wipers,* ***89*** *– electromagnetic relay of high beam,* ***91*** *– hazard warning lights signal lamp,* ***92*** *– hazard warning lights switch,* ***148*** *– low beam relay,* ***277*** *– upper / lower headlamps changeover switch,* ***278*** *– upper headlamp, RH,* ***279*** *– upper headlamp, LH.*

Fig. 15.16 Wiring diagram – 9th part



Legend: ***15*** *– turn signals interrupter,* ***20*** *– combined changeover switch a) low / high beam b) wipers,* ***21*** *– turn signals signal lamp, vehicle,* ***22*** *– turn signals signal lamp, trailer,* ***23*** *– dome light,* ***24*** *– dome light switch,* ***27*** *– inspection lamp socket,* ***28*** *– wiper,* ***31*** *– windshield washer,* ***92*** *– hazard warning lights switch,* ***111*** *– hazard warning lights, LH+RH,* ***112*** *– hazard warning lights switch,* ***113*** *– hazard warning lights signal lamp,* ***137*** *– electronic cooling control regulator,* ***161*** *– electric speedometer,* ***191*** *– front preservative source socket,* ***262*** *– lamp switch, RH,* ***268*** *– rear dome light,* ***447*** *– horn (horn valve),* ***525*** *–"15" circuit switching-on relay,* ***566*** *– voltmeter,* ***682*** *– rear preservative source socket.*

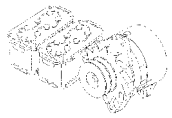
Fig. 15.17 Wiring diagram – 10th part

15.2 Faults Causes, Symptoms and their Troubleshooting

Fault	Cause	Troubleshooting	Mentioned in
The charging signal lamp **does not go on** after turning the ignition key to the 1st position	Faulty battery	Replace one or both faulty batteries	(See Subchapter **15.5.3**)
	Batteries cut-off switch turned off	Turn on the batteries cut-off switch	(see the "Driver´s Manual")
	Faulty batteries cut-off switch	Replace the batteries cut-off switch	(See Subchapter **15.5.4**)
	Faulty signal lamp bulb	Replace the signal lamp bulb	(see the "Driver´s Manual")
	Faulty ignition box	Replace the ignition box	
	Blown fuse	Replace the fuse F11	(see the "Driver´s Manual")
	Faulty circuit "15" relay	Replace the relay K525	
The charging signal lamp **does not go out** after starting the engine	Faulty alternator voltage regulator	Replace the alternator	(See Subchapter **15.5.18**)
	Faulty alternator	Replace the alternator	
	Broken flat alternator drive belt	Replace the alternator drive belt with a new one	
The charging signal lamp **will go out at the high engine speed only**	Faulty (short) brushes	Replace the alternator	(See Subchapter **15.5.18**)
	A poor tension of the alternator drive belt	Tension the flat alternator drive belt properly	
The charging signal lamp **flashes** when more electric consumers are turned on	A poor tension of the alternator drive belt	Tension the flat alternator drive belt properly	(See Subchapter **15.5.18**)
	Short or faulty alternator brushes	Replace the alternator	
The charging signal lamp and lubrication signal lamp start to light with a **considerably reduced brightness** after turning the ignition key to the 2nd position	Vehicle batteries much discharged	Start the engine by means of the external current source	(See Part **A**)
		Replace the batteries	(See Subchapter **15.5.3**)
		Charge the batteries at the charging station	(See Subchapter **15.5.3**)

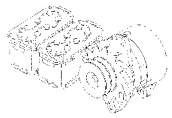
Fault	Cause	Troubleshooting	Mentioned in
Some light or lamp do not light	Faulty bulb	Replace the faulty bulb	(see the "Driver´s Manual")
	Faulty (blown) fuse	Check the feed cable or the bulb socket whether they are not short-circuited to ground, then replace the faulty fuse	
	Faulty lamp grounding	Clean the corroded bulb socket, clean grounding cables terminals	
The bulb will blow repeatedly (several times in succession)	Electronic regulator on the alternator has not a good contact to the alternator ground	Check the regulator attachment, replace spring washers under regulator fastening screws, tighten the screws	(See Subchapter **15.5.18**)
	Faulty electronic regulator on the alternator, a high voltage in the network, bulbs light with a full brightness	Replace the alternator	(See Subchapter **15.5.18**)
The windshield wiper does not work even when the wiper motor is working	Loose lever on the bevel gearing of the wiper gear shaft	Adjust the wiper motor to the run-out position	(See Subchapter **15.5.16**)
		Install and attach the lever on the wiper gear shaft properly	
Wiper arms do not stop in the marginal position	Faulty run-out wiper contact	Replace the wiper motor	(See Subchapter **15.5.16**)
The wiper motor does not work at all	Faulty wiper motor	Replace the wiper motor	(See Subchapter **15.5.16**)
	Faulty switch in the combined change-over switch	Replace the combined change-over switch (LH)	(See Subchapter **15.5.14**)
	Blown current fuse	Replace the current fuse F14	(see the "Driver´s Manual")
The liquid does not squirt out of the windshield washer nozzles	Empty windshield washer container	Add the prescribed liquid to the container	(see the "Driver´s Manual")
	Clogged nozzles	Clean the washer nozzles	
	Faulty washer pump	replace the washer pump	(See Subchapter **15.5.17**)
	Blown current fuse	Replace the current fuse F14	(see the "Operation Manual")
	Faulty switch in the combined change-over switch	Replace the combined change-over switch (LH)	(See Subchapter **15.5.14**)

Fault	Cause	Troubleshooting	Mentioned in
The starter does not	Faulty ignition box	Replace the ignition box	(See Part **13**)
	Blown current fuse	Replace the current fuse F11	(see the "Driver´s Manual")
	Faulty starter motor relay	Replace the starter motor	(See Part **1**)
	Faulty starter motor electromagnet	Replace the starter motor	
	Faulty vehicle batteries	Replace the vehicle batteries	(See Subchapter **15.5.3**)
Starter motor will not start running	Faulty starter motor	Replace the starter motor	(See Part **1**)
	Faulty vehicle batteries	Charge the vehicle batteries and/or start the engine using the external source	(See Subchapter **15.5.3**)
	Faulty starter motor electromagnet	Replace the starter motor	(See Part **1**)
The starter motor will crank the engine several times only	Faulty starter motor	Replace the starter motor	(See Part **1**)
	Much discharged vehicle batteries	Start the engine using the external current source	(See Part **A**)
		Replace the batteries	(See Subchapter **15.5.3**)
Some of signal lamps	Faulty bulb	Replace the faulty bulb	(see the "Driver´s Manual")
Some of combined changer-over switch functions does not operate	Faulty combined change-over switch	Replace the combined change-over switch	(See Subchapter **15.5.14**)
Some of instruments on the instrument board does not indicate	Faulty instrument	Replace the faulty instrument	(See Subchapter **15.5.13**)
	Faulty sensor	Replace the sensor	



15.3 List of Special Tools

No special tools have been prescribed for the mentioned technological procedures related to the electric accesssories of the vehicles BEML - TATRA **T 815 - 26RR36 22 255 6x6.1R/50T** and BEML - TATRA **T 815 - 26RR36 22 255 6x6.1R/51T.**



15.4 Survey of Torque Specifications

For the mentioned technological procedures related to the electrical equipment installed on the vehicles BEML - TATRA **T 815 - 26RR36 22 255 6x6.1R/50T** and BEML - TATRA **T 815 - 26RR36 22 255 6x6.1R/51T** the below given torque has been stipulated.

Tab. 15.3 Electrical equipment torque specifications

Data	Unit	Value
Fastening nut of the wipers drive lever	Nm	34 ± 2

15.5 Working Procedures

15.5.1 Adjustment of Main Headlamps

a) Reasons for Adjustment

1. The inspection of main headlamps adjustment is carried out at the prescribed intervals of service inspections and always after the replacement of the headlamp asymmetrical bulb ,optical insert or complete headlamp.

b) Technical Conditions

1. Main headlamps can be checked and set either by means of the checking wall or by the special instrument (regloscope).
2. The low beam incline should be set to 1.5 % and the asymmetrical lighting angle is 15^{o} right. After the headlamps adjustment these values must be kept.
3. The headlamps adjustment is carried out at the vehicle curb weight and with tires properly inflated. The vehicle must stand on a level ground so that the checking wall can be placed in the distance of 5 or 10 m. The distance of 10 m is preferred as the adjustment can be performed more accurately. The adjustment should be carried out on places, which are hidden from the direct sunshine (e.g. at a garage twilight) where the lighting boundary after turning on the vehicle headlamps could be seen well.
4. The checking wall from front headlamps of the checked vehicle must be in the distance of 5 or 10 m, the vehicle longitudinal centerline must be perpendicular to the checking wall plane in the axis of symmetry. The optical axis of the left and right headlamp must be parallel to the plane on which the vehicle stands and simultaneously to the vehicle longitudinal central plane. The permissible tolerance is ± 3^{o}.
5. Mark the following points, distances and boundaries angles on the check wall.

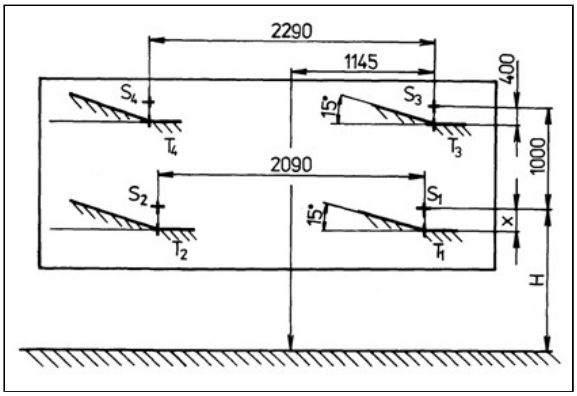


Fig. 15.18 Checking wall for the headlamps adjustment

H - height of headlamps centres above the roadway,
x = 150 mm (value for adjustment of low beam of main headlamps),
S_1, S_2 - centres of shining surface of main headlamps,
S_3, S_4 - centres of shining surface of upper headlamps,
T_1, T_2 - points for adjustment of low beam of main headlamps,

T_3, T_4 - points for adjustment of low beam of upper headlamps

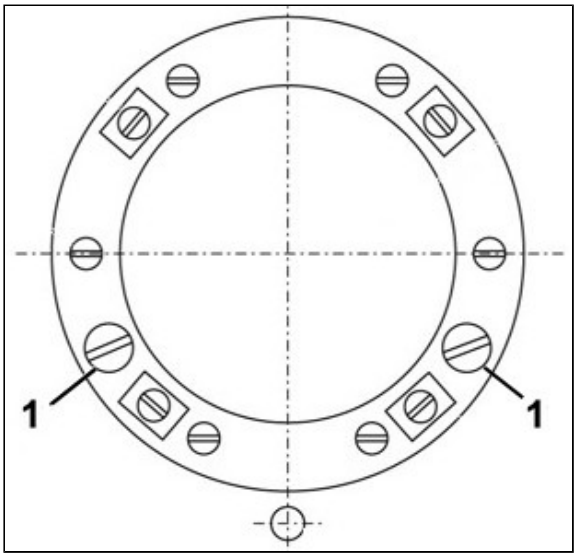
Note:
The distance "**X"** is a length value of the specified 1.5 % low beam inclination, which depends also on the distance from the check wall to the vehicle. The distance values "**X"** are as follows:

- **150 mm** for the distance of **10 m**

c) Adjustment of Lower Main Headlamps Procedure

1. Set a mutual position between vehicle and checking wall properly.
2. Measure the headlamps centres height „**H**" on the respective vehicle and accordingly, set the checking wall height position.
3. Turn on headlamps to the position „**high beam**".
4. Check whether points „**S_1**" and „**S_2**" are situated in the centre of the high beam lighting area approximately.
5. In case that the adjusment is not correct, remove the headlamp rim and cover (See Subchapter **15.5.4**).
6. Use the screwdriver to carry out the side adjustment by means of adjusting elements **1**.

   Note:
   The halogen bulbs are intense source of heating. Then is useful to cut off the unnecesary light by removing the relevant fuse.
   P1, P2 - high beam of the lower headlamp
   P3, P4 - low beam of the lower headlamp.



7. Turn over the headlamps change-over switch to the position „ **low beam** ".
8. Remove the fuse of the headlamp that is not adjusted.
9. Check the position of the „light/darkness boundary" of the adjusted headlamp asymmetrical lighting. In case that the light/darkness boundary is not correct (See Fig. **15.18**), use the screwdriver to carry out the adjustments by means of **both** adjusting elements **1** (See Fig. **15.19**).
10. After high adjusting of the light check again the side adjustment. Correct if it is necessary.
11. Swith off the headlamps and install the removed fuses.
12. Install the headlamps covers and rims (See Subchapter **15.5.5**).

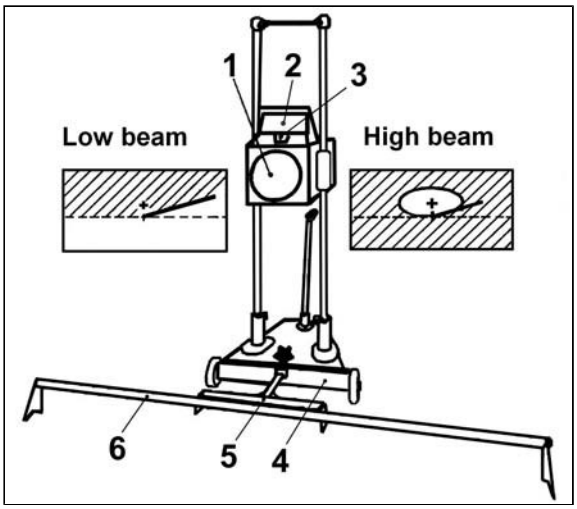
d) Adjustment of Upper Main Headlamps Procedure

1. Dismount the plastic covers from the cabin.

2. Slightly loosen the nut under the headlamp cover for moving with headlamp.
3. Adjust the low beam to the points T_3 and T_4 on the checking wall.
4. Fasten the nut for headlamp securing in the correct position.
5. Install the plastic covers on cabin.

e) Adjustment with using of regloscope

1. Shoud you use the regloscope, proceed according to the user´s instruction manual.
2. Adjusting is similar as in point **c**), **d)**.



Legend: ***1*** *- optic system;* ***2*** *- focusing screen;* ***3*** *- luxmeter;* ***4*** *- stand,* ***5*** *- telescopic rod,* ***6*** *- stop rod*

Fig. 15.20 Regloscope

15.5.2 Adjustment of Fog Headlamps

a) Reasons for Adjustment

1. The inspection of fog headlamps adjustment is carried out

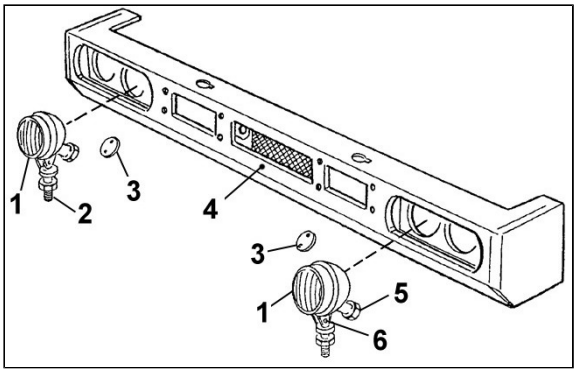
   - at the prescribed intervals of service inspections and always after the replacement of the fof headlamp asymmetrical bulb, optical insert or complete headlamp,
   - after the crash into the bumper or fog headlamp.

b) Technical Conditions

1. Adjust the fog headlamps so that the upper boundary of their light is lower than the upper boundary of low beam.

c) Adjustment Procedure

1. Switch the batteries circuit breaker on.
2. Slightly loosen the screw nut **6** (See Fig. **15.21**) for the up-and-down adjustment of the headlamp.
3. Turn the side marker lights and fog lights on.
4. Adjust the fog headlamp.
5. The left-and-right adjustment can be carried out after you loose and retighten the fixing nut **2** in the front bumper.



Legend: ***1*** *– fog headlamp;* ***2*** *– headlamp attachment;* ***3*** *– packing;* ***4*** *– front bumper;* ***5*** *– flange;* ***6*** *– headlamp leveling adjustmen*

Fig. 15.21 Fog headlamps - adjustment

15.5.3 Removal and Installation of Batteries

a) Reasons for the Batteries Removal and Installation

1. For attendance of the batteries in charging station.
2. When the batteries are replaced.

b) Technical Condition

1. Mount only the fully charged bateries of prescribed type.

c) Removal Procedure

1. Turn off the batteries cut-off switch.
2. Raise the vehicle cab. Before lifting the cab, remove all objects from inside the cab, which could get loose during lifting and could be damaged or cause damage to the windshield.
3. Release two wing nuts **5** c/w washers from the upper cover **4** of the batteries case **1** and remove the upper cover **4**.

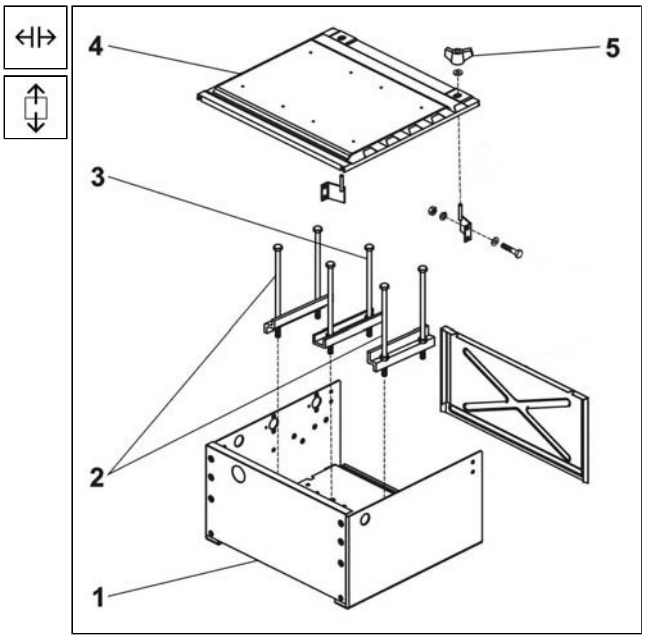


Fig. 15.22 Batteries case – removal

4. Disconnect the left negative (–) clamp of the left battery cable **1** leading to the vehicle ground. Secure the cable terminal using the binding wire so that it could not touch the positive batteries terminals in any case.
5. Dismount clamps of the connecting cable **3** between batteries and remove the cable.
6. Disconnect the right positive (+) clamp of the right battery **5** cable **4** leading to the batteries cut-off switch.
7. Loosen and remove all fastening yokes of the batteries attachment in the case, i.e. 2x marginal ones **2** (See Fig. **15.22**), 1x middle one **3**.
8. Disconnect the degassing hoses from individual batteries.
9. Carefully lift the batteries from the case. The batteries handling is not easy because of its weight - it makes about 60 kg - and therefore you should have an assistant to lift the batteries and to place them on a ground.
10. Use the special terminal cleaner or the emery cloth to clean the inner surfaces of all connecting cable clamps.
11. Check the inner surface of the batteries case, if need be, remove the corrosion using the wire brush and coat it with primer and epoxide paint.

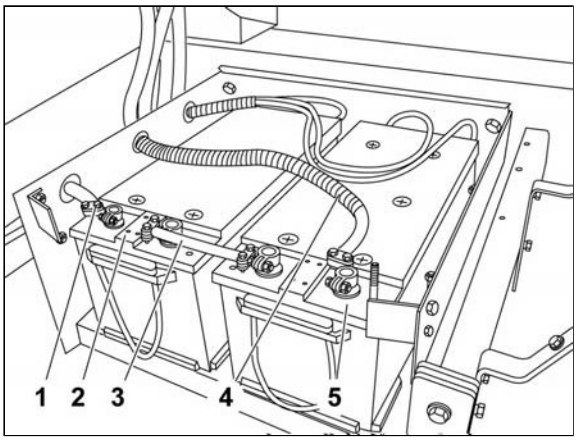
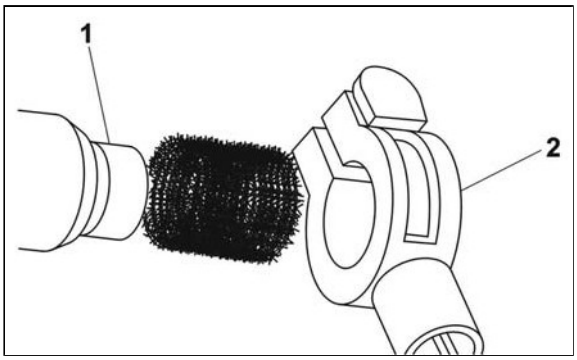


Fig. 15.23 Accumulator batteries - removal



Legend: ***1*** *– cleaner with steel wire brush,* ***2*** *– cable clamp*

Fig. 15.24 Use of the terminal cleaner

d) Installation Procedure

1. After servicing the batteries at the charging station, it is necessary to check the installation of plugs on filler holes including the draught degasification system (if installed). In addition, check the batteries outlets, which must not be coated with the preservative grease before installation of cable clamps. If need be, use the clean rag and the terminal cleaner and/or the emery cloth to clean them from oxides.
2. Check the servicing of the batteries case interior.
3. Install accumulators into the batteries case **1** from above with terminals pointing rearwards and use yokes **2** and **3** to attach them properly.
4. Connect the draught degasification system and move the hose outside the batteries case space.

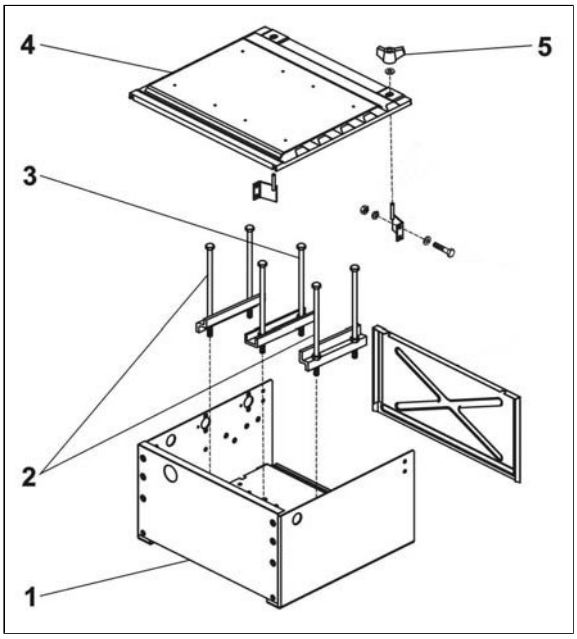


Fig. 15.25 Batteries case - installation

5. Connect the clamp of the cable **4** leading from the batteries cut-off switch to the positive (+) terminal of the right battery **5**.
6. Connect the connecting cable **3** between the batteries.
7. Connect the clamp of the cable **1** leading from the vehicle ground to the negative (–) terminal of the left battery **2**.

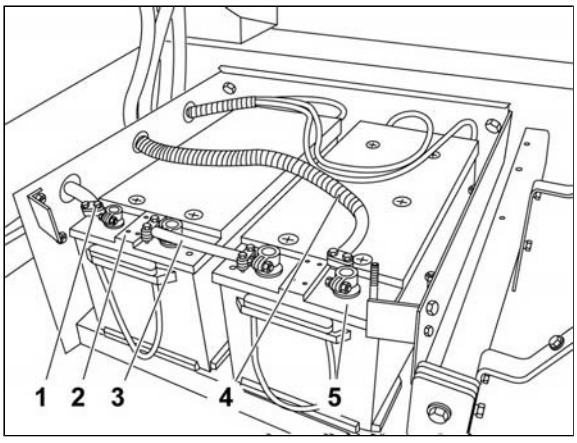


Fig. 15.26 Accumulator batteries - installation

Note:
Tighten the clamping bolts **2** of connecting clamps **3** on batteries outlets with care to avoid their deformation.

8. After installation of clamps **3** on batteries outlets, gently apply the preservative grease to metal surfaces.

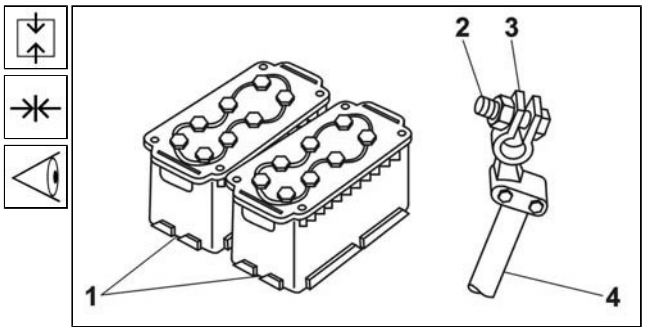


Fig. 15.27 Connecting clamps - installation

9. Move the batteries cut-off switch to the vertical position to turn it on and move the ignition key to the 1st position. The charging signal lamp must go on and the voltmeter must show the voltage in the field “A”, i.e. 24 V at least.
10. Start the engine to check the batteries for a proper function.
11. Make sure that the source system is working properly while watching the charging signal lamp (it must not light) and the voltmeter at various speed and load regimes, when the voltmeter shows the voltage in the field “B”, i.e. within the range up to 29.5 V on the instrument board.
12. Shut off the engine and turn off the batteries cut-off switch
13. Install the upper cover **4** on the batteries case **1** and use wing nuts **5** c/w washers **6** to fix it.
14. Tilt the cab into the operating position.

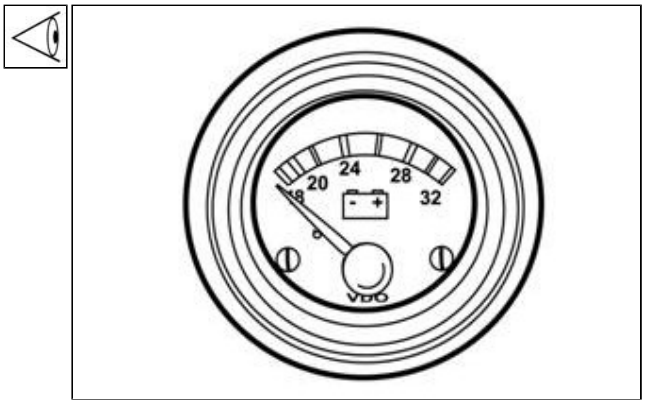


Fig. 15.28 Voltmeter

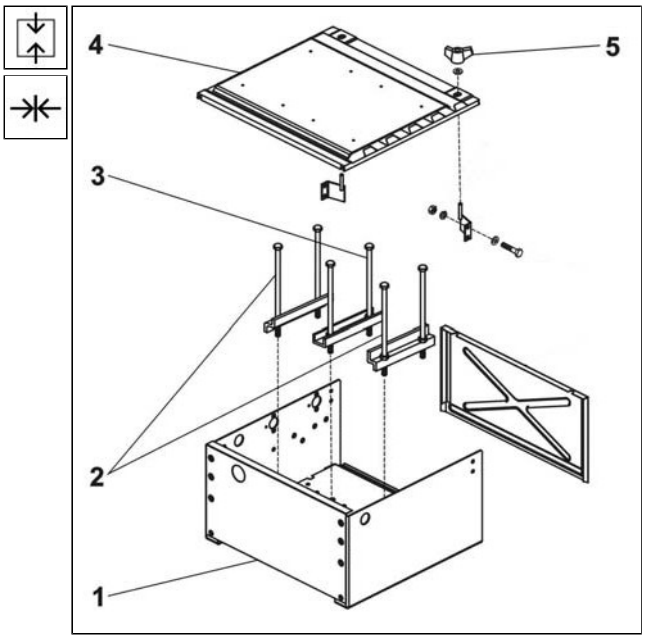


Fig. 15.29 Batteries case - installation

15.5.4 Removal and installation of the batteries circuit breaker

a) Reasons for Removal and Installation

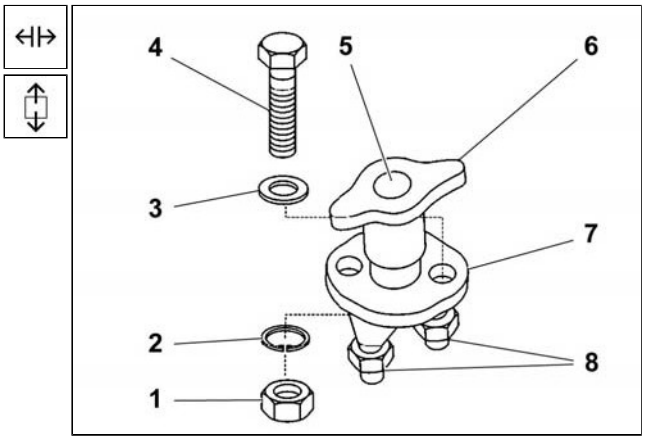
1. The mechanical batteries circuit breaker is a very reliable part of the vehicle electric equipment. It should be replaced after it has suffered mechanical damage, exceptionally after excessive wear (oxidization) of contactor contacts.
2. The worn contacts will produce a big contact resistance and heat the circuit breaker excessively during the current load. On start of the engine, the worn contacts result in a low speed of the electric starter motor even with fully charged vehicle batteries.

b) Technical Conditions

1. After replacement of the batteries circuit breaker the contacts must switch on the grounding circuit of the vehicle batteries reliably and the contact resistance of the batteries grounding circuit must be minimum (fast zero).

c) Removal Procedure

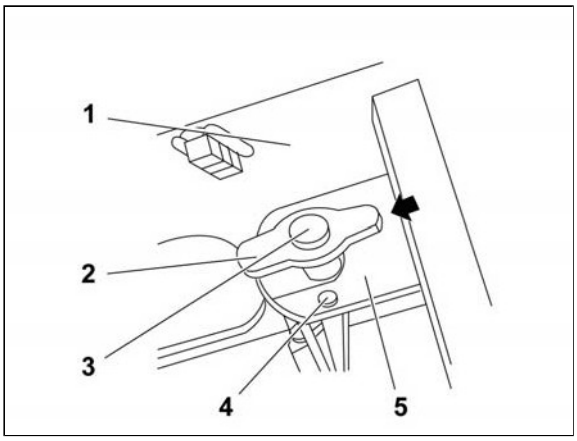
1. Switch off all electrical consumers of the vehicle.
2. Lift the box cover behind the co-driver's seat and secure it in the lifted position.
3. Dismount two nuts M10 c/w washers from terminals of the circuit breaker **8** and disconnect the connected cables.



Legend: ***1*** *– nut M6,* ***2*** *– spring washer,* ***3*** *– washer M6,* ***4*** *– screw M6,* ***5*** *– blind piece of handle nut,* ***6*** *– rotary handle,* ***7*** *– batteries circuit breaker body,* ***8*** *– circuit breaker terminals*

Fig. 15.30 Mechanical batteries circuit breaker - removal

4. Dismount two fastening screws **4** from holder **5**.
5. Remove the faulty circuit breaker.

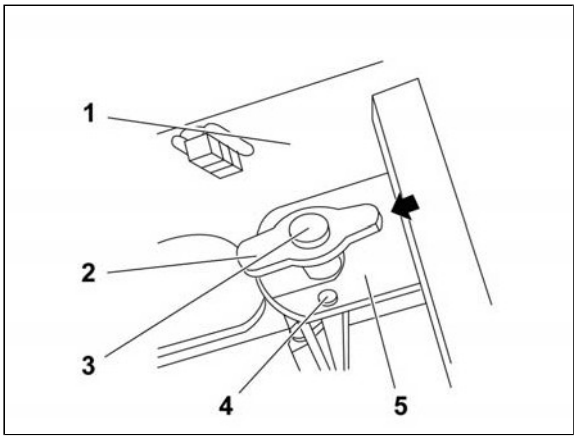


Legend: ***1*** *– Cab's side wall (LH),* ***2*** *– batteries circuit breaker rotary handle,* ***3*** *– blind piece,* ***4*** *– screw M6,* ***5*** *– circuit breaker holder*

Fig. 15.31 Mechanical batteries circuit breaker - location, removal

d) Installation Procedure

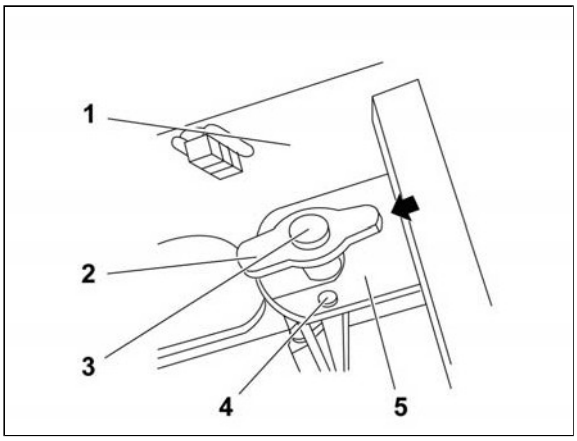
1. Fit a new circuit breaker into holder **5** and use screws **4** to attach it.
2. Use a wire brush (or emery cloth) to clean the bearing surfaces of connected cables.



Legend: ***1*** *– Cab's side wall (LH),* ***2*** *– batteries circuit breaker rotary handle,* ***3*** *– blind piece,* ***4*** *– screw M6,* ***5*** *– circuit breaker holder*

Fig. 15.32 Mechanical batteries circuit breaker - location, installation

3. Connect cables to terminals **8** of the circuit breaker and tighten the nuts properly.
4. Check the new batteries circuit breaker for a correct function for example so that you turn on the vehicle illumination and move the batteries circuit breaker rotary handle to turn the illumination off/on.
5. Close the box cover behind the co-driver's seat.



Legend: ***1*** *– nut M6,* ***2*** *– spring washer,* ***3*** *– washer M6,* ***4*** *– screw M6,* ***5*** *– blind piece of handle nut,* ***6*** *– rotary handle,* ***7*** *– batteries circuit breaker body,* ***8*** *– circuit breaker terminals*

Fig. 15.33 Mechanical batteries circuit breaker - installation

15.5.5 Removal and Installation of the Lower Headlamp Optical Insert

a) Reasons for Removal and Installation

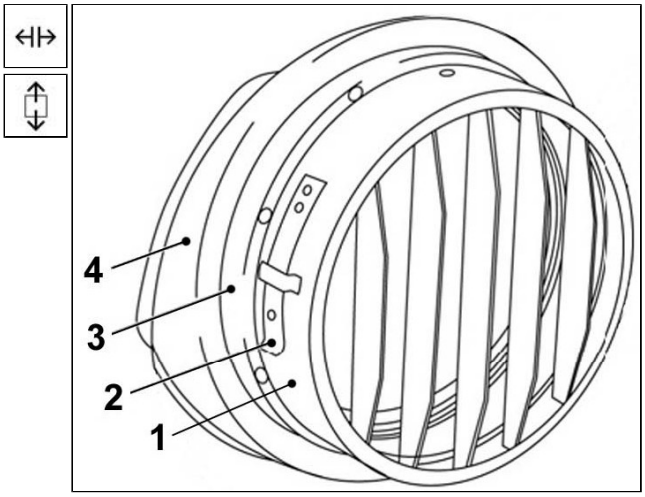
1. Reduced headlamp luminous efficiency (if the headlamp reflecting surface was corroded).
2. Mechanical damage to the headlamp.

b) Technical Conditions

1. Use only the optical insert of the prescribed type and version for the replacement (designed either for the LH or RH drive).
2. The headlamp must have a sufficient luminous efficiency.
3. The headlamp must allow a proper adjustment. The headlamps must be adjusted in accordance with the special technological procedure after replacement of the headlamp optical insert.

c) Removal Procedure

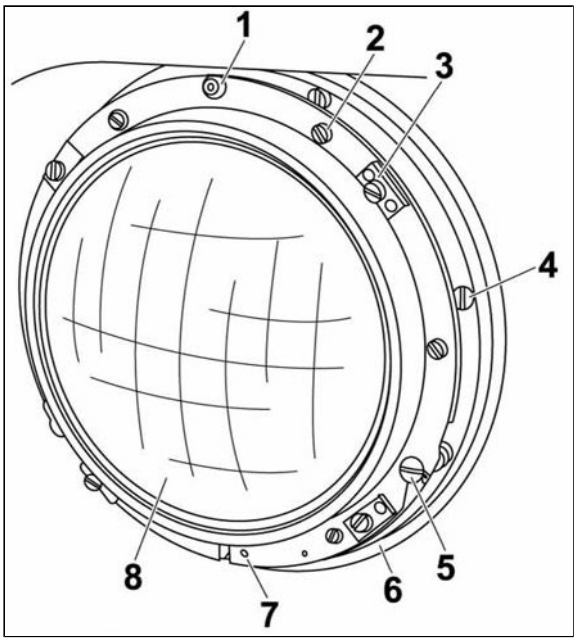
1. Turn the batteries circuit breaker off.
2. Use the screwdriver to raise two spring safety clips **2** fixing the headlamp hood (grill) and turn it anticlockwise to loosen and to remove the hood **1**.
3. Dismount the fastening screw and remove the headlamp covering rim **4**.



Legend: ***1*** *– headlamp hood;* ***2*** *– hood spring clip;* ***3*** *– headlamp flange;* ***4*** *– covering rim*

Fig. 15.34 Front headlamp

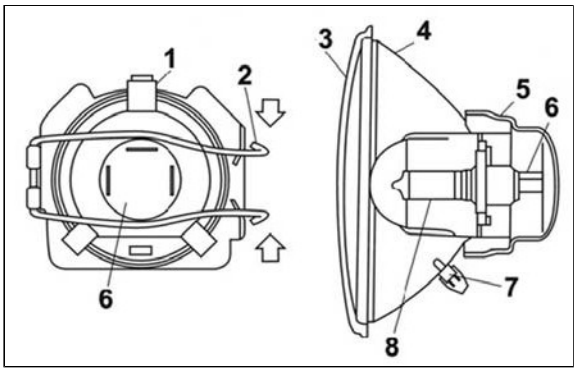
4. Dismount four screws **3** fixing the flange and turn the flange to remove it.
5. Loosen 6 screws **2** fixing the optical insert to the rear hood.
6. Pull the optical insert upwards to loosen it from two lower adjusting elements **5** and gently move it away ahead of the bumper.



Legend: ***1*** *– upper mounting of the optical insert;* ***2*** *– screw fixing the optical insert to the rear hood;* ***3*** *– screw fixing the flange to the insert;* ***4*** *– screw fixing the headlamp housing;* ***5*** *– adjusting elements;* ***6*** *– rubber washer;* ***7*** *– covering rim threaded connection;* ***8*** *– headlamp lens*

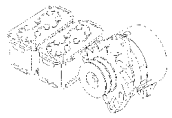
Fig. 15.35 Attachment of the optical insert of the main headlamp

7. Unplug the feed cable connector from the bulb socket **7** of the side marker light.
8. Carefully withdraw the plug **4** from the halogen bulb base **6** and place the loose front part of the optical insert aside.



Legend: ***1*** *– bulb lock;* ***2*** *– safety springs;* ***3*** *– lens;* ***4*** *– reflecting surface of insert;* ***5*** *– rubber cap; 6 – bulb base; 7 – socket c/w bulb of side marker light;* ***8*** *– halogen bulb*

Fig. 15.36 Optical insert of the main headlamp



d) Installation Procedure

1. Fit a good halogen bulb **8** (See Fig. **15.36**) into a new optical insert of the headlamp and use safety springs **2** to secure it in a correct position on the optical insert **4**.

   Note:
   To remove the halogen bulb from the package, grasp its base and **never grasp the bulb glass**. If need be, hold it catching its metal base only or use the plastic foam to do it.

2. Fit the base on the halogen bulb **8** in the optical insert.
3. Fit the socket c/w bulb **7** of the side-marker light and plug the feed connector of the side-marker light.
4. Turn the batteries circuit breaker on and check the side-marker lights, low and high beam for a correct function. Turn the batteries circuit breaker off.
5. Install the optical insert on the rubber washer **6** (See Fig. **15.35**) into a hole in the bumper.
6. Use screws **2** to connect the front part and rear part of the optical insert.
7. Mount the optical insert with a recess on both lower adjusting elements **5** and into the upper mounting **1**.
8. Adjust the headlamp according to the technological procedure.
9. Fit four screws **3** into a flange for the headlamp hood and tighten.
10. Mount the headlamp covering rim **4** (See Fig. **15.34**) and use the bolt to fix it into a threaded connection **7** (See Fig. **15.35**) of the lower part.
11. Fit and slightly turn the spring safety clip **2** (See Fig. **15.34**) to lock the hood **1** (grill) on the headlamp.

15.5.6 Removal and Installation of the Upper Headlamp Optical Insert

a) Reasons for Removal and Installation

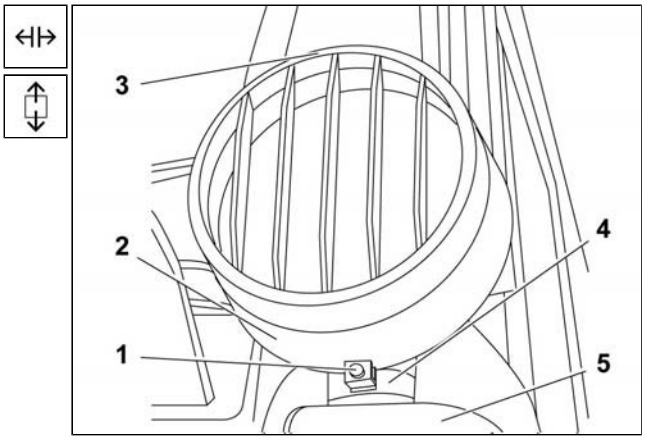
1. Reduced headlamp light intensity (in case of the headlamp reflected surface corrosion).
2. Mechanical damage to headlamp.

b) Technical Conditions

1. The vehicle illumination must function correctly after replacement of the upper headlamp optical insert (high beam, low beam and side marker lights), their luminous intensity must be sufficient and they must allow a correct adjustment of low beam.

c) Removal Procedure

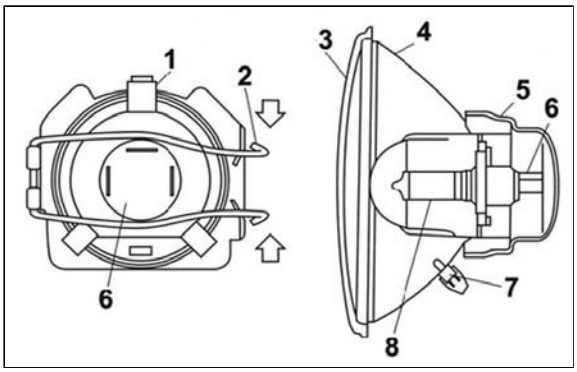
1. Turn the batteries circuit breaker off.
2. Dismount the plastic cover **5** from the cabin.
3. Loosen the mounting screw **1** of the rim **2** and tilt the rim c/w grille **3** away from the headlamp housing.



Legend: ***1*** *– rim fastening screw,* ***2*** *– rim,* ***3*** *– grille,* ***4*** *– headlamp holder,* ***5*** *– plastic cover*

Fig. 15.37 Location of the upper headlamp - removal

4. Remove the rubber cover **5** and withdraw the socket **6** from base **1** of the halogen bulb H4.
5. Unlock the halogen bulb springs **2** from position and grasp the base **1** to remove the bulb **8** (if good). Attention - never touch the surface of the bulb with your fingers!
6. Remove socket **7** c/w side marker lamp bulb.
7. Place the rim c/w grille and optical insert aside.
8. If damaged mechanically, replace individual pertaining components of the front part of the headlamp.

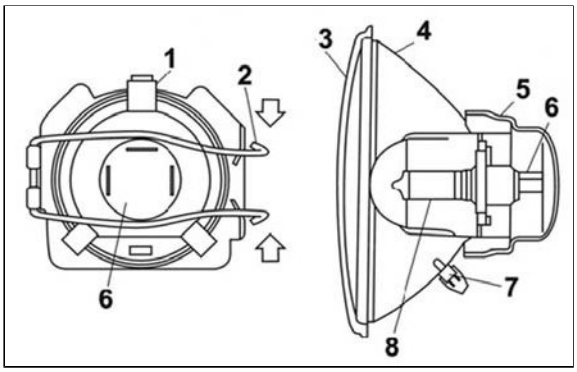


Legend: ***1*** *– bulb base,* ***2*** *– bulb retaining springs,* ***3*** *– lamp lens,* ***4*** *– optical insert,* ***5*** *– base rubber cover,* ***6*** *– base socket,* ***7*** *– side marker lamp socket,* ***8*** *– halogen bulb glass*

Fig. 15.38 Headlamp optical insert - removal

d) Installation Procedure

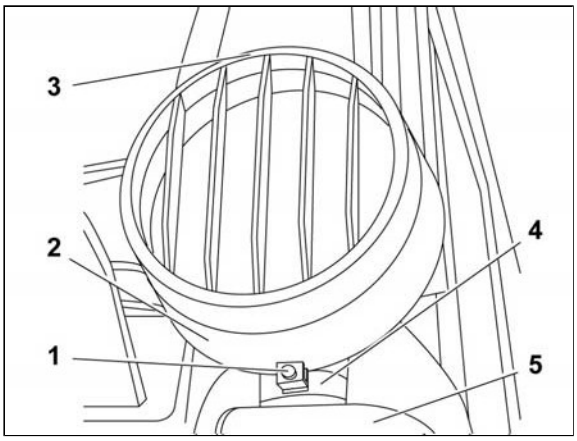
1. Fit the base **1** of the halogen bulb on a new optical insert **4** correctly and secure it with retaining springs **2** in position.
2. Slide the socket of the side marker lamp **7** into a hole in the optical insert.
3. Turn the batteries circuit breaker on and check the side marker lamp, low and high beam for a correct function. Turn the circuit breaker off.



Legend: ***1*** *– bulb base,* ***2*** *– bulb retaining springs,* ***3*** *– lamp lens,* ***4*** *– optical insert,* ***5*** *– base rubber cover,* ***6*** *– base socket,* ***7*** *– side marker lamp socket,* ***8*** *– halogen bulb glass*

Fig. 15.39 Headlamp optical insert - installation

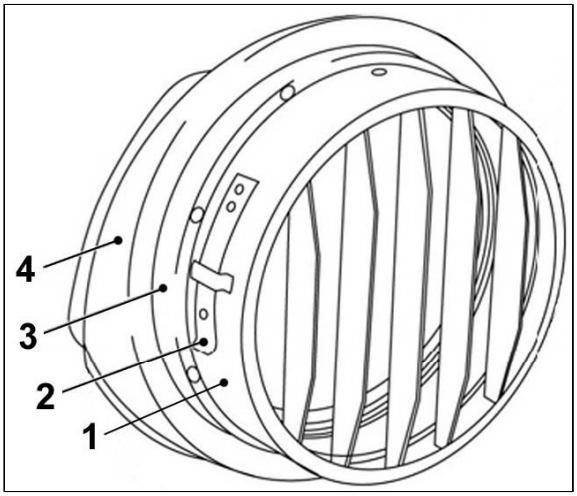
4. Fit the assembled optical insert into a rim **2** of the headlamp and secure it in a correct position.
5. Fit the rim **2** c/w optical insert on the rear part of the headlamp and secure it with screw **1**.



Legend: ***1*** *– rim fastening screw,* ***2*** *– rim,* ***3*** *– grille,* ***4*** *– headlamp holder,* ***5*** *– plastic cover*

Fig. 15.40 Location of the upper headlamp - installation

6. Fit the grille **1** on the rim **3** (Viz Fig.3.) and secure it with spring **2**.
7. Adjust the headlamps according to a method mentioned in the article “Adjustment of Main Headlamps”.
8. Tighten the mounting nut of the upper headlamp in holder **4** (See Fig. **15.40**)).
9. Fit and tighten the plastic cover **5** on the driver’s cabin.
10. Carry out the adjustment - see the article (See Subchapter **15.5.1**) after replacement of the optical insert.



Legend: ***1*** *– headlamp hood;* ***2*** *– hood spring clip;* ***3*** *– headlamp flange;* ***4*** *– covering rim*

Fig. 15.41 The headlamp

15.5.7 Removal and Installation of the Main Headlamp

a) Reasons for Removal and Installation

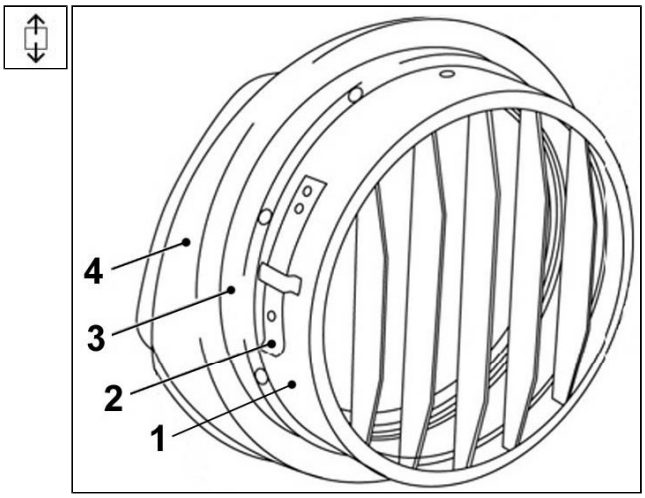
1. Mechanical damage to the headlamp.
2. The headlamp cannot be adjusted.

b) Technical Conditions

1. It is necessary to check and to adjust the headlamps by means of the electronic instrument (regloscope) or using the measuring wall after replacement of the main headlamp.
2. The headlamp light intensity must meet the specified technical conditions; side and height adjusting elements must allow a proper adjustment.

c) Removal Procedure

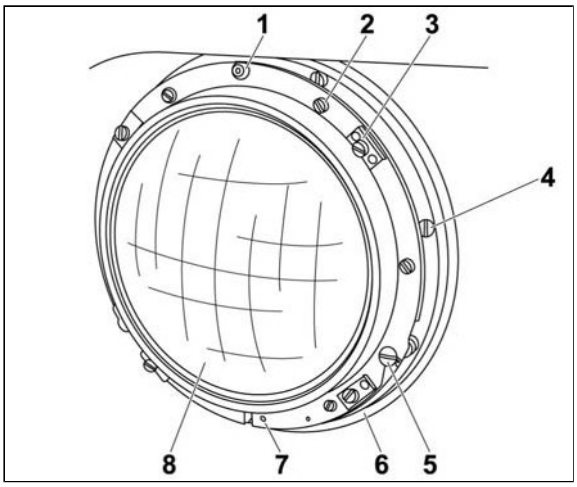
1. Turn off the batteries cut-off switch.
2. Use the screwdriver to lift two spring safety clips **2** fixing the headlamp cover (grille) and turn it anticlockwise to loosen and to remove the cover **1**.
3. Dismount the fastening screw and remove the headlamp rim **4**.



Legend: ***1*** *– headlamp hood;* ***2*** *– hood spring clip;* ***3*** *– headlamp flange;* ***4*** *– covering rim*

Fig. 15.42 Front headlamp - removal

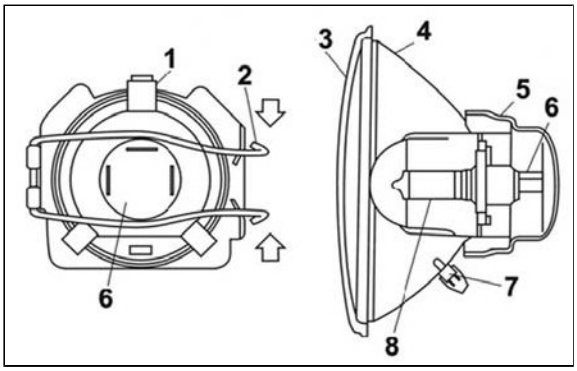
4. Dismount four screws **3** fixing the flange and turn the flange to remove it.
5. Loosen six screws fixing the optical insert **2** to the rear cover.
6. Pull the optical insert upwards to loosen it from the two lower adjusting elements **5** and gently move it ahead of the bumper.



Legend: ***1*** *– upper mounting of the optical insert,* ***2*** *– screw fixing the optical insert to the rear cover,* ***3*** *– screw fixing the flange to the insert,* ***4*** *– screw fixing the headlamp housing,* ***5*** *– adjusting elements,* ***6*** *– headlamp rubber gasket,* ***7*** *– rim thread,* ***8*** *– headlamp glass*

Fig. 15.43 Headlamp attachment - removal

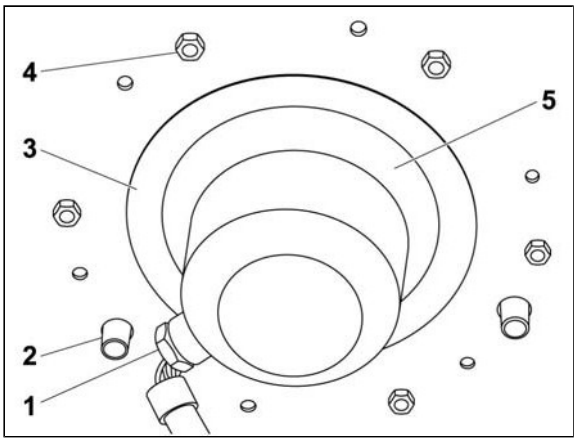
7. Unplug the electric feed cable connector from the side marker light bulb base **7**.
8. Carefully remove the socket from base of the halogen bulb **6** and place the loose front part of the optical insert aside.
9. Loosen all the three feed cables step by step (you should mark the connection of individual cables to the socket).



Legend: ***1*** *– bulb lock;* ***2*** *– safety springs;* ***3*** *– lens;* ***4*** *– reflecting surface of insert;* ***5*** *– rubber cap; 6 – bulb base; 7 – socket c/w bulb of side marker light;* ***8*** *– halogen bulb*

Fig. 15.44 Optical insert of the main headlamp

10. Unscrew the nut **1** fixing the sealing packing shim on inlet of feed cables into the headlamp.
11. Carefully pull cables c/w sealing packing shims out of the headlamp.
12. Dismount six screws **4** from the front part of the bumper fixing the rear cover of the optical insert and remove the rubber gasket **3** c/w metal rim.

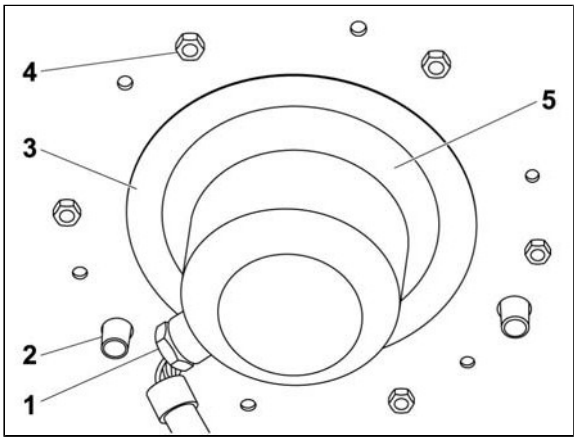


Legend: ***1*** *– feed cable sealing packing shim nut,* ***2*** *– adjusting element,* ***3*** *– headlamp rubber gasket,* ***4*** *– headlamp fastening screws,* ***5*** *– rear cover of the optical insert*

Fig. 15.45 Front headlamp rear view - removal

d) Installation Procedure

1. Dismantle a new headlamp into individual parts including removal of feed cables sealing packing shims.
2. Fit the rubber gasket **3** c/w metal rim from the front part of the bumper and fix it using six screws **4**; gently apply the plastic lubricant to the protruding part of screw threads.
3. Fit the union nut **1** and a new sealing packing shim on headlamp feed cables. Gently apply the plastic lubricant to the shim.
4. Pull feed cables c/w sealing packing shims into a rear cover of the new headlamp through a headlamp hole in the bumper and make it tight using the nut **1** in the socket of the headlamp feed cable.
5. Install the optical insert c/w rubber gasket into a hole in the bumper and fix with six svrew **4**. Tak care of the headlamp grounding cable.



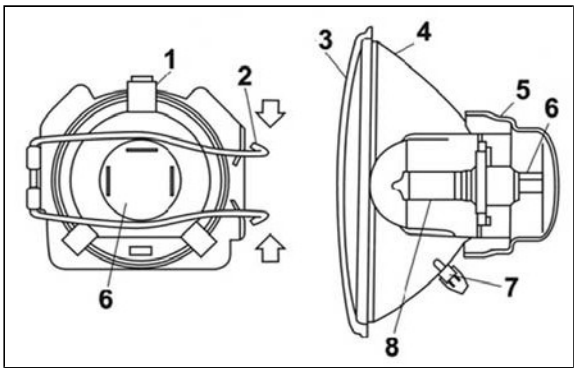
Legend: ***1*** *– feed cable sealing packing shim nut,* ***2*** *– adjusting element,* ***3*** *– headlamp rubber gasket,* ***4*** *– headlamp fastening screws,* ***5*** *– rear cover of the optical insert*

Fig. 15.46 Front headlamp rear view - intallation

6. Connect the ends of feed cables to the halogen bulb base
7. Install a good halogen bulb **8** into the optical insert of a new headlamp and lock it using safety springs **2** in a correct position on the optical insert **4**.

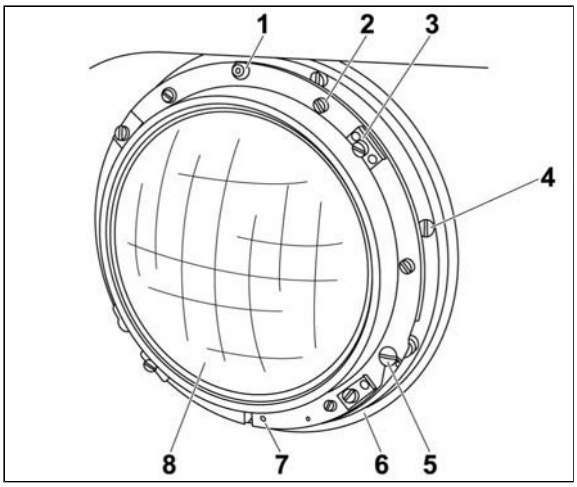
   Note :
   To remove the halogen bulb from the paper box, grasp its base and never grasp the bulb glass. If need be, hold it grasping its metal base or use the plastic foam.

8. Install the bulb base on the halogen bulb **8** in the optical insert.
9. Fit the socket c/w side marker light bulb **7** a connect the cable.
10. Turn the batteries circuit breaker on and check the side-marker lights, low and high beam for a correct function. Turn the batteries circuit breaker off.
11. Install the optical insert on the rubber washer **6** into a hole in the bumper.
12. Use screws **2** to connect the front part and rear part of the optical insert.
13. Mount the optical insert with a recess on both lower adjusting elements **5** and into the upper mounting **1**.
14. Adjust the headlamp according to the technological procedure (See Subchapter **15.5.1**).
15. Fit four screws **3** into a flange for the headlamp hood and tighten.



Legend: ***1*** *– bulb lock;* ***2*** *– safety springs;* ***3*** *– lens;* ***4*** *– reflecting surface of insert;* ***5*** *– rubber cap; 6 – bulb base; 7 – socket c/w bulb of side marker light;* ***8*** *– halogen bulb*

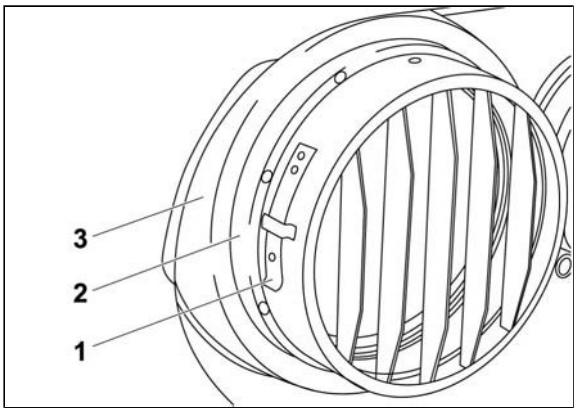
Fig. 15.47 Optical insert of the main headlamp



Legend: ***1*** *– upper mounting of the optical insert,* ***2*** *– screw fixing the optical insert to the rear cover,* ***3*** *– screw fixing the flange to the insert,* ***4*** *– screw fixing the headlamp housing,* ***5*** *– adjusting elements,* ***6*** *– headlamp rubber gasket,* ***7*** *– rim thread,* ***8*** *– headlamp glass*

Fig. 15.48 Headlamp attachment - installation

16. Mount the headlamp rim **4** and use the screw **7** (See Fig. **15.48**)to fix it in the lower part.
17. Fit and slightly turn the spring safety clip **2** (See Fig. **15.49**) to lock the cover (grille) **1** on the headlamp.



Legend: ***1*** *– cover spring safety clip,* ***2*** *– headlamp flange,* ***3*** *– rim*

Fig. 15.49 Front headlamp - installation

15.5.8 Removal and Installation of the Upper Headlamp

a) Reasons for Removal and Installation

1. The whole unit of the main headlamp needs to be replaced when it does not comply with its function and it is not enough to replace the bulb or the optical insert. The upper headlamp should be replaced if:

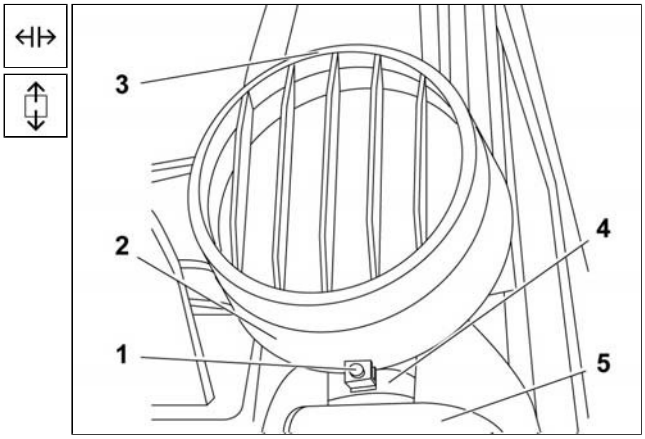
   - it has been damaged mechanically
   - it has corroded excessively

b) Technical Conditions

1. The vehicle illumination must function correctly after replacement of the headlamp (high beam, low beam and side marker lights), their luminous intensity must be sufficient and they must allow a correct adjustment of low beam.

c) Removal Procedure

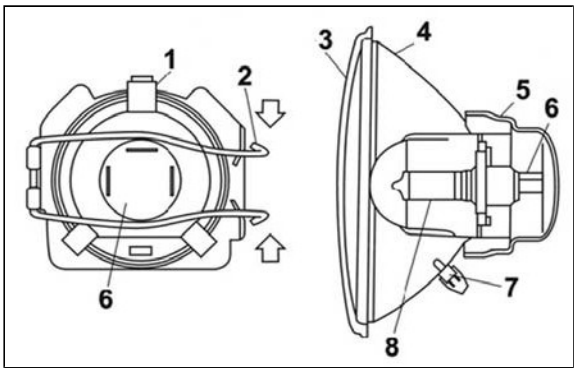
1. Turn the batteries circuit breaker off.
2. Dismount the plastic cover **5** from the cabin.
3. Loosen the mounting screw **1** of the rim **2** and tilt the rim c/w grille **3** away from the headlamp housing.



Legend: ***1*** *– rim fastening screw,* ***2*** *– rim,* ***3*** *– grille,* ***4*** *– headlamp holder,* ***5*** *– plastic cover*

Fig. 15.50 Location of the upper headlamp - removal

4. Remove the rubber cover **5** and withdraw the socket **6** from base **1** of the halogen bulb H4.
5. Unlock the halogen bulb springs **2** from position and grasp the base **1** to remove the bulb **8**. Attention - never touch the surface of the bulb with your fingers!
6. Remove socket **7** c/w side marker lamp bulb.
7. Place the rim c/w grille and optical insert aside. If need be, replace individual components too.
8. Disconnect the cables from the base socket **6** of the halogen bulb and side marker lamp **7**. Remember to note down correct positions of cables.
9. Loosen the union nut on the upper headlamp housing fixing the cable harness and pull out the cables c/w seal bushings from the flange.
10. Dismount the headlamp housing from holder on the cab and remove the rear part.

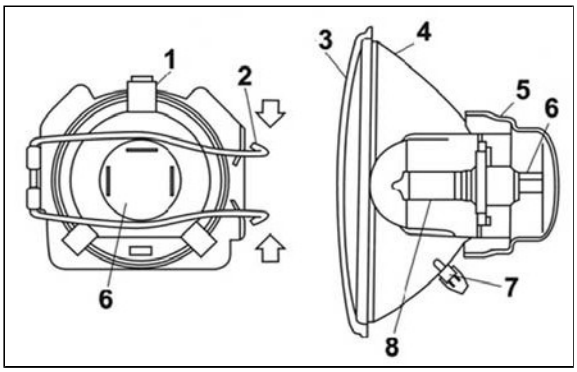


Legend: ***1*** *– bulb base,* ***2*** *– bulb retaining springs,* ***3*** *– lamp lens,* ***4*** *– optical insert,* ***5*** *– base rubber cover,* ***6*** *– base socket,* ***7*** *– side marker lamp socket,* ***8*** *– halogen bulb glass*

Fig. 15.51 Headlamp optical insert - removal

d) Installation Procedure

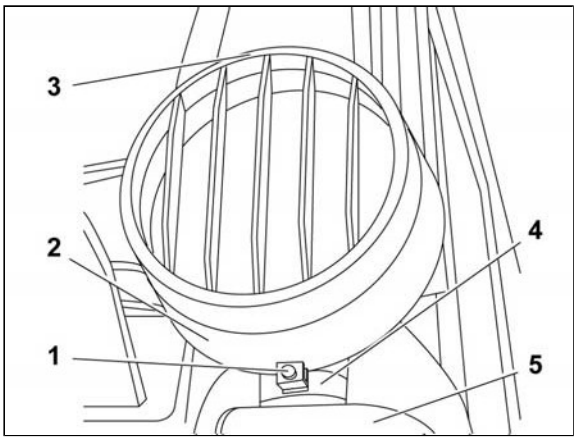
1. Dismantle the upper headlamp into individual components.
2. Fit the rear part of the headlamp into holder and slightly fix it.
3. Slide the feeder cables into headlamp and pull them out to reach the required length. Fit the seal bushing of cables and secure it in position.
4. Pull the cables through the rubber cover **5** of the base and connect to the base socket **6** correctly.
5. Connect cables to socket of the side marker lamp **7**.
6. Fit the base **1** of the halogen bulb on the optical insert **4** correctly and secure it with retaining springs **2** in position.
7. Slide the socket of the side marker lamp **7** into a hole in the optical insert.
8. Turn the batteries circuit breaker on and check the side marker lamp, low and high beam for a correct function. Turn the circuit breaker off.



Legend: ***1*** *– bulb base,* ***2*** *– bulb retaining springs,* ***3*** *– lamp lens,* ***4*** *– optical insert,* ***5*** *– base rubber cover,* ***6*** *– base socket,* ***7*** *– side marker lamp socket,* ***8*** *– halogen bulb glass*

Fig. 15.52 Headlamp optical insert - installation

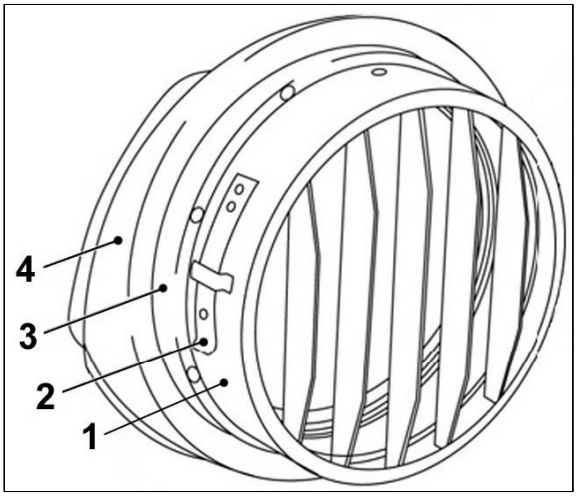
9. Fit the assembled optical insert into a rim **2** of the headlamp and secure it in a correct position.
10. Fit the rim **2** c/w optical insert on the rear part of the headlamp and secure it with screw **1**.



Legend: ***1*** *– rim fastening screw,* ***2*** *– rim,* ***3*** *– grille,* ***4*** *– headlamp holder,* ***5*** *– plastic cover*

Fig. 15.53 Location of the upper headlamp - installation

11. Fit the grille **1** on the rim **3** and secure it with spring **2**.
12. Adjust the headlamps according to a method mentioned in the article “Adjustment of Main Headlamps”.
13. Tighten the mounting nut of the upper headlamp in holder **4 (See Fig. Location of the upper headlamp - installation)**.
14. Fit and tighten the plastic cover **5** on the driver’s cabin.



Legend: ***1*** *– headlamp hood;* ***2*** *– hood spring clip;* ***3*** *– headlamp flange;* ***4*** *– covering rim*

Fig. 15.54 The headlamp - installation

15.5.9 Removal and Installation of Fog Headlamps

a) Reasons for Removal and Installation

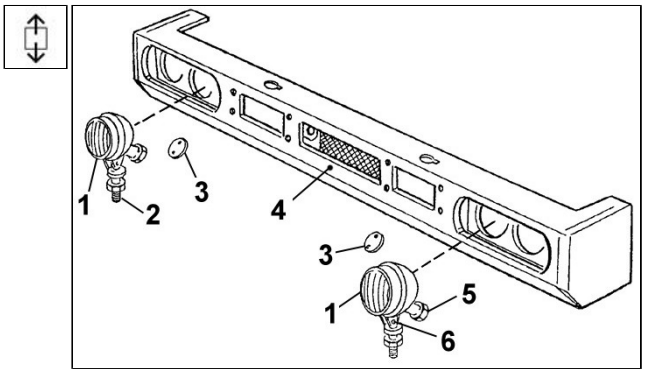
1. Mechanical damage to the headlamp.

b) Technical Conditions

1. Adjust the fog headlamps so that the upper boundary of their light is lower than the upper boundary of low beam.

c) Removal Procedure

1. Switch the batteries circuit breaker off.
2. Unscrew 5 screws M5 fixing the front headlight rim and remove the headlight rim c/w optical insert.
3. Move the plastic insulating tube on the connecting cable towards the bulb, unplug the connector and remove the tube.
4. Dismount the halogen bulb H3 (if not blown) from below the spring holders and do not touch the surface of the bulb with your fingers because it could cause its pollution.
5. Unplug the ground cable from the bulb base ground connector.
6. Unscrew the cap nut from the flange **5** (Fig.26.) of the connecting cable to the headlamp.
7. Pull the cable out to release the packing **3** c/w connecting cable.
8. Unscrew the retaining nut **2** from the fog headlamp and withdraw the headlamp from the front bumper.

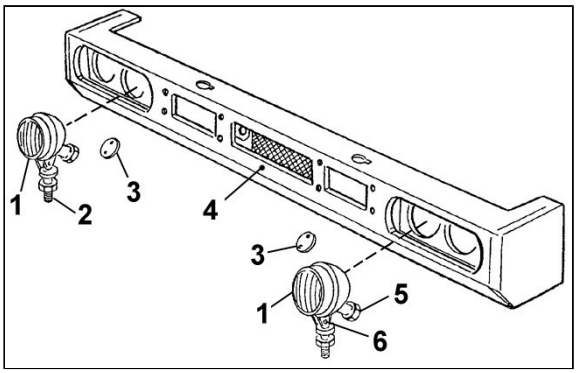


Legend: ***1*** *– fog headlamp;* ***2*** *– headlamp attachment;* ***3*** *– packing;* ***4*** *– front bumper;* ***5*** *– flange;* ***6*** *– headlamp leveling adjustment*

Fig. 15.55 Fog headlamps - removal

d) Installation Procedure

1. Dismount the front rim of a new headlamp and remove the optical insert.
2. Install a good halogen bulb H3 and secure it with springs holders.
3. Slide the insulating tube on the bulb connecting cable.
4. Fit the metal rear part of the fog headlamp on the vehicle front bumper and use washer c/w nut **2** to attach it.
5. If the rubber packing **3** of the connecting cable was damaged, replace it with a new one.
6. Gently apply the plastic grease to the packing **3** and pull it inside the flange **5** sufficiently together with connecting cable and tighten the cap nut.
7. Gently apply the plastic grease to the rubber sealing ring under the optical insert of the headlight and fit it on the rear part of the optical insert.



Legend: ***1*** *– fog headlamp;* ***2*** *– headlamp attachment;* ***3*** *– packing;* ***4*** *– front bumper;* ***5*** *– flange;* ***6*** *– headlamp leveling adjustment*

Fig. 15.56 Fog headlamps - installation

8. Plug the bulb connector to the connecting cable of the headlight and pull the insulating tube over the connection.
9. Install the ground connector on the bulb holder.
10. Switch the batteries circuit breaker on and check the fog headlamp for function. Turn the batteries circuit breaker off.
11. Fit the optical insert into the headlight so that the insert lock engages up in place and the rubber sealing ring is pushed thoroughly.
12. Install the fog headlamp rim and mount 5 retaining bolts. While dosing so, take care that the insert lock and insert rubber sealing ring are positioned properly all the time.
13. Adjust the for headlamps (See Subchapter **15.5.2**)

15.5.10 Removal and Installation of the Front (Side) Turn Signal Light

a) Reasons for Removal and Installation

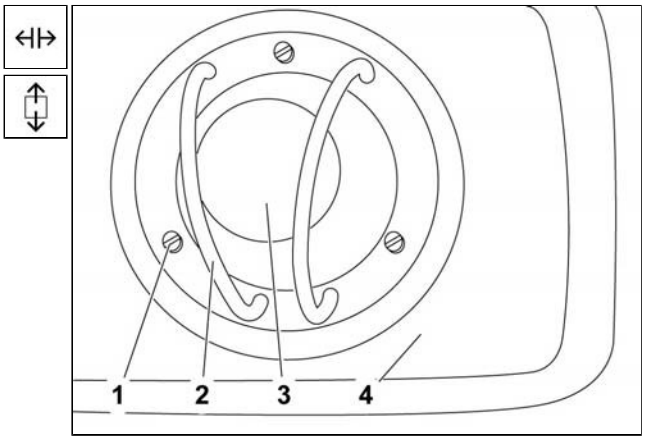
1. The turn signal light should be replaced if has been damaged mechanically and/or when the bulb socket has corroded excessively.

a) Technical Conditions

1. The turn signal light function must comply with respective requirements after replacement.

c) Removal Procedure

1. Turn the batteries circuit breaker off.
2. Unscrew 3 screws **1** from cover **2** of the turn signal light and withdraw it together with lens **3** and seal.
3. Remove the light bulb.
4. Disconnect the feeder and grounding leads from the light.
5. Move the light base forwards and move the cables out of the turn signal light together with the rubber bushing.

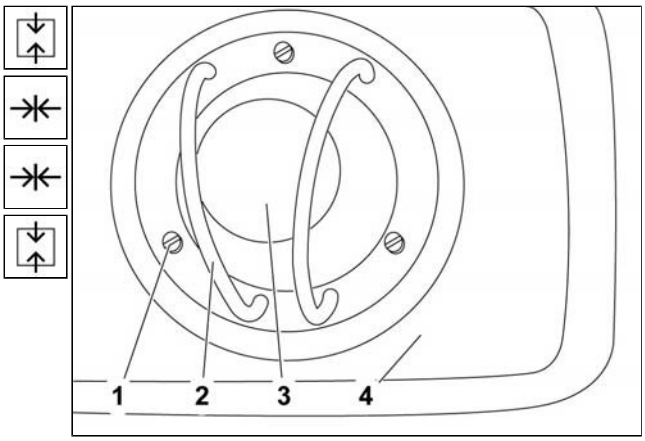


Legend: ***1*** *– screw,* ***2*** *– cover,* ***3*** *– lens,* ***4*** *– front bonnet*

Fig. 15.57 Front Turn Signal Light - removal

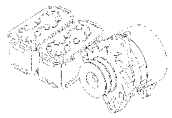
d) Installation Procedure

1. Dismantle a new turn signal light into individual components and remove the bulb.
2. Slide the connecting cables from the rear side of the lamp and connect them.
3. Fit the rubber bushing on cables inlets.
4. Fit the bulb into a socket.
5. Turn the batteries circuit breaker on and move the ignition to the 1st position.
6. Check the turn signal light for a correct function and turn the batteries circuit breaker off.
7. Assemble the unit of the turn signal light (light base, seal, lens **3** and cover **2**) so that the holes for fastening screws are aligned. Pull the screw **1** through the upper hole.



Legend: ***1*** *– screw,* ***2*** *– cover,* ***3*** *– lens,* ***4*** *– front bonnet*

Fig. 15.58 Front Turn Signal Light - installation



8. Fit the screw **1** into the upper thread and gently tighten.
9. Fit the resting screws and gently tighten.
10. Check a correct location of the rubber seal under the lens.
11. Tighten all mounting screws **1**.
12. Turn the batteries circuit breaker on, move the ignition to the 1st position and check the turn signal lights for a correct function again.

Note:
To replace the side turn signal light, proceed as mentioned above.

15.5.11 Removal and InstalLation of the Rear Cluster Lamp

a) Reasons for Removal and Installation

1. The rear cluster lamp needs to be replaced when it has been damaged mechanically or in case that the bulbs holder corroded excessively. It is possible to replace the damaged lamp cover, seal and organic glass individually.

b) Technical Conditions

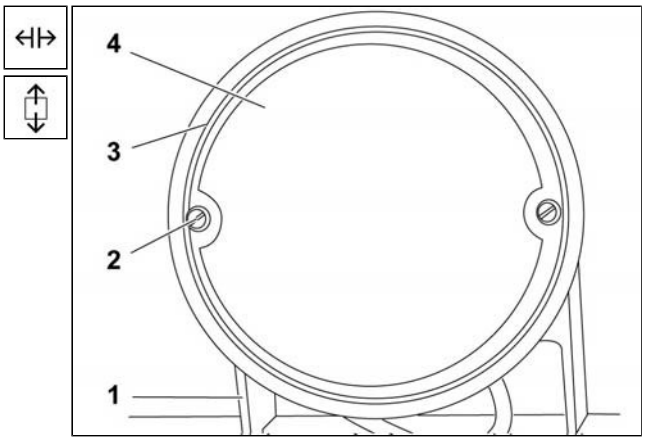
1. Before removal of the rear cluster lamp cover, you should check:

- the respective fuse on the fuse panel
- respective bulb
- correct function of the respective switch or relay (including interrupter)
- the wiring cable harness to the lamp for a good condition

2. After replacement of the tail lamp the vehicle must have a good-working and specified illumination at the rear.

c) Removal Procedure

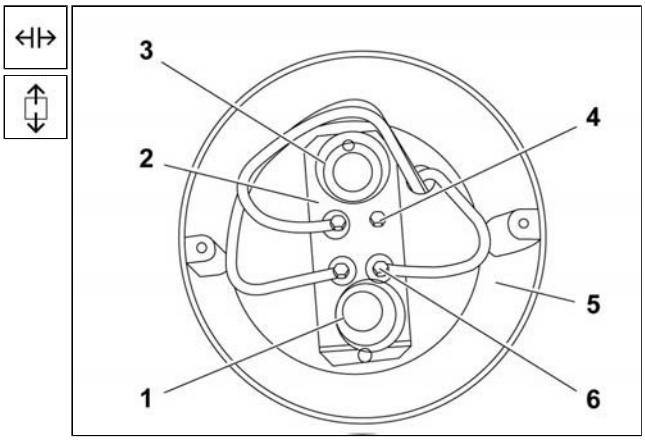
1. Turn the batteries circuit breaker off.
2. Use a screwdriver to loosen the screws **2** and remove the metal sheet rim **3** c/w organic glass **4** and rubber seal.



Legend: ***1*** *– bracket,* ***2*** *– screw,* ***3*** *– rim,* ***4*** *– organic glass*

Fig. 15.59 Rear cluster lamp - removal

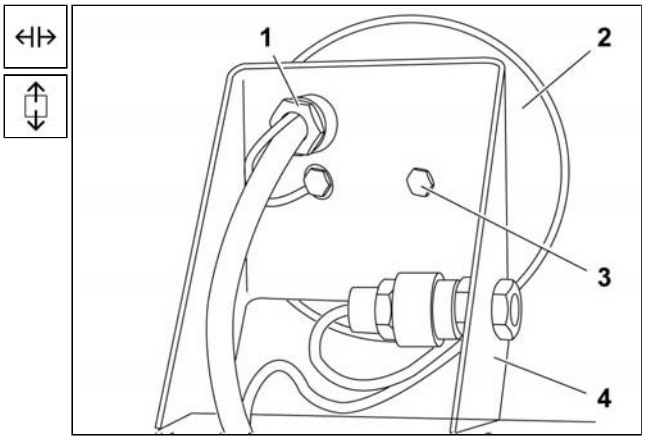
3. Remove both bulbs **1** and **3** from the rear cluster lamp.
4. Loosen cables from individual terminals **6**.



Legend: ***1*** *– tail light and stop light bulb (license plate illumination),* ***2*** *– bulbs holder,* ***3*** *– turn signal light bulb,* ***4*** *– grounding terminal,* ***5*** *– lamp housing,* ***6*** *– terminal c/w cable*

Fig. 15.60 Inner arrangement of the rear cluster lamp

5. Loosen the union nut **1** from the rear side of the cluster lamp **2**.
6. Pull the cable harness c/w rubber bushing out of the rear cluster lamp.
7. Dismount both screws **3** fixing the lamp **2** to bracket **4** and withdraw the lamp.

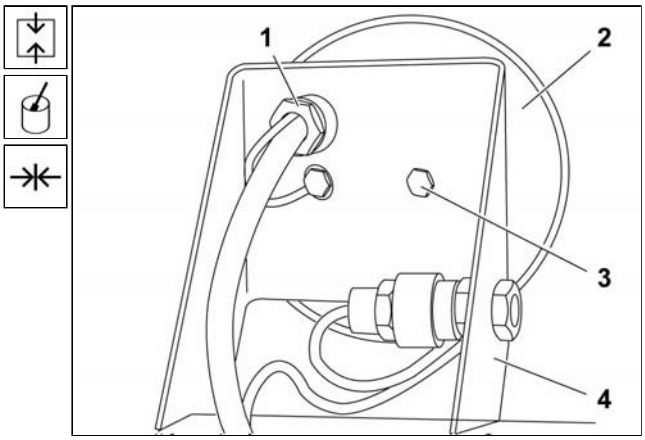


Legend: ***1*** *– flange union nut,* ***2*** *– lamp,* ***3*** *– mounting screw,* ***4*** *– bracket*

Fig. 15.61 Attachment of the tail lamp - removal

d) Installation Procedure

1. Dismount a new tail lamp and remove its bulbs.
2. Use screws **3** to attach the lamp **2** to bracket **4**.
3. Pull the cable harness through the flange inside the lamp and connect individual cables to terminals. Adjust the length of cables inside the lamp as needed.
4. Gently apply the plastic lubricant to the sealing bushing of cables, slide it into flange and tighten the union nut **1**.



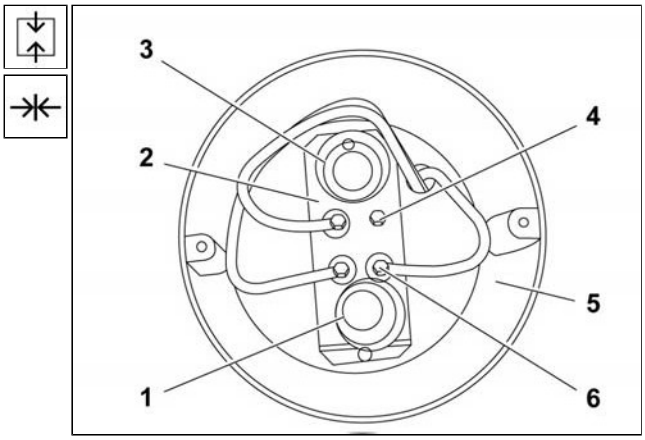
Legend: ***1*** *– flange union nut,* ***2*** *– lamp,* ***3*** *– mounting screw,* ***4*** *– bracket*

Fig. 15.62 Attachment of the tail lamp - installation

5. Fit good bulbs into the bulbs holder **2**. The two-filament bulb fits into a lower holder (tail and stop light).
6. Turn the batteries circuit breaker on, switch the ignition on and check individual lights for a correct function individually.

- you will need an assistant who will depress the brake pedal in the cabin to check the stop light for a correct function
- to check turn signal light, push the turn signal lights change-over switch (direction flasher)
- to check the tail lamp (and the license plate light as well), push the vehicle illumination switch

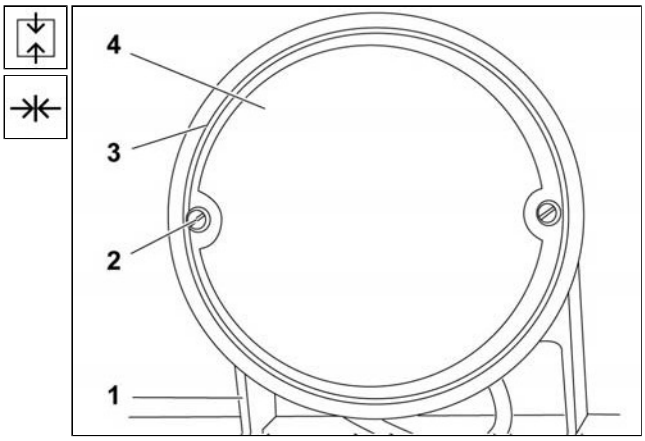
7. If all the lights are functioning correctly, turn the vehicle illumination, ignition switch and batteries circuit breaker off.



Legend: ***1*** *– tail light and stop light bulb (license plate illumination),* ***2*** *– bulbs holder,* ***3*** *– turn signal light bulb,* ***4*** *– grounding terminal,* ***5*** *– lamp housing,* ***6*** *– terminal c/w cable*

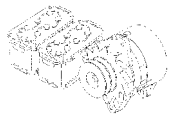
Fig. 15.63 Inner arrangement of the rear cluster lamp - installation

8. Gently apply the rubber seal with the plastic lubricant from both sides.
9. Fit the organic glass **4** and rubber seal into rim **3** on screws **2**. Fit the whole assembly on the lamp and tighten the screws **2** carefully.
10. After the complete installation has been accomplished, it is necessary to check the stop light, turn signal light and tail light for a correct function once more.



Legend: ***1*** *– bracket,* ***2*** *– screw,* ***3*** *– rim,* ***4*** *– organic glass*

Fig. 15.64 Rear cluster lamp - installation



15.5.12 Replacement of Signal Lamps and Switches on the Instrument Board

a) Reasons for Replacement of Bulb, Signal Lamp or Switch

1. It is necessary to replace some signal lamp, push-button, switch or change-over switch when it is not functioning, mostly because of mechanical damage. However, malfunctions of signal lamps bulbs are more frequent.
2. Push-buttons, switches and change-over switches need to be replaced also when their circuit opening / change-over contacts have been burnt extremely resulting in unreliable switch / change-over switch function and in many cases in their extreme heating.

b) Technical Conditions

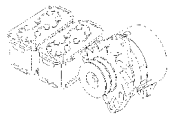
1. After replacement of the bulb (signal lamp), this must indicate a condition of the checked equipment correctly provided that respective sensors are working correctly.
2. After replacement of some push-button, switch or change-over switch, the controlled equipment must work properly provided that the malfunction does not lie in the controlled equipment.

c) Instructions for Removal

1. Switches and change-over switches fit into a panel of the instrument board from below and are fixed using a respective mounting nut from above. Rotary change-over switches are usually fitted with a lock protecting the whole change-over switch against turning and allowing an arrestment of the correct mounting position.
2. Removal of individual signal lamps, push-buttons, switches and change-over switches calls for a disconnection of respective electrical leads. If connectors are used, then find out whether they are not protected against falling-out and first release this lock.
3. Connectors may be stated either for individual leads or for cable harnesses. Sometimes it is necessary to use a screwdriver or pliers to make their removal easier.
4. It is recommended to switch the batteries circuit breaker off before starting with disconnection of individual feeder cables to prevent possible short-circuits of the disconnected feeder cable to the vehicle ground connection.
5. To allow a better access, it is sometimes more convenient to dismount the whole change-over switch or switch from location in the instrument board and then to disconnect individual leads from terminals.
6. It is recommended to note down the connection of individual leads to respective terminals of the equipment and/or to check the pertaining wiring with the valid overall wiring diagram.
7. To gain an access to some mounting nut of rotary change-over switches of vehicle lights, winch, warning light and oil heater fan, it is necessary to carefully remove the control knob by applying a slight manual force in direction of the change-over switch axis. Knobs of other switches must be unscrewed.
8. To carry out a replacement of the signal lamp bulb, first carefully pry the signal lamp out of the instrument panel and then replace the bulb.

d) Instructions for Installation

1. Signal lamps, switches and change-over switches on the driver’s instrument board are made of plastic materials in prevailing cases. For that reason, take an extreme care when installing these devices and do not use the force not to cause damage to new instruments.
2. First connect respective leads to corresponding terminals and secure adequately in position.
3. Connectors may be fitted in position mostly after mechanical installation into the instrument board.



4. It is not recommended to carry out experiments when connecting the respective leads - this could result in damage to the electric equipment, change-over switches or burning of the respective feeder circuit fuse. If in doubt, check the correct connection according to the overall wiring diagram.
5. It is very important - especially for rotary change-over switches - to be fixed in the initial position. The respective arresting lugs and recesses in location, which also protect them from turning, are designed for this purpose. Be sure that the arresting elements fit correctly in position always before tightening the mounting nuts.
6. Apply an appropriate force when tightening the mounting nuts with regard to the plastic material used.
7. Apply a slight pressure on the shaft with regard to position of the lock on the shaft (a little ground-off area) when mounting the control knob of rotary change-over switches.

e) Checking for a Correct Function

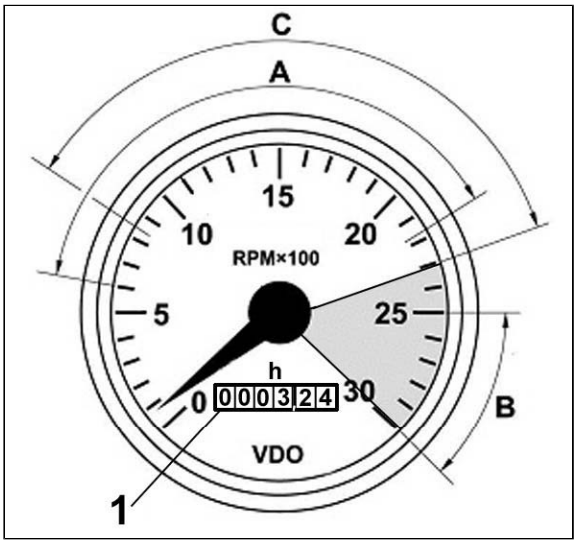
1. Before you turn the batteries circuit breaker on and start with checking the equipment for a correct function, it is suitable to check once more if all terminals and leads are connected correctly.
2. After turning the batteries circuit breaker on, use respective buttons, switches and change-over switches to check the respective equipment for a correct function.
3. A correct function of signal lamps is checked by switching-on the equipment into a condition when the signal lamp should indicate the condition to be checked.

15.5.13 Removal and Installation of Instruments from /onto the Instrument Panel

a) Reasons for Removal

1. The individual instruments of the instrument panel must be replaced in case that the instrument does not fulfill its function properly or when its function cannot be relied on (see symptoms of a proper function). Especially the instruments, which could reduce the traffic safety or the engine reliability, must be replaced in time.
2. The technical condition of individual gauges and measuring instruments can be considered according to the following symptoms of a proper function:

Tachometer – after turning the ignition key to the 1st position and with the vehicle at standstill, the tachometer pointer must indicate a zero. During a change of the engine speed frequency, the pointer must move continuously without jumps. After shutting off the engine and turning off the ignition key, the pointer need not always return to the initial zero position. The hours counter must correspond to real values.



Legend: ***1*** *- hours counter;* ***A*** *- economical cruising range;* ***B*** *- overrun range;* ***C*** *- exhaust brake using permissible range*

Fig. 15.65 Tachometer

Speedometer – on the move, the pointer must move continuously without rubbing and jumps. The clock time indicator and the odometer readings must correspond to real values

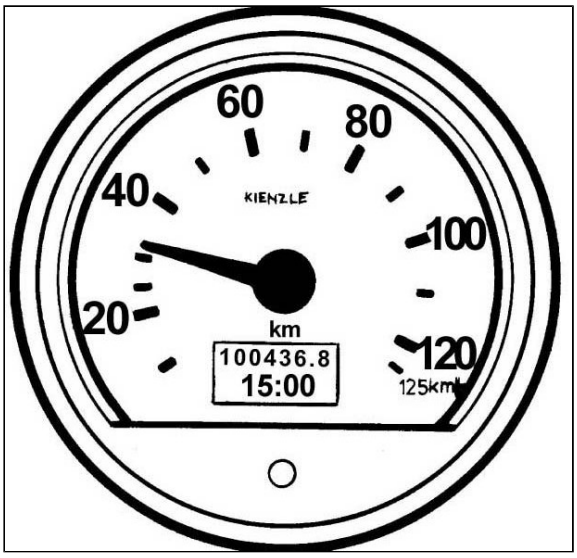
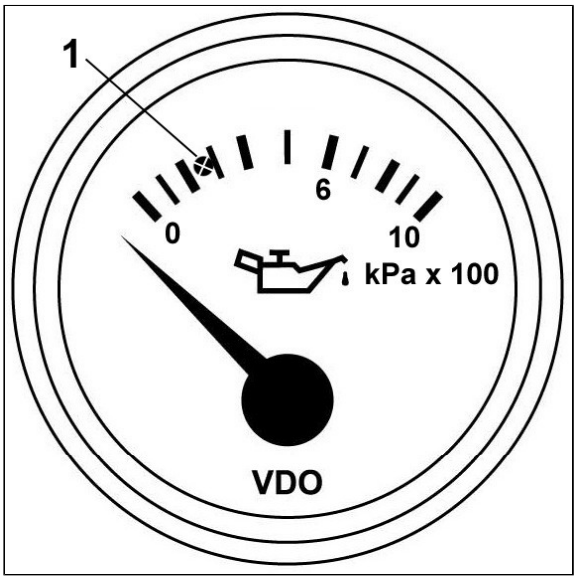


Fig. 15.66 Speedometer

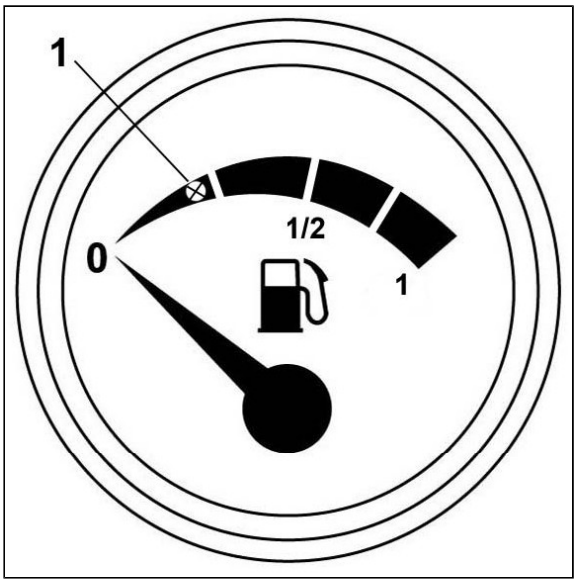
Engine oil pressure gauge – after turning the ignition key to the 1st position, the pointer should show the lowest value, after starting the engine, the pointers must move to the right the actual oil pressure dependent.



Legend: ***1*** *- cheking lamp of the minimum oil pressure*

Fig. 15.67 Engine oil pressure gauge

Fuel gauge – the pointer position should be checked especially with a full and an empty fuel tank; the inaccurate readings at other fuel levels are tolerated regarding the fact that there is no danger of damage to engine, which only will stop when a shortage of fuel occurs. After turning the ignition key to the 1st position it is possible to check whether the pointer moves continuously to a position related to the actual fuel amount in the tank.



Legend: ***1*** *- checking lamp of the minimum fuel level*

Fig. 15.68 Fuel gauge

Voltmeter – the voltage in the vehicle network with the engine running below 25 V or above 29 V should be considered to be wrong. To verify the condition, use the workshop voltmeter (more accurate).

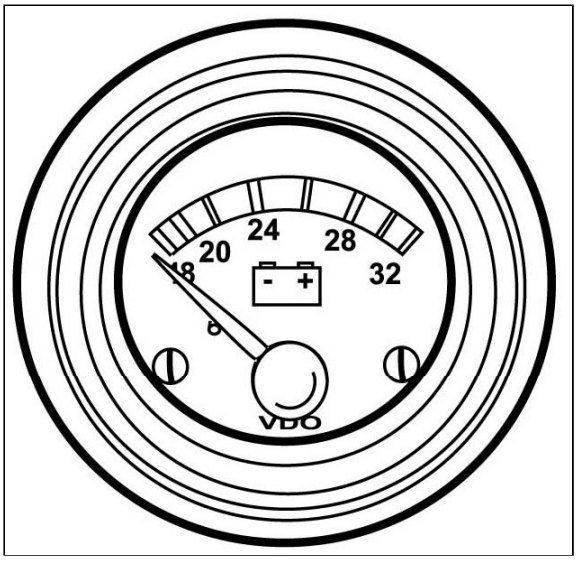
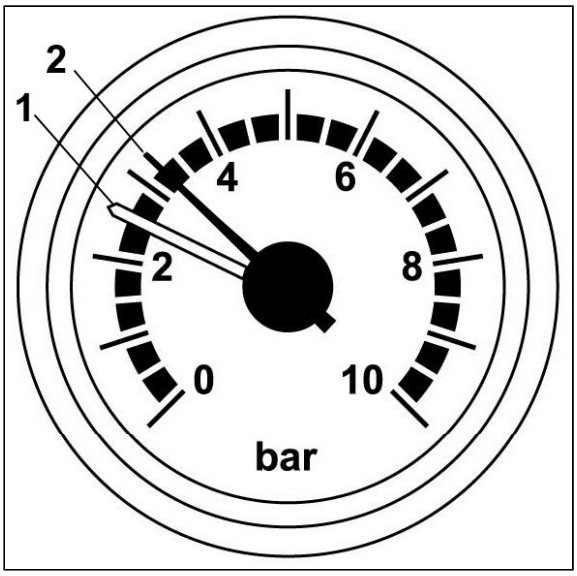


Fig. 15.69 Voltmeter

Air pressure gauge in the brake system - indicates the air pressure in air reservoirs in both air pressure brake circuits. The pressure gauge contains also switches to indicate the pressure drop by means of signal lamps on the instrument board



Legend: ***1*** *- air pressure in front axle brake circuit;* ***2*** *- air pressure in rear axles brake circuit*

Fig. 15.70 Air pressure gauge in the brake system

Tyre pressure gauge - indicates the air pressure in tyres. It is necessary to open the closing valve on the pertaining tyre. The cocks on the control panel must be closed.

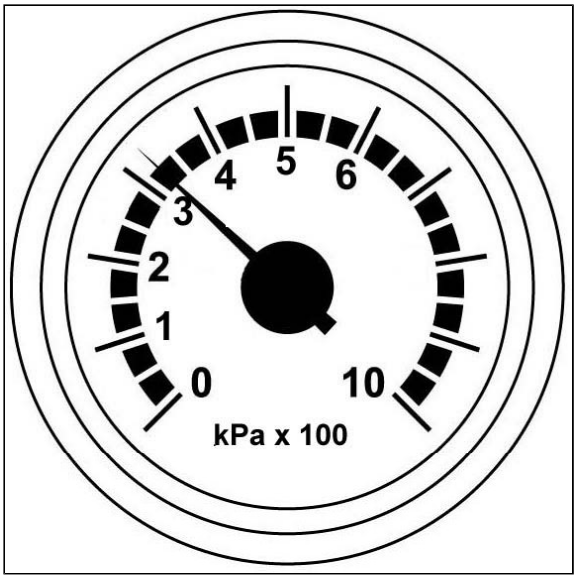
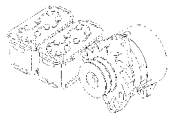


Fig. 15.71 Tyre pressure gauge

Note:
With the gauge, which does not indicate correctly or does not indicate at all, it is necessary to find the cause and locate the place of malfunction. It may occur that gauges, their sensors, connecting elements (connectors) or connecting cables have been damaged.



b) Technical Conditions

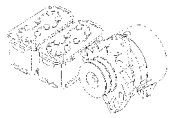
1. After replacement of the gauge this must indicate the respective value in all operating function modes of the engine or pertaining vehicle system reliably.

c) Tachometer Removal and Installation Procedures

1. Turn the batteries cut-off switch off.
2. Open the front engine cover.
3. Release and remove two nuts M5 from tachometer holders and withdraw both instrument holders.
4. Shift the tachometer out ahead of the instrument board and pull out the instrument lighting cable harness.
5. Unplug the electrical connector and remove the tachometer.
6. Install the electrical connector and instrument lighting harness onto a new tachometer.
7. Turn the batteries cut-off switch on.
8. Start the vehicle engine and check the tachometer in various engine speed modes for a proper function and stop the engine.
9. Check the instrument lighting
10. Turn the batteries cut-off switch after stopping the engine off.
11. Fit the instrument into a hole on the instrument board in a correct position.
12. Install tachometer holders and use a wrench to tighten their nuts.
13. Check whether connectors of other instruments and especially those of signal lamps are plugged correctly.
14. Turn the batteries cut-off switch on. Start the engine and check the tachometer for a proper function again.
15. Stop the engine.
16. Close the front engine cover.

d) Speedometer Removal and Installation Procedures

1. Open the front engine cover.
2. Remove the connector from the speedometer back side.
3. Remove two sockets with bulbs of the gauge lighting.
4. Remove the holders of the gauge attachment
5. Shift the tachometer out of the instrument board.
6. Unplug the electrical connector.
7. Install the electrical connector onto a new speedometer.
8. Fit the gauge into a hole on the instrument board in a correct position.
9. Install speedometer holders and use a wrench to tighten their nuts.
10. Install two sockets with bulbs of the gauge lighting.
11. Plug the electrical connector from the speedometer sensor.
12. Close the front engine cover.
13. Start the vehicle engine and realize the test ride for checking the speedometer in various speed



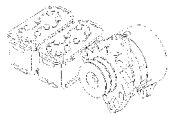
modes for a proper function.

e) Engine Oil Pressure Gauge Removal and Installation Procedures

1. Turn the batteries cut-off switch off.
2. Open the front engine cover.
3. Remove the socket with instrument lighting.
4. Release and remove nuts of instrument holders.
5. Shift the tachometer out ahead of the instrument board.
6. Unplug the electrical connector.
7. Install the electrical connector onto a new tachometer.
8. Turn the batteries cut-off switch on.
9. Turn the ignition key to the 1st position. The checking lamp **1** must light up (See Fig. **15.67**).
10. Start the vehicle engine. The checking lamp **1** must light off and check the tachometer in various engine speed modes for a proper function.
11. Stop the engine. Switch off the ignition key and batteries cut-off switch.
12. Fit the instrument into a hole on the instrument board in a correct position.
13. Install tachometer holders and use a wrench to tighten their nuts.
14. Install the socket with instrument lighting.
15. Turn the batteries cut-off switch on.
16. Start the engine and check the tachometer for a proper function again.
17. Close the front engine cover.

f) Fuel Gauge Removal and Installation

1. Turn the batteries cut-off switch off.
2. Open the front engine cover.
3. Unscrew tne nuts and remove the holders of the fuel gauge attachment.
4. Shift the fuel gauge out of the instrument board.
5. Unplug the electrical connector.
6. Remove socket with bulb of the fuel gauge lighting.
7. Install the electrical connector onto a new fuel gauge.
8. Install socket with bulb of the fuel gauge lighting.
9. Turn the batteries cut-off switch on and turn the ignition key to the 1st position. The fuel gauge must indicate the approximate amount of the fuel in the tank. The minimum fuel level is indicated when the diesel fuel level drops below 50 litres in the tank.
10. Switch off the batteries cut-off switch on and the ignition key.
11. Install the fuel gauge into a hole in a correct position, fit holders and attach them using nuts.
12. Close the front engine cover.

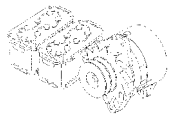


g) Voltmeter Removal and Installation

1. Turn the batteries cut-off switch off.
2. Open the front engine cover.
3. Release holders of the faulty voltmeter.
4. Shift the instrument out ahead of the instrument panel.
5. Unplug the feed connector and lighting.
6. Install the lighting harness and electrical connector to a new voltmeter.
7. Fit the voltmeter into a hole on the instrument panel, install and attach the voltmeter holders.
8. Turn the batteries cut-off switch on.
9. Start the vehicle engine.
10. Check the voltmeter for a proper function in various speed and load modes of alternator.
11. Stop the engine.
12. Close the front engine cover.

h) Removal and Installation of the Brake System Double Air-pressure Gauge

1. Turn the batteries cut-off switch off.
2. Secure the vehicle with chocks against motion.
3. Use the valves for the water separation from air reservoirs to release the pressure air from 1st and 2nd circuit air reservoirs.
4. Open the front engine cover.
5. Remove the socket with the pressure gauge lighting.
6. Detach both pressure air supply manifolds.
7. Unscrew pressure gauge holders' nuts.
8. Remove the faulty pressure gauge.
9. Check whether the connecting cones of pressure hoses are in a good condition and/or clean them.
10. Install a new pressure gauge into a hole on the instrument board in a correct position.
11. Fit and tighten nuts on pressure gauge holders.
12. Fit and tighten cap nuts on the pressure air supply manifold.
13. Turn the batteries cut-off switch on.
14. Start the engine and check the pressure increase to reach the operating value in the 1st and 2nd circuit of the brake system and a function of the low air-pressure indication.
15. After reaching the operating pressure stop the engine and check if no air leaks from connections of pressure hoses to the pressure gauge. If you are not quite sure about it, use the brush and soap water to find the leakage.
16. Install the pressure gauge lighting.
17. Close the front engine cover.
18. Remove the chocks against motion.



e) Removal and Installation of the Tyre Pressure Gauge

1. Turn the batteries cut-off switch off.
2. Chewch the closing of the cocks on control panel.
3. Check the closing of the wheel cocks.
4. Open the front engine cover.
5. Remove the socket with the pressure gauge lighting.
6. Detach pressure air supply manifold.
7. Unscrew pressure gauge holders' nuts.
8. Remove the faulty pressure gauge.
9. Check whether the connecting cone of pressure hose is in a good condition and/or clean it.
10. Install a new pressure gauge into a hole on the instrument board in a correct position.
11. Fit and tighten nuts on pressure gauge holders.
12. Fit and tighten cap nuts on the pressure air supply manifold.
13. Open the wheel cocks.
14. Turn the batteries cut-off switch on and the ignition key to the 1st position.
15. Start the vehicle engine and check the pressure gauge function in various value of tyres pressure.
16. Set the tyre pressure to the prescribed value.
17. After reaching the operating pressure stop the engine and check if no air leaks from connection of pressure hose to the pressure gauge. If you are not quite sure about it, use the brush and soap water to find the leakage.
18. Close the wheel cocks.
19. Install the pressure gauge lighting.
20. Close the front engine cover.

15.5.14 Removal and Installation of the Combined Change-over Switch

a) Reasons for Removal and Installation

1. The combined change-over switch or the engine brake switch must be replaced when it works unreliably or it does not fulfill some of the below mentioned functions:

   - Turn indicators control,
   - Low/high beam switching-over,
   - Headlamp flasher control,
   - Wiper operation control,
   - Windshield washer operation control.

b) Technical Conditions

1. The change-over combined switch uses mostly the plastic components in its design what calls for a gentle handling. A violent handling will cause a mechanical malfunction, which cannot be repaired, and the whole combined change-over switch including control lever, cable harness and two connectors are necessary to be replaced in that case.
2. After replacement of the combined change-over switch make sure that the low/high beam, turn indicators, flasher horn, windshield wiper and washer work correctly.
3. With regard to a complicated electrical and mechanical design, the combined change-over switch can be repaired only exceptionally and thus at the specialized service station only.

c) Combined change-over Switch Removal

1. Turn the batteries cut-off switch off.
2. Unscrew screws **3** c/w spring washers and withdraw the combined change-over holder **1** from the complete spindle holder **2**.

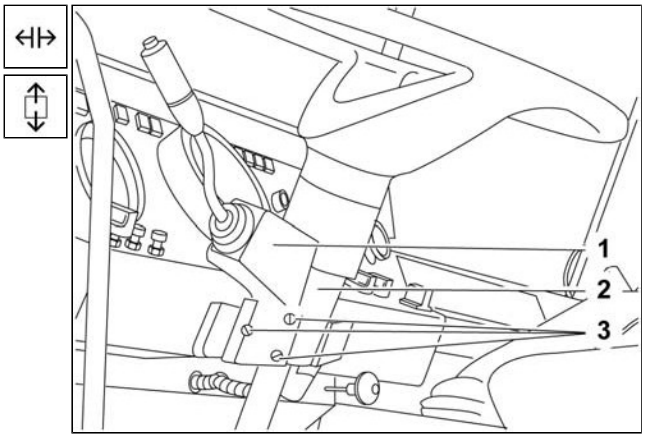


Fig. 15.72 Combined change-over switch holder - removal

3. Use a screwdriver to loosen the holder **1** fixing the cable harness to the combined change-over switch.
4. Loosen the rubber cap **3** (dust cap) of the change-over switch between the control lever and cover of the combined change-over switch **6**.
5. Use a screwdriver to unscrew 3 mounting screws M5 **5** fixing the combined change-over switch to its cover **6**.
6. Move the complete combined change-over switch c/w control lever and rubber cap out of the cover body **5** of the combined change-over switch.
7. Use the 10 mm wrench to loosen the holder of feeder cable harness from below the instrument board behind the steering wheel shaft.
8. Lift the front engine bonnet.
9. Unplug two connectors situated to the right behind the fuse and relays panel.
10. Attach a string to the connector, which should be pulled inside the cabin to make the pulling-through of new connectors from cabin into a space below the front bonnet easier. To protect the string from inadvertent complete pulling-out of the string, it is recommended to fix its end to some part in the space under the front bonnet.
11. Pull out the connectors through inside the cabin so that the faulty combined change-over switch is loosened completely.
12. Loose the end of string being connected to connectors of a faulty change-over switch.

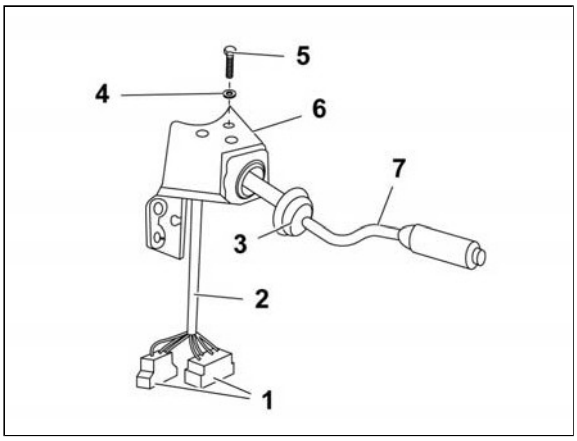


Fig. 15.73 Combined change-over switch - removal

d) Combined change-over Switch Installation

1. Use the insulating tape to stick together the connectors of a new combined change-over switch so that their cross-section would allow their pulling-through into a space under the front bonnet.
2. Attach the end of string to the stuck connectors inside the cabin.
3. Your assistant will pull gently the string to help pulling through of connectors into a space under the front bonnet.
4. After pulling through the connectors, loosen the fixed string and clamping insulating tape.
5. Plug the connectors to respective counter-pieces under the front bonnet.
6. Slide a new combined change-over switch into its cover **6** and use a screwdriver to attach it using 3 screws M5 **5** from above.
7. Fit the rubber cap **3**.
8. Fit and attach the cable harness holder **2** under the instrument board.
9. Turn the batteries circuit breaker on, move the ignition to 1st position and check the combined change-over switch for a correct function in all operating regimes.

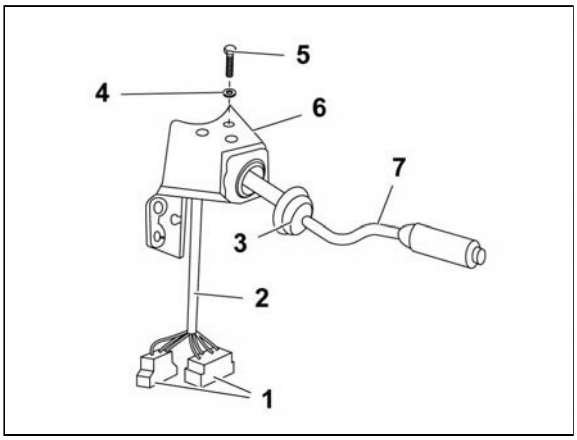
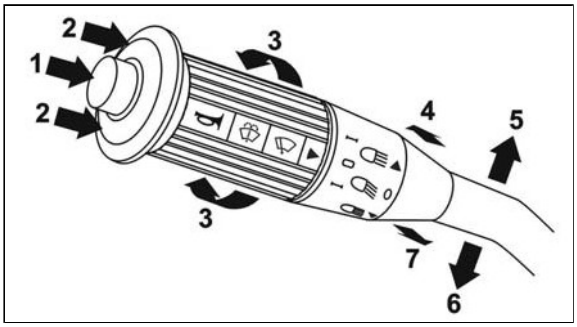


Fig. 15.74 Combined change-over switch - installation



Legend: ***1*** *– acoustic horn,* ***2*** *– washer pump,* ***3*** *– wipers functions,* ***4*** *– high beam,* ***5*** *– headlamp flasher,* ***6*** *– turn signal lights, RH,* ***7*** *– turn signal lights, LH*

Fig. 15.75 Functions of combined change-over switch

10. Fit the combined change-over switch holder **1** to the complete spindle holder **2** and use screws **3** c/w spring washers to attach it.

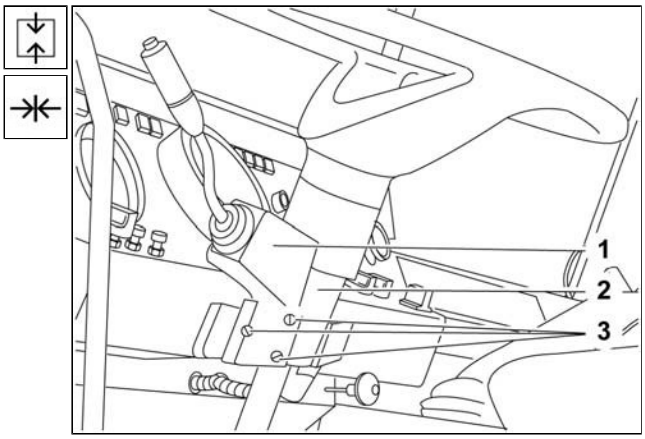
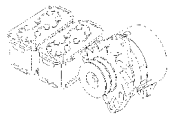


Fig. 15.76 Combined change-over switch holder - installation



15.5.15 Removal and Installation of the Stop Lights Switch

a) Reasons for Removal and Installation

1. It is necessary to replace the stop lights switch when the stop lights are not functioning properly and the malfunction is not caused by a faulty bulb or fuse.
2. Replace the stop lights switch when:

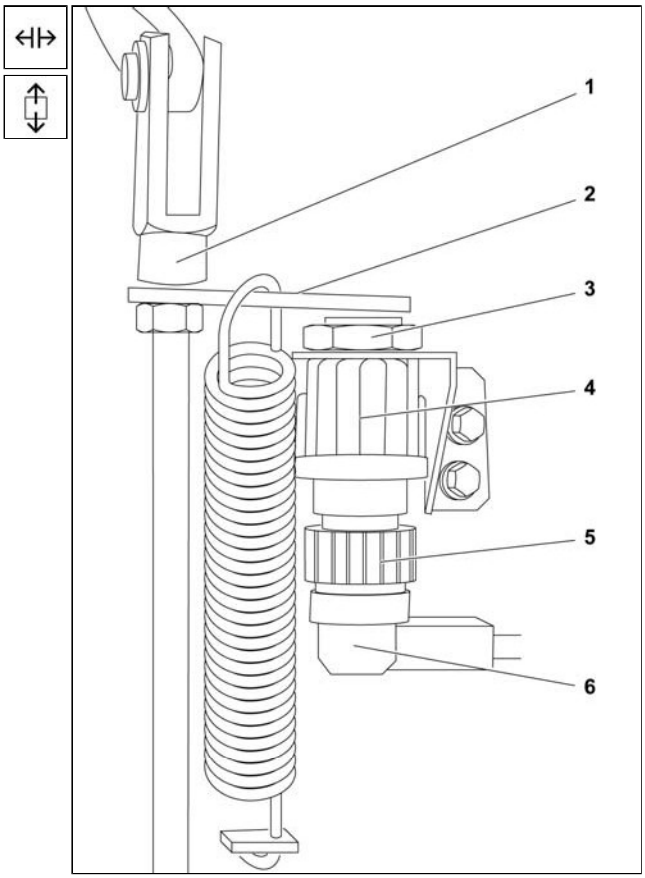
   - It has been damaged mechanically
   - It does not pass the current for stop lights (lights do not come on)
   - It does no break the current for stop lights (lights are on permanently)

b) Technical Conditions

1. The stop lights must work correctly after replacement of the stop lights switch, it means that they must come on immediately after depressing the brake pedal by the driver.
2. The proper switch **4** (See Fig. **15.77**) is of water-proof and inductive type. The position (distance) of the control bridge **2** of the switch is important for its correct function. Move the holder **5** c/w sensor accordingly to set the appropriate distance of the control bridge **2** from face of the sensor to **1 ÷ 2 mm**.

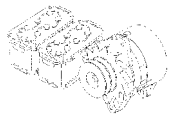
c) Removal Procedure

1. Lift the engine front bonnet.
2. Loosen the union nut **6** of connector **7** and move away the connector down.
3. Gently loosen 2 screws M6 fixing the switch holder **4**.
4. Move the holder **5** down in the recess and gently tighten the screws.
5. Use the 27 mm wrench to unscrew the mounting nut **3** of the switch and move the switch **4** out.



Legend: ***1*** *– master brake valve control tie-rod;* ***2*** *– switch control bridge;* ***3*** *– switch mounting nut;* ***4*** *– stop lights switch;* ***5*** *– angular connection union nut;* ***6*** *– connector*

Fig. 15.77 Stop lights switch - removal



d) Installation Procedure

1. Fit a new switch **4** (See Fig. **15.77**) into holder **5** and tighten the mounting nut **3**.
2. Fit electrical connector **7** and secure it with a union nut **6**.
3. Gently loosen 2 screws M6 fixing the holder and adjust the distance of the face of the switch **4** from the control bridge **2** to **1 - 2 mm**.
4. Adequately tighten both mounting screws M6 of the holder.
5. Tilt the engine front bonnet.

e) Checking the Stop Lights Switch for a Correct Function

1. Turn the batteries circuit breaker on.
2. To check the stop lights switch for a correct function, depress the brake pedal and check whether the stop lights come on.

15.5.16 Removal and Installation of the Wiper Motor

a) Reasons for Removal and Installation

1. The wiper motor is replaced when some fault mentioned below occurs while the fuse **F14** is OK and wiper blades controllers work normally:

- The motor does not work at all.
- The motor runs jerky.
- Wiper blades do not stop in the initial position, but immediately after turning off the switch.

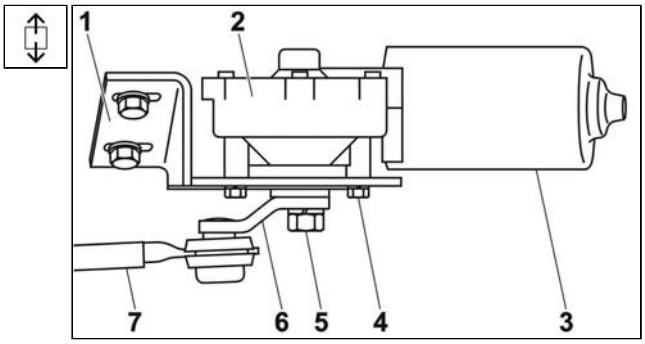
b) Technical Conditions for the Wiper Motor Replacement

1. After replacement of the wiper motor the wiper leverage mechanism must work properly, it means that:

- It must work smoothly both in a slow and a quick run.
- It must stop in the wiper blades initial position.

c) Removal Procedure

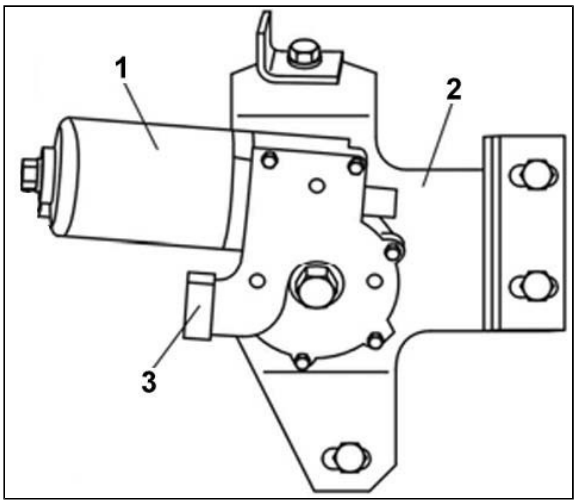
1. Turn off the batteries cut-off switch.
2. Open the front engine cover.
3. Use the socket 17 mm wrench to loosen the nut **4** from the splined shaft (from its conical milihedron) of the wiper motor **1** and remove nut **4** c/w washer. Take care that the **nut has a left-hand thread**.
4. Use the screwdriver to remove the wiper blades control lever **3** from the splined shaft.
5. Use the 13 mm wrench to loosen three screws **5** fixing the wiper motor to the flange **6**. Hold the wiper motor from below from the electric terminal board housing during removal of the last screw.



Legend: ***1*** *– wiper motor,* ***2*** *– wiper blades mechanism tie-rod,* ***3*** *– control lever,* ***4*** *– nut,* ***5*** *– screws fixing the motor,* ***6*** *– flange to mount the motor,* ***7*** *– motor gear*

Fig. 15.78 Wiper motor mounting - removal

6. Unplug the electrical connector **3** of the wiper motor.

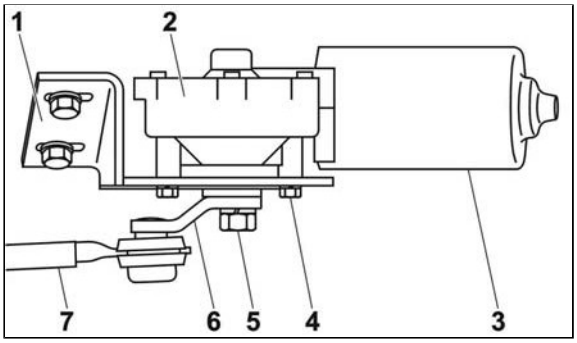


Legend: ***1*** *– wiper motor blades linkage,* ***2*** *– motor flange,* ***3*** *– electrical connector*

Fig. 15.79 Wiper motor – connector

d) Installation Procedure

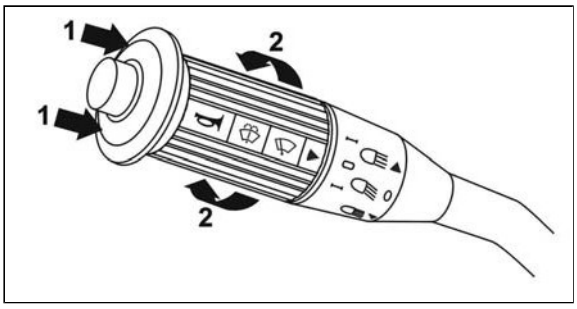
1. Plug the electrical connector **3** of a new wiper motor (See Fig. **15.79**).
2. Slide the wiper motor to the mounting flange **4** from below and use three screws M8 **5** c/w washers to attach it to the flange from above; tighten the screws.
3. Turn on the batteries cut-off switch and move the ignition key into the 1st position.
4. Turn the wipers on/off to achieve the initial position by means of the run-out contact.
5. Turn off the ignition key and turn off batteries cut-off switch.
6. Fit the lever **3** of the wiper blades mechanism onto the splined shaft of the wiper gear (the lever is in the centreline of the shortest tie-rod when wiper blades are in the initial position).
7. Install washers and fastening nut **4**. The control lever must be installed onto the gear shaft perpendicularly so that the splined cones of the lever and the shaft are in mesh exactly.
8. Tighten the nut **4** to the torque of **34 ± 2 Nm**. Take care that the nut **4 has a left-hand thread** .



Legend: ***1*** *– wiper motor,* ***2*** *– wiper blades mechanism tie-rod,* ***3*** *– control lever,* ***4*** *– nut,* ***5*** *– screws fixing the motor,* ***6*** *– flange to mount the motor,* ***7*** *– motor gear*

Fig. 15.80 Location of the wiper motor - installation

9. Turn on the batteries cut-off switch and move the ignition key to the 1st position.
10. Use the washer to sprinkle the windshield and check the wiper motor and wiper blades for a correct function.
11. When turned off, wiper blades must stop in the initial position. Slight deviations from the initial position can be set on the tie-rod, the bigger ones by bigger oversetting of the arm on the conical milihedron.
12. Turn off the batteries cut-off switch.
13. Close the front engine cover.



Legend: ***1*** *– washer pump,* ***2*** *– wiper functions*

Fig. 15.81 Wiper control positions

15.5.17 Removal and Installation of the Windshield Washer Motor

a) Reasons for Removal and Installation

1. The electric pump of the windshield washer needs to be replaced when the washer system is not working correctly, especially when:

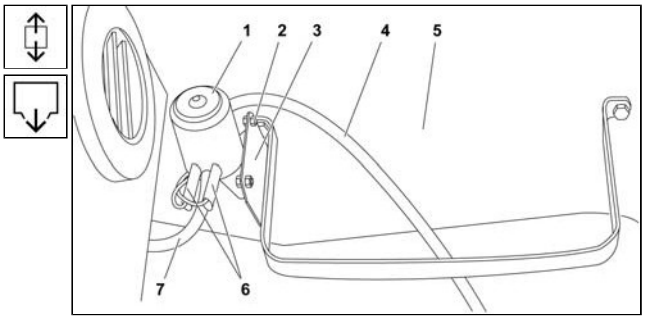
   - Washer pump does not deliver the fluid into the discharge manifold of the pump although there is a sufficient amount of fluid in the tank.
   - Electric motor of the pump is not functioning at all (you can hear no sound coming out of it) although the electric current is supplied to terminals of the pump directly.

b) Technical Conditions

1. After the electric pump of the washer has been replaced, the pump must deliver a sufficient amount of fluid into jets spraying the fluid onto the windshield.
2. Repair of the own electric pump may be performed at an authorized repair facility only.

c) Removal Procedure

1. Turn the batteries circuit breaker off.
2. Unscrew the washer tank cap and put it aside on the cab's floor together with the intake hose **4**.
3. Remove the tank with fluid.
4. Unplug electrical feeder cable harness connectors **6** from the pump washer **1**.
5. Detach the intake **4** and discharge **7** hose from the pump.
6. Dismount the pump **1** from holder **3**.

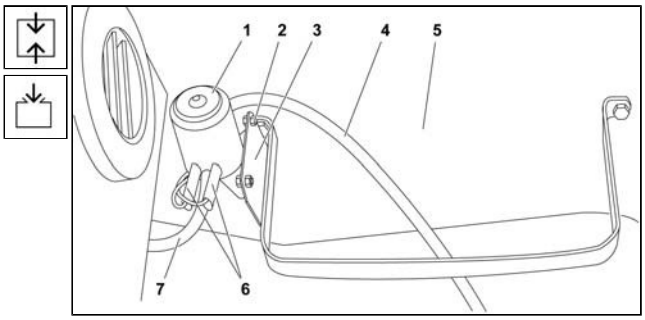


Legend: ***1*** *– pump,* ***2*** *– screw,* ***3*** *– pump holder,* ***4*** *– intake hose,* ***5*** *– engine bonnet,* ***6*** *– connector,* ***7*** *– discharge hose*

Fig. 15.82 Washer pump - removal

d) Installation Procedure

1. Fit a new pump **1** into holder **3** and use two screws **2** to attach it.
2. Fit the intake **4** and discharge **7** hose on the pump **1**.
3. Plug electrical feeder cable harness connectors **6** on the pump **1**.
4. Fit the tank filled with fluid into a holder and check the fluid level.
5. Fit the washer tank cap together with intake hose **4**.



Legend: ***1*** *– pump,* ***2*** *– screw,* ***3*** *– pump holder,* ***4*** *– intake hose,* ***5*** *– engine bonnet,* ***6*** *– connector,* ***7*** *– discharge hose*

Fig. 15.83 Washer pump - installation

6. Tilt the wiper blades away from the windshield.
7. Turn the batteries circuit breaker on.
8. Keep depressing the washer push-button to make sure that water gets into all washer jets.
9. Tilt the wiper blades back on the windshield and check the washer and wipers for a correct function.
10. Check whether the jets of washer are adjusted properly.
11. Turn the batteries circuit breaker off.
12. Tilt the cabin into the operating position.

Note:
After turning on the washer, it will take some time before the fluid is delivered from pump to jets. A stream of water coming out of jets should be directed to the upper edge of the wiped area on the move. Adjust the direction of water stream by adjusting the position of jets if need be.

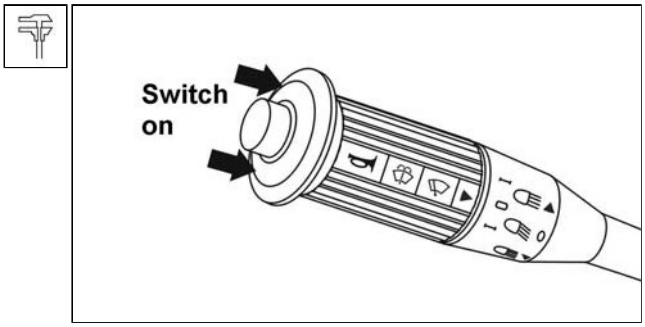


Fig. 15.84 Turning on the washer on the combined switch lever

15.5.18 Removal and Installation of the Alternator

a) Reasons for Removal and Installation

1. The alternator should be replaced if:

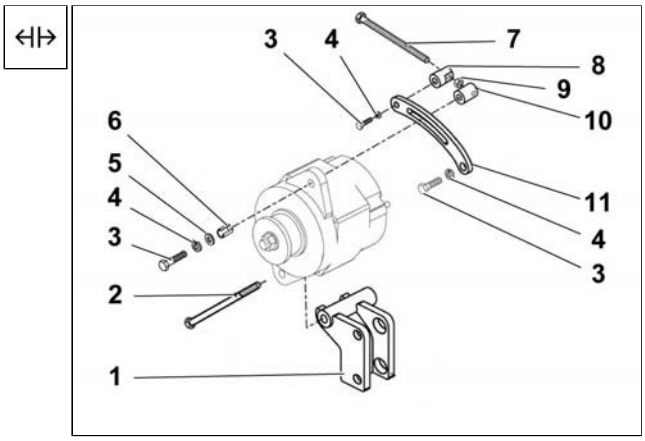
- It does not supply the electric current to the vehicle network.
- The vehicle network voltage is not within the range of 26.5 to 28.5 V.
- It has been damaged mechanically.
- It is noisy excessively (due to faulty bearings).

b) Technical Conditions

1. The removal of the alternator should be started only after a reliable diagnostics of its function, for example after measuring the vehicle network voltage with the engine at standstill and running in various speed and load regimes by means of the workshop voltmeter.
2. The vehicle network voltage must be maintained within 26.5 ÷ 28.5 V in various speed and load regimes with the engine running after replacement of the alternator.
3. If a good alternator was installed, this must run without developing noise and without drive V-belt creeping.

c) Removal Procedure

1. Select the neutral in gearbox and set the parking brake.
2. Turn the batteries circuit breaker off.
3. Unlock and tilt the driver's cabin. Before tilting the cab, remove all loose objects from inside the cab to avoid their damage or the windshield glass damage.
4. Dismount the alternator drive shaft cover.
5. Dismount and remove screw **3** c/w washers **4** and **5** from pin **10** of the upper alternator mounting.
6. Push the alternator towards the engine, loosen and remove both V-belts from the alternator drive pulley.
7. Loosen and remove the self-locking screw **2** of the lower alternator mounting.
8. Swing the alternator away from engine, remove rubber caps from clamps, unscrew nuts from alternator clamps and unplug all cables connected from clamps. If needed, mark the initial wiring of cables before their removal from clamps.
9. Remove the alternator from engine.
10. Unscrew nut, washers, dismount pulley, fan and shaft key from the faulty alternator.

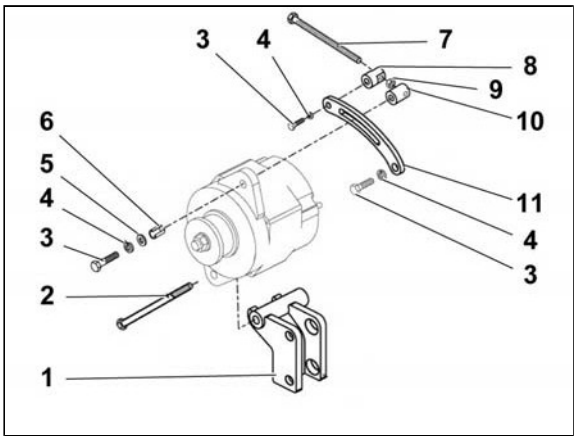


Legend: ***1*** *– alternator holder;* ***2*** *– screw of lower attachment;* ***3*** *– screw M8;* ***4, 5*** *– washers;* ***6*** *–alternator lug insert;* ***7*** *– tensioning screw;* ***8*** *– tensioner pin;* ***9*** *– locking nut;* ***10*** *– threaded pin;* ***11*** *– tensioner holder*

Fig. 15.85 Alternator - removal

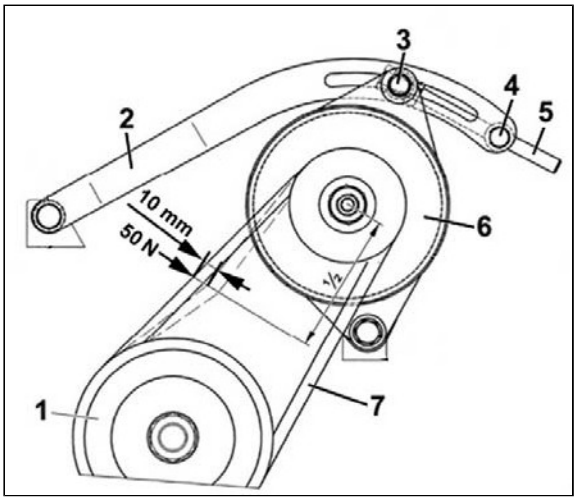
d) Installation Procedure

1. Install key, fan, pulley, washers and nut on the shaft of a good alternator and tighten the nut properly.
2. Slide the complete alternator into the alternator holder **1**, fit screw **2** of the lower mounting and tighten the screw so that the alternator is free to move.
3. Swing the alternator away from engine; connect lugs of all cables to alternator screw connections, and fit washers and nuts. After tightening, mount rubber caps of alternator clamps and cable clips.
4. Push the alternator utmost to the engine, fit screw **3** with washers **4** and **5** into the upper lug of the alternator and screw it into the threaded pin **10** through a slot in the tensioner holder **11**.
5. Check both V-belts for condition. If both of them are good having no visible cracks, they can be reused. With regard to a great importance of the alternator correct function, we recommend to use new V-belts.
6. Loosen the locking nut **9** and turn the tensioning screw **7** to release the tensioner so that both V-belts are easy to be installed.
7. Fit V-belts on both drive pulleys of the alternator.
8. Tension the flat drive belt by turning the tensioning screw **7** so that when the belt is depressed with the force of 50 N in the half distance between the pulleys, the belt would deflect by 10 mm as a maximum.



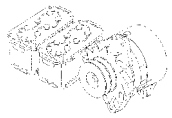
Legend: ***1*** *– alternator holder;* ***2*** *– screw of lower attachment;* ***3*** *– screw M8;* ***4, 5*** *– washers;* ***6*** *–alternator lug insert;* ***7*** *– tensioning screw;* ***8*** *– tensioner pin;* ***9*** *– locking nut;* ***10*** *– threaded pin;* ***11*** *– tensioner holder*

Fig. 15.86 Alternator - installation



Legend: ***1*** *– drive pulleys;* ***2*** *– tensioner;* ***3*** *– upper mounting;* ***4*** *– threaded pin;* ***5*** *– tensioning screw;* ***6*** *– alternator pulley;* ***7*** *– V-belt*

Fig. 15.87 V-belt tensioning



9. Tighten the screw **3** (See Fig. **15.87**) and locking nut **9** of the upper alternator mounting.
10. Tighten the self-locking nut **2** of the lower alternator mounting.
11. Install the alternator drive shaft cover.
12. Tilt the cabin into the driving position and secure it.
13. Turn the batteries circuit breaker on, start the engine and check the alternator for a proper function as indicated by the charging indicator lamp and measurement of the vehicle network voltage using the workshop voltmeter.
14. Shut the engine off.

15.5.19 Replacement of the Brushes Holder c/w Regulator

Note:
The alternator28V/50A c/w rectifier and semi-conductor (contactless) voltage regulator are installed on the vehicle. The semi-conductor voltage regulator is integrated onto the brushes holder and is located in the rear cover of the alternator. In case that the alternator function is impaired due to worn brushes (carbons) or faulty voltage regulator, it is suitable to replace the brushes holder only. To replace it, you need not dismount the alternator from the vehicle engine.

a) Reasons for the Replacement

The holder with brushes and voltage regulator must be replaced if:

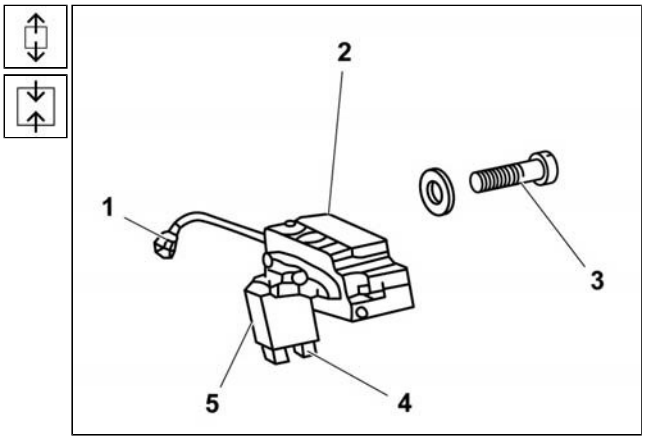
1. Voltage in the vehicle network is not within the recommended range of 26.5 – 28.5 V,
2. The charging indicator lamp is going out at high engine speed only,
3. Components have been damaged mechanically.

b) Technical Conditions

1. The replacement should be carried out only after a reliable diagnostics of the alternator function, for example after measuring the vehicle network voltage with the engine at standstill and running in various speed and load regimes by means of the workshop voltmeter.
2. The vehicle network voltage must range from 26.5 to 28.5 V in various speed and load modes with the engine running after replacement of the brushes with regulator.

c) Replacement Procedure

1. Use the offset screwdriver to unscrew 2 screws **3** fixing the brushes holder c/w regulator **2** to the alternator.
2. Unplug the regulator cable connector **1** from the clamp and move the holder c/w regulator out.
3. Plug the connector **1** on the alternator clamp.
4. Insert the brushes holder **5** c/w voltage regulator **2** into a hole in the rear cover of the alternator and use original bolts **3** to attach it.
5. Check the alternator for function after starting the engine while watching the charging indicator lamp and the workshop voltmeter which should indicate and maintain the voltage between 26.5 and 28.5 V.



Legend: ***1*** *– alternator connecting cable;* ***2*** *– integrated voltage regulator;* ***3*** *– fixing bolt;* ***4*** *– brush (carbon);* ***5*** *– brushes holder*

Fig. 15.88 Brushes holder c/w voltage regulator