

Electrical installation

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Technical Data for Maintenance Service

Electronic SCR Drive Control (puise control system)	Stilltronic R70
Accelerator pedal control transmitter	potentiometer
Angle of rotation sensor, hydraulics	potentiometer
Current draw:	
Start	approx.. 160 A / 400 rpm
Drive motor field excitation	12 ---35 A
Generator field excitation	12 --- 15 A (40A)
Current limit/armature current	460 A max.
Travel speed	adjustable up to 22 km/h max.
Travel speed reduction	optional equipment
Electrical braking	rate of braking power can be selected by means of a 5-stage rotary switch
Contactors 1K3, 1K4	12 Volt (5,06 ohms)
Fuses for	
- power board	1F3 — 60 A (LET)
- Master board	1F11, 1F14, 1F15 — 1 A
	1F12 — 10 A
	4F1 — 10 A
	6F1, 9F1 — 5 A
- Pc.b. 9A2 diesel engine shut down controller	1F17 — 5 A
- Pc.b. A7 control circuit fuse	1F21 — 10 A
	1F16 — 15 A
	1F18 , 1F19, 1F20 — 20 A
- Contactor control panel A 5	9F4 —250 A
	F2 , F5 — 20 A
	F3 , F4 — 1 A
	F6 — 30 A
Alternator 9G2	28 volts / 55 A
Starter batteries GI, G2	2 batteries, 43Ah — 210A (VW -/ MB-Motor)
Starter batteries GI, G2	2 batteries, 48Ah — 320A (DEUTZ-Motor)
Excitation generator/ motor field	transistorized 24-volt power section
Electronic rpm regulation, engine	TFG (LPG): throttle positioning solenoid
	DFG (Diesel): servomotor for injection pump
	DFG : EMR / DEUTZ-Motor
Insulation resistance	
Electrical equipment (motor/generator circuit)	1000 ohms/ volt — approx. 190 kohms
Electrical machines	1000 ohms/ volt — approx. 190 kohms
Electrical protection, construction complying with DIN 40050	
Electrical equipement: IP 54	

Electrical installation

Mechanical configuration

The electrical installation is composed of two main sections.

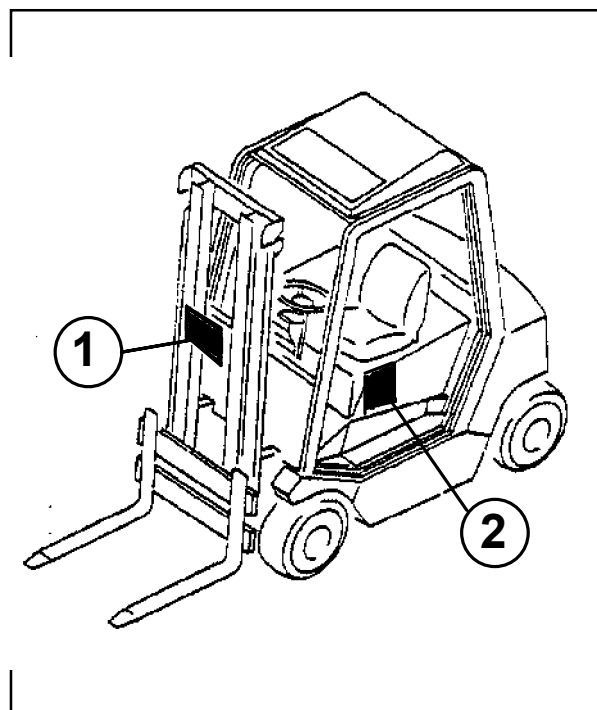
1 The **SCR control equipment** is mounted to the front cowling on the RH side. It consists of:

- **power board - P.C.b.**
- drive control - p.c. b.
- engine starting via generator - p.c. b.
- throttle positioning solenoid (TFG=LPG model)
- p.c.b.- servomotor (DFG=diesel model)
- p.c. b.- electronic charge compensating/ balancing device (TI'G=LPG model)
- p.c.b.- shut-down solenoid (DFG=diesel model)
- p.c.b.- control circuit fuse ffG=LPG model)

- **Master Board** (base plate)

2 Protected by a cover, the **contactor panel** is located on the LH side and is accessible from under the engine bonnet. Mounted on the contactor panel are:

- **contactor**, driving 1 K4
- **contactor**, starting 1 K3
- **p.c.b. with current sensor** 1A6/1 U1
- **glow plug relay** (DFG=diesel model) 9K3



The components listed below also belong to the electrical installation (see illustration page 4)

A. Dash panel comprising

- | | | |
|---|--|------|
| 3 | keyswitch | S1 |
| 4 | directional control switch
for fwd - neutral - rev. | 1S1 |
| 5 | hour meter | 6P1 |
| 6 | 5-stage switch
various indicator lights | 1S14 |
| 7 | horn button in the steering
wheelhub | 4S1 |

B. Within the front cowl arealleg compartment:

- | | | |
|----|--|------|
| 1 | electronic control unit | A4 |
| 8 | accelerator pedal control
transmitter (floor plate) | 1B1 |
| 9 | brake switch
(front cowling, LH side) | 1S12 |
| 10 | warning horn
(front cowling, LH side) | 4H1 |

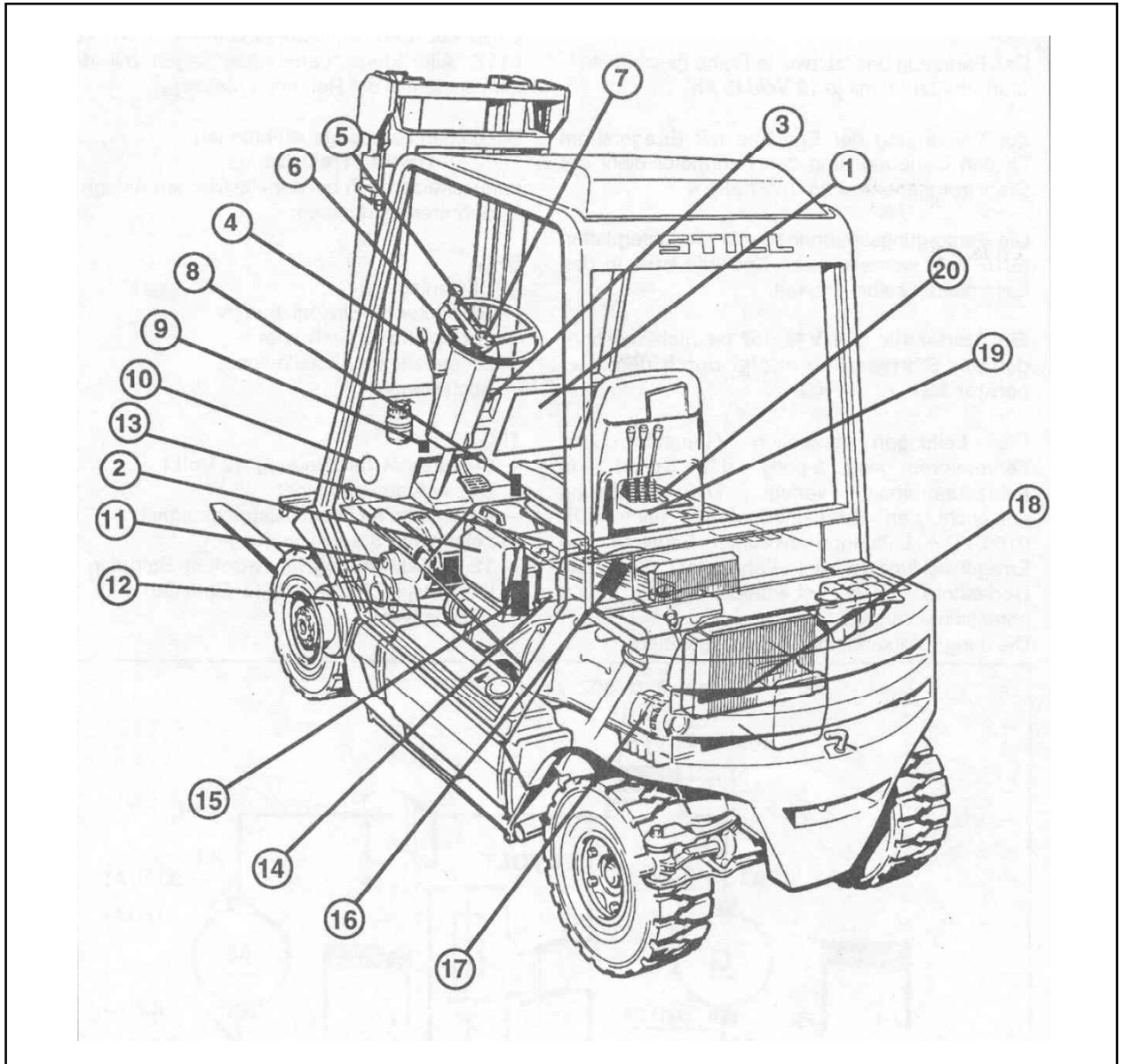
C. Drive motor/Generator

- brush wear monitoring
- 11 tachogenerator 6B7
- 12 rpm sensor 6B9

D. Under the engine bonnet

- | | | |
|----|---|-------|
| 13 | starter batteries | G1/G2 |
| 14 | servomotor for injection pump
(DFG=diesel model) | 9M7 |
| 2 | contactor panel | A5 |
| 15 | ignition system (7G=LPG model) | |
| 16 | throttle positioning solenoid
(TFG=L13G model) | 9Y3 |
| 17 | alternator | 9G2 |
| 18 | preheat resistor
(DFG=diesel model) | 9R8 |
| 19 | shut-down solenoid | 9Y5 |
| 20 | angle of rotation sensor, hydraulics | 2R2 |
| 21 | parking brake switch | 1S4 |

Electrical installation



Electrical installation

General Description

Electrical supply is by means of two 12-volt/43 Ah starter batteries which are wired in series.

The 28-volt/10/55 alternator supplies exciting current to the power board for generator and drive motor.

The supply voltage for the printed circuit boards (5/15 volts) is generated in the power board and the printed circuit board respectively.

There does not exist an electric starter as generator «IGII is the means of starting the engine.

Connections between d.c. generator and drive motor are the bipolar type, i.e. they are completely isolated electrically from truck frame. Wiring conforms to VDE 0100 standards. Also of the bipolar type, the electrical connections between power board and excitation windings of drive motors and generator are not grounded. The remaining wiring is of the unipolar type.

Routing of truck cables meets VDE 0117 requirements. All control voltages are with negative against the body (frame).

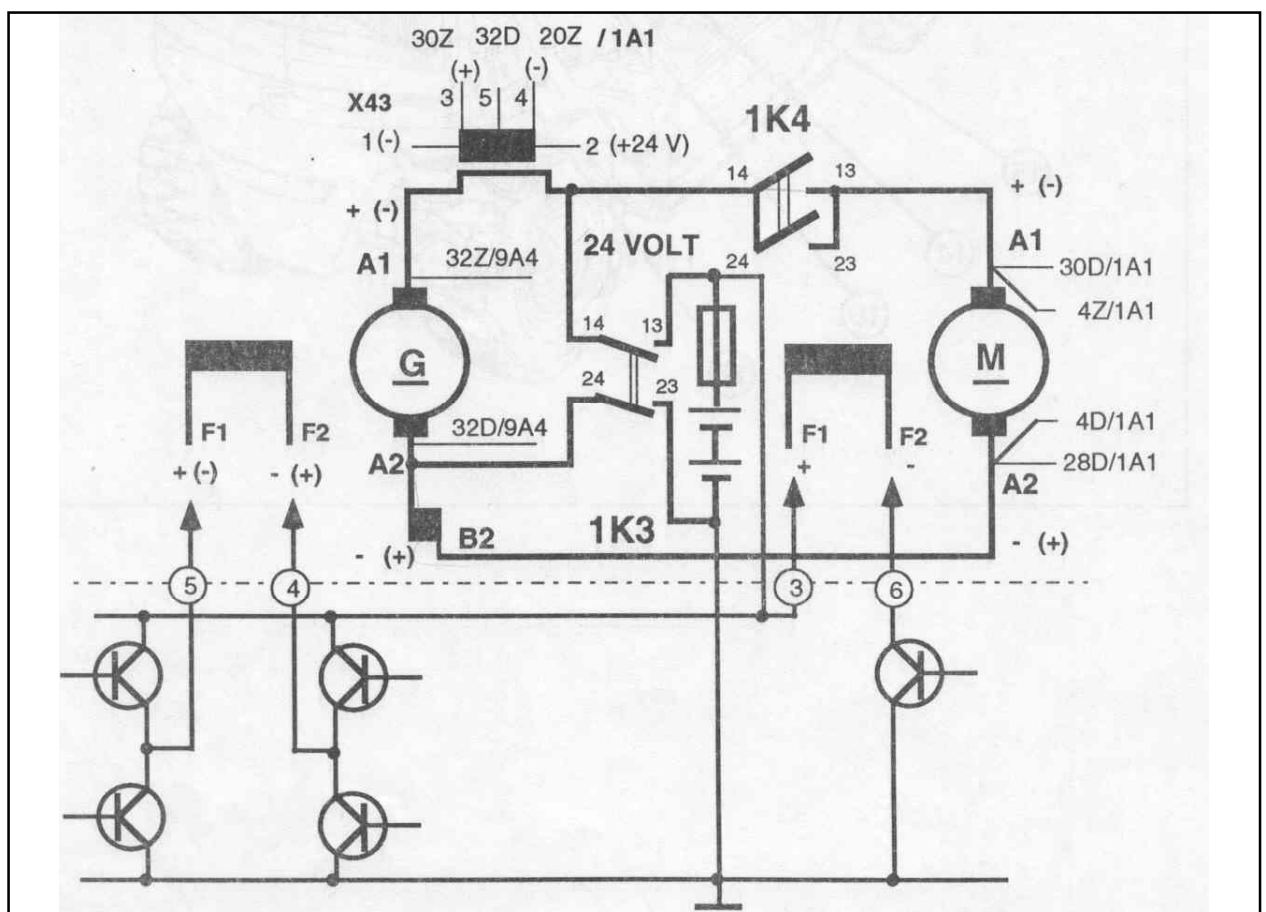
There are differences in the electrical system of **diesel and LPG powered** models, viz.:

DM (diesel model)

- glow plug system
- servomotor for injection pump
- p.c.b. for servomotor
- p.c.b. for shut-down solenoid
- shut-down solenoid

TFG (LPG model)

- control unit for **12-volt** ignition system!
- throttle positioning solenoid
- p.c.b. for throttle positioning solenoid
- p.c.b. for control circuit fuses
- **12-volt central tapping** between batteries
- charge balancing/compensating circuit for batteries
- shut-off valve



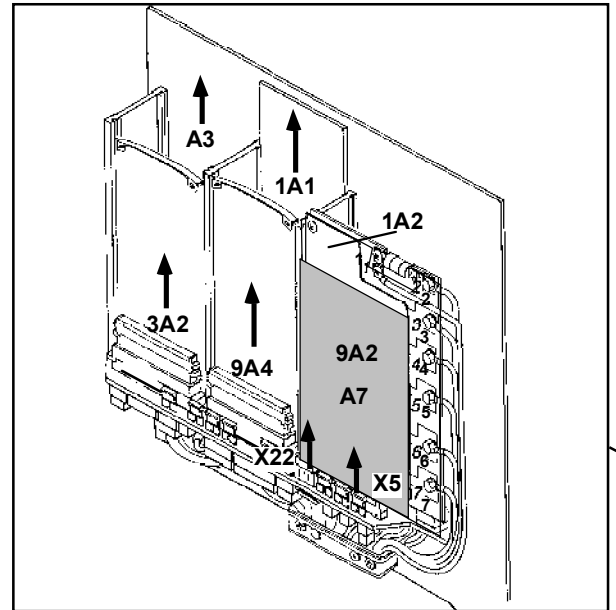
Insulation test

Preparation for testing

Before carrying out test: Disconnect or remove all printed circuit boards incorporated in electronic control unit, and then disconnect connectors

X5 (power board 1A2) and

X22 (p.c.b. 9A2 diesel engine shut down controller/p.c.b. A7 control circuit fuse).



Testing the insulation resistance (earthing)

After any repair work on electric components on contactor panel and/or electrical machines (generator/drive motor) it will be necessary to test the insulation resistance before installation or putting the truck back into service again.

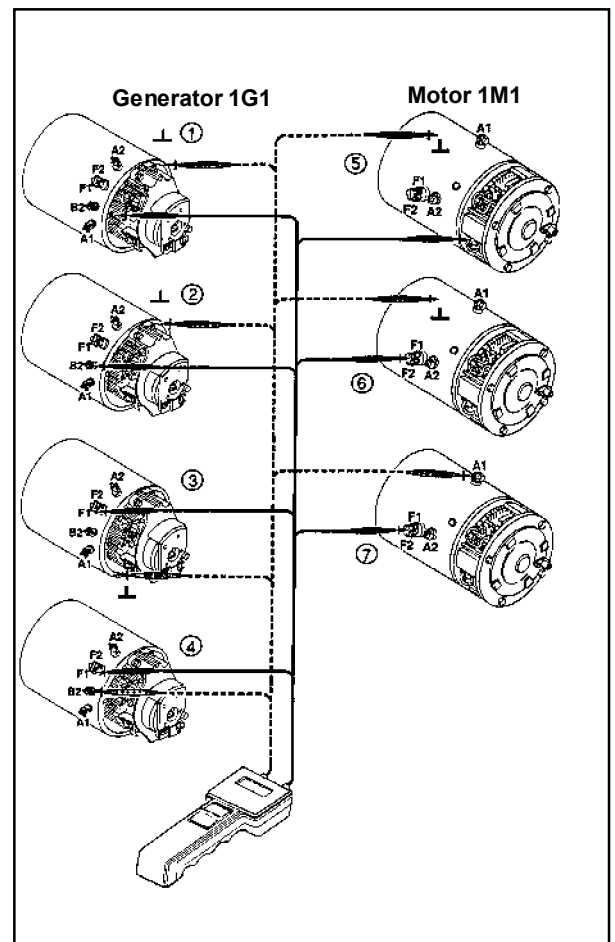
The insulation material used on the truck must have a resistance of at least 190 000 ohms (190 kohms).

Testing against the body - figures 1, 2, 3, 5 and 6

Testing armature and stator against field winding - figures 4 and 7

Check armature and stator of both drive motor and generator and associated leads in the circuit.

The test should be carried out by applying a d.c. voltage of 500 volts at the minimum. The megger (e.g. Isolavi 8) used for checking for earthing must supply a current rating of at least 1 mA.



Drive controls

Keyswitch S1

Located on the RH section of the dash panel on the steering column, keyswitch S1 is operated with a removable key to prevent unauthorised use of the truck.

The keyswitch is used for starting the engine and operating the electrical equipment belonging to the engine.

The keyswitch incorporates a starter safeguard lock preventing the key from being turned to the „START“ position once the engine has started.

It is only after the key has been turned to the 'OFF' position and the engine has stopped turning that a second attempt to start the engine can be made.

The keyswitch has 3 positions:

0 = 'OFF' . 1 = 'ON' , 2 = 'START'
(key turned clockwise)

When released from the 'START' position the keyswitch will automatically return to the 'ON' position.

The keyswitch has 3 connections on its reverse:

30/S1 supply line from pos. (+) battery terminal
(24 volts)

50/S1 p.c.b. 9A4 'engine starting via generator'
supplied with battery voltage in 'START' position
of keyswitch

15/S1 the electrical system is supplied with battery
voltage in 'START' and 'ON' position of
keyswitch

Starting

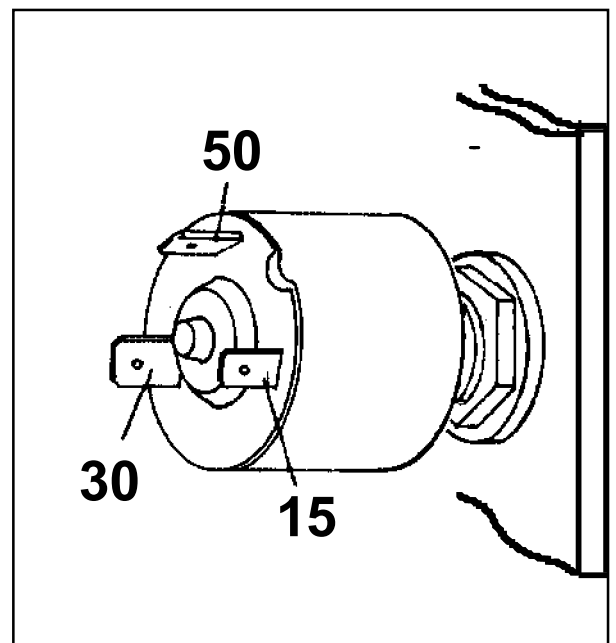
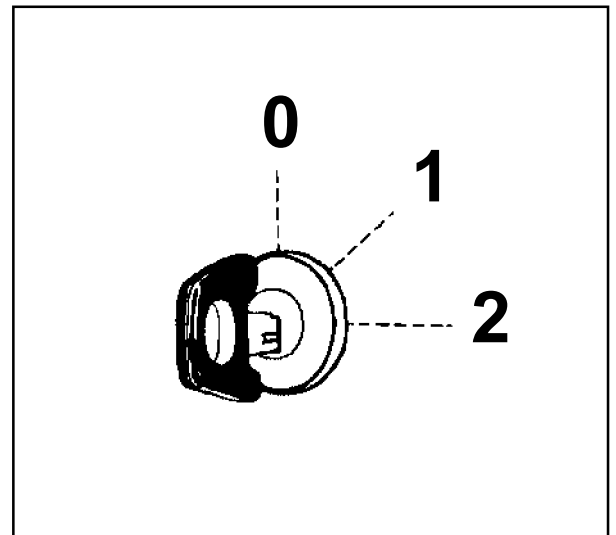
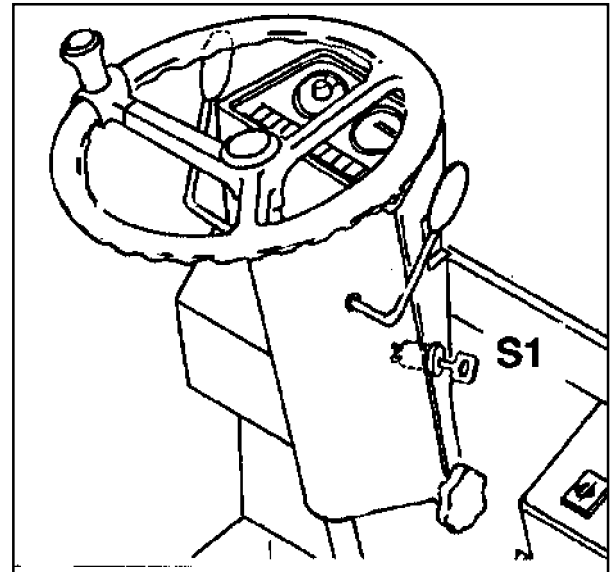
The starting operation can only be carried out with directional control lever in neutral and engine completely stopped. The engine will start with a delay of around 1 sec.

The neutral position is indicated by indicator light H3. Indication of 'preglow' is by start indicator lamp 6H12 (diesel model).

Turning off the engine

Turn key S1 to the 'OFF' position.

The engine of LPG model will continue running until total consumption of residual gas quantity!
(see: relay 9K4).



Drive controls

Directional control switches

Manual change of direction of travel

Well protected by the dash panel, the switch assembly controlling the direction of travel is mounted on a base plate welded to the steering column.

The double-type directional control lever is supported on a die-cast bracket. The direction switch can be switched to 3 positions:

„forwards“ - „neutral“ - „reverse“

The directional control lever is locked in the different spring-loaded positions by a notch and cam with roller. Arranged between the two bearing points of the bracket, a plastic switching segment on the direction control lever actuates the following waterproof microswitches (2):

- 1S1 - forwards
- 1S2 - reverse
- 1S15 - neutral

Microswitches

Rest position: contact 1 - 2 closed
contact 1 - 4 open

Note: Earlier models are fitted with standard microswitches that are not waterproof. Both microswitch designs are interchangeable.

Two-pedal control

(one pedal for each direction of travel)

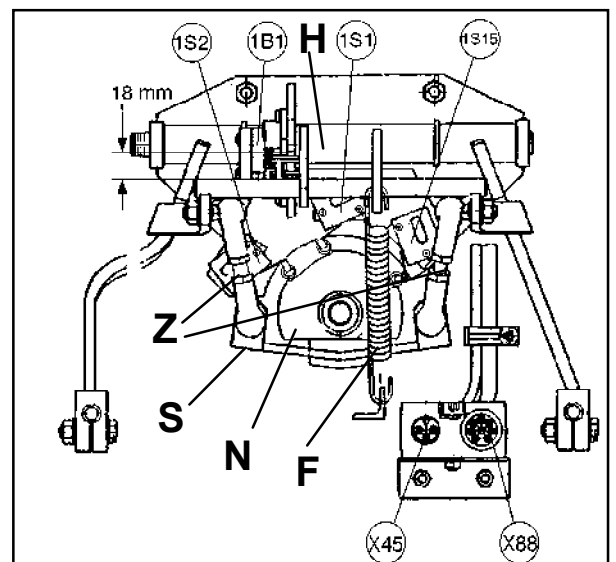
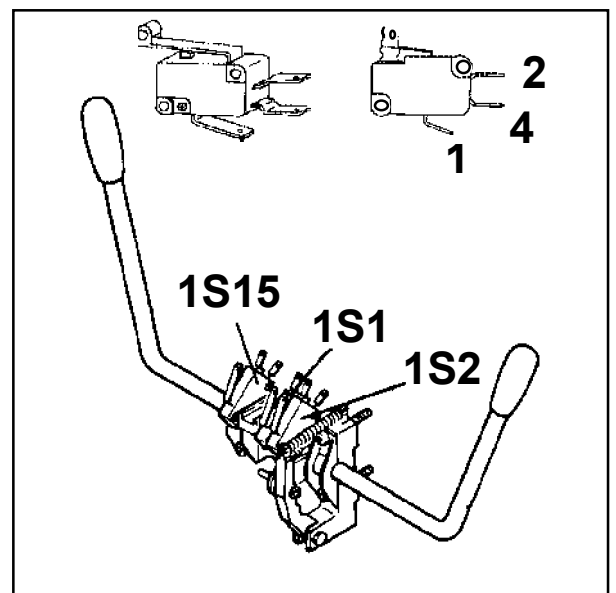
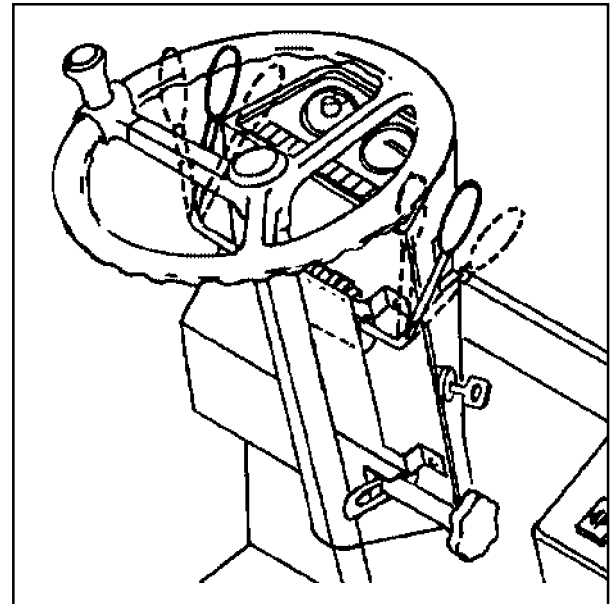
The accelerator transmitter 1 BI is operated by two pedals (one for forward travel, the other for reverse travel) mounted on a common shaft together with a lever (H).

This lever comprises a return spring (F) which ensures that both pedals upon being released automatically return to the initial or rest position. The pedals are mechanically linked to a rocker (S) via control rods (Z). Located on the rocker and provided with appropriate notches, cam (N) operates the waterproof microswitches 1S1, 1S2, 1S15, causing them to actuate.

The control rods must be adjusted so that the stroke of the rocker is 18 mm, pedal travel being 5 +/- 2 mm.

Microswitches

Rest position: contact 1 - 2 closed
contact 1 - 3 open



Drive controls

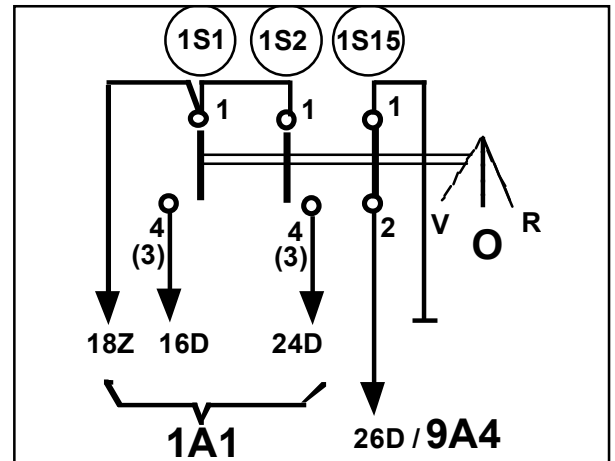
Directional control switches

Manual/foot-operated change of direction of travel

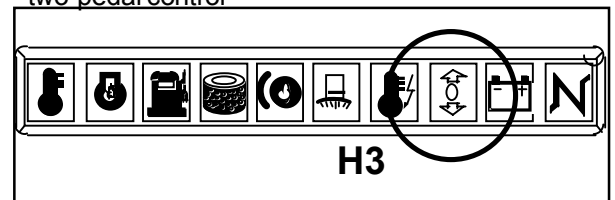
Microswitches 4(3)/1S1 (fwd. travel) and 4(3)/1S2 (rev. travel) on truck model featuring manual control of direction of travel are connected to p.c. board IIAl (X3) 'traction circuit control' via connections 4/X32, 5/X32 and 2,1/X29, and on truck model fitted with two-pedal directional control to the same p.c. board via connections 2,3/X88 and 2,1/X29.

Connection 1 of 1S1 and 1S2 is connected to earth (negative) via 18Z/1A1.

When the opposite direction of travel is selected, connection D16/1A1 (V = fwd. travel) or D24/1A1 (R = rev. travel) is connected via direction switch to 18Z/1A1.



The figure in brackets apply model fitted with two-pedal control

**Neutral position switch 1S15**

Connection 2/1S15 is brought via 6/X32 or 6/X88 and 3/X29 respectively to board 26D/9A4 (p.c.b. 'engine starting via generator').

When the directional control is placed in NEUTRAL, 26D/9A4 is connected to earth (-) via 1S15.

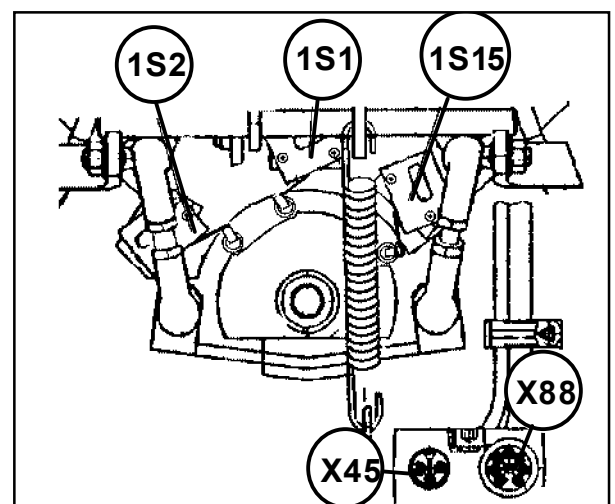
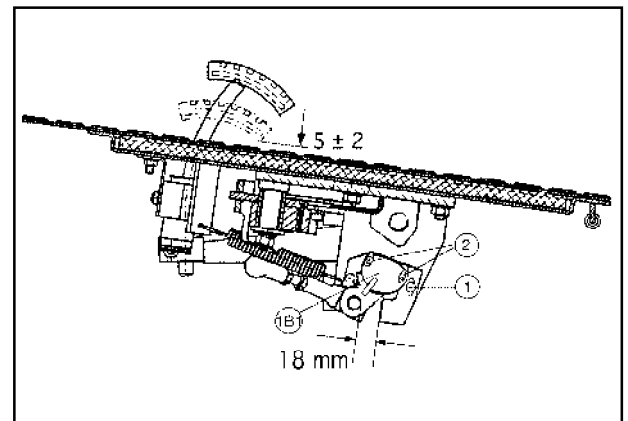
The neutral position is indicated by indicator light H3 which lights with a delay of around 1 second.

Two-pedal control - Adjustments

(foot-operated changes of direction)

- The control rods must be adjusted so that the stroke of the rocker is 18 mm, pedál travčí being 5 ± 2 mm.
- Adjust microswitch 1S15 so that it is in the centre of the notch.
- Bring mounting bracket (1) of accelerator transmitter into central position.
- By twisting accelerator transmitter (2) adjust voltage until it is between 3.3 - 3.5 volts (proceed as described in Section 'Travel sender unit 1B1 (accelerator pedal control transmitter)').
- Adjust microswitches 1S1 and 1S2 so that they are actuated the instant around 4.2 to 4.5 volts of transmitter voltage are reached.

Once the adjustments are completed seal the screws with varnish.



Drive controls

Two pedal control (double pedal drive)

Direction of travel is controlled by two accelerator pedals, the right pedal is pressed for forward travel and the left pedal for reverse travel.

Mechanically interconnected by linkage, pedals move in opposite direction in relation to each other when pressing the pedal for the opposite direction of travel.

Controlled by pedal movement, two potentiometers (transmitters 1B3 and 1B4) are mounted to the underside of the right pedal. When pedals are un-operated, the potentiometers are in their neutral position.

Electrical connections of accelerator transmitters

Transmitter (travel sender) 1B3:

+10.8volts	—	1/X16
set-point value	—	2/X16
0 volts	—	5/X16

Transmitter (travel sender) 1B4:

+10.8volts	—	8/X16
set-point value	—	3/X16
0 volts	—	4/X16

Basic adjustment

With the engine switched off, proceed as follows.

- Bring both pedals to dimension **H** above the floor plate.
(R7032...40: Remove non-slip rubber matting)
R7032... 40 : H = 83 ±5 mm ; dimension G = 52.5 ±1 mm
R7048 - 50 : H = 78 ±5 mm ; dimension G = 88.4 ±1 mm
- Plug *universal measuring adaptor Mark II plus* into connector X16 accessible from beneath the floor plate.
- Turn keyswitch ON.
- Connect digital multimeter to measuring adaptor :
Transmitter 1B3
1/X16 (+) — 2/X16 (-)
Transmitter 1B4
8/X16 (+) — 3/X16 (-)
- *Both pedals un-operated*, potentiometer in midposition:
Meter reading for each of the two potentiometers should be between 4.95 and 5.05 volts.
Slacken screws * and carry out adjustment by operating on potentiometers.

- Pedal for rev. travel depressed fully :

1/X16 (+) — 2/X16 (-) voltage 8.8 - 9.3 volts.

8/X16 (+) — 34/X16 (-) voltage 0.7 - 1.4 volts

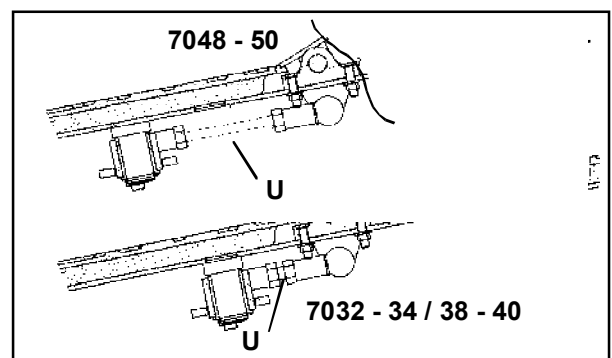
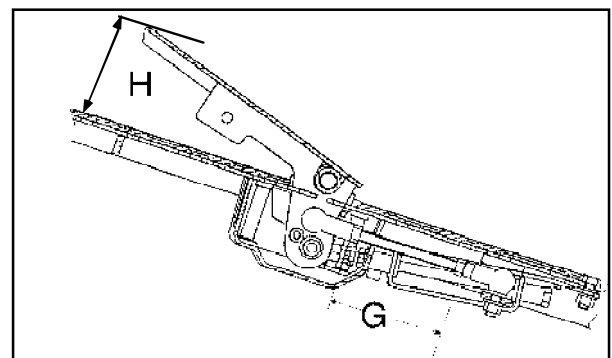
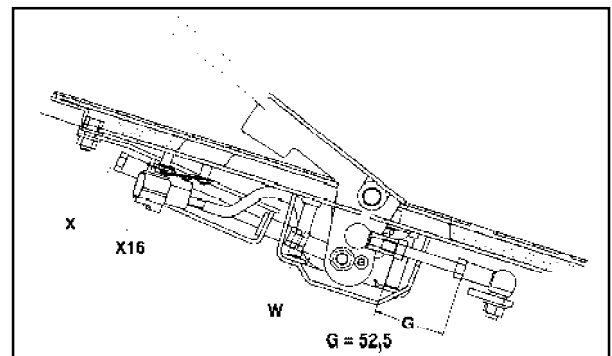
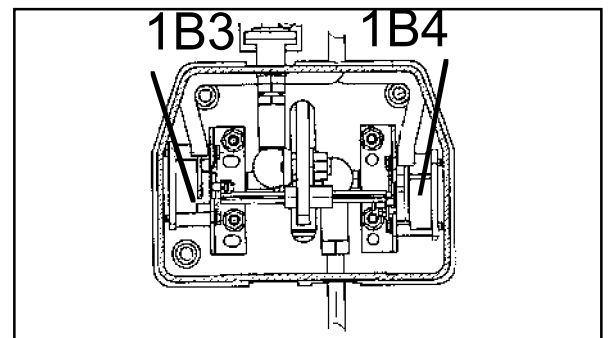
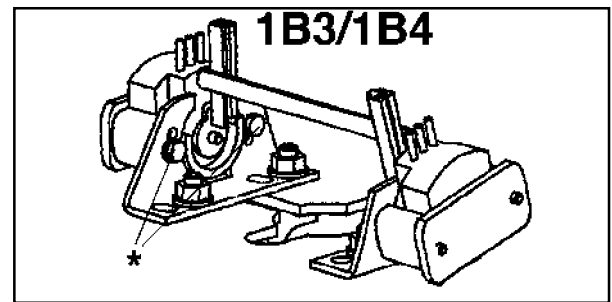
Adjustment is achieved by altering the length of screwed rod **U**.

- Pedal for fwd. travel depressed fully :

1/X16 (+) — 2/X16 (-) voltage 0.7 - 1.4 volts.

8/X16 (+) — 3/X16 (-) voltage 8.8 - 9.3 volts.

Adjustment is achieved by turning screw **X** (slacken locknut **W**).



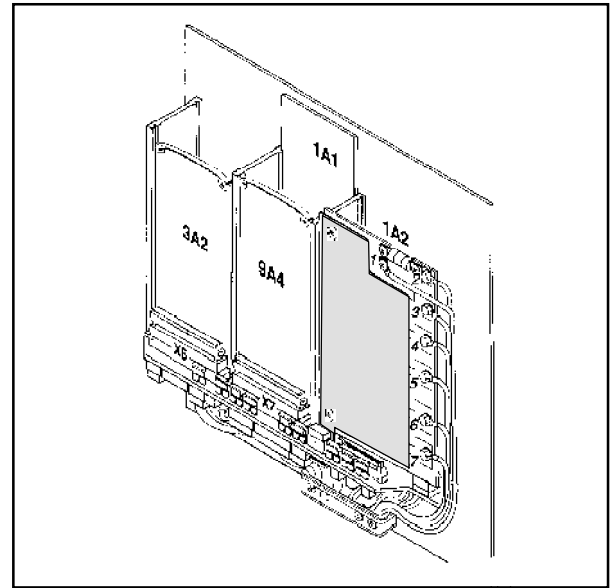
Drive controls

P.c.b. 9A7 (9A8) „two-pedal control“

P.c.b. 9A7 (9A8) and power board 1A2 are mechanically joined by screws. P.c.b. 9A7 (9A8) constitutes the link between drive sender potentiometers 1B3/1B4 and p.c.b. 1A1 „drive control“.

P.c.b. 9A7 (9A8) produces the 10-volt supply voltage for transmitters 1B3/1B4, processes the set-point value signal supplied by the transmitters, conveying it to p.c.b. 1A1 as an information on direction. At the same time the information on neutral position is transmitted to p.c.b. 9A4 „engine starting via generator“.

P.c.b. 9A7 (9A8) combines the functions of both p.c.b. 9A2 (DIESEL model) ‘shut down controller’ and p.c.b. A7 (LPG model) ‘control circuit fuse’. As a result, p.c.b. 9A7 (9A8) is of universal application, no matter whether the truck is fitted with two-pedal control or not.

**Electrical settings on p.c.b.****„two pedal control“**

Parking brake applied Keyswitch ON

Accelerator pedals un-operated

Adjustment:

Adjusting neutral position of accelerator pedal:

Adjust potentiometer R112 until light-emitting diodes V20 and V21 glow with even brightness.

Adjusting the neutral position monitor circuit:

Adjust potentiometer R115 until light-emitting diodes V38 and V39 glow with even brightness.

Adjusting the end stroke of accelerator pedal for fwd. travel:

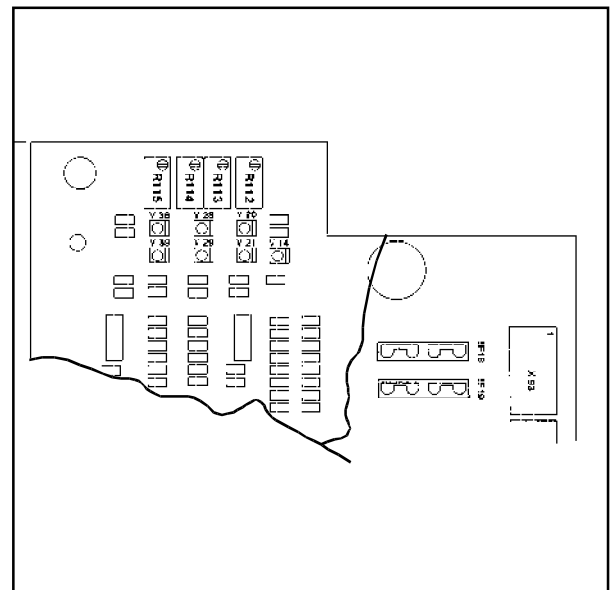
Fully depress accelerator pedal for fwd. travel.

Adjust potentiometer R114 until light-emitting diodes V28 and V29 glow with even brightness.

Adjusting the end stroke of accelerator pedal for rev. travel:

Fully depress accelerator pedal for rev. travel.

Adjust potentiometer R113 until light-emitting diodes V28 and V29 glow with even brightness.



Green LED : V20,V21 ; V28,V29 ; V38,V39

Red LED : V14 — will come on in the event of an incorrect setting.

Once the adjustment has been completed, seal potentiometers.

Drive controls

Retrofitting a „two-pedal control“ with p.c.b.“

Below you will find a description on how to proceed when replacing the previous two-pedal control with switching cams on the underside of the floor plate by the actual *standard design using two potentiometers*.

The conversion kit consists of:

- Floor plate, p.c.b. and wiring harness.
- Only 7032-34/38-40 models:* Support for external cooling fan and tension roller.

Procedure

- Place the truck on a dry, level surface and disconnect the starter batteries.
- Lift floor plate, disconnect connectors X88 and X45 from the connection point located under the floor plate, then remove floor plate.
7032-34/38-40 :
- *Replace support for external fan and tension roller. The support must be replaced to provide for a sufficient amount of clearance for the parts which operate mechanically and are located under the floor plate.*
- Remove cover from controller and withdraw p.c.b. A7 'control circuit fuse' (VW & KHD engines) or, depending on truck model, p.c.b. 9A2 'engine shut down controller' (MB engine), from power board 1A2, then fit new p.c. board.

Modification to leads :

Connectors X27 ; X29 ; on controller unit :

- Remove leads 1, 2 and 4 from connector X27, as well as 1,2,3 and 4 from connector X29, sever the ends of the leads if necessary.
- Remove connection X88 and X45 (sever leads or attach them to wiring harness after having insulated them first - reserve).

Connect wiring harness to controller unit:

- The wiring harness must pass through the water-proof grommet.
- Connect leads to connectors X27 and X29, and earth lead to master board.
- Connect wiring harness to the connection point on the underside of the floor plate (X16) and carefully route harness.
- Make truck ready for operation

END of fitting operation

Electrical settings on p.c.b.**„two-pedal control“**

Parking brake applied
Keyswitch ON
Accelerator pedals un-operated

Adjustment:

Adjusting neutral position of accelerator pedal::
Adjust potentiometer R112 until LEDs V20 and V21 glow with even brightness.

Adjusting the neutral position monitor circuit:
Adjust potentiometer R115 until LEDs V38 and V39 glow with even brightness.

Adjusting the end stroke of accelerator pedal for fwd. travel:

Fully depress accelerator pedal for fwd. travel.

Adjust potentiometer R114 until LEDs V28 and V29 glow with even brightness.

Adjusting the end stroke of accelerator pedal for rev. travel:

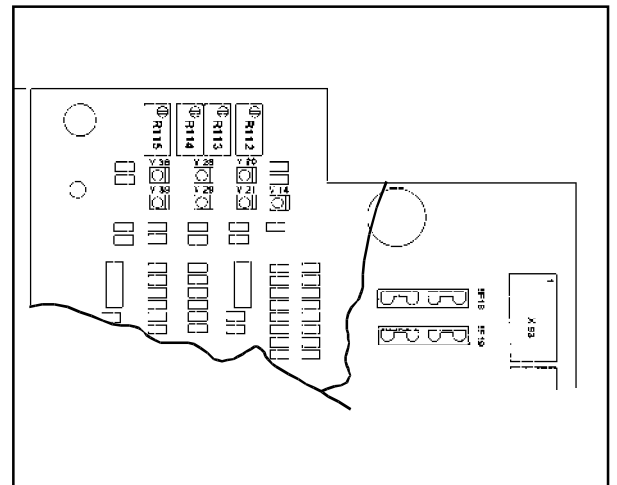
Fully depress accelerator pedal for rev. travel.

Adjust potentiometer R113 until LEDs V28 and V29 glow with even brightness.

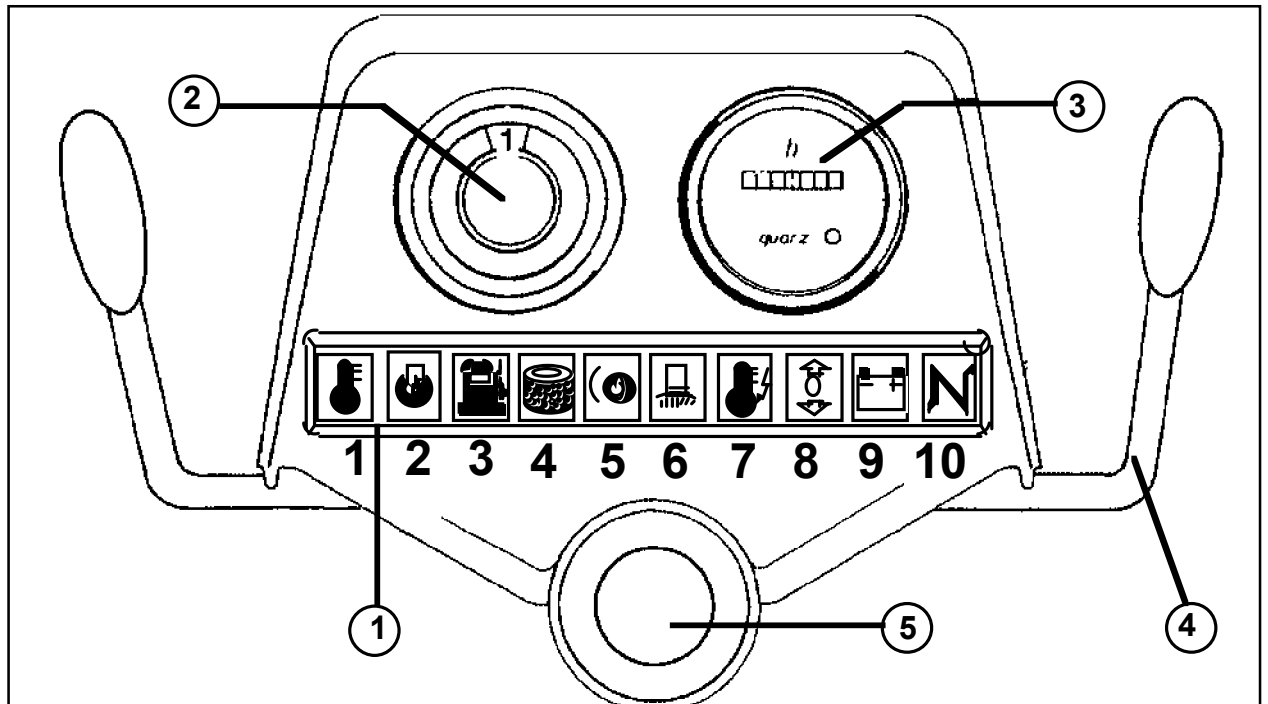
Green LED : V20, V21 ; V28, V29 ; V38, V39

Red LED : V14 — will come on in the event of an incorrect setting.

Once the adjustment has been completed, seal potentiometer.



Dash panel



1 Indicator lights (from left to right)

- 1 — 6H1 coolant temperature warning light
- 2 — 6H2 oil pressure warning light
- 3 — 6H3 fuel level warning light
- 4 — 6H5 air cleaner warning light
- 5 — 6H11 brake fluid warning light
- 6 — 6H10 brush monitor warning light
- 7 — H2 engine temperature warning light
- 8 — H3 neutral position indicator light
- 9 — 9H2 alternator warning light
- 10 — 6H12 start indicator light

2 1S14 multi-position switch

3 6P1 hour meter

4 directional control lever

5 4S1 horn button

Dash panel

Indicator lamps

The indicator lamps indicate the different operational situations. At the same time they alert the driver to forestall possible failures. Indicator lamps -2-6-8-9-10 are tested every time keyswitch S1 is turned **ON**. For further information see section 'Engine starting via generator'.

6H1 (1) water temperature warning light

indicates that the water temperature is above 110° C centigrade.

6H2 (2) engine oil pressure warning light

will light up when the key switch is turned 'ON'. It must go off after the engine is started.

6H3 (3) low fuel warning light

(Diesel version): Will light up when the amount of fuel in the tank has dropped to a residual quantity of around 5 litres.

(Gas version): Lights green as long as the gas cylinder still contains a sufficient amount of gas.

6H5 (4) air cleaner warning light

will light up if the filter cartridge of the dry type air cleaner of the engine is clogged.

6H11 (5) brake fluid warning light

will light up when the brake fluid in the reservoir has dropped to the minimum level (float type switch in the reservoir).

6H10 (6) Brush monitoring light

(controlled by p.c.b. 9A4 'Engine starting via generator') will light up when the key switch is turned 'ON' and go off after 1-2 secs if no fault exists. If the light is on and fails to go off, check motor and generator brushes for wear.

H2 (7) electrical machine warning light

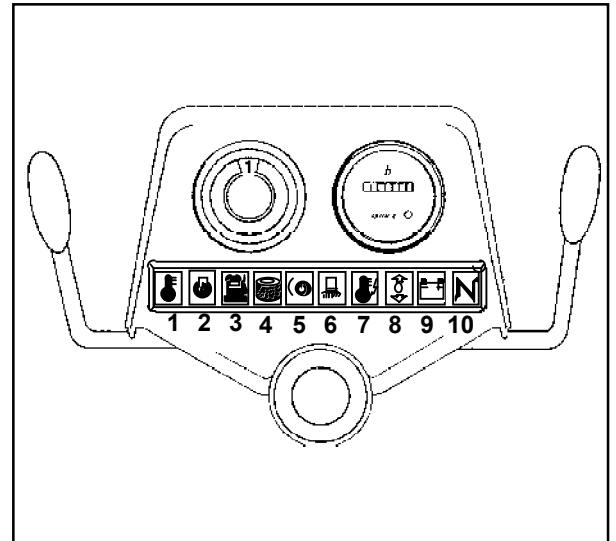
indicates when the limit temperature for the drive motor 1M1 or generator 1G1 is reached (130° C).

H3 (8) neutral position indicator

(controlled by p.c.b. 'Engine starting via generator') will light up with a delay of around 1 sec when the directional control lever is placed in neutral.

TFG/DFG: H3 fault indicator

The indicator lamp will flash at an average frequency (1/sec) if the direction switch is not in its neutral position while an attempt is made to start the engine. (Note: The starting circuit is wired in such a way that the engine cannot be started unless the direction switch is in neutral position).

**6H4 /6H12 (10) start indicator lamp**

(controlled by p.c.b. 'Engine starting via generator') indicates when key switch is turned to **ON** position.

TFG (Gas version):

Indicator lamp goes off when key switch is turned to **START** position,

DFG (Diesel version):

Indicator lamp flashes slowly during the preglowing procedure (key switch turned to **PREGLOW** position) and goes off when engine is started (key switch turned to **START** position).

TFG/DFG: 6H12 fault indicator

Indicator light flashes very quickly (3/sec) if a fault in the electrical circuit has been detected during the starting operation. In that case interrupt attempt at starting engine and carry out fault finding procedure in compliance with the instructions in our '**System Diagnosis**' under section '**Engine starting via generator**'.

All indicator lamps are the 24-volts/3W type and comply with standard DIN specification 72601

Dash panel

Indicator lights

9H2 (9) alternator warning light

will light up when the key switch is turned 'ON' and go off the instant the engine is started and the alternator 9G2 supplies electrical current. The warning light is connected to the plus (+) of starter battery G2 and via a diode to terminal D+ of alternator 9G2.

All indicator lamps are the 24-volt/3 W type and comply with Standard DIN Specification 72601

Diode 4V1

Protected by a tube, diode 4V1 is inserted into the circuit between indicator light 9H2 and connection D+/9G2 (in direction of current flow to D+). In the event of a defective/blown control circuit fuse it will prevent current from being drawn from terminal D+ of alternator 9G2.

Multi-position switch 1S14

A 5 or 12 position type selector switch 1S14, depending on truck model, is mounted on the dashboard. The corresponding switching positions are displayed on a dial.

5-position switch:

1-2-3-4-5

12-position switch, without stop:

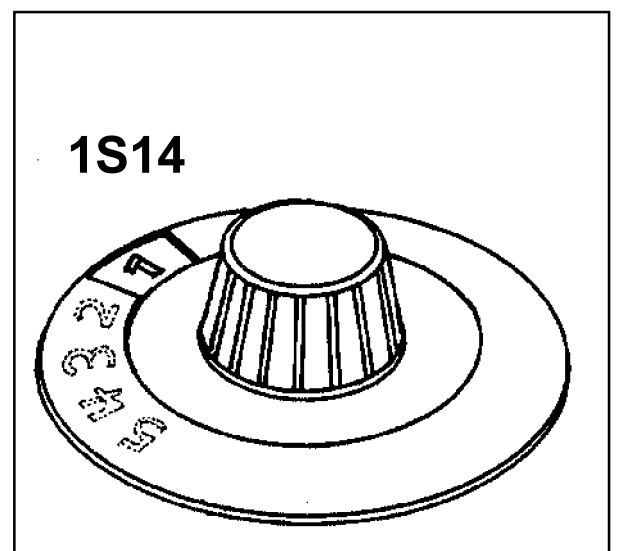
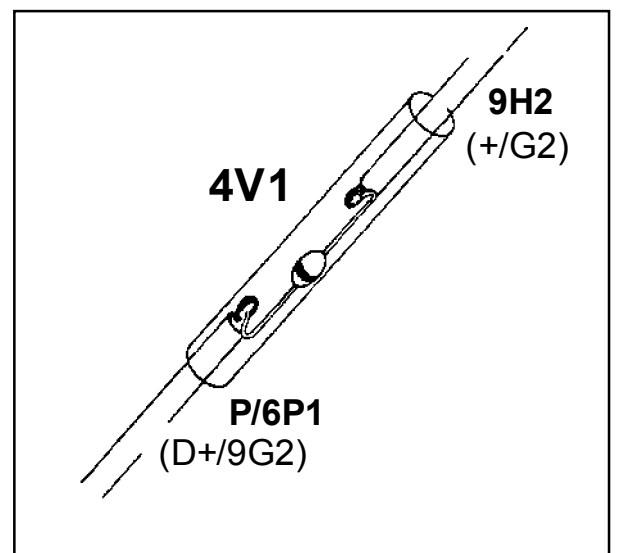
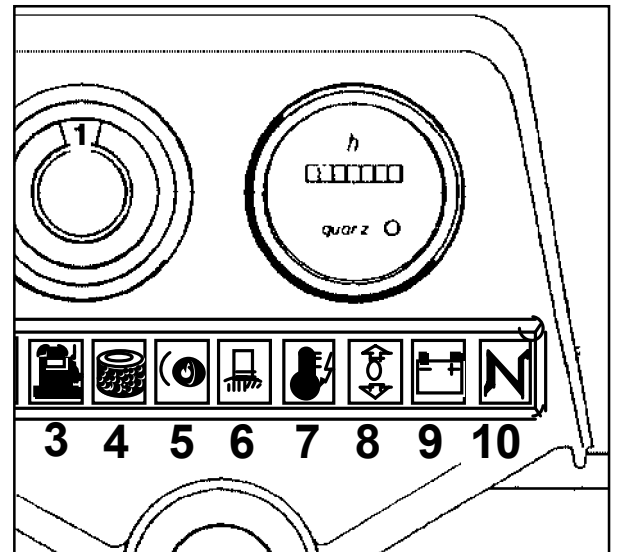
1-2-3-4-5-5-5-4-3-2-1-1 ... etc.

With the aid of this switch braking deceleration accomplished by releasing the accelerator pedal, and also acceleration of the truck by means of abrupt accelerator pedal operation, can be adapted to suit the operating conditions.

Stage 1 = moderate acceleration/braking deceleration

Stage 5 = powerful acceleration/braking deceleration

The rotary switch can be turned to a different position at any time - even while the truck is in motion.



Dash panel / Warning horn

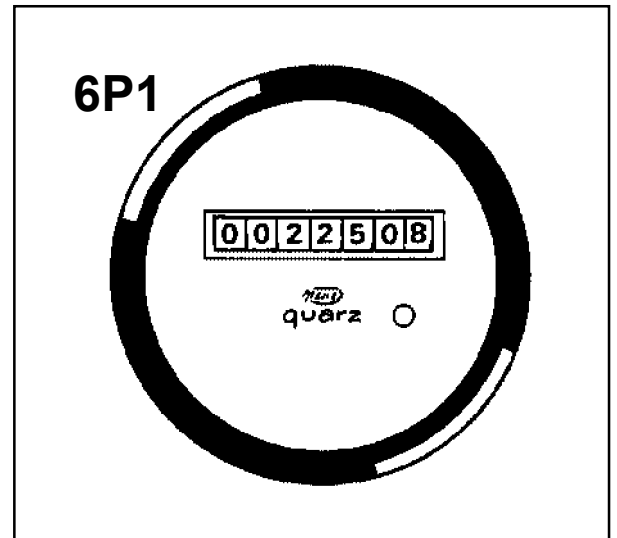
Hour meter 6P1

The work hour meter 6P1 is operated only by the voltage supplied by the alternator 9G2. It will begin to register only provided the engine is running. (Hour meter designed for a voltage of 12-80 volts).

Wire connections:

P/6P1- 9/X32- D+/9G2

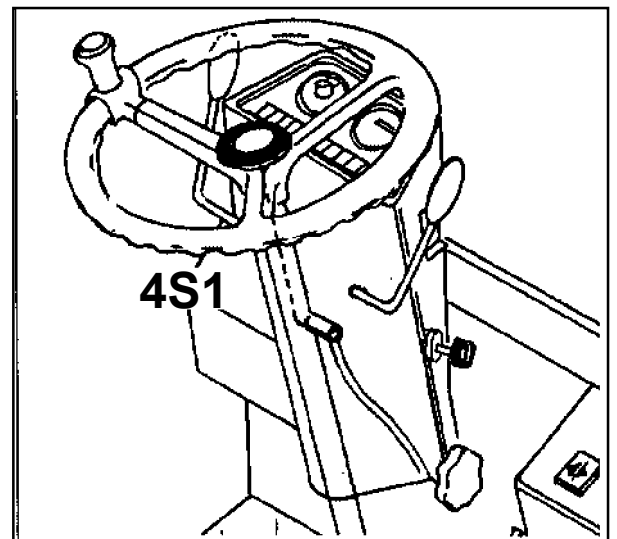
N/6P1 -10/X32 - N2 (-)

**Horn button 4S1**

The horn button is pressed into the centre of the steering wheel. It is connected via two **slip rings** 9W1 inside the steering column to the warning horn and terminal stud N2 for earthing .

To enable removal of the horn button the latter must be levered out of the steering wheel centre with the aid of a screwdriver. The lead routed inside the steering column and attached to the horn button can then be disconnected/ connected .

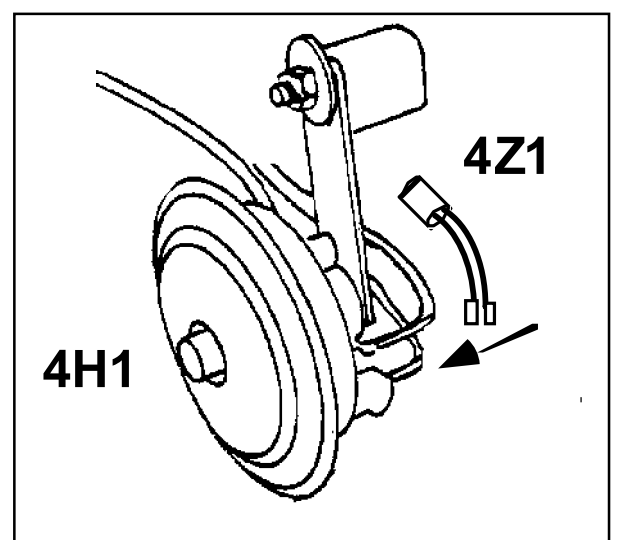
The horn button connects the warning horn to terminal stud N2 (neg. battery) for earthing.

**Warning horn 4H1**

The warning horn is an audible warning device giving warning to others of the approach of the machine, and the operator must sound the horn especially when approaching a blind corner and at all blind intersections. The warning horn is therefore part of the safety requirements and must constantly be in good working order.

Mounted to the front cowl, the horn is located on the LH side under the front panel.

To avoid disturbances to the electronic control circuit every time the horn is operated the latter is wired with **circuitry 4Z1** for protection.



Travel sender unit

Travel sender unit 1B1

(accelerator pedal control transmitter)

Linked to the accelerator, the travel sender unit is a transmitting device controlling travel speed.

Depression of the foot pedal controls a potentiometer which acts directly on the electronic control unit. At the same time the injection pump of the engine is operated electrically via a servomotor.

Two studs secure the travel sender unit (transmitter) to the underside of the floor plate. Only the pedal passes through the floor plate.

Made from fibreglass- reinforced plastics, the pedal is articulated on a greased-for- life, sealed shaft mounted in a housing. It is maintained in the rest position by a return spring located on the lower end of the pedal.

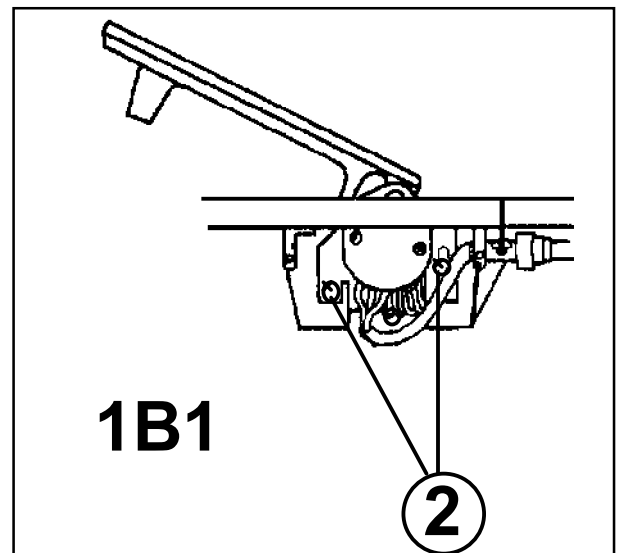
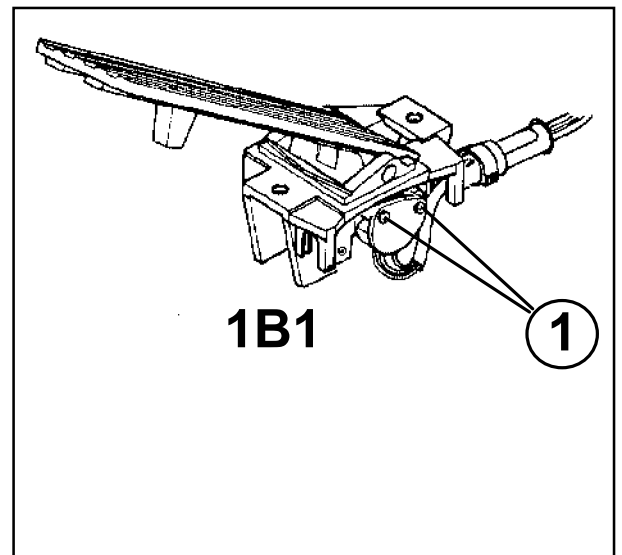
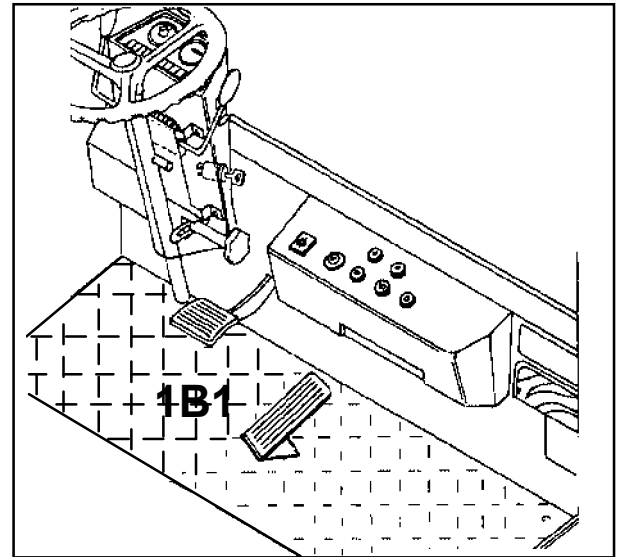
Transmitter voltage: pedal un-operated
 $1/1 \text{ B1 (-) - } 2/1 \text{ B1 (+) = approx. 4.5 volts}$
 The voltage can be corrected to obtain correct setting by slackening screws (1) and adjusting position of potentiometer.

Transmitter voltage: pedal operated
 $1/11 \text{ B1 (-) - } 2/1 \text{ B1 (+) = approx. 9.2 volts}$
 The voltage can be corrected to obtain correct setting by slackening screws (2) and adjusting position of potentiometer.

Voltage supply:
 $1/1 \text{ B1 (-) - } 3/1 \text{ B1 = 10, 8 volts}$

Removal

To remove the travel sender unit slacken the screws retaining the floor plate and lift the latter from the LH side. Pull out plug from travel sender unit and lift out floor plate. Loosen nyloc nuts and remove the travel sender unit from under the floor plate.



Angle of rotation sensor

Potentiometer/Angle of rotation sensor 2R2 for hoist & tilt functions and 3rd & 4th hyd. functions

When a hydraulic valve control lever is operated, the angle of rotation sensor 2R2 supplies the rated value for engine rpm.

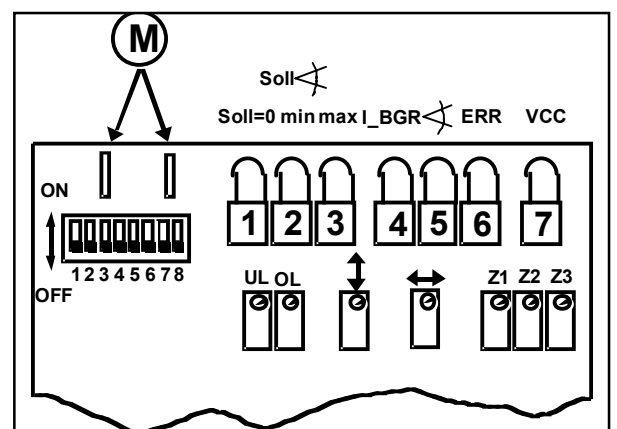
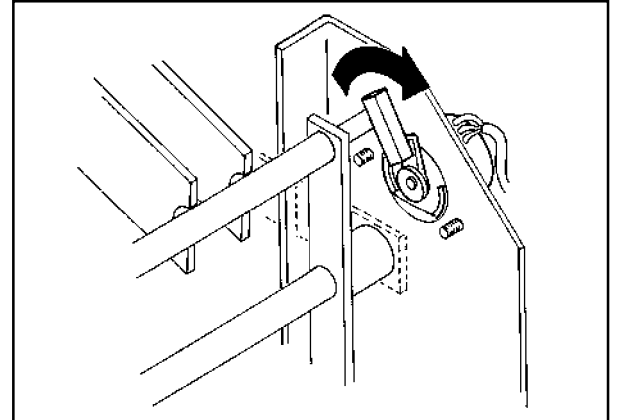
Sensor 2R2 is actuated by a shaft which in turn is controlled by different cams integrated into the individual hydraulic control valve levers.

Operational check**TFG (LPG model):**

Miniature (DIP) switch S2 on p.c.b. 'throttle valve regulator' A3 in 'ON' position. Connect digital multimeter to the test points on p.c.b. 'throttle valve regulator' A3. (M)

DFG (diesel model):

Miniature (DIP) switch S3 on p.c.b. 'servomotor' 3A2 in 'ON' position. Connect digital multimeter to the test points on p.c.b. 'servomotor' 3A2. (M)



The following voltage must be measured:

Hydraulics non activated 0 - 0.35 volts

Hoisting function fully activated 4.5-5.0 volts

Tilting function fully activated 0.9- 1.7 volts

Additional hydraulics (3rd & 4th functions) fully activated 0.9- 1.7 volts

Wire connections 2R2

- 2R2 -1 /X37 - 2/X73 - 24D/X6 (3A2) (0 volts)
- 2/X37 - 3/X73 - 24Z/X6 (3A2) (variable)
- 3/X37 - 1/X73 - 22D/X6 (3A2) (5 volts)

Adjustment

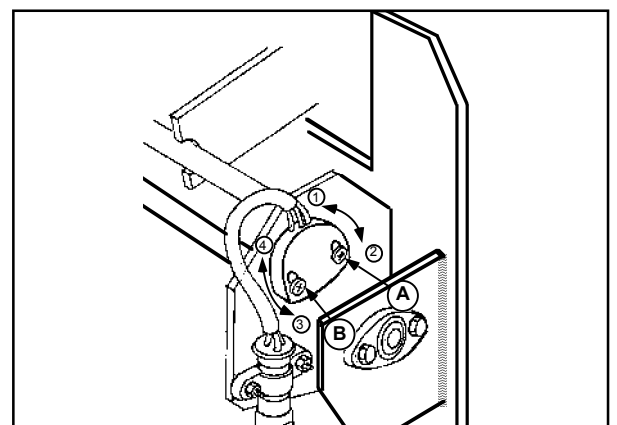
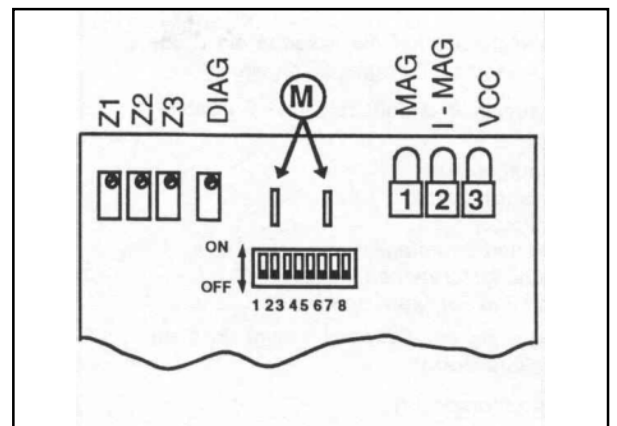
The angle of rotation sensor 2R2 is held in place by 2 screws.

Neutral or zero point setting: Slacken screw -A and move sensor 2R2 towards 1 (voltage decreases) or towards 2 (voltage increases).

Displacement of the zero point entails a modification of the potential for -Tilting function fully activated- and also for -Additional hydraulics fully activated-.

Maximum value setting: Slacken screw -B- and activate hoisting function fully. Move sensor towards 3 (the potential decreases) or towards 4 (the potential increases).

Once the adjustment is completed, move miniature (DIP) switch S2 on p.c.b. A3 or (depending on truck model) miniature (DIP) switch S3 on p.c.b. 3A2 to 'OFF' position.



Angle of rotation sensor / Control valve switches

Angle of rotation sensor 2R2 for hoist function
Valve microswitches 2S2 for tilt function,
2S3, 2S4 for 3rd & 4th hyd. functions (attach-
ments)

Since the middle of 93 each control valve block is fitted with an **angle of rotation sensor** and up to **3 microswitches**.

Angle of rotation sensor 2R2

The function of sensor 2R2 is to control engine speed during **hoist operation**.

The angle of rotation sensor is fitted with a 3 position 'Econoseal' connector X37 whose plug housing is secured to the control valve mounting bracket.

For operational check and adjustment

see preceding page

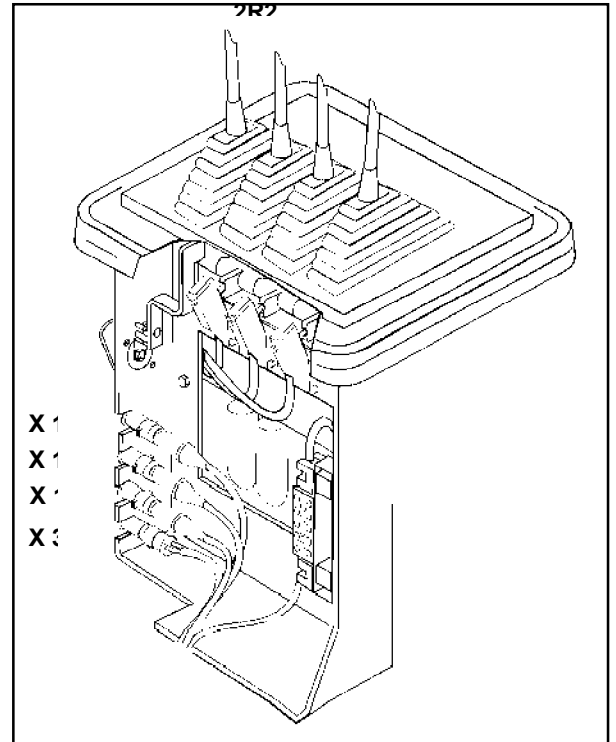
Valve microswitches 2S2, 2S3, 2S4

The control valve levers for **tilt and auxiliary operations** actuate each a microswitch via a cam. Each microswitch in turn activates a potentiometer on p.c.b. 3A2 'servomotor' or p.c.b. A3 'throttle valve regulator', depending on truck model.

The potentiometer serves to pre-set engine speed for each hydraulic function.

The control valve microswitches are connected to the electrical system via 3 position 'Econoseal' connectors.

To avoid mistaking the microswitch connections for the connection of the angle of rotation sensor, the ends of the microswitch leads are provided with receptacles likewise secured to the control valve mounting bracket.



Operational check

Move miniature or DIP switch S1 on p.c.b. 3A2 'servomotor' or (depending on truck model) S4, 5, 6 on p.c.b. A3 'throttle valve regulator' to ON position. Connect digital multimeter to the test points (**M**) on p.c.b.

Operate valve lever and note the meter reading. This should be approx. 12 volts.

Wire connections:

2S2 tilt operation

1/X100 - 5/X74 - 18D/X6 (3A2, pot. ↔)

2S3 3rd hyd. function (pot. Z1)

1/X101 - 7/X74 - 20Z/X6

2S4 4th hyd. function (pot. Z2)

1/X102 - 1/X74 - 16D/X6

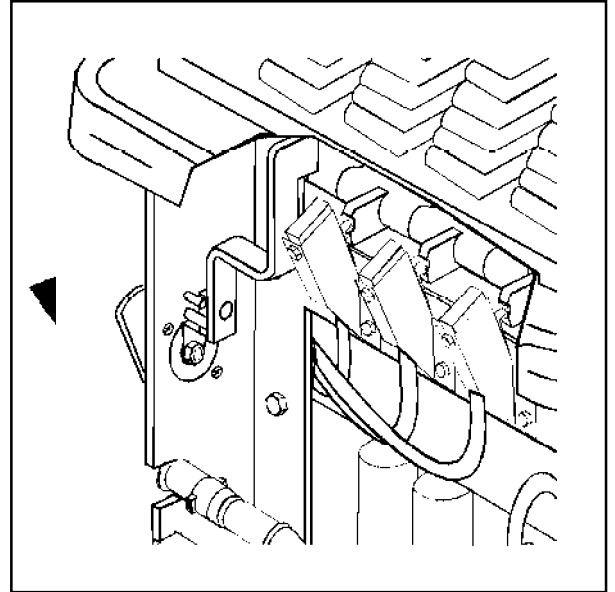
Note:

On early models pin 3/X74 instead of 5/X74 may already be occupied. In that case engine speed has been pre-set for the tilt function by means of potentiometer Z3.

Angle of rotation sensor / Control valve switches

Angle of rotation sensor

On later models the angle of rotation sensor is located on the hydraulic control valve, **l.h. side**. Lever travel of sensor is restricted - during **lowering** of the load - in the rest position by a roll pin.



The sensor is moved by the hydraulic valve control lever in a clockwise direction during **hoist operation**.

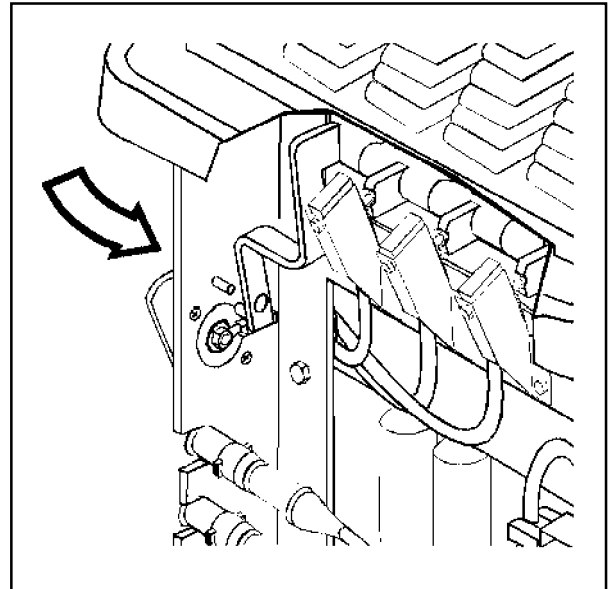
Operational check and Adjustment

Move miniature (DIP) switch **S3** on p.c.b. 3A2 'servomotor' to ON position.

Connect digital multimeter to test points (**M**) on p.c.b. 3A2 'servomotor' and note the reading on the meter which should be

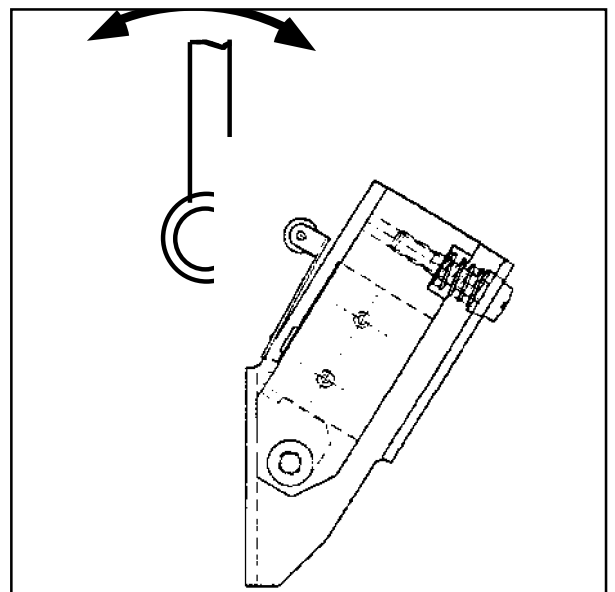
between 0 - 0.35 volts (with hydraulics inoperative) and between 4.5 - 5.0 volts (with hoist function fully activated)

On completion of adjustment, miniature switch S3 on p.c.b. 3A2 'servomotor' must be moved to OFF position.



Control valve microswitches

It should be noted that the microswitch actuator is depressed when the control lever is in its neutral position---the switch is open. The microswitch operating point can be altered via an adjusting screw to suit the requirement.



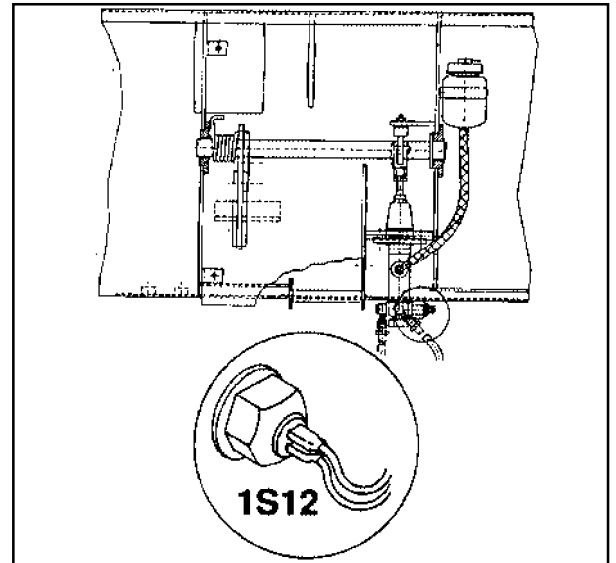
Foot - / Parking brake switch

Foot brake switch 1S12

A pressure type brake switch is located on the master brake cylinder.

Upon actuation of the hydraulic foot brake the switch will close, causing the electronic modulation to be suppressed instantly

Before performing any work on the master cylinder/ brake switch it will be necessary to first remove the front panel (shroud) from the cowl.

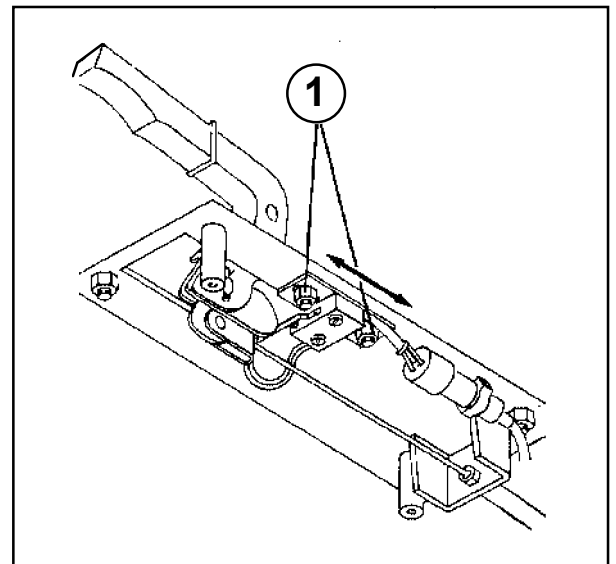
**Parking brake switch 1S4**

Applying the parking brake will open the parking brake switch, causing the safety relay on the power board 1A2 to drop out.

The parking brake switch 1S4 receives the 24 volt battery voltage via key switch S1, whence the voltage is supplied via connector X26 to the monitor unit of the power board.

The switch must cut off power before the parking brake is engaged to the 1st notch.

To achieve correct brake switch adjustment, slacken the nuts (1) and move the switch with its bracket in the slot provided to that effect so that the switch will open before the lever is engaged to the 1st notch.



NOTE: Be careful not to bend, nor twist the actuator of the switch, as otherwise it is likely to break!

Speed sensor

Speed sensor 6S9

Engine speed is sensed by speed sensor 6B9 which is located at the lower front end of the generator. The sensor can be considered as an inductive type impulse transmitting device that evaluates the 12 lobes on the vee belt pulley. When the vee belt pulley rotates, the speed sensor supplies an AC voltage signal whose rate depends on the rotating speed of the vee belt pulley.

Removal

The speed sensor is mounted on a sheet-metal support from which it can be withdrawn after loosening a hex hd screw (M6)

The connector plug is secured with a clamp which can be withdrawn from the lateral side after which the plug can be disconnected. The plug incorporates a seal which protects the contacts against the ingress of dirt.

Operational check

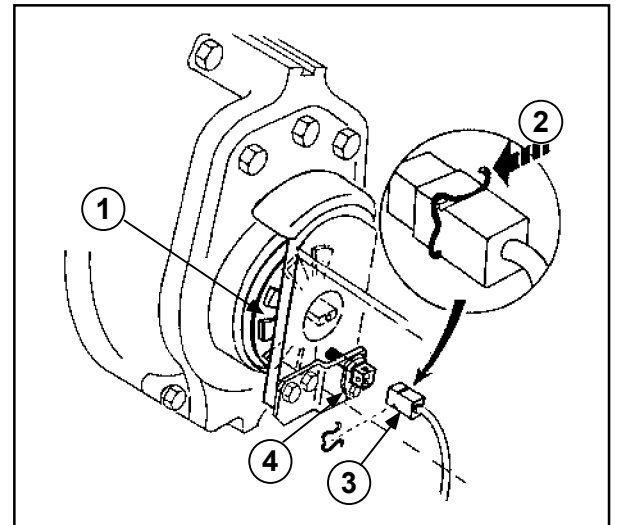
The speed sensor supplies an AC voltage whose value depends on the rotating speed of the vee belt pulley. The AC voltage can be checked at connector X30 (11/X30 --- 4/X30) using a digital multimeter. For the cranking speed (about 400 rpm) the voltage must be higher than 0.5 volts (AC voltage) and for the engine idle speed higher than 0,8 volts (AC voltage). The coil resistance of the speed sensor 6B9 must be checked with engine off:

$R_{coil} = 500 \text{ ohms to } 1000 \text{ ohms,}$

Signal shaper

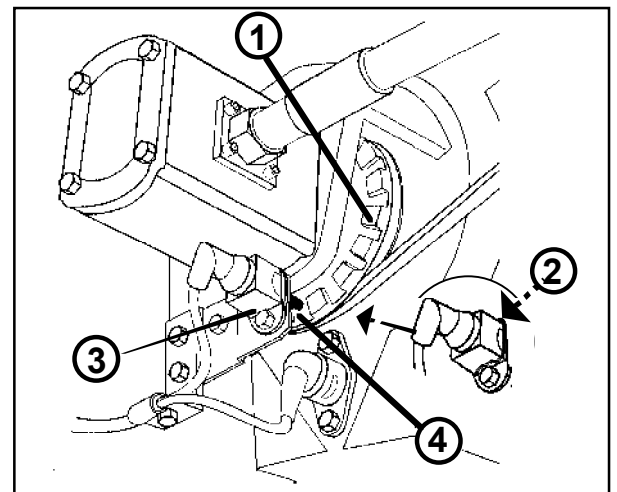
The AC voltage signal of speed sensor 6B9 is recorded in p.c.b. 9A4 'Engine starting via generator' and transformed into a signal of square waveform. The square-wave signal is sent into p.c.b. 1A1 'Traction control circuit' and p.c.b. A3 'Throttle valve regulator' (T17G = LPG model) or speed governor 3A2 (DFG = diesel model). The signal can be measured with a digital multimeter: D6/X6 --- D4/X6 (adapter R20 or test adapter) with engine running. Correct reading AC voltage 8 V to 12 V.

Model fitted with MB engine



- 1 = vee belt pulley
- 2 - clamp
- 3 - plug
- 4 - speed sensor 6B9

Model fitted with VW engine



Speed sensor

Speed sensor 6B9

Engine RPM is sensed by speed sensor 6B9 which is located at the front end of the generator. The sensor can be considered as an approach switch reacting upon the approach of iron—in this specific case the 12 cams on the vee belt pulley. When the vee belt pulley rotates, the speed sensor supplies a positive voltage every time a cam moves past it.

The number of the positive voltage impulses within a pre-determined amount of time reveals engine rpm. Counting and processing the impulses is effected on the 9A4 logic card via connection Z14.

Connected to the truck electrical system via a 3-pole Econoseal connector, the speed sensor 6B9 has 3 connections, viz.:

6B9/ (black) — 1/X38 — 4/X30 = actual value
 6B9/ (brown) — 2/X38 — 3/X30 = +24 volts
 6B9/ (blue) — 3/X38 — 1/X30 = chassis (-)

Operational check

Once removed from the truck the approach switch can be tested quickly and easily. Voltage is supplied via a 9 volt battery:

2/X38 (+) — 3/X38 (-)

Connect meter between:

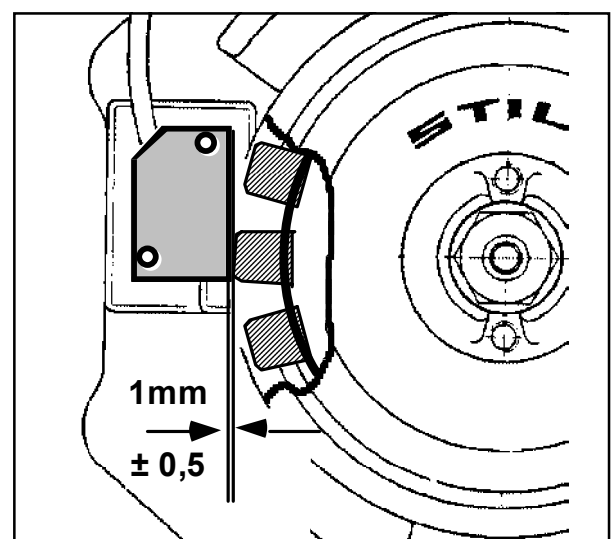
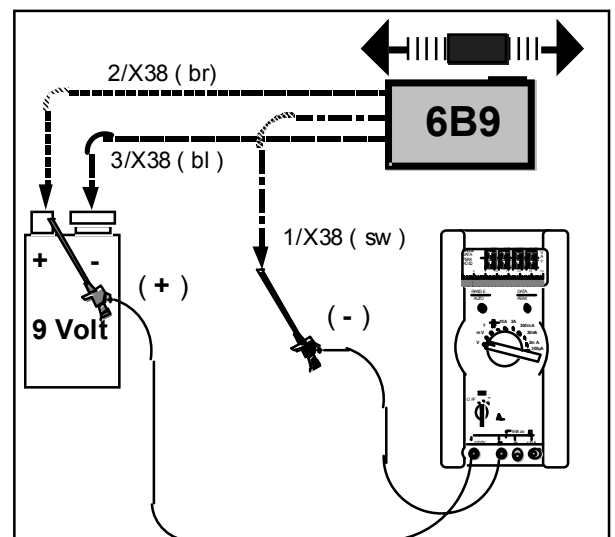
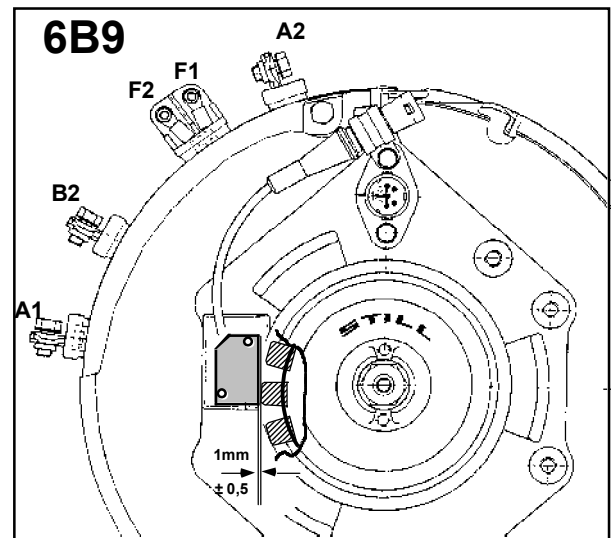
1/X38 (-) — 2/X38 (+)

If a piece of iron (e.g. a bolt, tool or similar object) is now moved at a distance of 1—2mm the length of the face of the switch at the spot identified by an appropriate mark, the meter will clearly indicate a voltage surge of around 8 volts.

Installation

When reinstalling the switch make sure a gap of abt. 1 mm is maintained between the cams of the vee belt pulley and the front end of the switch.

Model equipped with a DEUTZ engine



Tachogenerator

Tachogenerator 6B7

Tachogenerator 6B7 is located on the gearbox on the LH side of the truck - on the same level as the drive motor armature shaft.

The tachogenerator is linked through the hollow gear shaft of the transmission to the armature shaft via a diaphragm type coupling.

Hermetically sealed in an injection moulded housing, at the same time being fitted with a waterproof 'Econoseal' connector, tachogenerator 6B7 supplies information to p.c.b. 1A1 on rpm and direction of rotation of the drive motor armature shaft (drive wheels).

As the rotating speed of the wheel increases, the voltage will rise until attaining around 17 volts, whereas the polarity across the motor is reversed with every change of direction of travel.

The tachogenerator rotates in the same direction as the wheel.

Speed / Tachogenerator voltage

V (km/h)	22	20	15	10	7
U (V)	17,3	15,7	11,8	7,9	5,5

Removal / Installation

The tachogenerator is directly accessible through an aperture in the wheel well of the LH front wheel. Slacken the three fixing screws and pull the plug. The tachogenerator can now be withdrawn from the gearbox.

Power to the tachogenerator pinion is transmitted via a diaphragm type coupling that is inserted into the hollow gear shaft. After removal of the coupling, and every time a repair has been carried out, the **coupling** must be inserted into the hollow **shaft first** and the tachogenerator must then be installed.

This sequence must absolutely be observed!

Operational check

(front of the truck securely chocked up)

Disconnect connector X36

Connect a voltmeter to 1 /X36-2/X36

Rotate one drive wheel by hand

(lock 2nd wheel)

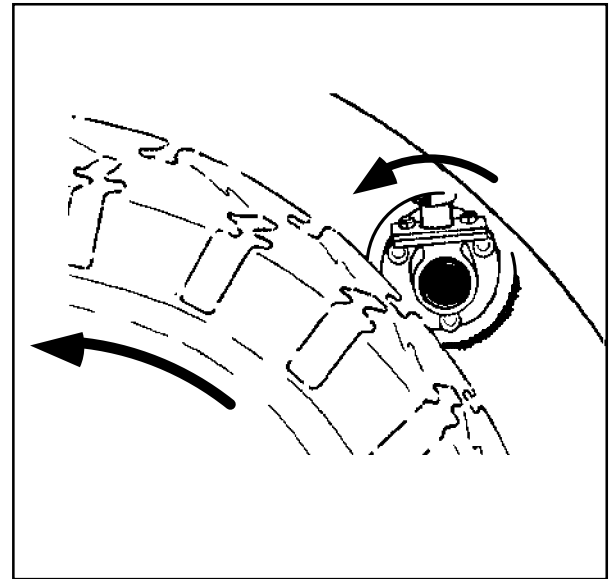
The voltage reading will rise progressively in proportion to rotating speed of wheel (a voltmeter reading of around 5 volts will be obtained).

Forwards 1/X36 = (-), 2/X36 = (+)

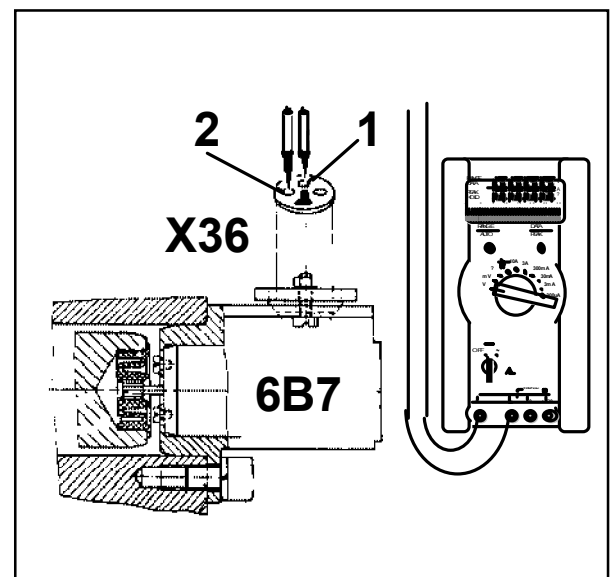
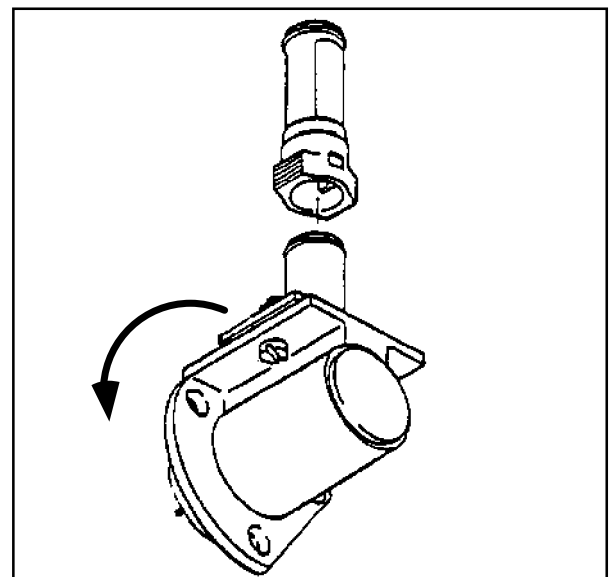
Backwards 1/X36 = (+), 2/X36 = (-)

Note: The driver that is pressed into the hollow gear shaft must be checked for tight seat.

* the hollow shaft must be cleansed absolutely free of grease and oil



Arrow = fwd. travel



Alternator

**Alternator 9G2
(generator)**

Driven by the engine via a flat belt, the alternator supplies a current of 55 amperes at the maximum in the case of 28 volts charging voltage.

The alternator fulfils two separate tasks in the truck:

1. It supplies electrical energy to the starter batteries G1, G2 to maintain them in a charged condition, simultaneously supplying electrical energy to the lighting equipment
2. It supplies excitation current for drive motor and generator fields
3. Maintaining the power supply of the p.c. boards after the keyswitch has been turned off and the engine is still running.

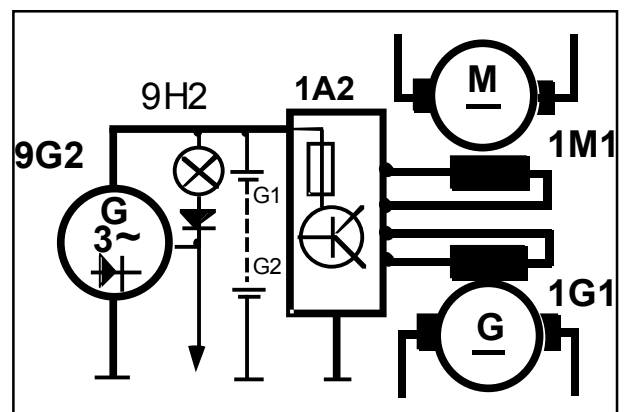
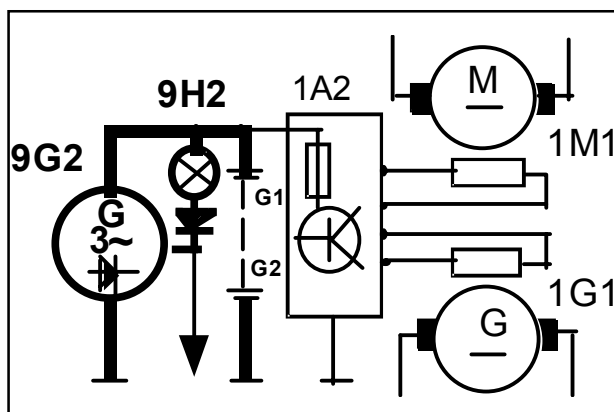
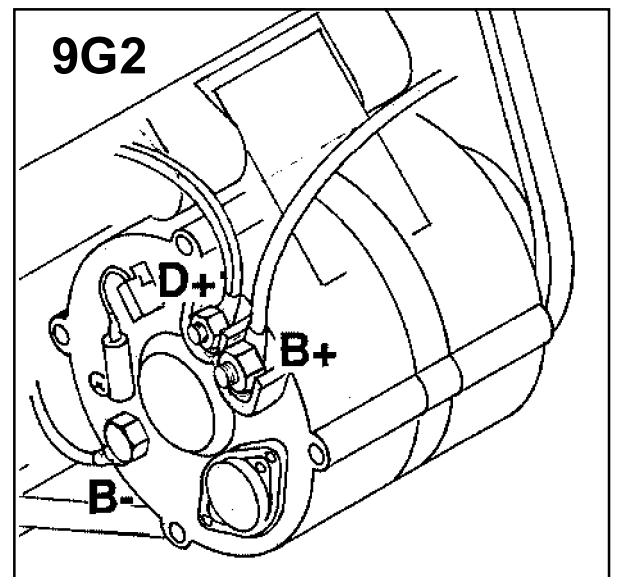
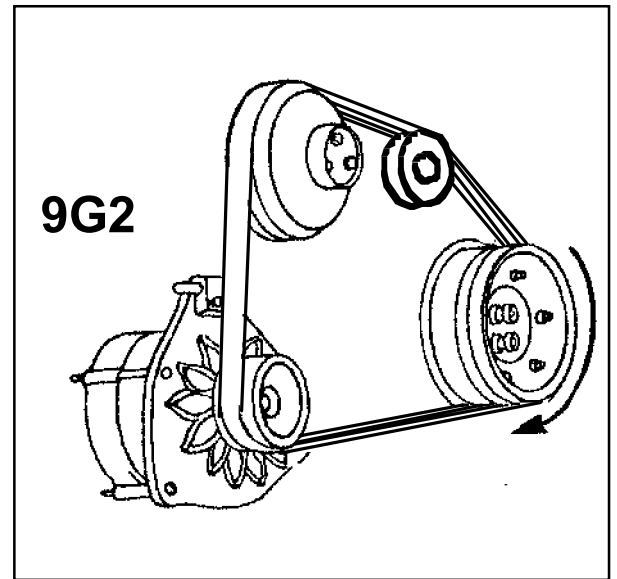
Terminals:

B+ - P/G2 (pos. battery)

B+ - body (neg. battery)

negative during starting - positive during operation

D+ - fuse 1F15 - B22/9A4



Throttle positioning solenoid

Throttle positioning solenoid 9Y3

(exists on LPG model only)

The throttle positioning solenoid 9Y3 whose function is to control the throttle valve is located above the valve cover. Controlled by p.c.b. A3 'Throttle positioning solenoid', the 'throttle valve regulator' is the regulating unit of the rpm regulating circuit.

Wire connection:

5X/78 --- 2/9Y3

4/X78 --- 1/9Y3

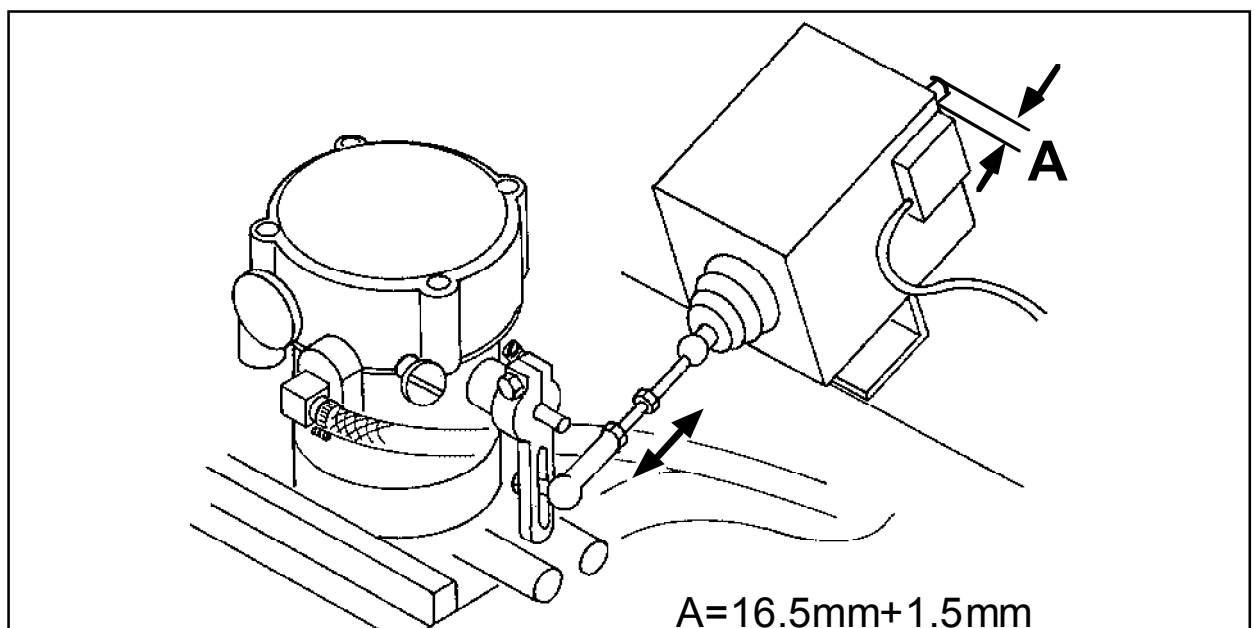
The throttle positioning solenoid has an inherent resistance of something between 4ohms and 6 ohms.

When battery voltage (24 volts) is applied to the throttle positioning solenoid (10 amp. fuse) the latter must open the throttle valve completely

Solenoid linkage adjustment

Withdraw ball stud from throttle control lever. Hold throttle valve in fully closed position. Set the solenoid linkage so that the centre of its ball cup extends out 1.5 mm when the ball stud is fitted.

$A = 16,5 \text{ mm} + 1.5 \text{ mm} = 18 \text{ mm}.$



Servomotor controlling the injection pump

Servomotor injection pump 3M3

(exists on diesel model only)

The servomotor injection pump 3M3 is located in front of the cylinder head of the engine. Controlled by p.c.b. 3A2 'servomotor', the lever of the servomotor which moves within the limits of a predetermined angle range operates the injection pump control lever. The angle of rotation is measured by a potentiometer which is integrated into the servomotor and reduction gear unit. The total range of the angle of rotation extends up to _____ 96 deg. An electronic circuitry limits this range to ____ 75 deg. Adjustable length of lever on servomotor:

from 27.5 to 45 mm

Wire connections:

4/X80 5/X78 (motor)

5/X80 4/X78 (motor)

1/X80 3/X78 (neg. potentiometer)

2/X80 1/X78 (potentiometer sliding contact)

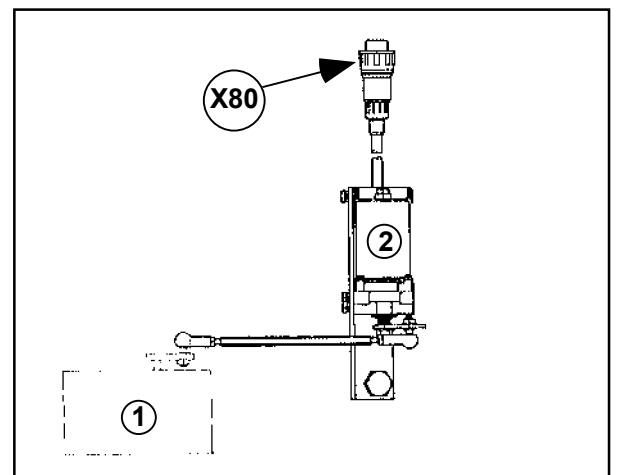
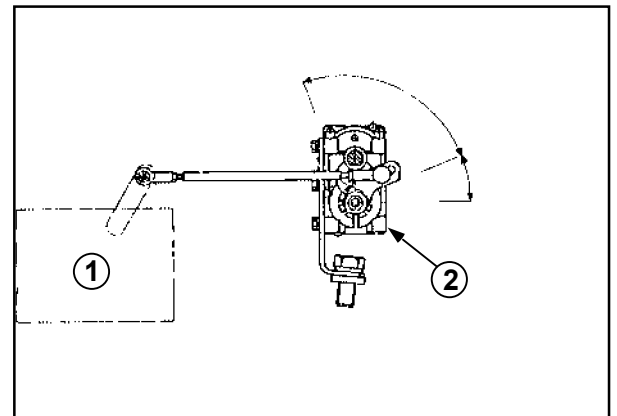
3/X80 2/X78 (pos. potentiometer)

When a voltage of about 12 volts (intermittently sometimes also 24 volts) is applied to servomotor terminals, the operating lever of the servomotor (linkage being disconnected) will move to the upper or lower mechanical stop, depending on the polarity of the voltage applied. The servomotor has an internal resistance of about 5 ohms.

The potentiometer (position sender) is supplied with a voltage of 5 volts from p.c.b. 'servomolui'. The voltage at the potentiometer sliding contact amounts to at least 0.5 volts at the lower stop and to 4.5 volts maximum at the upper stop. The potentiometer has a resistance of something between 800 and 1400 ohms, whereas the internal resistance of the sliding contact amounts to 600-1400 ohms.

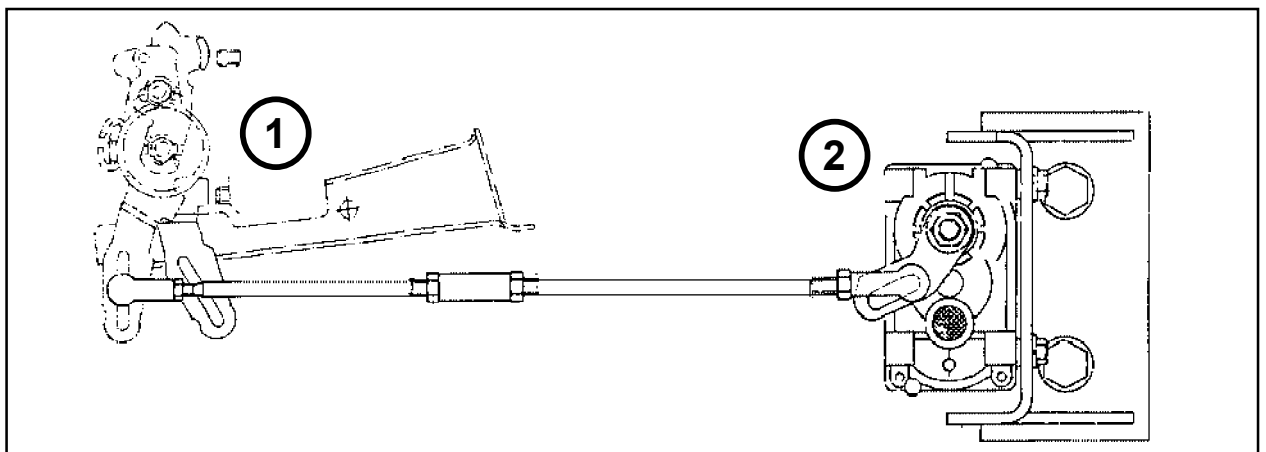
Carry out adjustment of control linkage and r.p.m.s as instructed under Functional Group 08, Electronic control unit, p.c.b. 3A2 'servomotor'.

MB - engine



1: injection pump,,
2: servomotor injection pump 3M3

VW - engine



Shutoff solenoid / Engine shutoff valve

Shutoff solenoid 9Y5 (MB engine)

Shutoff solenoid 9Y5 (electro-magnetic cut-off) operates the shut-down lever of the injection pump. The solenoid is provided with two coils: a holding coil and a pull or attraction coil. When ignition is turned on, the pull coil is energized for a brief instant (200 msec), after which the holding coil remains energized until the engine is switched off.

Wire connections:

2/X90 — 4/X91 (COM) common connection

3/X90 — 3/X91 (PULL) pull coil

1/X90 — 2/X91 (HOLD) holding coil

15-amp. fuse 1F16, 15 A

The coils have these inherent resistances:

Pull coil: 3/X90 — 2/X90: approx. 1 ohm

Holding coil: 2/X90 — 1/X90: approx 50 ohms

Note:

In the event of pull coil failure the shut-down lever can be moved by hand to the **ON** position.

Never apply a voltage to pull coil terminals!! (not even momentarily!!)

Engine shutoff valve 9Y2 (VW engine)

The shutoff valve 9Y2 must produce a clicking sound when turning the keyswitch S1 on or off. The supply line of the shutoff valve is protected by a 10 amp. fuse (1F21) located on p.c.b. A7 'control circuit fuse'.

Wire connection: 3/X93 — 1/9Y2

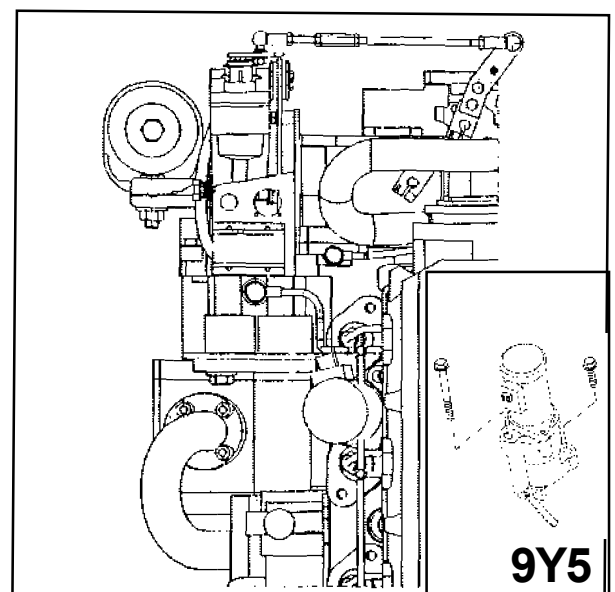
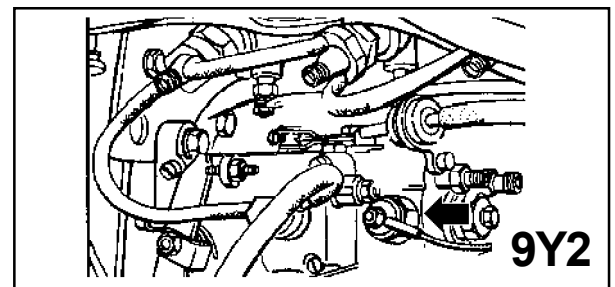
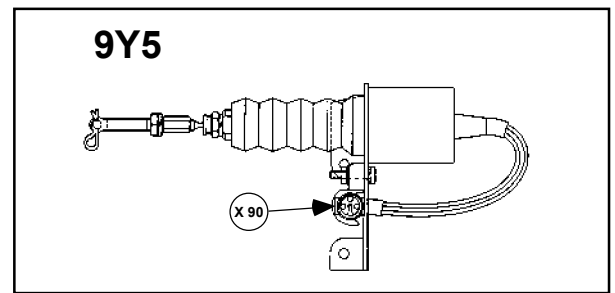
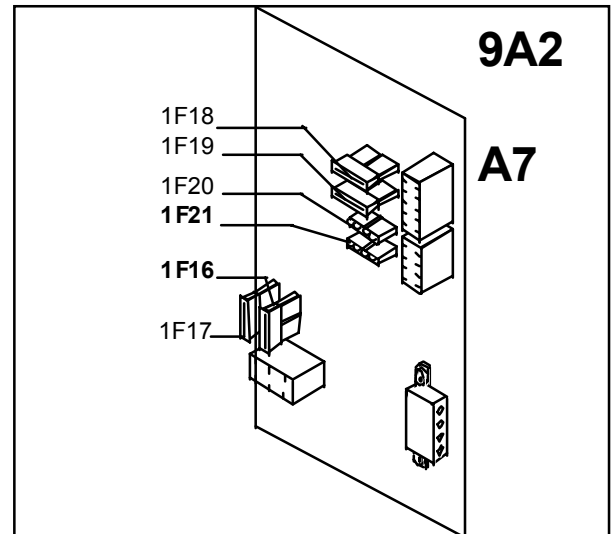
Shutoff solenoid 9Y5 (DEUTZ engine) Arranged between first and second individual injection pump sections, the shutoff valve is located on the l.h. side of the engine, as viewed in the direction of forward travel. Once the keyswitch is turned **ON**, the shutoff solenoid is supplied with 24 volts via fuse 1F21 which causes it to attract, as a result of which the control rod of the injection pump sections is released. The engine will not start until the solenoid has attracted.

Removal

- Disconnect the plug after having disengaged it first
- Remove oil dipstick
- Remove protective sheet from fuel lines
- Slacken the two screws securing the shutoff solenoid and withdraw the latter from the top

Installation (See Functional Group 15)

- Bring the control rod into **STOP** position (turn the rod in an anti-clockwise direction until it is against its stop)
- Insert shutoff solenoid (lightly oil the O-ring)
- Tighten the screws to a torque of 21 Nm
- Re-connect the plug
- Restore engine to running order.



Coolant temperature sensor

Coolant temperature sender 6B11 The signal from the temperature sensor (temperature-dependent resistor) is sent to p.c.b. 9A4 „Engine starting via generator“. The duration of the preglowing and postglowing operation is determined by p.c.b. 9A4 as a function of coolant temperature.

Coolant temperature sensor 6B11 (VW) Incorporated in the pipe connection of the coolant hose, on the RH side of the engine, sensor 6B11 - black connector X35 - is positioned horizontally, whereas coolant temperature switch 6B2 - brown connector X42 - controlling the water temperature warning light is positioned vertically. Resistance value of coolant temperature sender 6B11:

217 ± 30 ohms in the case of 60°C
 87 ± 5 ohms in the case of 90°C
 ~ 50 ohms in the case of 110°C

Coolant temperature switch 6B2 will switch on the warning light 6B11 when the temperature rises to reach 110°C and will switch off the light again when the temperature has dropped to 104°C.

Located on the front end of the engine, switch 6S1 closes or opens the circuit to the engine oil pressure warning light.

Coolant temperature sensor 6B11/6B2 (MB)

Coolant temperature sensor 6B11 is screwed into the cylinder head near the fuel filter housing. Resistance value of coolant temperature sensor, depending on coolant temperature:

higher than 400 ohms in the case of 10 to 30°C
 lower than 100 ohms in the case of 70 to 95°C

Coolant temperature sensor 6B11 (DEUTZ)

Located on the front end of the engine above the coolant pump, the coolant temperature sensor/switch 6B11 (combined in one unit) has two connections:

- 1 - warning contact
- 2 - sensor

Housing is negative earthed

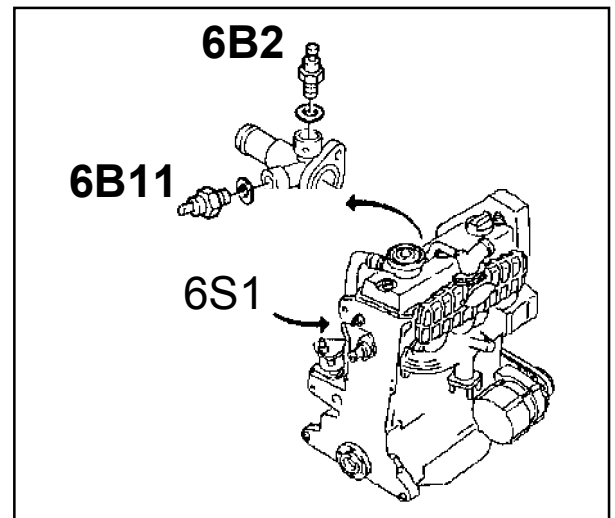
Switch 6B11 will switch on the water temperature warning light when the temperature has reached 118°C ± 3°C, switching it off again the instant the temperature has dropped by 5°C below the switch point.

Sensor 6B11 presents the following resistance value, depending on coolant temperature:

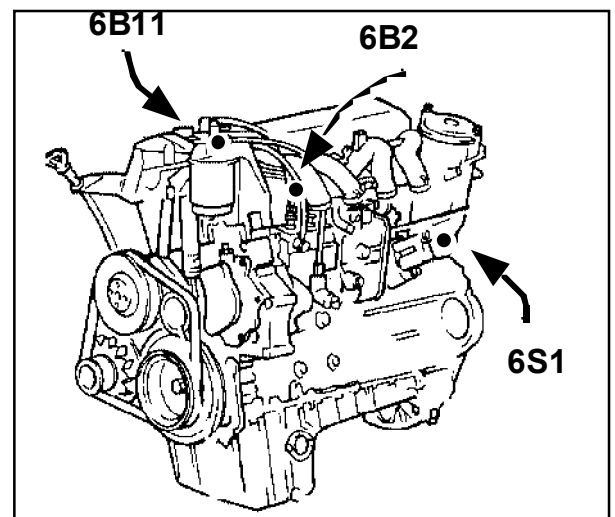
1138 ohms in the case of 20°C
 225 ohms in the case of 60°C
 83 ohms in the case of 90°C
 37 ohms in the case of 120°C
 29 ohms in the case of 130°C

* Oil pressure switch 6S1

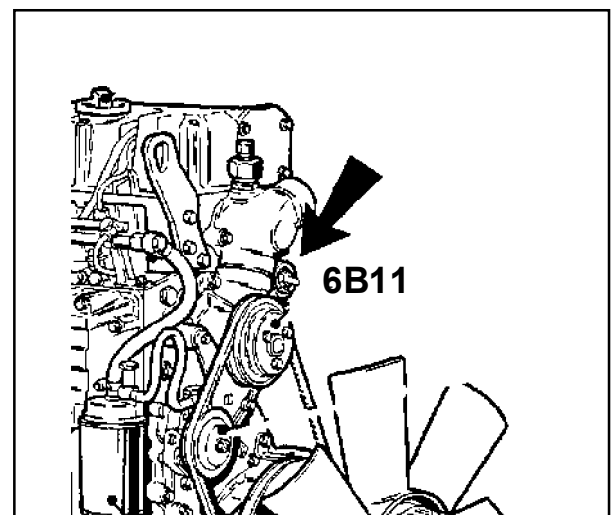
VW - engine



MB - engine



DEUTZ - engine



Batteries

Starter Batteries

Starter batteries G1 and G2 are located on a carrier plate that is transversely mounted in front of the engine. The cables and electrical connections are routed on the underside of the carrier plate where they are well protected. **7032-34 / 38-40 :**

These truck models are each fitted with two 12-volt / 43 Ah batteries.

The 12-volt/43 Ah starter batteries are both connected in series. Fitted with terminals designed for screwed connections, they supply the electrical devices with 24 volts operating voltage. Provided in addition, a centre tapping P/G1 supplies via fuse F2 on contactor panel the ignition system of the LPG version with 12 volts. The heavier demand thus placed on the battery is compensated for by means of p.c.b. A1 (see Electronic charge compensating circuit).

7048-50 :

Due to the higher starting output, these truck models are fitted with 12-volt/48 Ah, 310 A high-current batteries.

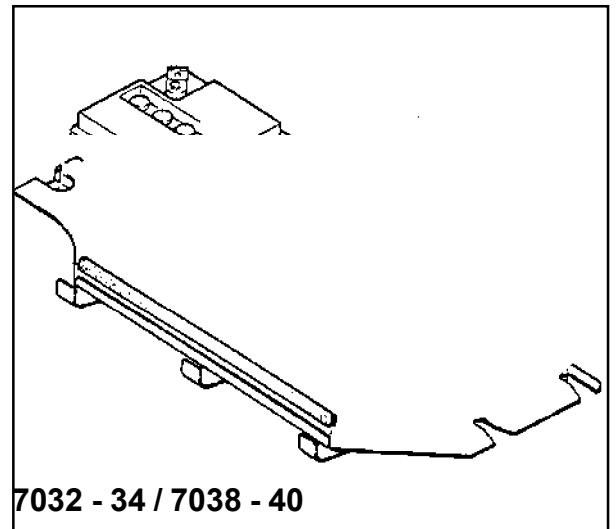
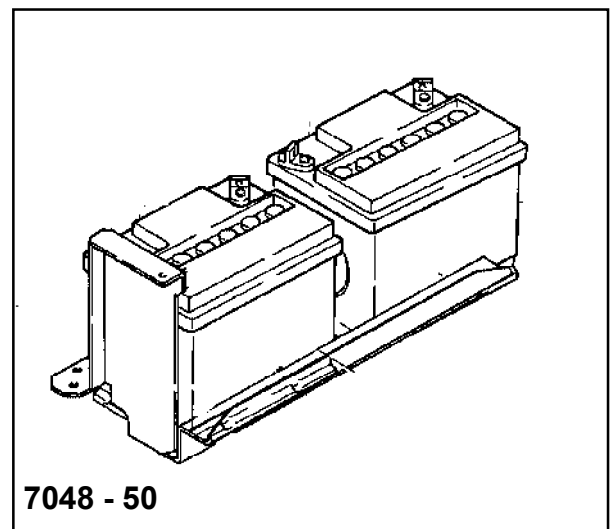
12-volt connections for optional equipment
(electrical accessories)

The electrical system of a certain number of the trucks in this range is provided with 12-volt external connections. Designed for optional equipment, the external connections are brought to fuses F2-F6.

NOTE:

Never disconnect battery cables with engine running, as otherwise alternator 9G2 and power board 1A2 may get destroyed!

Disconnect both batteries before carrying out any repairs!

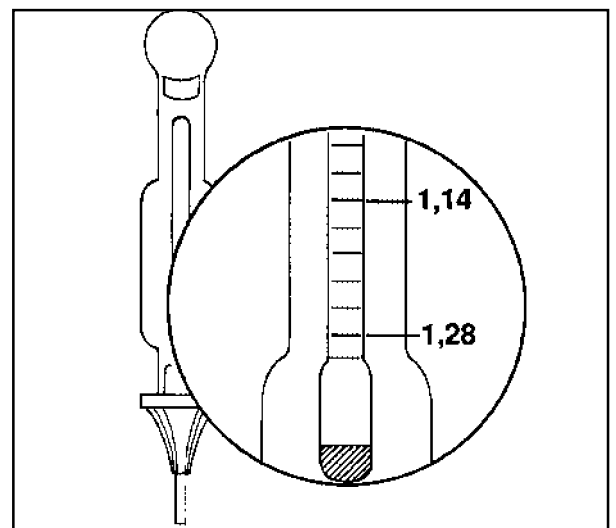
**7032 - 34 / 7038 - 40****7048 - 50****Battery maintenance**

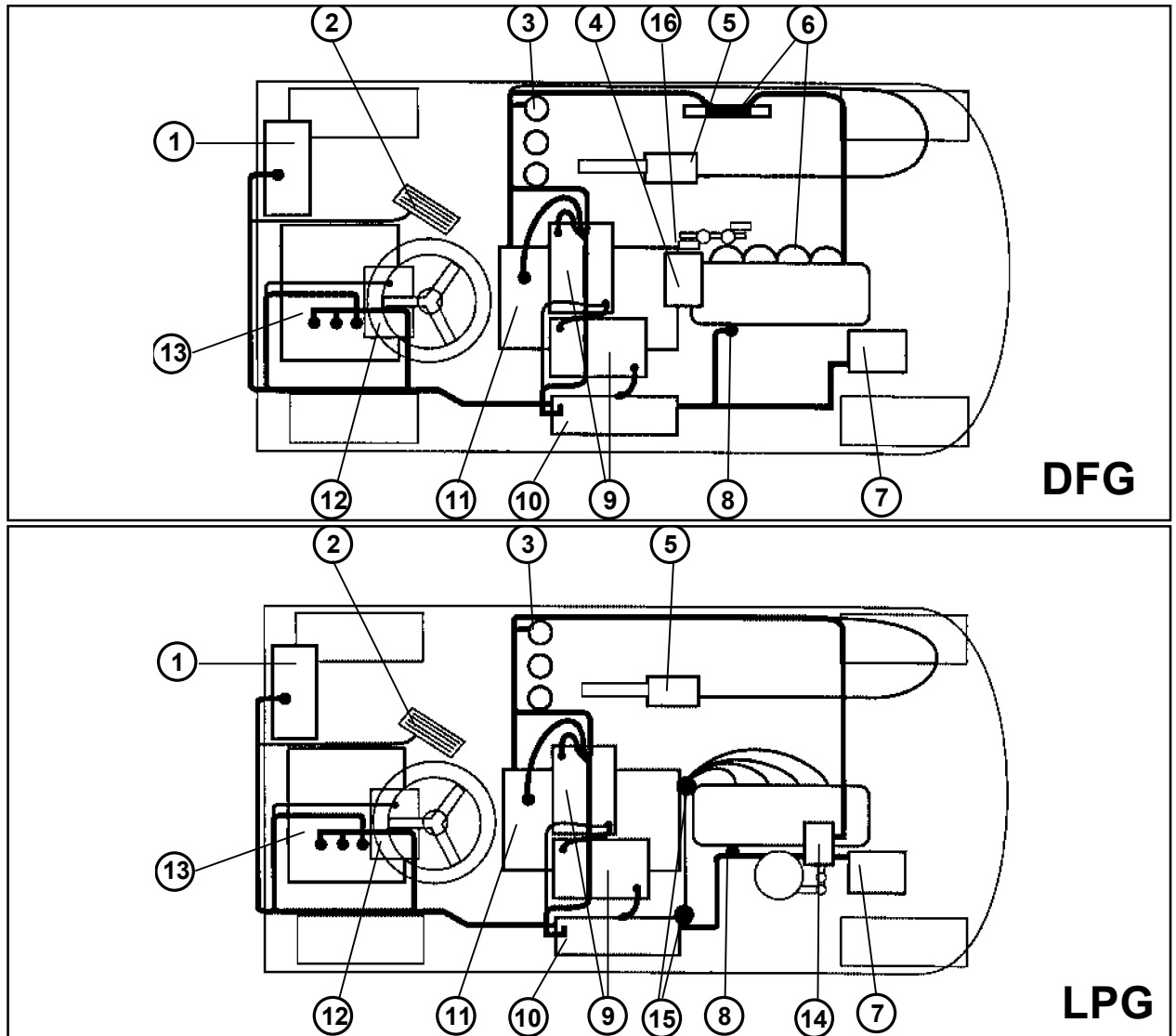
(Unless the forklift has a sealed-for-life battery, use a hydrometer to check the electrolyte condition)

The specific gravity amounts to 1.28 kg/l for a fully charged and filled battery. When the battery is in a discharged condition, the specific gravity should never drop below 1.14 kg/l. The specific gravity is measured using an acidimeter. The acidimeter incorporates a hydrometer whose scale permits direct reading of the specific gravity.

The electrolyte level should be checked at regular intervals. If the electrolyte level should drop below the minimum mark, top up only with distilled water.

Topping up should always be carried out **after** every battery recharge.





1 —electronic pulse controller

9 — starter batteries

2 —accelerator pedal transmitter

10—contactor panel

3 —potentiometer - hoisting, valve microswitches

11 —generator

4 —servomotor / injection pump

12 —dash panel

5 —parking brake

13 — drive motor

6 —preglow system (DFG = diesel model)

14 — throttle positioning solenoid

7 — alternator

15 — ignition system (TFG = LPG model)

8 —ground or earthing point(-), engine

16 — shut-down solenoid

13 —

Fuses

Fuses

The entire electrical equipment of the truck with the exception of the generator start circuit is protected by the 60 amp. 1F3 fuse. All other fuses of the plug-in type are located inside the electronic pulse control unit A4 where they are grouped on the p.c.base board and on p.c.b. 9A2 'shut-down solenoid' (DIESEL) p.c.b. A7 'control circuit fuse' (LPG), as well as inside contactor panel or support A5 on p.c.b. 1A6 'current sensor'.

Fuses inside the electronic pulse control unit A4:

**1. P.c.b. 9A2 'shut-down solenoid' (DIESEL)
P.c.b.A7 'control circuit fuse' (LPG)**

- 1F16---15 A protecting shutoff solenoid (MB engine)
- 1F17---5A protecting p.c.b. 1A1 'traction circuit control'
p.c.b. 9A 'engine starting via generator'
- 1F18---20A protecting instruments on dashboard via
keyswitch 30/SI
- 1F19---20 A protecting the lighting equipment
- 1F20---20 A protecting additional fan motor 9M5
- 1F21---10A protecting engine shutoff valve 9Y2
(VW engine)

2. P.c.base board

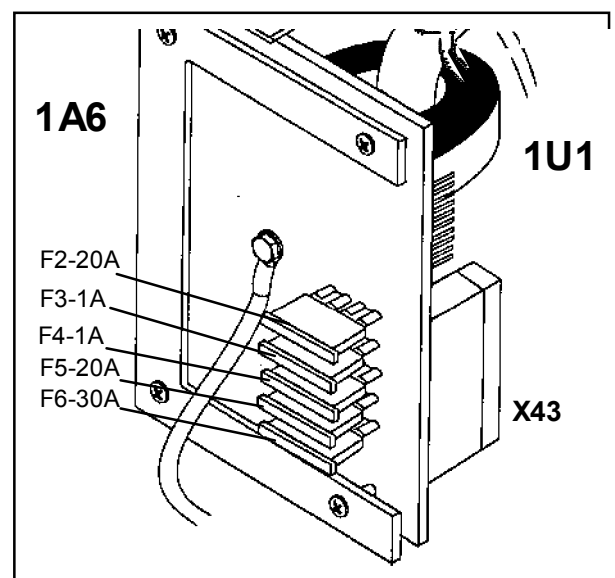
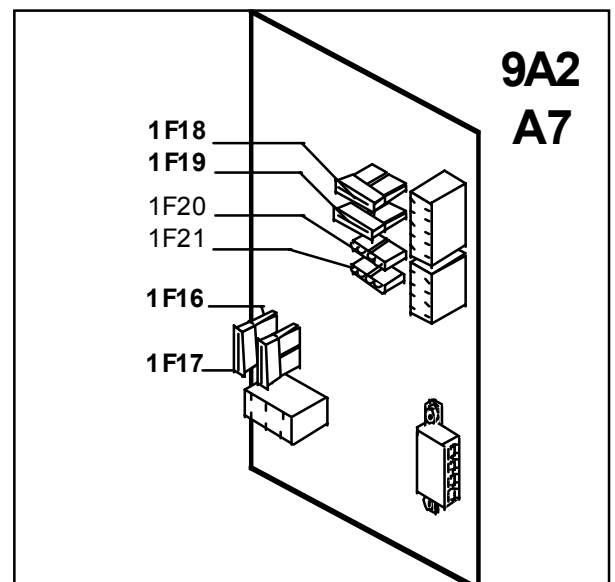
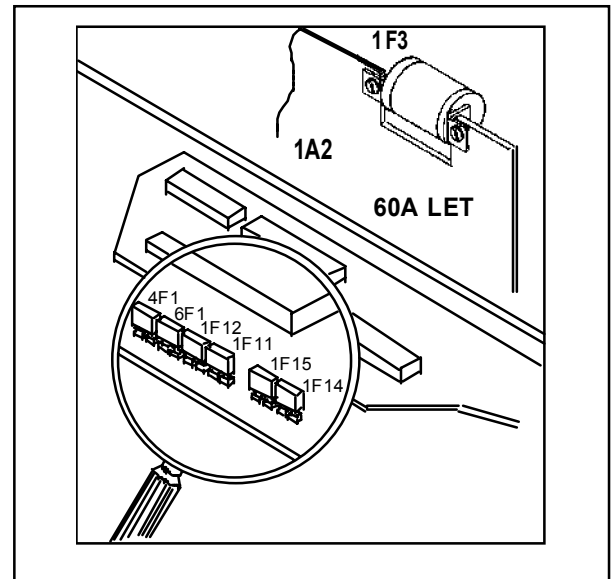
Fuses 4F1 - 6F1 - 1F1 1 - 1F1 2 are supplied with a voltage of 24 volts via terminal 15/S1 with keyswitch ON.

The following components are protected by these fuses:

- 4F1 10 A 4H1 - warning horn
- 6F1 5 A indicator/warning lamps
- 1 F1 15 A power board 35/1 A2 via
1S4 - parking brake microswitch and
p.c.b. 1A1 'traction circuit control'
- 1F12 10 A : p.c.b. 9A4 'engine starting via generator'
and DIESEL: p.c.b. 3A2 'servomotor'
or LPG: p.c.b. A3 'throttle valve regulator'
- 1F 15 1 A lead D +19G2 -- 25/1 A2
- 1F14 1 A diagnostic device, 22B/1A1
- 9F1 5 A LPG: wired in ignition circuit, **12 volts !**

Fuses inside contactor panel A5:

- F2 20 A charge compensator/L1PG
- F3 1 A test point +24 volts for 9A4
- F4 1 A test point +24 volts for 9A4
- F5 20A charge compensator/L1PG
- F6 30A ignition circuit/ LPG



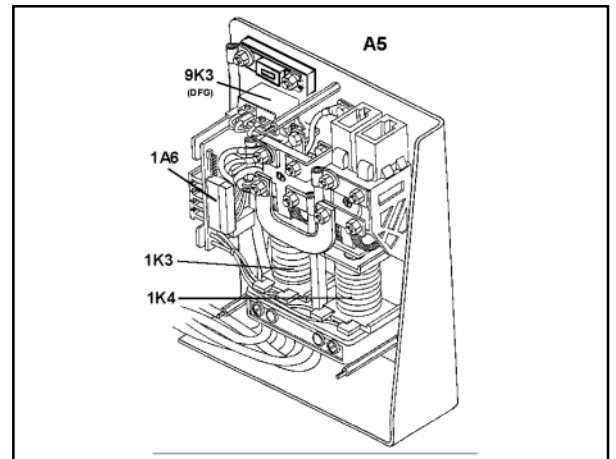
Contactor panel

Contactor panel or support

Mechanical configuration

The contactor panel is located under the engine bonnet on the LH side. Protected against water splashes by a removable plastic hood with gasket, all components are mounted to a carrier plate. The following components are mounted on the contactor panel:

- 1K3 - engine start-contactor
- 1K4 - driving contactor
- 1U1 - current sensor with p.c.b. 1 A6 and fuses F2, F3, F4, F5, F6
- 9K3 - glow plug relay (DFG)
- 9F4 - main power fuse 250A



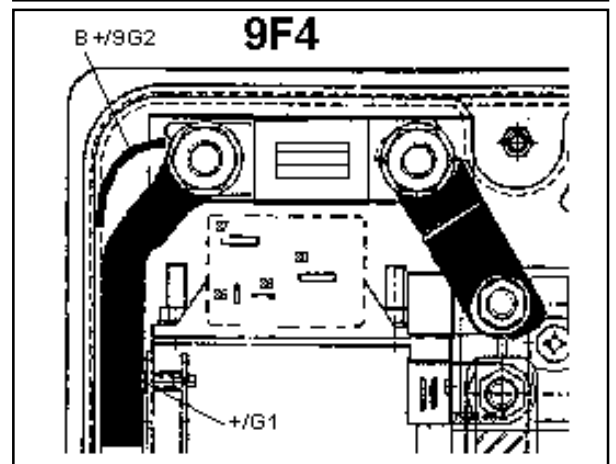
Main power fuse

Since August 1992 the positive (+) supply lead to the battery is protected by a **250 amp** main power fuse.

Retrofit

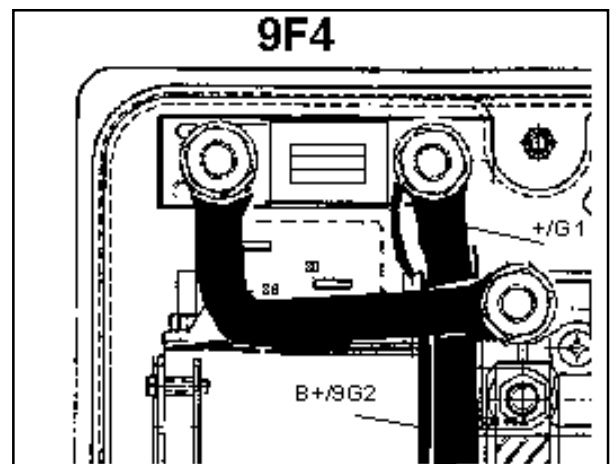
The fuse can be retrofitted to older truck models in this range. Mounting holes have been provided to that effect.

As a temporary solution proceed in compliance with Fig. 3 since the contact bridge from contactor to fuse is not yet available.



IMPORTANT

In the event of a blown fuse the alternator must on no account be disconnected from the battery. The wire connection between battery positive (+) and alternator 13+/9G2 must absolutely be placed in front of the fuse



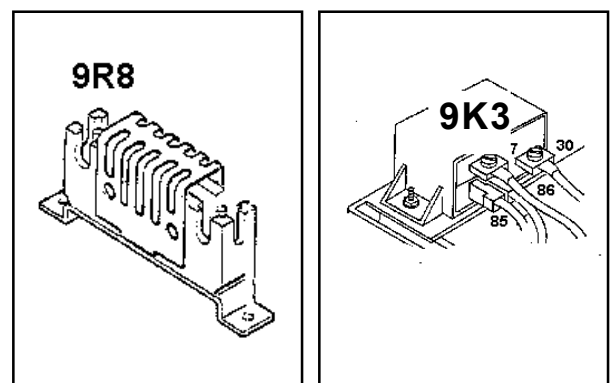
DFG - Glow plug system

The glow plug system consists of **4 glow plugs 9E13 - 9E16 inside the engine, the series resistor 9R8**

fitted to the RH frame section (from the inside between the two vibration mounts of the diesel generator unit), and the

glow plug relay 9K3 - 24 volts/50 amps

Glow plug relay 9K3 and thereby the pre-glow period are controlled by p.c.board 9A4 'engine starting via generator'.



Once the engine is started the glow system will remain in circuit for a period which **depends on engine temperature**. This period too is controlled by p.c.b. 9A4.

Note:

Due to the different glow periods which vary with the type of engine (VW or MB), the p.c.board 'engine starting via generator' is available under different ordering numbers.

Contactor panel

Contactors 1K3 / 1K4

The task of contactor 1K3 consists in establishing during the starting operation the battery current up to an intensity of abt. 160 amps.

Once the engine has started, contactor 1K3 is opened and following a short delay contactor 1K4 will close the armature circuit between generator 1G1 and drive motor 1M1.

Control voltage

Once the safety relay incorporated in power board 1A2 has been closed, both contactor coils will be supplied with voltage by the positive battery terminal. Contactor coil 1K3 is then supplied via keyswitch S1 with voltage by the positive battery terminal, while the coil of contactor 1K4 is supplied with voltage directly

The **contactor coils** have been designed for the **12 volts** operating voltage, at the same time **being controlled** by p.c.b. 9A4 (engine starting via generator) against the neg. terminal of the battery, thus **not being supplied with full battery voltage!**

Mechanical configuration

The contactor frame is made of impact resistant plastics. At its upper half the frame comprises 4 M8 studs imbedded in the plastic material.

The lower two studs serve as terminals for connecting the contact bridge of the armature by means of flexible links. The contact screws/tips are screwed from the inside into the upper studs.

The coil assembly comprises:

Coil - magnetic core - frame - protective circuitry.

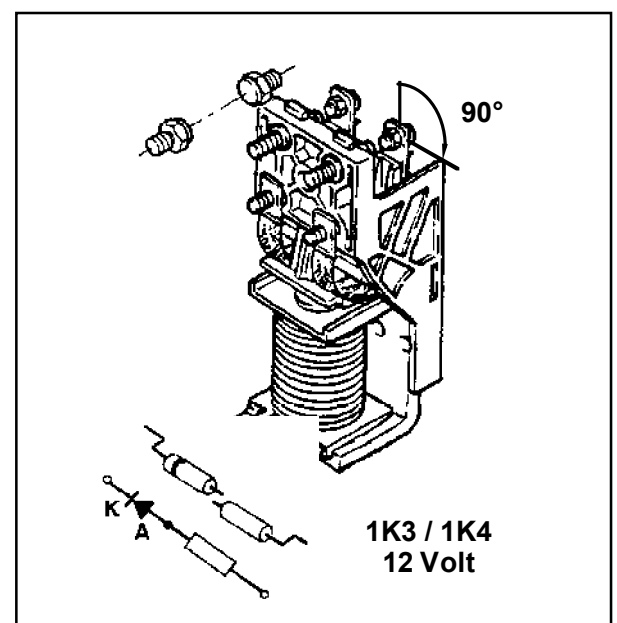
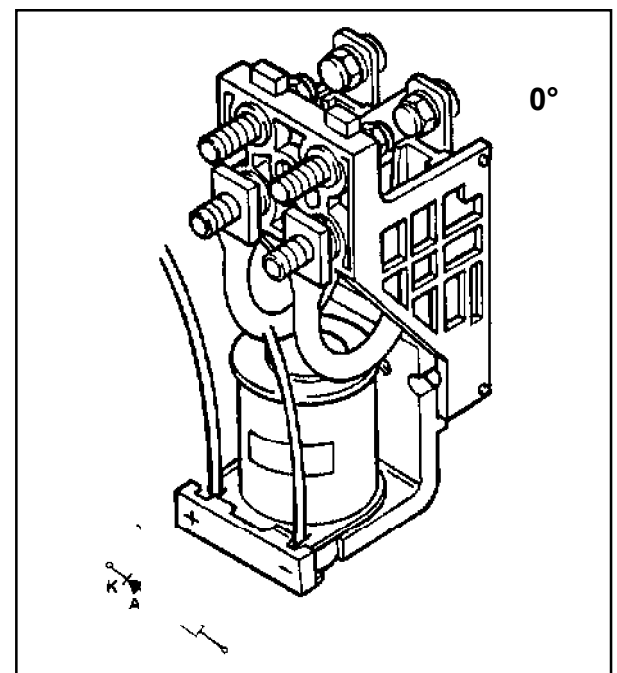
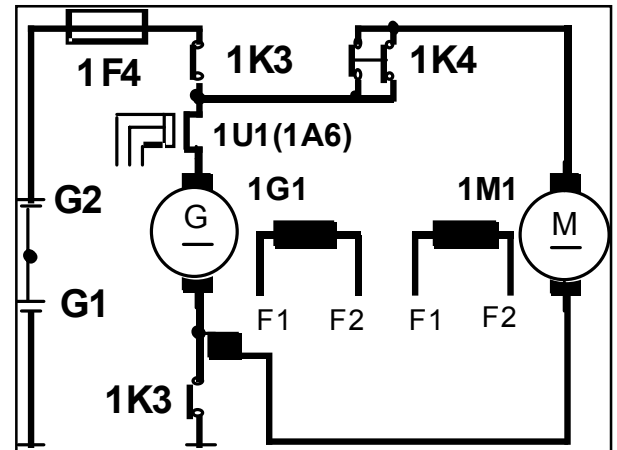
The protective circuitry consists of: Diode 1 N 4005 and 10 Q resistor. Coil resistance is approx. 5.11 ohms in the case of 12 volts battery voltage.

The movable part of the contactor - the armature assembly - is mounted between contactor frame and coil frame.

The contact screws/tips of contactor housing and armature are identical.

Torque loading of contact screws = 10 + 1 Nm

in which case contact screws must be screwed fully home (i.e. up to the thread root) and further tightened with 60° angle of rotation (against, 90° for the previous design).



STILL contactor

Adjustment**1. Contact pressure**

Contact pressure of contactor in the fully operated state: Required value 9.0 ... 10.5 N for each contact, centre of contact taken as a reference.

Adjustment

- Fully actuate contactor (electrically or mechanically)

- Attach contacts centrally to a spring balance or scale and apply a load of 950 to 1050 grammes at the maximum (equals 9.5-10.5 N).

Contact pressure can now be accurately adjusted by operating on the hex. head screw passing through the contact spring. Rotating the hex. head screw in a clockwise direction will increase the pressure.

Note:

The contact spring is subjected to a certain degree of friction. The contact pressure is therefore correctly adjusted if when applying a pressure load of 10 ... 10.5 N the contact during slow approach does not yet close, but in the case of a rapid approach makes contact and remains closed.

2. Pull-in stroke

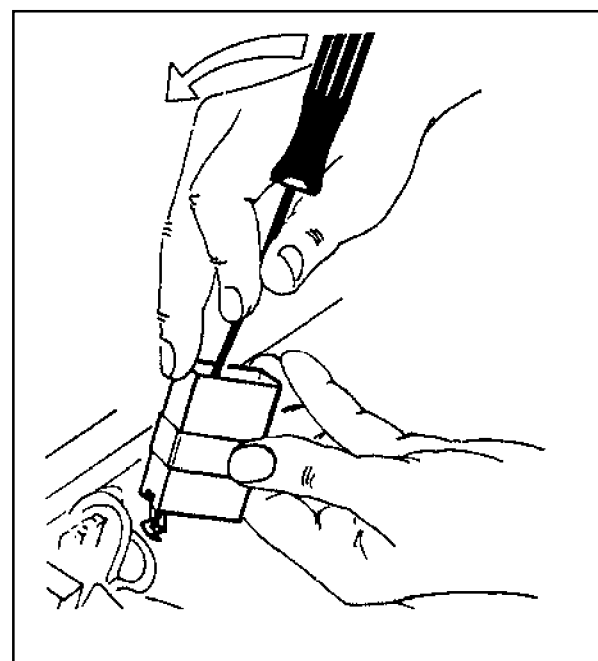
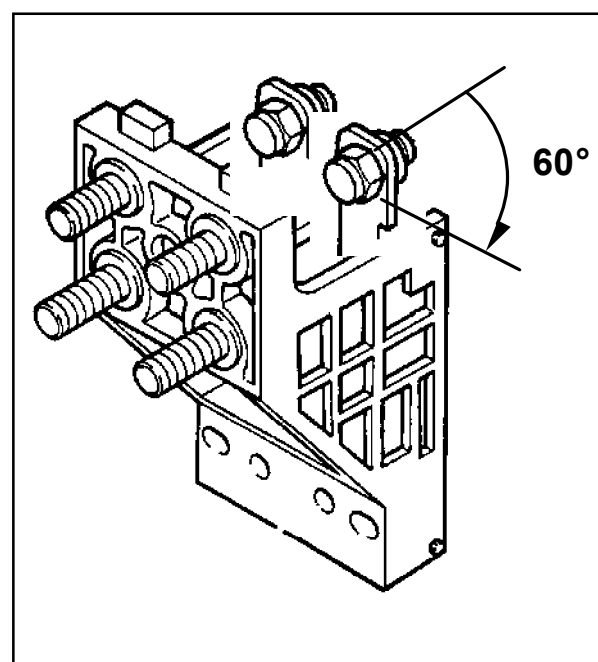
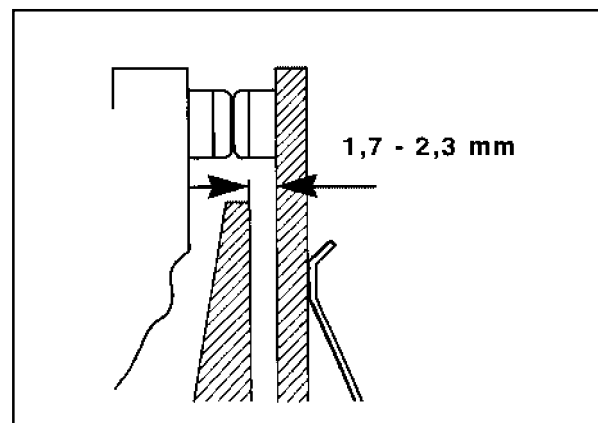
Provided the contactor is correctly assembled, a spacing of 1.3 to 2.7 mm between contact bridge and support finger must be achieved with contactor being pulled in.

3. Torque loadings

The contact screws must be tightened to a torque of 10 ± 1 Nm. To achieve this torque loading without using a torque wrench, the contact screws must be screwed fully home and then rotated through a further 60° .

4. Mounting the arc blow-out magnets

To install the arc blow-out magnets or arc suppression chambers on the contactors, a screwdriver must be passed through a hole in the leaf spring. By exerting a light pressure on the leaf spring the latter is pressed inwards until the arc blow-out magnet has reached its final position. After withdrawal of the screwdriver the leaf spring will retain the arc blow-out magnet in position.



Contactor panel

P.c.b. 1A6

P.c. board 1A6 comprises:

- **Voltage supply**, + 24 volts of battery voltage
- **Adaption** to p.c.b. 1A1
- **Monitoring** the connections of actual current value sender to p.c.b. 1A1
- **Fuses** F2 - F6

There are differences in the electrical system (contactor panel) of diesel and LPG powered models, viz.:

DIESEL model

- Glow/heater relay 9K3
- Fuses F2, F5, F6 unused
- Fuse F3 / F4: connected via leads to p.c.b. 9A4 'engine starting via generator' for monitoring battery voltage

LPG model

- Fuses F2 / F5 for charge compensation
- Fuse F6 for ignition system
- Control unit and ignition coil externally mounted on base board

Actual current value sender 1U1 with p.c.b. 1A6

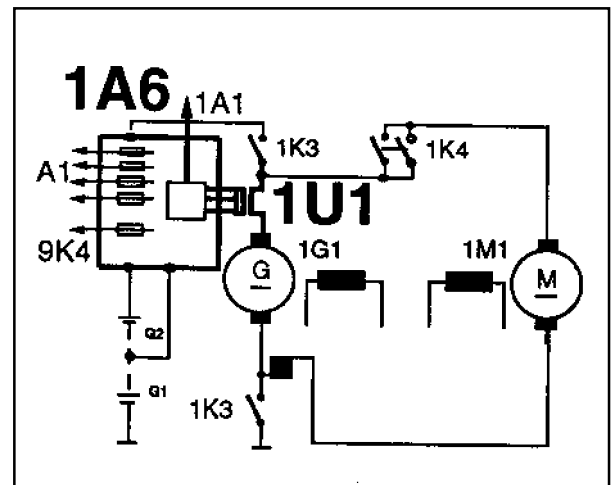
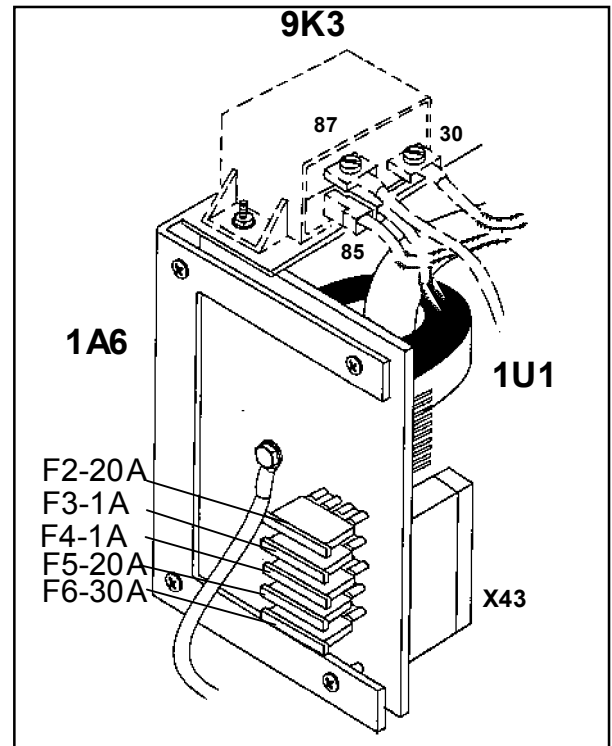
The actual current value sender consists of the current sensor 1U1 and the p.c. board 1A6 related to it. The current sensor is located in the air gap of a ring with magnetic conductivity. A conductor of the armature circuit passes through the ring. When current is flowing the conductor generates an output voltage which is proportional to the current. If no current is flowing through the armature, the current sensor will supply at its output around 5.1 volts. This equals half the supply voltage (10.8 volts) from which must be deducted the voltage consumed by the sensor itself. As soon as the armature is traversed by current, the output voltage will be modified by around 4 mV/A.

This means that in the case of 460 A of armature current, either a voltage of 6.9 volts
 $(460 \text{ A} \times 4 \text{ mV/A} = 1840 \text{ mV} = 1.8 \text{ volts})$

5.1 volts (half the supply voltage)
+ 1.8 volts (in the case of 460 A)
 6.9 volts FORWARDS

or a voltage of 3.3 volts will be present in the opposite direction.

5.1 volts (half the supply voltage)
- 1.8 volts (in the case of 460 A)
 3.3 volts BACKWARDS



Voltmeter checks on current sensor

On the **DFG** (diesel model) the voltmeter checks can be carried out directly on **p.c.b. 3A2** „servomotor“:

DIP switch 4 moved to **ON** position
 and

on the **TFG** (LPG model),
 on **p.c.b. A3** „throttle valve regulator“

DIP switch 7 moved to **ON**.

Once the voltmeter checks are completed, move the DIP switches to **OFF** position without fail.

Electronic controller

Electronic controller

DFG (DIESEL model), TFG (LPG model)

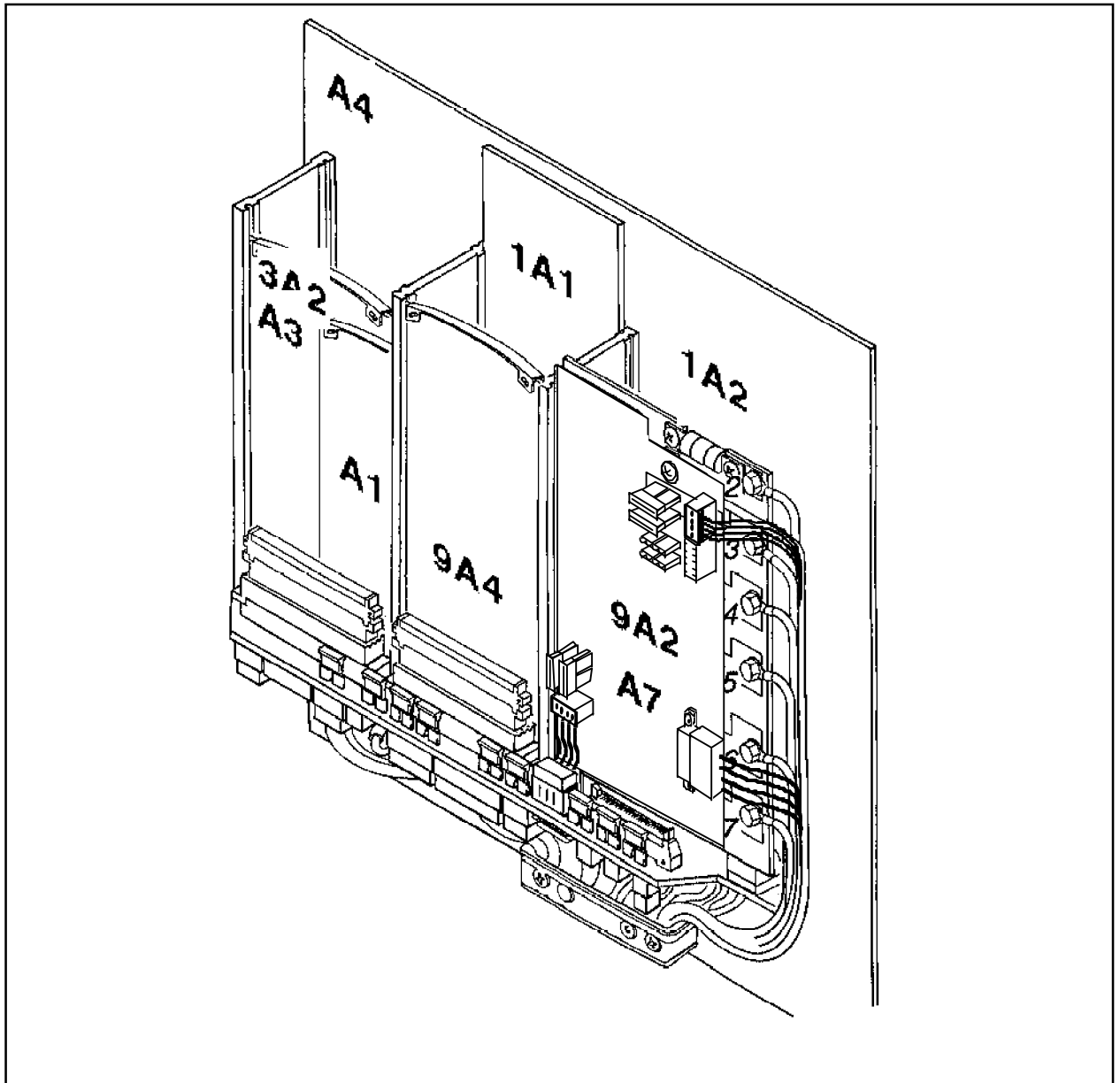
The base plate as well as the components listed below form an integral pad of the controller for the **DFG(diesel model):**

Power board	1A2
P.c.b. 'engine starting via generator'	9A4
P.c.b. 'traction control circuit'	1A1
P.c.b. 'servomotor'	3A2

P.c.b. 'diesel engine shut down controller' 9A2 with fuses for ancillary equipment.

The base plate as well as the components listed below form an integral part of the controller for the **TFG (LPG model):**

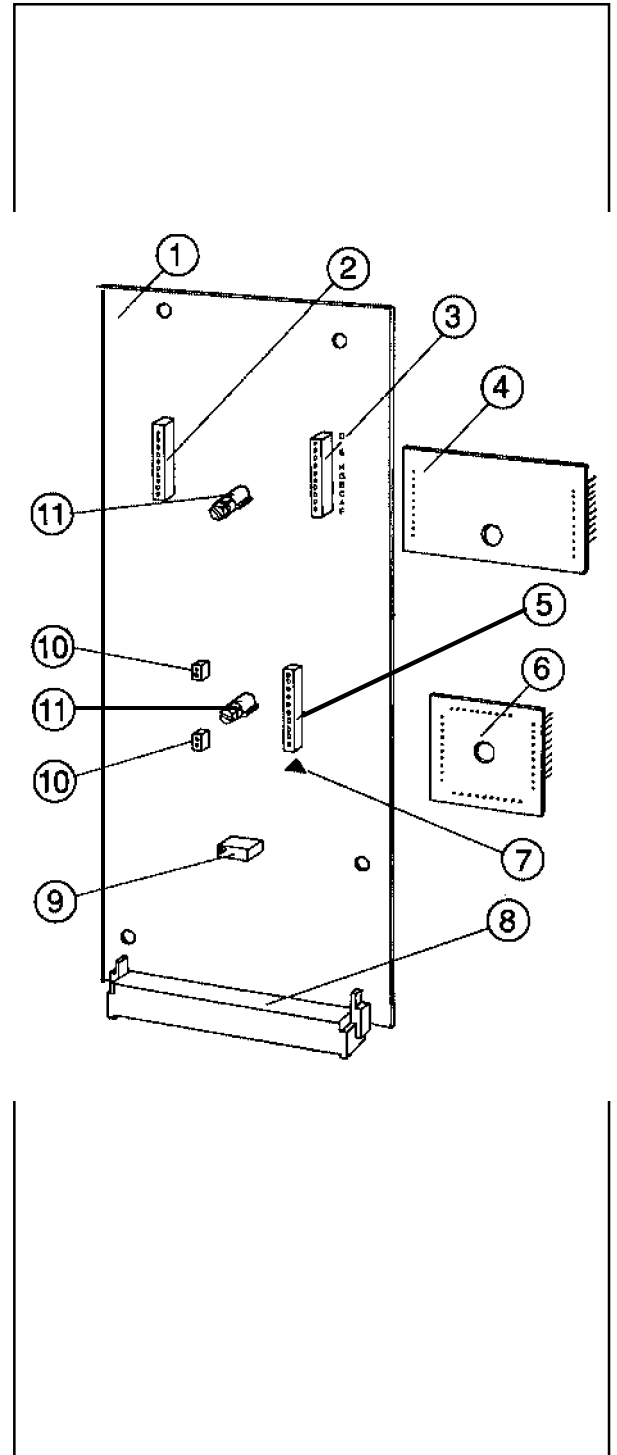
Power board	1A2
P.c.b. 'engine starting via generator'	9A4
P.c.b. 'traction control circuit'	1A1
P.c.b. 'throttle valve regulator'	A3
P.c.b. 'control circuit fused with fuses for ancillary equipment'	A7
P.c.b. 'electronic charge compensating circuit'	A1



Electronic controller

P.c.board 1A1

- 1** P.c. board
- 2** Supporting block for 'zero braking'/limitation of RPM' MODULE
- 3** 'Multi-socket connector block for 'zero braking/limitation of RPM' MODULE
- 4** 'zero braking' MODULE or 'limitation of RPM' MODULE
- 5** Connector block for 'traction functions' MODULE
- 6** Variable MODULE 'traction functions'
- 7** Position mark
- 8** Connector block
- 9** Speed limitation potentiometer
- 10** Supporting block for MODULE
- 11** Screw locking MODULE in place



Values: look at group 08 page 81

Electronic controller

P.c.b. 1A1 'traction control circuit'

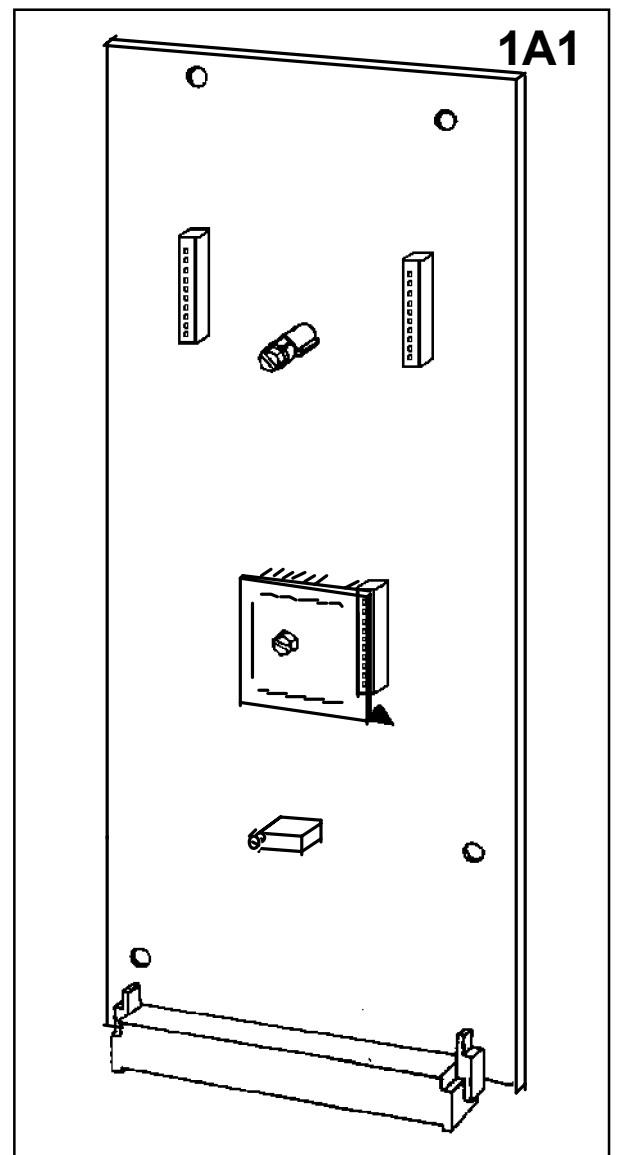
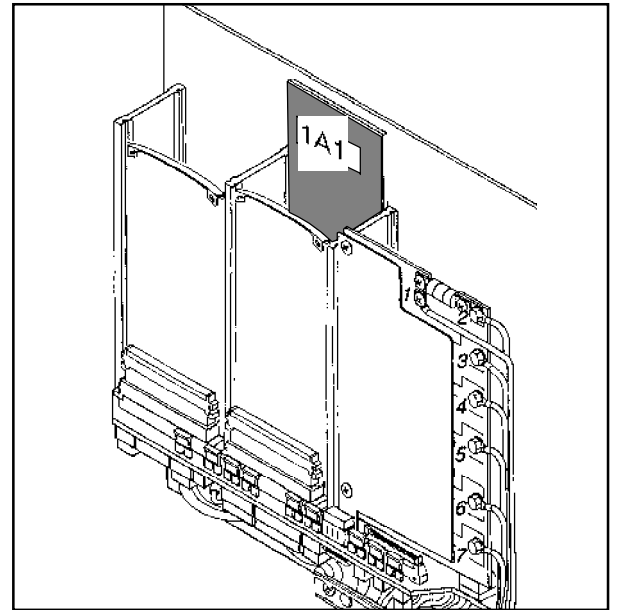
Mounted on the electronic control unit, p.c.b. 1A is connected at its lower end to the electrical equipment via a 48 position DIN connector.

The printed circuit board records all the information necessary for the driving operation, transforming it into driving commands which are transferred via power board 1A2 to motor and generator field in the form of exciting current.

The printed circuit board receives and compares orders/information from the following components and functional groups: ‘

1. **Directional control switch**
FORWARDS - NEUTRAL - REVERSE
2. **Accelerator pedal transmitter 1B1'**
(travel sender unit) -
nominal value of sender determined as a function of pedal depression
 - 2.1 Accelerator pedal transmitter 1B1 - braking the truck by releasing the pedal progressively or removing foot from pedal, braking power being governed by the position of the
3. **5-stage switch 1S14**
4. **Current sensor 1U1** - rate of armature current (drive power), (comparing it with nominal value of accelerator pedal transmitter)
5. **Tachogenerator 6B7** - sensed voltage
 - 5.1 Direction of rotation of drive wheels (polarity of voltage)
 - 5.2 Rotating speed of drive wheels (voltage level)
 - 5.3 Movement and direction of movement when stopping truck on a down or up gradient
6. **Rpm sensor 6B9** emitting a signal which is proportional to engine speed
7. If there results an **unbalance** between the above mentioned information, the drive will be regulated accordingly, if necessary relieved of load (speed droop) in order to prevent 'stalling' of engine, for example when operating on a steep gradient. Even with pedal fully depressed, the vehicle will come to a complete stop without the engine being stalled.
8. In the event of defective components/open circuit faults, the fail safe system (an electronic sensing circuit to detect any malfunction) will become operative, breaking the circuit to the safety relay K1 (incorporated in power board 1A2) to cut off electrical power to field excitation.

The vehicle will coast without being braked electrically.



Electronic controller

P.c.b. 'traction control circuit'

Adapting the **p.c.b.** to the relevant truck model is made by simply plugging in a **MODULE**.
Each **MODULE** can be plugged in **4** different positions

identified on each corner by

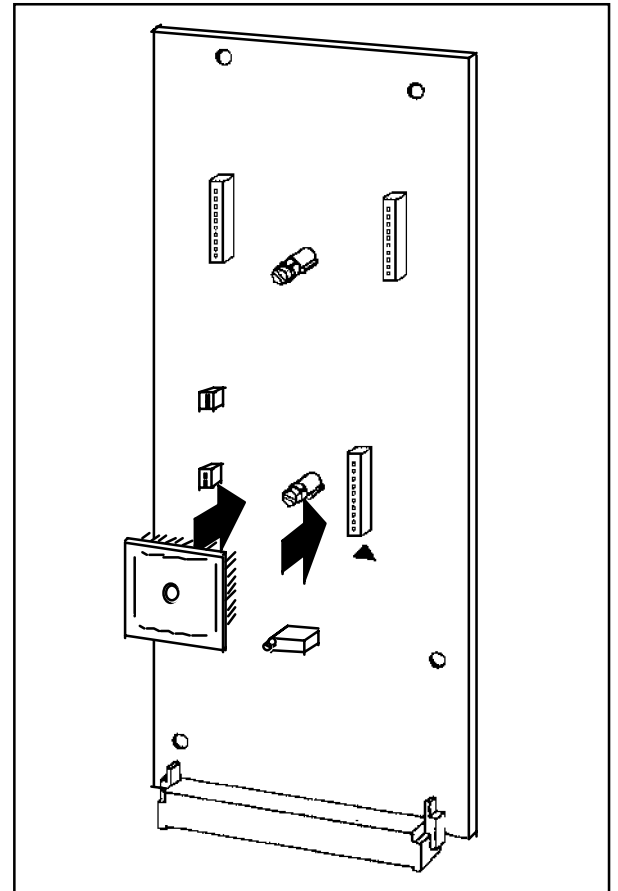
the letters **A - D**

The table on page 81 allows you to identify

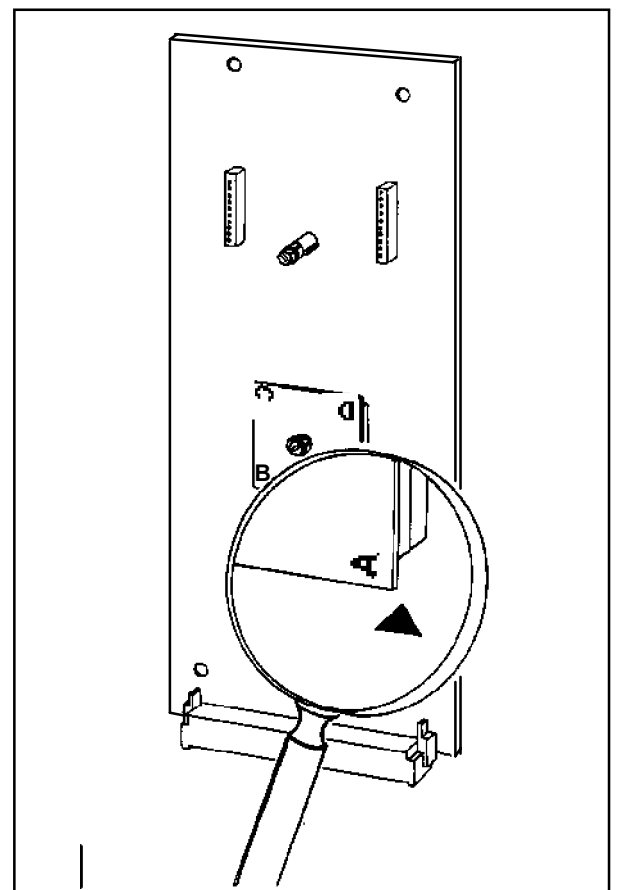
the **MODULE** you require

the position in which the **MODULE** must be plugged.

The corresponding code letter must always appear above the symbol



**Always remove p.c.b. 1A1
before disconnecting or
removing a MODULE!**



Electronic controller

P.c.b. 1A1 'traction control circuit'

Plugging in or changing MODULES

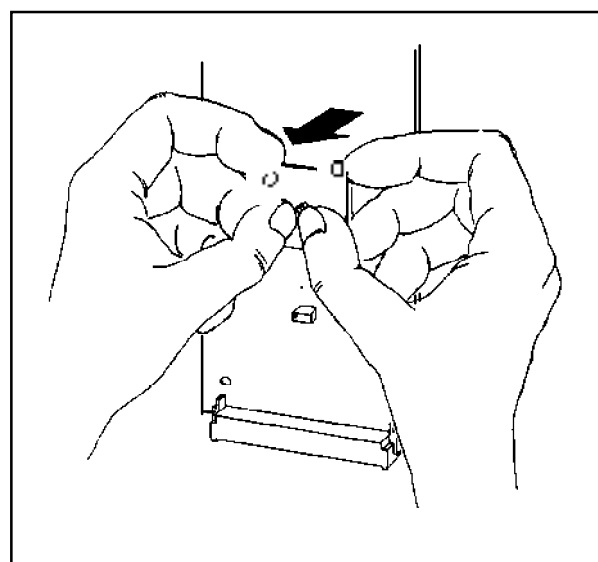
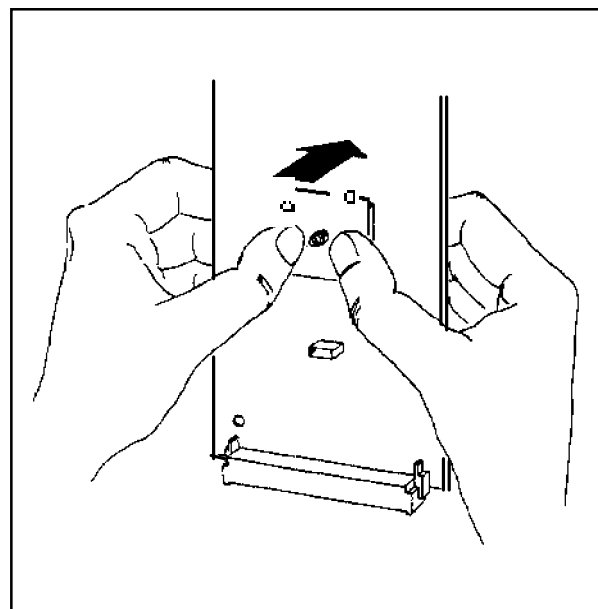
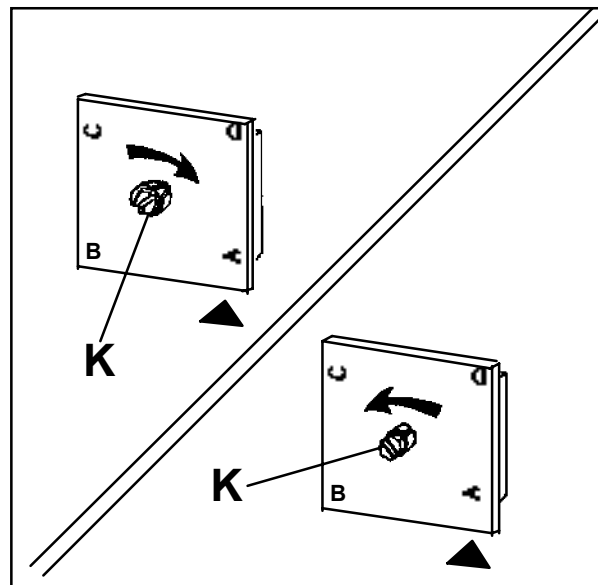
A MODULE should never be plugged in or changed unless the p.c.b. has first been removed.

By rotating the tommy screw a 1/4 of a turn in a clockwise direction, the split-type support is spread apart, causing the MODULE to get locked in place.

Rotating the tommy screw a 1/4 of a turn in an anti-clockwise direction causes the MODULE to get unlocked.

When plugging in the MODULE make sure all pins are straight and fitted in their respective sockets. It is only then that the MODULE must be pressed into the connector by exerting a moderate pressure with both thumbs, at the same time turning the tommy screw.

To pull out the MODULE, insert your index and middle fingers under the edge of the MODULE and withdraw the MODULE, simultaneously pressing with both thumbs against the tommy screw.



Electronic controller

P.c.b. 1A1 'traction control circuit'

The technical advantages provided by the p.c.b. with plug-in module become evident when the truck is operating under arduous conditions.

Here are some typical examples:

- Abrupt braking:
The vehicle will come to a smooth stop
- Stopping the truck on a gradient with a load on the forks:
The truck will come to a smooth stop
- Abrupt reversal of the directional control (plugging) while the truck is travelling at top speed:
The truck will smoothly decelerate and then gradually reaccelerate in the opposite direction in a continuous motion.
- Powerful electrical braking effect even if the foot brake is operated only to a small degree.
- Completely smooth acceleration from standstill to maximum speed even if the operator should jam the accelerator pedal to the floor.

Adjustment instructions

Travel speed: potentiometer R 31

Current limit level: potentiometer R120

Creep: potentiometer R112

Do not tamper with the adjustment of the other potentiometers

Travel speed limitation R31

Travel speed can be reduced without loss of tractive effort by operating on potentiometer R31.

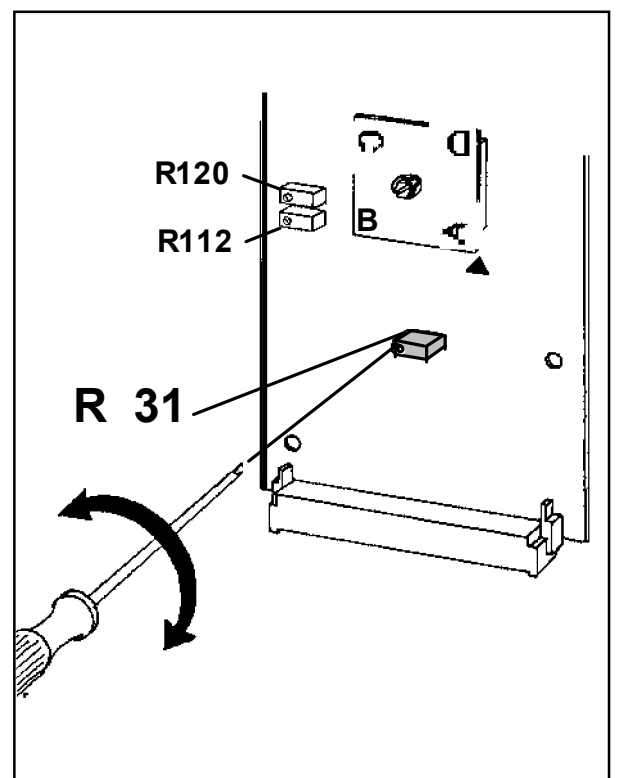
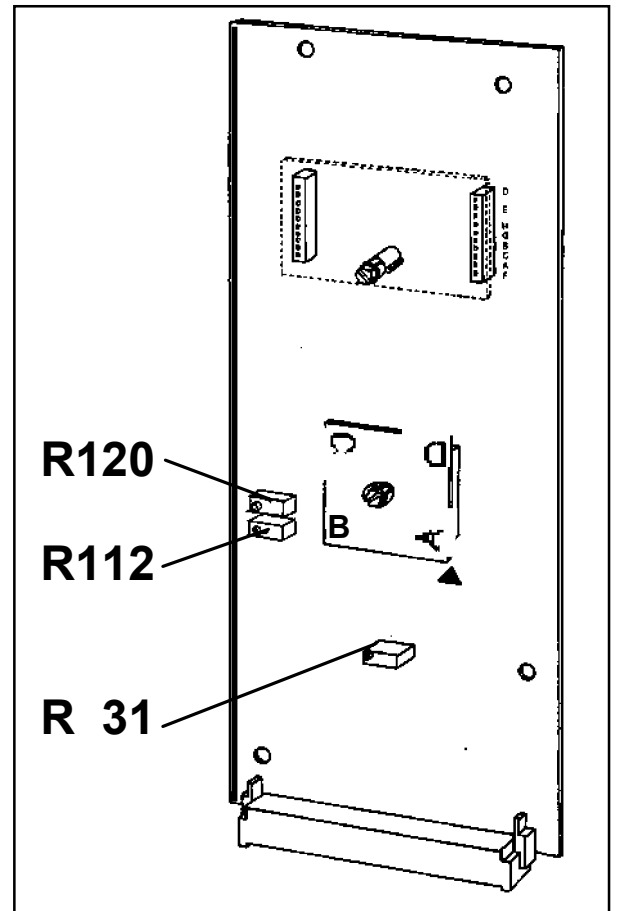
For speed adjustment check tachogenerator voltage and adjust potentiometer R31 as required. To this end chock up the truck and carry out adjustment on a track clear of obstructions.

Here are some values for comparison:

V (km/h)	22	20	15	10	7
U (V)	17,3	15,7	11,8	7,9	5,5

Checking travel speed: Using a proper jack, raise one of the drive wheels clear of the ground (it must rotate freely) and chock into position (the other drive wheel must be locked). Speed of wheel rotating freely:
330 rpm = 22 km/h.

(truck fitted with standard tyres)



Electronic controller

P.c.b. 1A1 'traction control circuit' with 'zero braking module'

Normally, releasing the accelerator pedal will provide controlled electrical braking.

Should the automatic braking feature not be desired, it can be eliminated by fitting the truck with a specially designed p.c.b. 1A1 comprising the 'zero braking' module.

Acceleration

The truck will accelerate normally, depending on position of 5-stage switch (1S14).

Braking

When the accelerator pedal is released the truck will coast slowly to a stop.

Braking is effected either mechanically by using the footbrake or electrically by placing the directional control lever in neutral. (On -models fitted with twin accelerator pedals, both pedals are in neutral when un-operated).

Adjustment Procedure-Module

Do not tamper with the adjustment of pot. R1 Setting of maximum current limit level = 450 A. This setting must on no account be altered!

NOTE.

Pot. R120 on p.c.b. 1A1 has no function on this variant.

Pot. R2

The braking current can be adjusted to correspond to current limit level should a light electrical braking power be desired.

DIP switch 1 moved to ON

When directional control lever is in neutral, **braking power** will correspond to maximum current limit level.

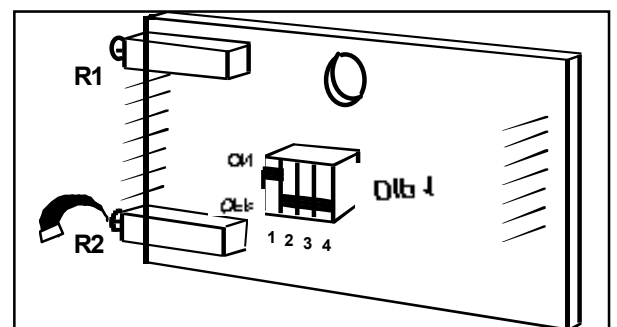
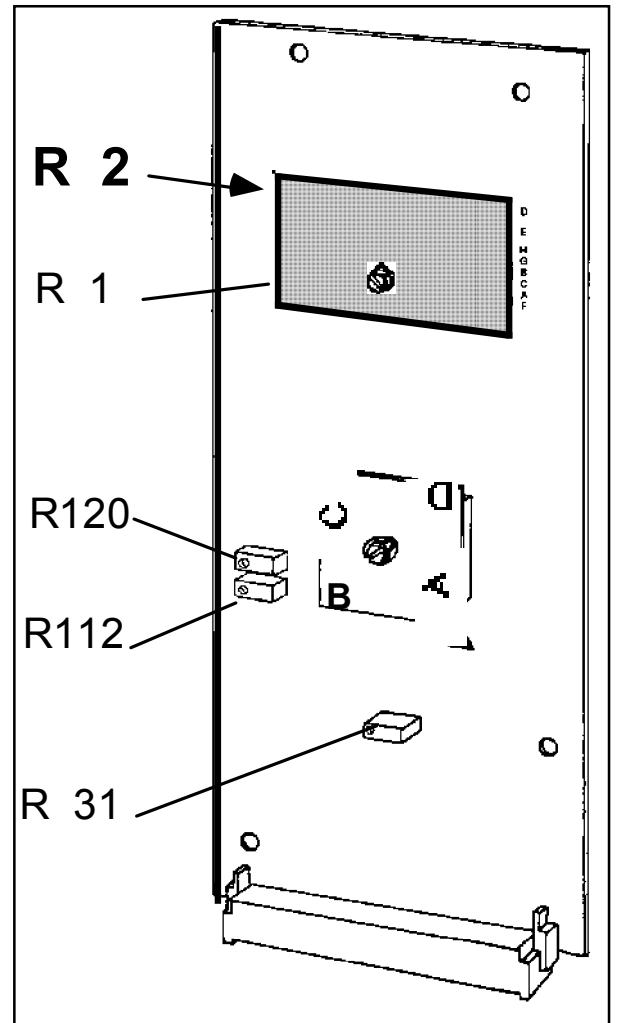
DIP switch 1 moved to OFF

With directional control in neutral, **braking power** will correspond to maximum setting of braking current.

NOTE:

When driving on inclines, the truck will roll downwards if the directional control is moved in the direction facing downhill.

When plugging in the module ensure **all** pins are straight and located in their respective sockets.



Electronic controller

P.c.b. 1A1**'Limitation of RPM' module**

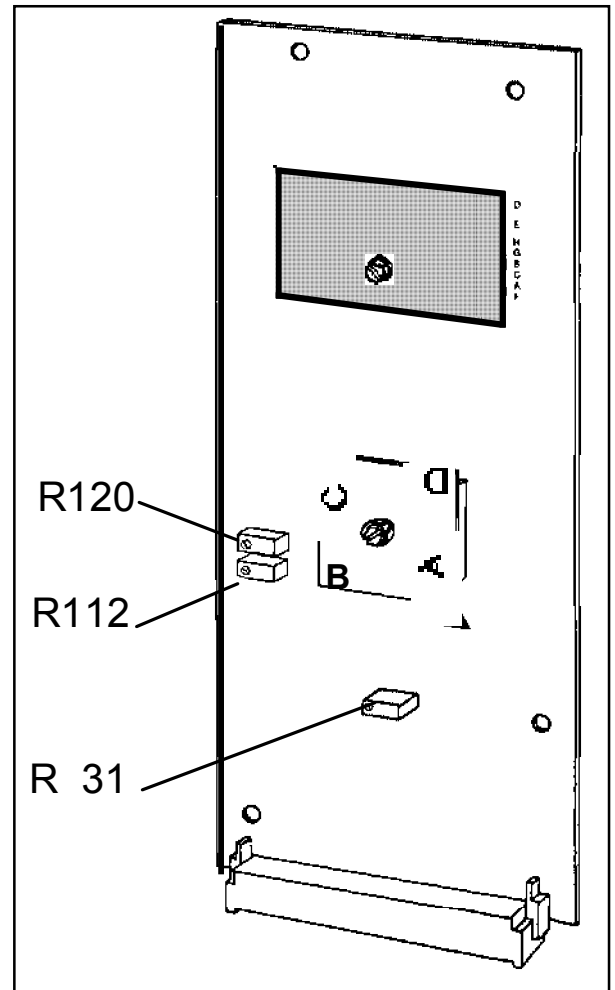
The truck is braked electrically when the operator removes his foot from the accelerator.

Depending on truck model, travel speed and size of load, engine speed will rise more or less excessively during electrical braking .

In order to keep engine rev-up (racing) at the lowmost level, the 'limitation of RPM' module has been provided as standard on all trucks in this range on which high idle speed of engine has been set to 2450 rpm.

Older truck models (on which engine idling speed has been set to 2800 rpm) can be readily fitted to the 'limitation of RPM' module provided the appropriate p.c.b. 1A1 'traction control circuit' is installed at the same time in accordance with our table on page 82. The upper or high idle speed setting will be modified automatically when the p.c. board is exchanged for the one as per our table. No adjustments whatsoever will be necessary in that case.

When providing the truck with the zero braking feature, it will do to simply fit the 'zero braking' module in place of the 'limitation of RPM' module.



Electronic controller

P.c.b. 1A1 1 Adjustment instructions

Maximum armature current setting

Remove panel from front cowl and cover from electronic controller.

Connect tong tester (current clamp) to multimeter. Open-core of tong tester and close it around generator cable B2/1 G1.

**Observe safety hints.
Safeguard the truck against
accidental movement**

Start engine - depress foot brake pedal powerfully - direction of travel: FORWARDS - accelerator pedal fully depressed.

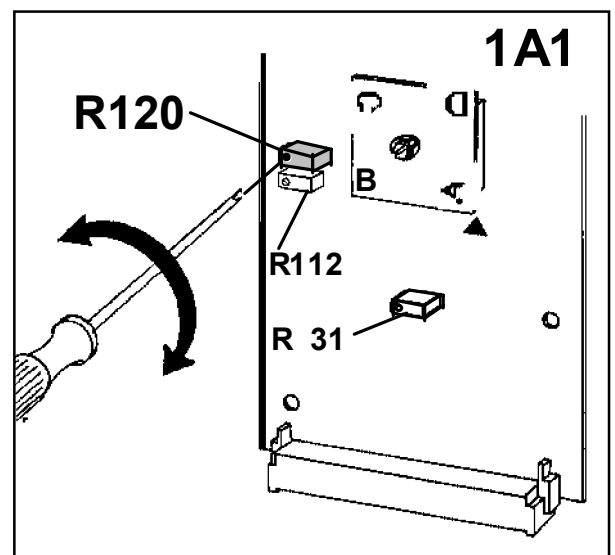
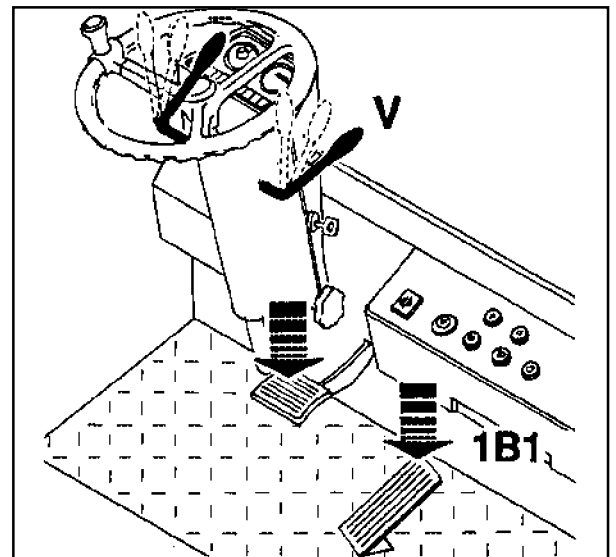
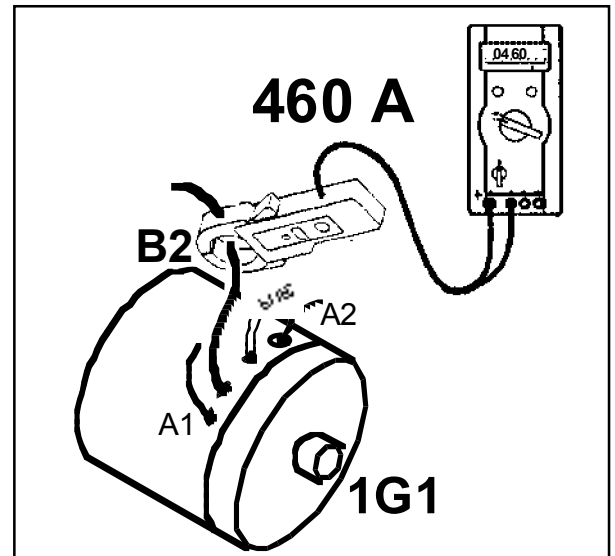
Take reading of current measured: maximum setting

460 A

If the reading is not correct, readjust
potentiometer R120 on p.c.b. 1A1.

Where the truck is fitted with zero braking, the value of the current has been adjusted on 'zero braking' module by means of potentiometer R1.

Stop engine - make truck ready for operation - carry out test drive.



Electronic controller

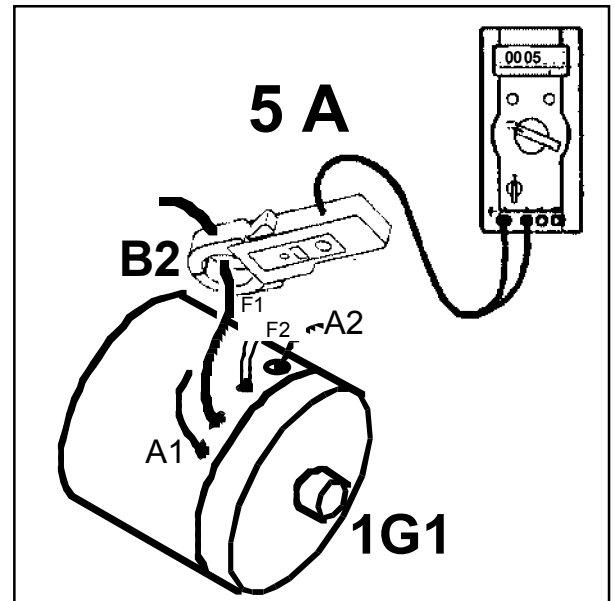
P.c.b. 1A1 / Adjustment instructions

'CREEP' adjustment

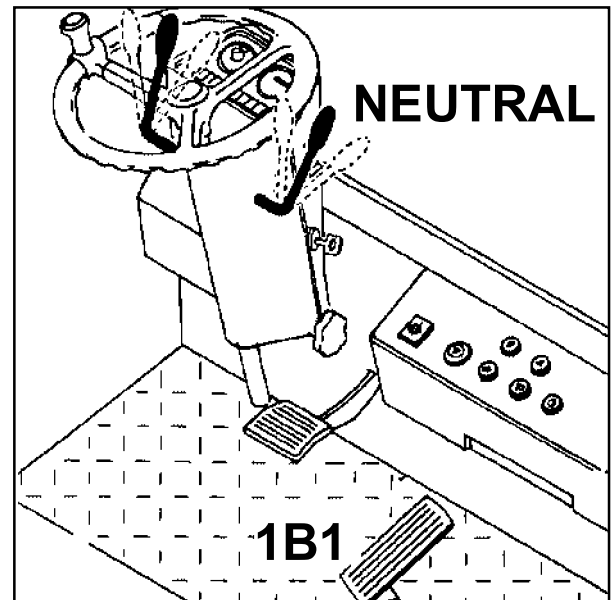
If after replacement of p.c.b. 1A1 due to repairs, the truck should creep on a **level ground** with directional control switch in neutral, it will be necessary to readjust **potentiometer R112** (CREEP).

Remove panel from front cowl and cover from electronic controller.

Connect tong tester to multimeter. Open core of tong tester and close it around generator cable B2/1G1. Reset tong tester.

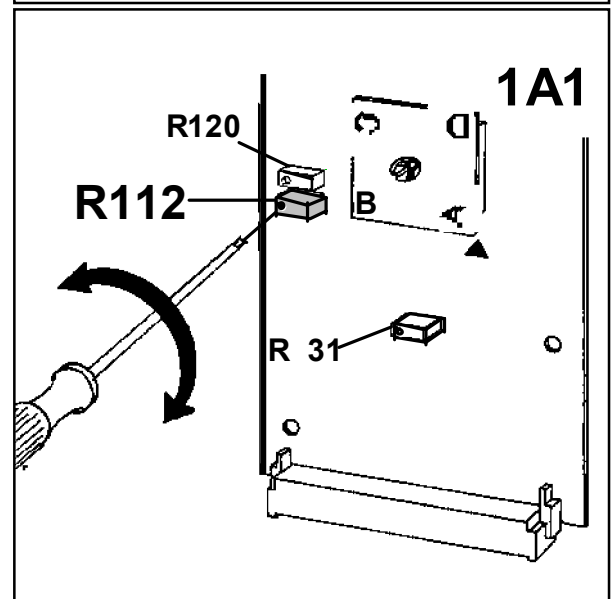


Start engine - With directional control lever in neutral and **accelerator pedal un-operated**, the armature current measured should not be higher than 5 amps.



If reading is greater, potentiometer **R112** must be readjusted until correct adjustment is obtained.

Stop engine - make truck ready for operation - carry out test drive.



Electronic controller

P.c.b. 9A4 'engine starting via generator'

P.c.board 9A4 fulfils the following functions:

- The generator is the means of **starting** the engine (no starter is used). The starting operation occurs via p.c.b. 9A4.
- **Brush monitoring** for generator and drive motor. Signalling is via the corresponding indicator lamp on dash panel. The electronic brush monitoring unit distinguishes the following situations:
 1. Brushes O.K.
 2. Brushes worn
 3. Open circuit fault
 (For closer details see Functional Group 11)
- **Recording/shaping the signal** of speed sensor 6B9 for
- p.c.b. 1A1 'traction control circuit'
- p.c.b. A3 'throttle valve regulator' (LPG)
- p.c.b. 3A2 'servomotor' (diesel)

Adaption of p.c.b. 9A4 to the corresponding truck version (VW, MB, KHD diesel models or LPG model) is via the programmed module -E-Prom (1).

The following voltages are applied to the p.c. board:

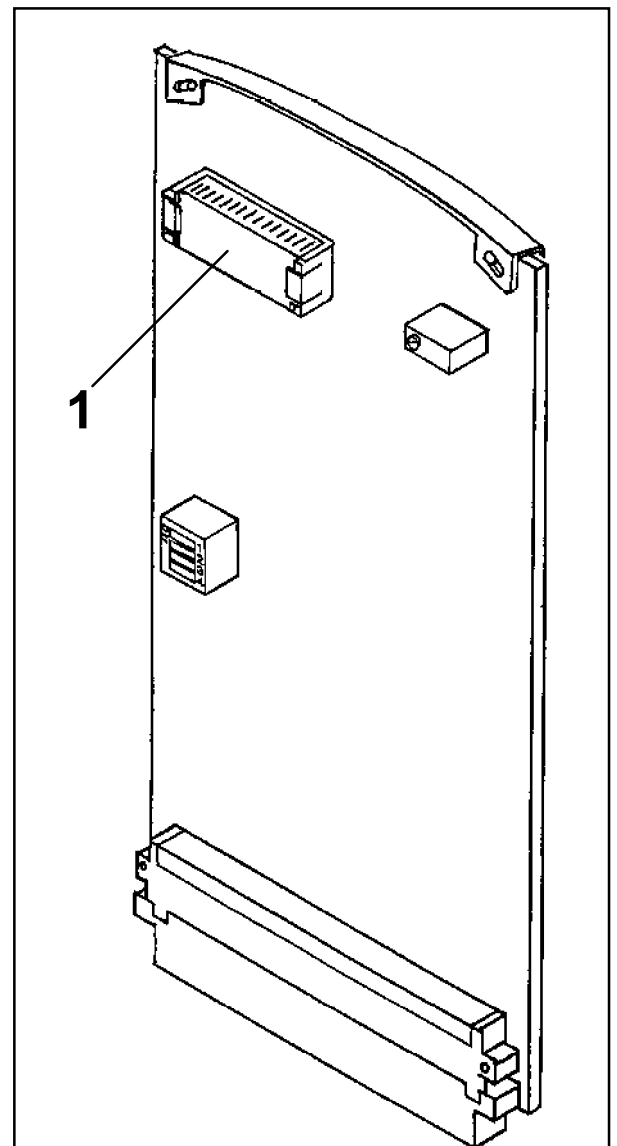
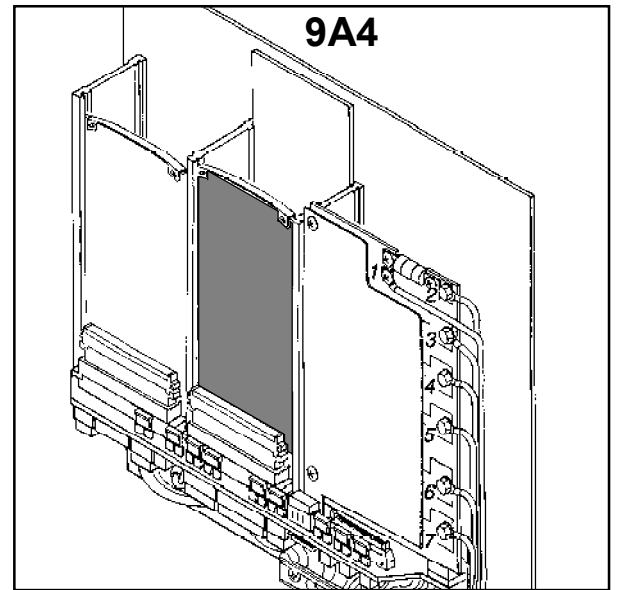
- 24 volts (battery voltage applied directly)
- 24 volts (across the keyswitch S1)
- 15 volts (from power board 1A2)
- 5 volts (from power board 1A2)
- D+ (from alternator 9G2)

Signals sent to the p.c. board:

- Directional control lever in 'NEUTRAL'
- Keyswitch S1 turned to the 'START' position - Actual current value from current sensor 1U1 - Generator armature voltage
- Drive motor armature voltage
- Coolant temperature signal from temperature sender 6B11

The following components are controlled via the printed circuit board:

- Start contactor 1 K3
- Driving contactor 1 K4
- Glow plug relay 9K3 (diesel model)
- Dash mounted indicator lamp H3 - directional control lever in neutral
- Dash mounted indicator lamp 6H10
 - electronic brush monitoring system
- Dash mounted indicator lamp 6H4
 - start check



Electronic controller

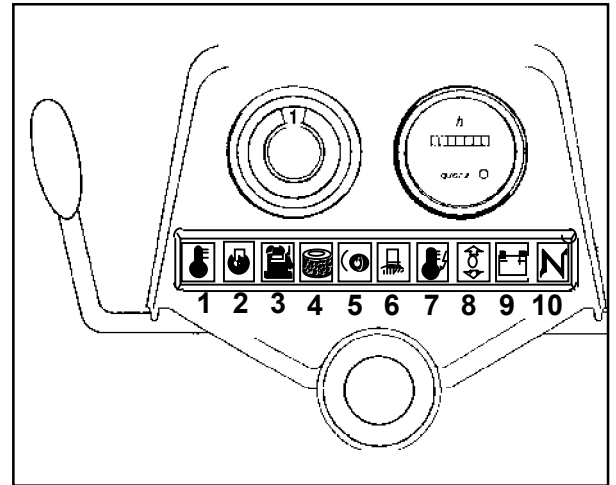
P.c.b. 9A4 'engine starting via generator'**Self testing of indicator lamps**

Every time the keyswitch S1 is turned 'ON', a self testing of indicator lamps 6, 8 and 10 will occur as outlined below.

Indicator lamp 6: lights momentarily and goes off again.

Indicator lamp 8: lights continuously if the directional control lever is in 'NEUTRAL', otherwise it lights up momentarily and goes off again.

Indicator lamp 10: lights up momentarily and goes off again.

**Fault. Indicator lamp 10 does not light**

Carry out fault *diagnosis* in accordance with our *diagnostic instructions* under section 'Engine starting via generator'.

Note 1: Following the self testing of the indicator lamps the pre-glow procedure begins with keyswitch 'ON' (on diesel model) which procedure is indicated by indicator 10 flashing slowly. This indication is not part of the lamp test.

Note 2: Indicator lamps 2 and 3 light continuously until engine starts. These two indicators do not belong to the lamp test.

Lighting of start indicator 1 Diagnosing the circuit 'Engine starting via generator'

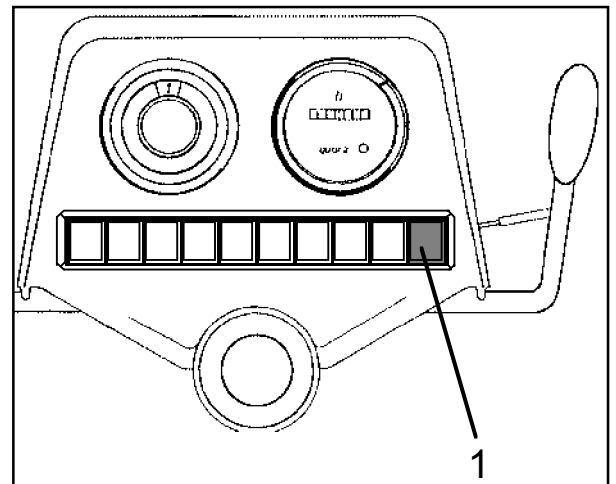
The starting procedure can be checked by means of a **diagnosis procedure** which is described in detail in our fault finding instructions. Below we explain when the fault diagnosis must be carried out.

During the normal starting operation two different indications of the start indicator lamp (1) are possible.

1. The indicator flashes slowly (every 2 sees)
pre---glow operation (on diesel model only)
2. The indicator flashes rapidly (3 times per sec)
A fault has occurred during the starting procedure. or an existing fault has been detected.

Perform fault diagnosis in accordance with our fault finding instructions (system diagnostics)

NOTE: The indicator lamp can also indicate the presence of a fault even with engine running. Refer to the appropriate section of our fault finding instructions where this possibility is dealt with.



Electronic controller

P.c.b. 9A4 'Engine starting via generator'**Explanation on starting procedure**

Keyswitch turned 'ON'

- Self testing of indicator lamps
- Beginning of the preglow procedure (on diesel model only)
- Sensing coolant temperature via sender unit 6B11 the preglow period depends on coolant temperature. Pre-glow is indicated by start check lamp flashing slowly - every 2secs.

The pre-glow procedure is terminated as soon as the start check lamp stops flashing.

A number of further checks are performed during the preglow procedure:

- Brush wear check (lasts at least 3 secs)
- Checking that the engine is stopped.
(The starting procedure will be prevented if engine is turning).

Keyswitch turned to 'START': (After termination of pre-glow procedure).

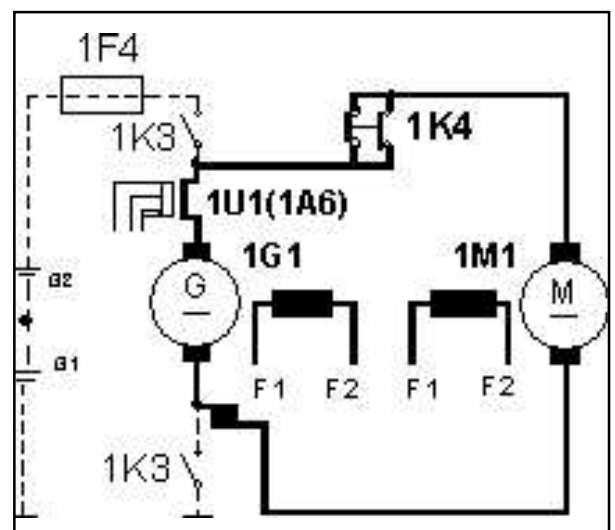
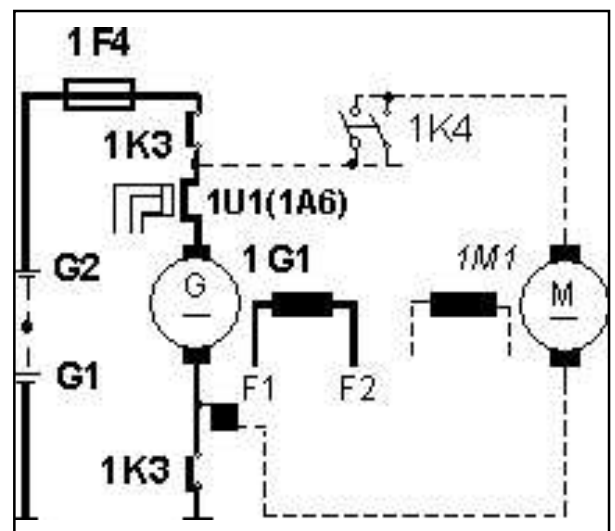
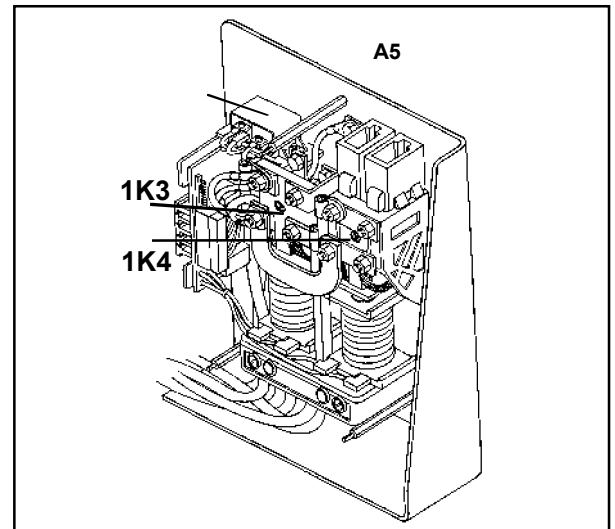
(The start check lamp lights continuously).

- Control of generator field and closing of start contactor 1K3.
 - As the engine starts, engine rpm gradually increase
 - Safety test: Testing whether start contactor 1K3 has opened the circuit
 - Adapting generator voltage to drive motor voltage.
 - Voltage check at D+/9G2
 - Closing of driving contactor 1K4.
- When driving contactor 1K4 energises, the starting procedure is terminated and the system releases the circuit for normal operation.

IMPORTANT REMARKS: On older truck models closing of driving contactor may possibly be prevented due to the absence of excitation of alternator 9G2 (start check lamp lights continuously and won't go out).

Remedy: With the directional control lever in neutral, quickly depress and release the accelerator pedal.

NOTE: When the diesel engine is started, an after-glow procedure sets in to achieve improved starting characteristics. The after-glow period, same as the pre-glow period, depends on coolant temperature.



Electronic controller

P.c.b. 9A4 'engine starting via generator'**Optional equipment**Travel speed reduction via a selector switch

This equipment is used in applications where the vehicle must be driven on public highways without a special permit.

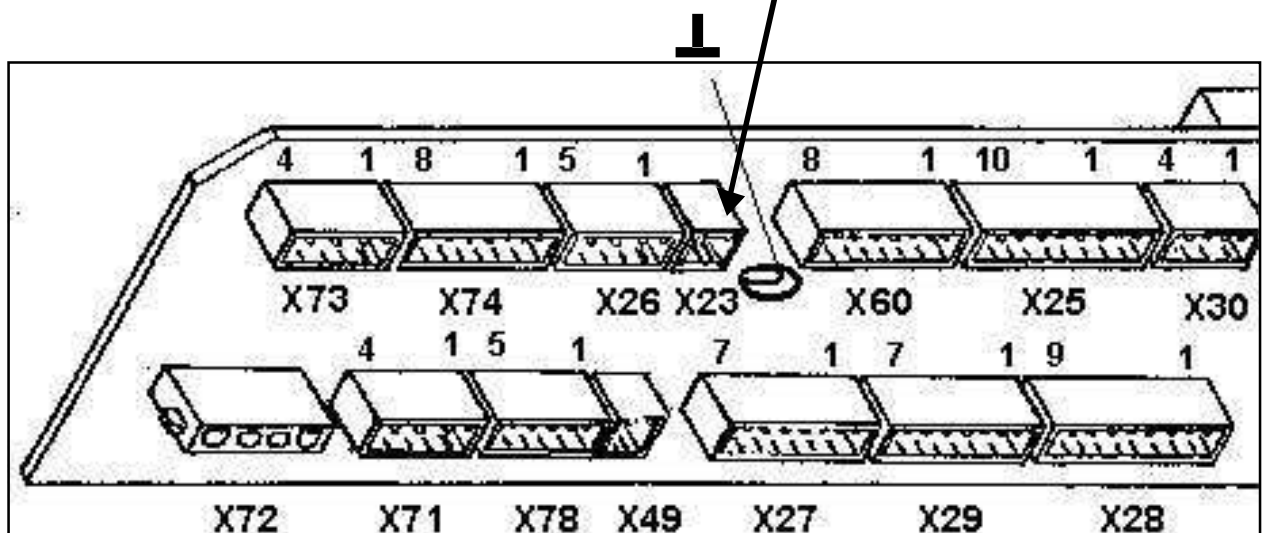
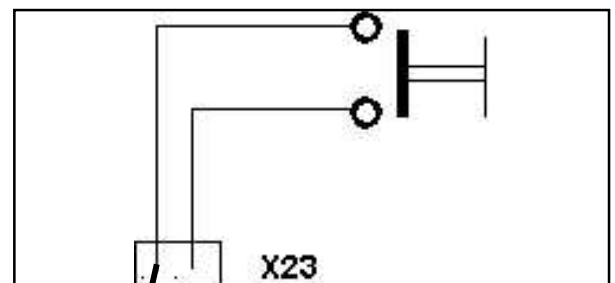
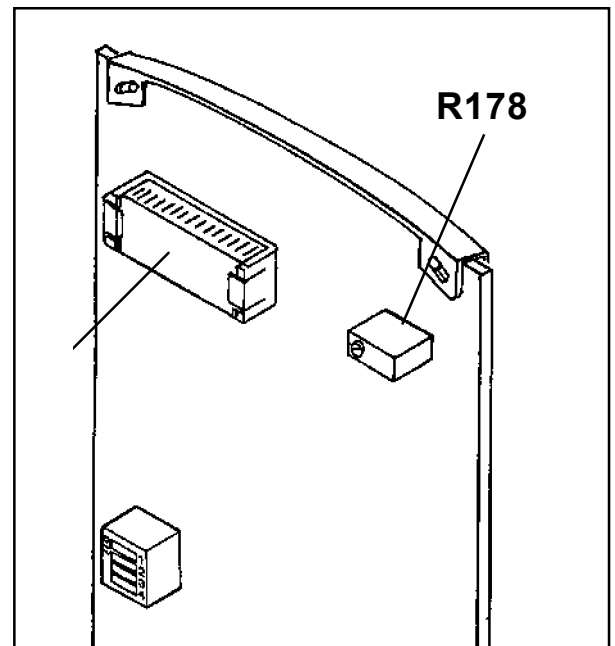
In that case the travel speed must be limited to 6 k.p.h.

A device for switching to reduced speed is provided as optional equipment. An externally arranged switch is connected via connector X23 to the electronic control unit.

The speed reduction becomes operative the instant the switch is closed. Speed setting is by means of potentiometer R178 mounted on p.c.b. 9A4 'engine starting via generator'.

IMPORTANT ! Travel speed reduction entails a loss of tractive effort!

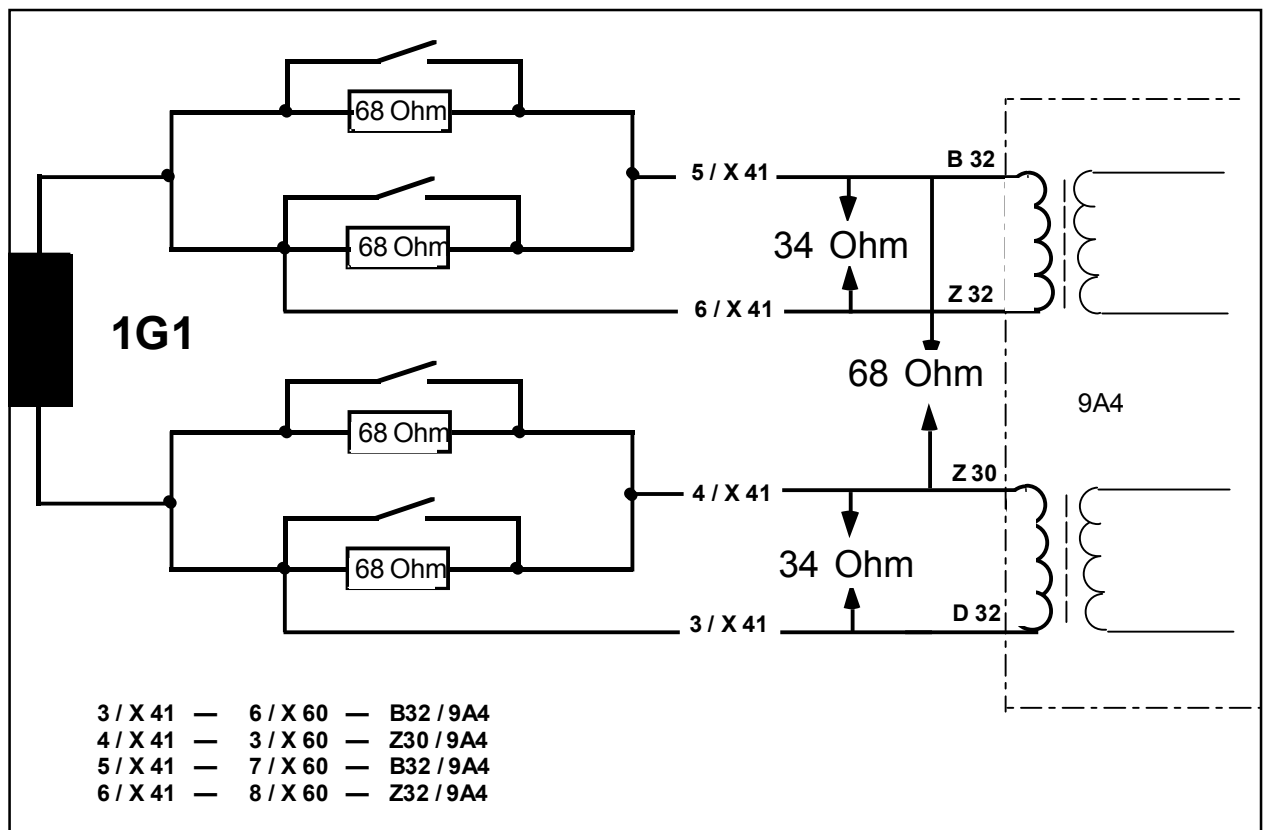
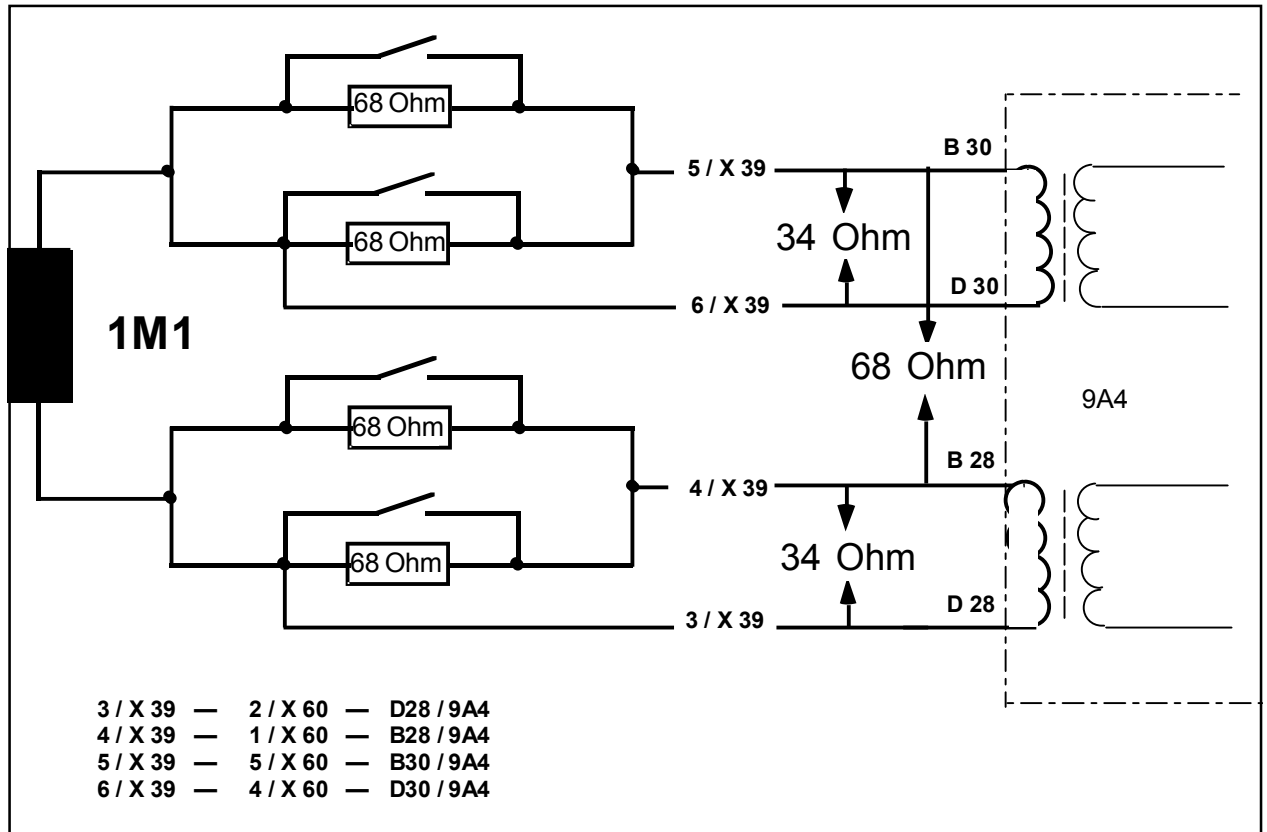
Travel speed reduction without loss of tractive effort:
See p.c.b. 1A1 'traction control circuit'.



Electronic controller

P.c.b. 9A4 'Engine starting via generator'

Brush monitoring unit



Electronic controller

P.c.b. 3A2 'servomotor' (diesel model)

The function of p.c. board 3A2 is to regulate the engine revs.

Main features of the p.c. board

- Electronic fine tuning of rpm range via potentiometer. Setting must be performed in the following sequence:

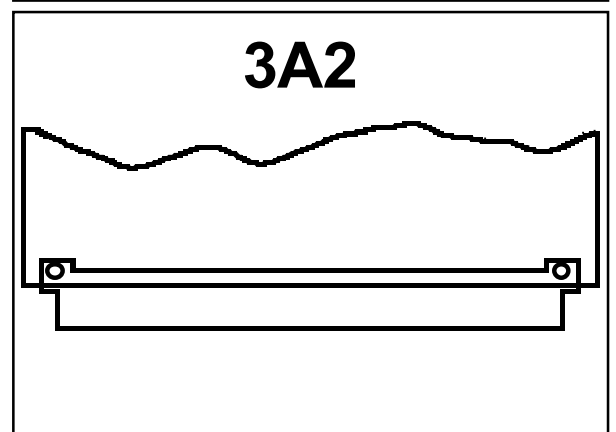
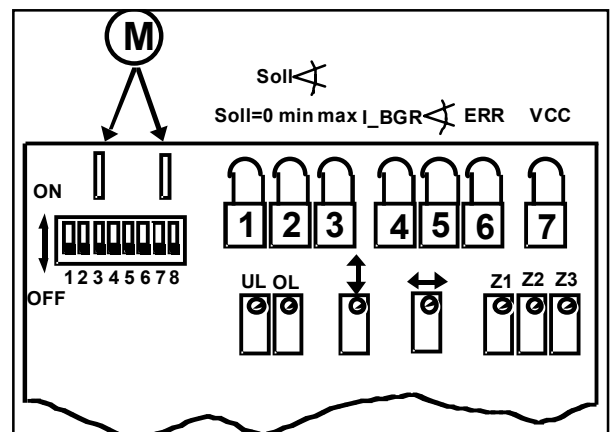
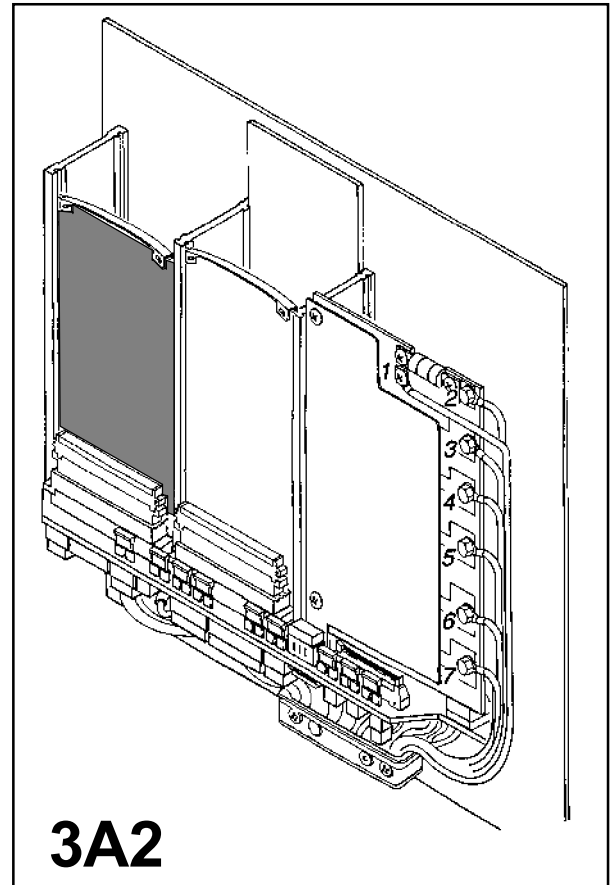
"lower idling speed" before
"upper idling speed".

Adjustment aids:

- Set-point adjustment should be 0 LED 1
- Adjustment of current limitation of servomotor 3M3 LED 4
- Adjustment in the event that the effective value of the angle is exceeded LED 5
- Pre-setting upper idling speed via DIP switch S8 on p.c.b. 3A2

Should not be used if truck is fitted with 'limitation of RPM' module **n = 2450 rpm !**

- Defined electronic limitation of end stroke. The mechanical stops of the servomotor will never be reached, not even if incorrect adjustments are made.
- Current-regulated power actuator for servomotor control.
- Maximum current: $I_{GR} = 3A$
- Continuous current: $I_D = 1.5A$
- Short-circuit current: $I_K = 7A$
- Outputs are insulated permanently against short circuits (against +/- supply voltage and in the case of short circuits at terminals; power board protection and display for short circuit).
- Time-evaluated for excess current monitoring to protect the servomotor against overloads. (Steady reduction of servomotor current from $I_{GR} = 3$ amps to $I_D = 1.5$ amps. Regulated current limiting to I_D).
- Monitoring the supply voltage for over- and undervoltage protection. Display of 'no fault' condition.
- Monitoring heat sink temperature to protect the transistors of the power board in case the servomotor should continually draw an excessive amount of current, for instance due to mechanical parts not moving freely. In the event of an overload power will be automatically cut off, causing LED 4 to light up. After the heat sink has cooled down, operation will be resumed.



Electronic controller

P.c.b. 3A2 'servomotor' (diesel model)**Engine speed = should be 670 rpm minimum:**

The servomotor cannot be operated unless engine revs amount to at least 670 rpm (the servomotor can be rendered inoperative by means of DIP switch 7).

Input signals supplied to p.c.b. 3A2:

The highest reading applies in each case:

Driving: P.c.b. 1A1 'traction control circuit' generates a signal proportional to accelerator pedal position, viz.:

+0.2 volts to -7 volts, 'n' equalling 2800 rpm

+0.2 volts to -6.5 volts, 'n' equalling 2450 rpm

The signal is supplied to p.c.b. 3A2 'servomotor'.

Hydraulics: To establish the required values when operating hydraulic components the signal emitted by potentiometer 2R2 (angle of rotation sensor) controlling the lift function, and the signal emitted by the control valve microswitches 2S2, 2S3 and 2S4 are evaluated by p.c.b. 3A2.

Armature current: From an armature current of 150 amps the lower idling speed is increased to abt. 1800 rpm.

TESTING: Place directional control in either forward or reverse then apply the footbrake powerfully, at the same time depressing accelerator progressively.

Integrated fault diagnosis:

All required values as well as the angle of rotation of servomotor 3M3 can be checked using a multimeter. Selection of the corresponding value is effected via DIP switches. P.c.b. 3A2 contains the test points for connecting a multimeter (**M**).

Visual indication of functions:

Supply voltage O.K LED 7

Set point value=0 LED 1

The lower limit of the effective angle range is reached LED 2

The upper limit of the effective angle range is reached LED 3

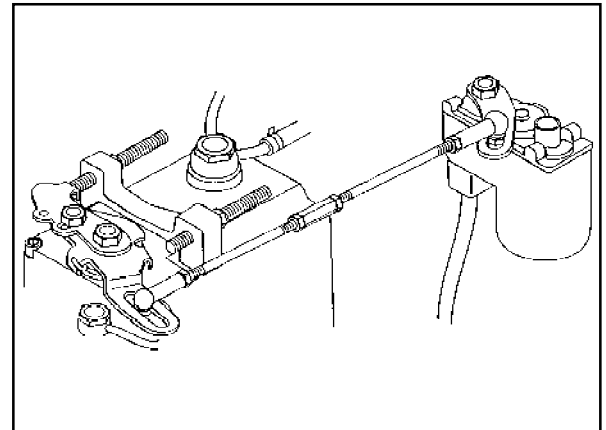
The current limitation circuit is operative LED 4

System faults are memorized and indicated visually:

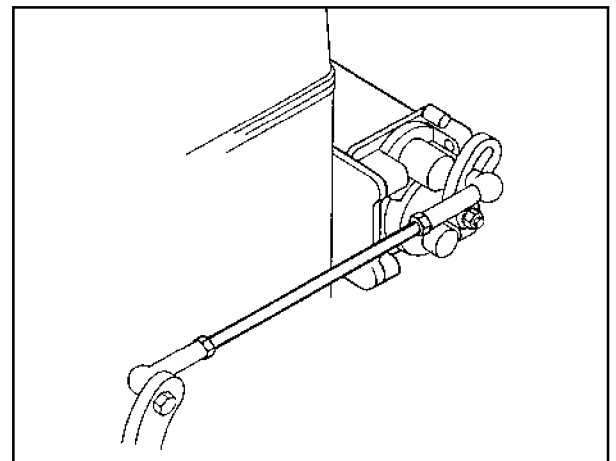
(as a result the power board is cut out. The safety circuit can be reset by operating keyswitch S1 (OFF/ON).

The device on p.c.b. 3A2 protecting the power board against short circuits is operative LED 6

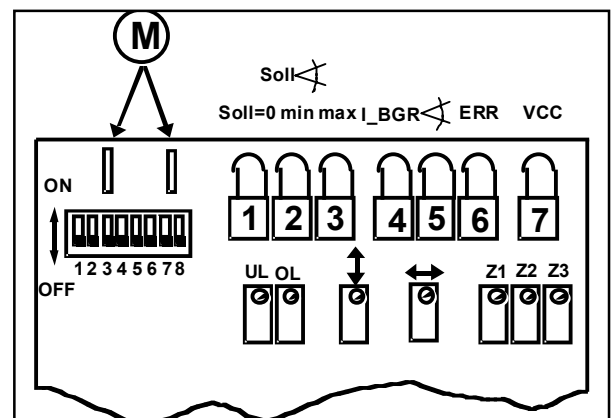
The effective range of the angle of rotation is exceeded, or the signal emitted by the sender unit controlling the position of the servomotor lever is faulty LED 5



Stellmotor — VW



Stellmotor — MB



Electronic controller

P.c.b. 3A2 'servomotor' (diesel model)

Adjustment instructions

Procedure:

1. It is assumed that the linkage between servomotor and injection pump has been adjusted as instructed.
2. The engine must be started and warmed up to normal operating temperature before making adjustments.
3. Light-emitting diodes LED 1* (set-point value = 0) and LED 7 (VCC) must light, otherwise carry out fault diagnosis.
4. If LEDs 2-6 remain illuminated, this indicates that the p.c. board has not been adjusted. They should go out once the adjustment has correctly been carried out. If the lights fail to go out, carry out fault diagnosis.

Low idle speed adjustment „UL“

Adjust potentiometer---UL---to obtain an engine idle speed (low idle) of

$$\begin{aligned} n &= 1150 + 50 \text{ rev/min (VW engine)} \\ n &= 970 + 30 \text{ rev/min (MB engine)} \\ n &= 900 \pm 25 \text{ rev/min (Deutz engine)} \end{aligned}$$

High idle speed adjustment

Where the truck is fitted with a VW or MB engine, there exist two different high idle speeds:

A) Reduced high idle „OL“

Fully depress accelerator pedal, at the same time adjusting pot. „OL“ to obtain an engine idle speed (VW/MB) of $n = 2450 + 30 - 20 \text{ rev/min}$.

B) Increased high idle „OL“

Depress accelerator fully, or move DIP switch 8 to the 'ON' position (max. pre-setting of set-point value)!!

Engine rpm will increase instantly to reach the pre-set high idle.

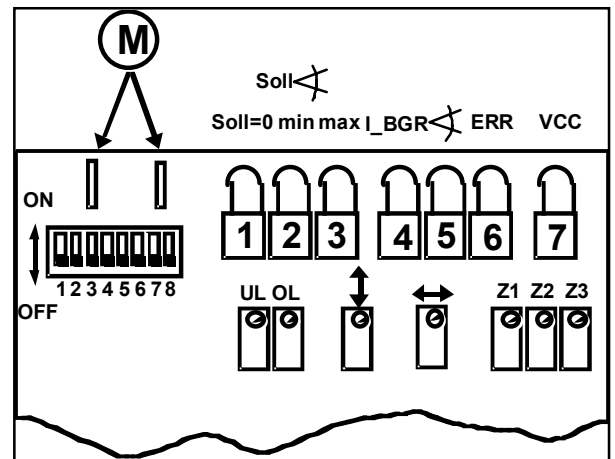
Set engine speed (VW/MB) to $n = 2800 \pm 40 \text{ rev/min}$,

set engine speed (Deutz) to

$n = 2200 \pm 50 \text{ rev/min}$, move DIP switch to 'OFF'.

Checking low idle

Release accelerator pedal, after abt. 3 secs check low idle.



P.c.b. 3A2 'servomotor'

Adjustment of engine speeds for hydraulic functions

(assuming that angle of rotation sensor 2R2 is correctly adjusted)

Design A:

Control valve assembly fitted with valve microswitches and potentiometer

Operate hoist lever fully*

Adjust potentiometer $\updownarrow$ so engine speed reaches
 $n = 2600 \pm 50 \text{ rev/min (VW, MB)}$
 $n = 2000 \pm 50 \text{ rev/min (KH D)}$

Move tilt control lever against bypass pressure, adjust potentiometer $\leftrightarrow$ so engine speed reaches
 $n = 1600 \pm 50 \text{ rev/min (VW, MB)}$
 $n = 1200 \pm 50 \text{ rev/min (Deutz)}$

3rd & 4th hydraulic functions - Attachments Fully operate a lever of the hyd. control valve, adjust pot. Z1, Z2, Z3 to requirements (VW, MB), to $n = 1200 \pm 50 \text{ rev/min (Deutz)}$

Design B:

Control valve assembly fitted with potentiometer on lever shaft

Operate hoist control lever fully*, adjust potentiometer $\updownarrow$ so engine speed reaches $n = 2600 \pm 50 \text{ rev/min}$

In enclosed areas: Watch for sufficient headroom!

To avoid any hoisting motion, the lever controlling the sliding contact of the potentiometer can be moved to its stop by hand.

Electronic controller

P.c.b. 3A2 'servomotor'

Curing defects/fault conditions:

If LED 7 (VCC) is off: Check supply voltage of p.c.b. 3A2.

If LED 1 (required value=0) is off: Check adjustment of both foot controller u25 (accelerator transmitter) and angle of rotation sensor 2R2.

If potentiometer „UL“ is turned to its RH stop: Turn potentiometer „UL“ to mid position, lengthen the linkage by means of which the servomotor and the injection pump control lever are joined together. Readjust.

If potentiometer „OL“ is turned to the LH stop: Turn potentiometer „OL“ to mid position, shorten the linkage by means of which the servomotor and the injection pump control lever are joined together. Readjust.

If LED 2 (min) is on: Turn potentiometer „UL“ to mid position, shorten the linkage between servomotor and injection pump control lever. Readjust.

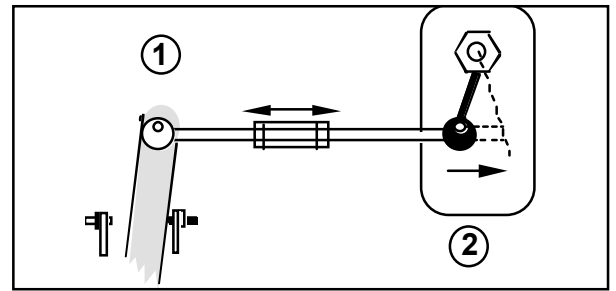
If LED 3 (max) is on: Turn potentiometer to mid position, lengthen the linkage between servomotor and injection pump control lever. Readjust.

If LED 4 0-BGR) is on: Check operating lever (linkage) of servomotor for free movement, and injection pump control lever for correct position. Readjust linkage 'servomotor-injection pump control lever'.

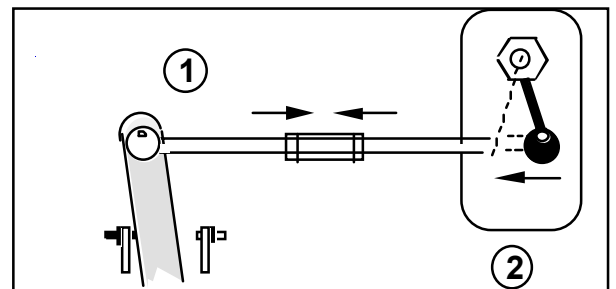
If LED 5 (<) is on: This is an indication that the permissible operating range of servomotor lever is exceeded:
Either servomotor failure or a fault in truck wiring or a defect in the mechanical device. The fault indication can be reset by operating keyswitch S1 (OFF-ON).

If LED 6 (ERR) is on: The device protecting the power board against shorts has been tripped due to the presence of a fault:

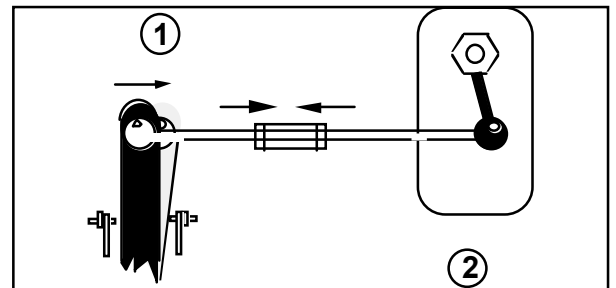
Either servomotor failure or a fault in truck wiring or p.c.b. 3A2 'servomotor' is defective. The fault indication can be reset by operating keyswitch S1 (OFF-ON).



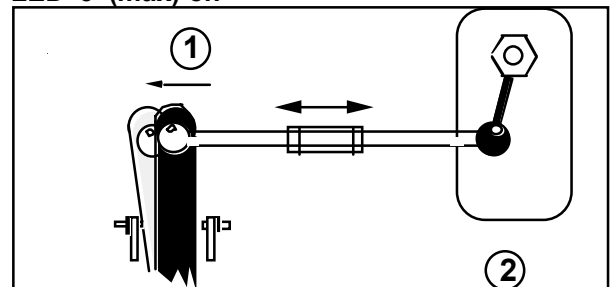
LED 4 (I_BGR) on



LED 2 (min) on

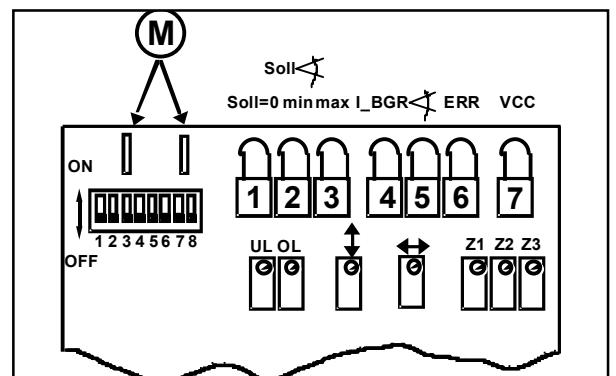


LED 3 (max) on



1 Injection pump control lever

2 Servomotor lever



Electronic controller

P.c.b. 3A2 'servomotor' (diesel model)**Adjustment instructions:****W engine in = 2800 rpm****General description:**

Potentiometers must be adjusted as follows:
counterclockwise to reduce rpm clockwise to increase rpm

Range of adjustment of potentiometers: 10 turns

Engine speed adjustment is performed via potentiometers (provided the linkage is correctly adjusted).

Function of the potentiometers:

- „UL“ → lower idle rpm adjustment
- „OL“ → upper idle rpm adjustment
- ↕ → rpm - lift function
- ↔ Z3 → rpm - tilt function
- Z1, Z2 → 3rd & 4th hydraulic functions

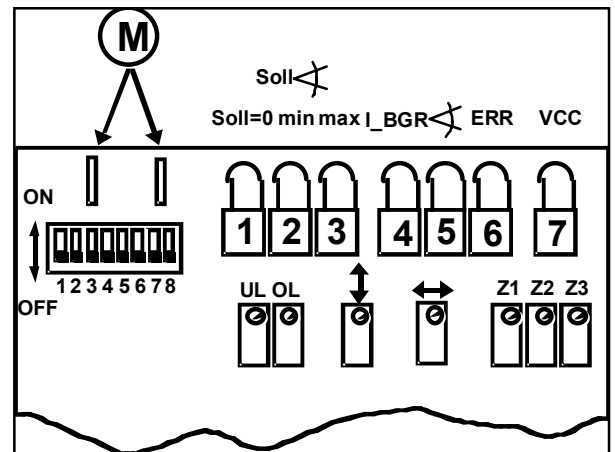
The adjustment of the mechanical adjusting device is assisted by LEDs.

Indication of LEDs:

- 1 (set-point=0) off: Presence of a set-point rpm value (accelerator pedal, hyd. control valve lever(s) or current sensor are actuated or incorrectly adjusted).
- 2 („min“) on: The maximum permissible operating range of servomotor lever is reached.
- 3 („max“) on: The maximum permissible operating range of servomotor lever is reached.
- 4 (I_{BGR}) on: The servomotor operates within the range of current limitation (free movement of adjusting device is impaired).
- 5 (<) on: The limit of maximum operating range of servomotor lever is exceeded.
- 6 (ERR) on: The circuit providing protection against shorts has been triggered.
- 7 (VCC) off: Absence of supply voltage for or on logic unit card.

The presence of a fault is indicated by lightemitting diodes 4 (I_{BGR}) and 6 (ERR). Once the fault has been corrected, the indication can be reset by breaking and remaking the circuit, i.e. keyswitch S1 turned 'OFF' then 'ON'.

Always turn keyswitch 'OFF' before performing work on the mechanical adjusting device (e.g. linkage adjustment).

**Function of the DIP switches:**

- 1 - :Do not operate
(function is vacant/unoccupied).
- 2 ON :set-point value-driving
This switch applies the pilot signal generated on p.c.b. 1A1 'traction control circuit' (which signal varies from **+0.1 to - 7 volts**), depending on the position of the accelerator pedal) to the test point connections **M** on p.c.b. 3A2 'servomotor'.
- 3 ON :set-point value-hoisting
(should be between **0.35 and 5 volts**)
This switch applies the output voltage of the angle of rotation sensor 2R2 for the hoist function to test point connections **M**.
- 4 ON :Armature current
(approx. **5.1 volts +/- 0.4 volts/100 A**)
This switch applies the signal corresponding to the armature circuit to test point connections **M**.
- 5 - :Do not operate (not suited as test point)
- 6 ON :Actual value of position of servomotor lever (**0.5 volts to 4.5 volts**)
This switch applies the signal corresponding to the position of the servomotor operating lever to test point connections **M**.
- 7 On :Shunting the „min rpm condition“
The „min rpm condition“ will be cut out the instant this switch is operated. The servomotor will follow the accelerator pedal movement (or a different value) even with engine stopped.
- 8 ON :Max. pre-setting of set-point value
Provided for the adjustment of the upper idling speed, this switch is used for presetting the maximum set-point value.

Electronic controller

P.c.b. 3A2 'servomotor' (diesel model)**Adjustment instructions:****W engine in = 2450 rpm****General description:**

Potentiometers must be adjusted as follows:
counterclockwise to reduce rpm clockwise to increase rpm

Range of adjustment of potentiometers: 10 turns

Engine speed adjustment is performed via potentiometers (provided the linkage is correctly adjusted).

Function of the potentiometers:

- „UL“ → lower idle rpm adjustment
- „OL“ → upper idle rpm adjustment
- ↕ → rpm - lift function
- ↔ Z3 → rpm - tilt function
- Z1, Z2 → 3rd & 4th hydraulic functions

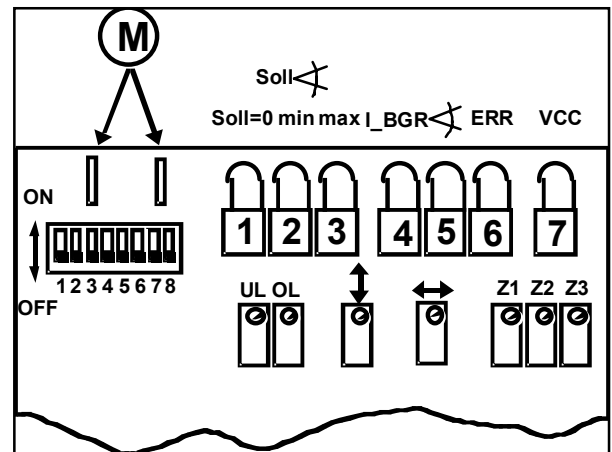
The adjustment of the mechanical adjusting device is assisted by LEDs.

Indication of LEDs:

- 1 (set-point=0) off: Presence of a set-point rpm value (accelerator pedal, hyd. control valve lever(s) or current sensor are actuated or incorrectly adjusted).
- 2 („min“) on: The maximum permissible operating range of servomotor lever is reached.
- 3 („max“) on: The maximum permissible operating range of servomotor lever is reached.
- 4 (I_{BGR}) on: The servomotor operates within the range of current limitation (free movement of adjusting device is impaired).
- 5 (<) on: The limit of maximum operating range of servomotor lever is exceeded.
- 6 (ERR) on: The circuit providing protection against shorts has been triggered.
- 7 (VCC) off: Absence of supply voltage for or on logic unit card.

The presence of a fault is indicated by lightemitting diodes 4 (I_{BGR}) and 6 (ERR). Once the fault has been corrected, the indication can be reset by breaking and remaking the circuit, i.e. keyswitch S1 turned 'OFF' then 'ON'.

Always turn keyswitch 'OFF' before performing work on the mechanical adjusting device (e.g. linkage adjustment).

**Function of the DIP switches:**

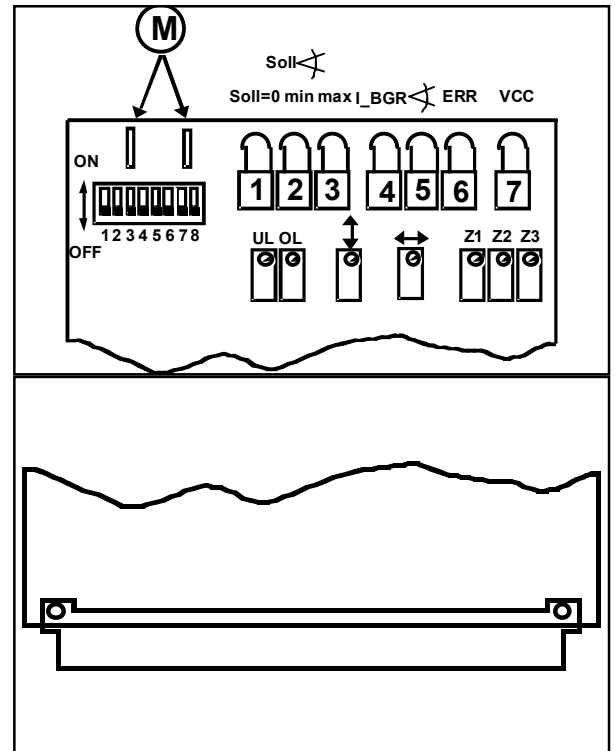
- 1 - :Do not operate (function is vacant/unoccupied).
- 2 ON :set-point value-driving
This switch applies the pilot signal generated on p.c.b. 1A1 'traction control circuit' (which signal varies from **+0.2 to - 5.7 volts**), depending on the position of the accelerator pedal) to the test point connections **M** on p.c.b. 3A2 'servomotor'.
- 3 ON :set-point value-hoisting (should be between **0.3 and 4.8 volts**)
This switch applies the output voltage of the angle of rotation sensor 2R2 for the hoist function to test point connections **M**.
- 4 ON :Armature current (approx. **5.1 volts +/- 0.4 volts/100 A**)
This switch applies the signal corresponding to the armature circuit to test point connections **M**.
- 5 - :Do not operate (not suited as test point)
- 6 ON :Actual value of position of servomotor lever (**0.5 volts to 4.5 volts**)
This switch applies the signal corresponding to the position of the servomotor operating lever to test point connections **M**.
- 7 On :Shunting the „min rpm condition“
The „min rpm condition“ will be cut out the instant this switch is operated. The servomotor will follow the accelerator pedal movement (or a different value) even with engine stopped.
- 8 ON :Max. pre-setting of set-point value
Provided for the adjustment of the upper idling speed, this switch is used for presetting the maximum set-point value.

Electronic controller

P.c.b. 3A2 'servomotor'

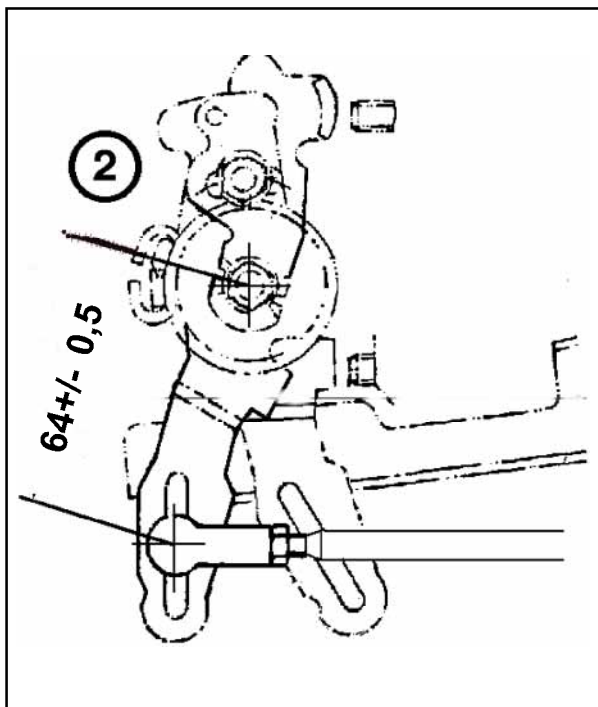
Basic linkage adjustment (VW engine):

1. Fit the ball head to stop (servomotor axis end) of slotted hole.
2. Set spacing (injection pump control lever end) between centre of injection pump axis and centre ball head to 64 ± 0.5 mm.
3. Turn the keyswitch S1 'ON'
4. Move DIP switch 6 (required value of position) to the 'ON' position.
5. Connect multimeter to test terminals M.
6. Disconnect then reconnect connector at servomotor. (This will simulate a fault in the electronic circuit which fault is memorized -LED 5 goes on - and power board of p.c.b. 3A2 is cut out. The servomotor can thus be adjusted by hand).

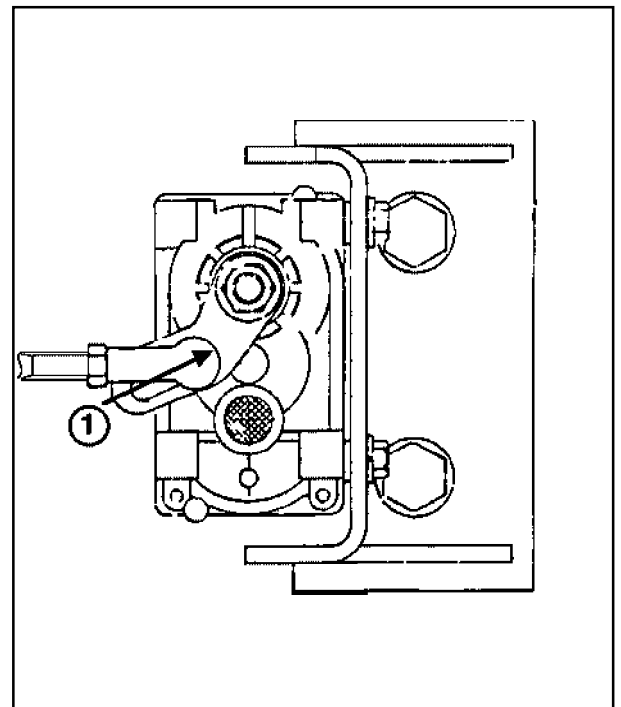


Continued →

Performed at the factory, the basic adjustment of the stop screws to
800 revl/rn in idle speed
3100 rev/min full throttle
should under no circumstances be altered!



Injection pump control lever



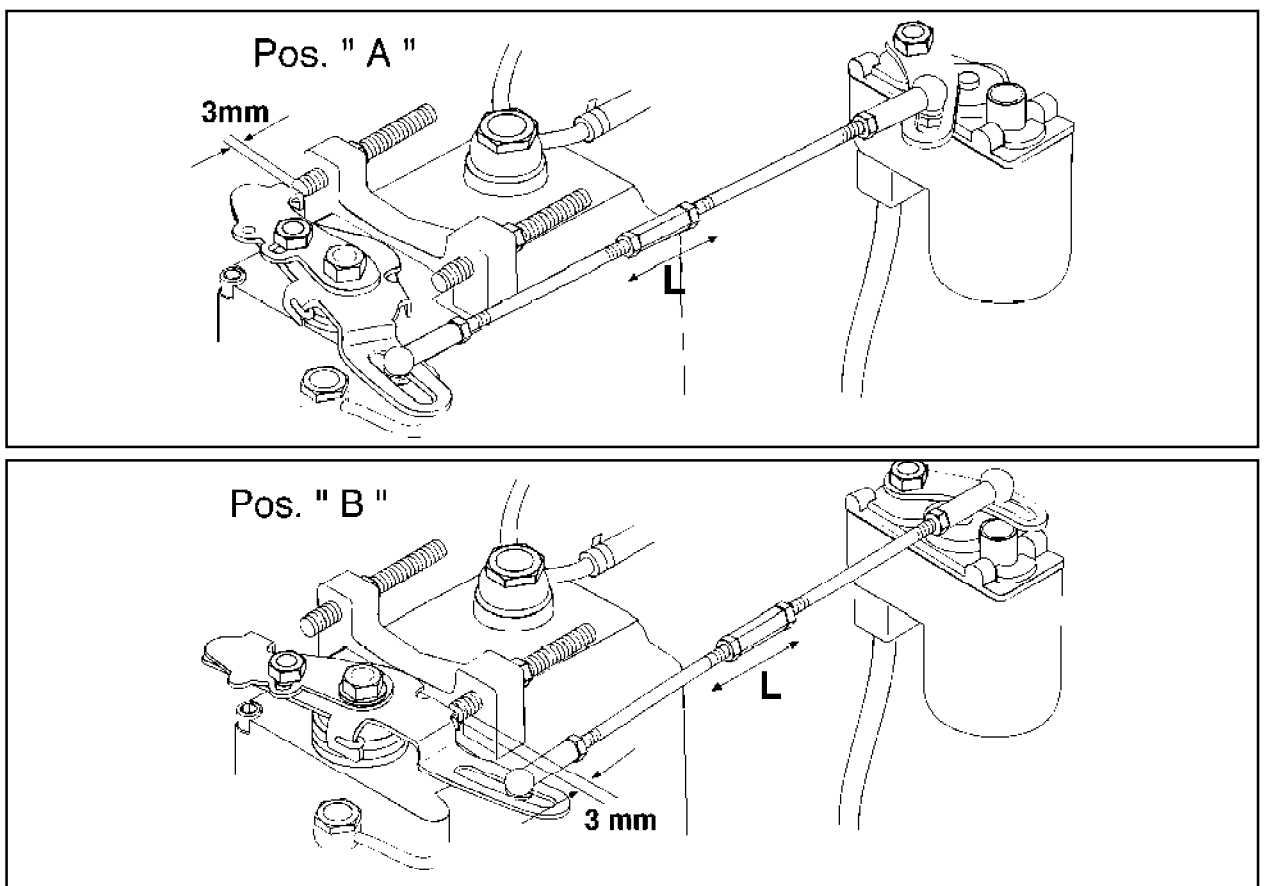
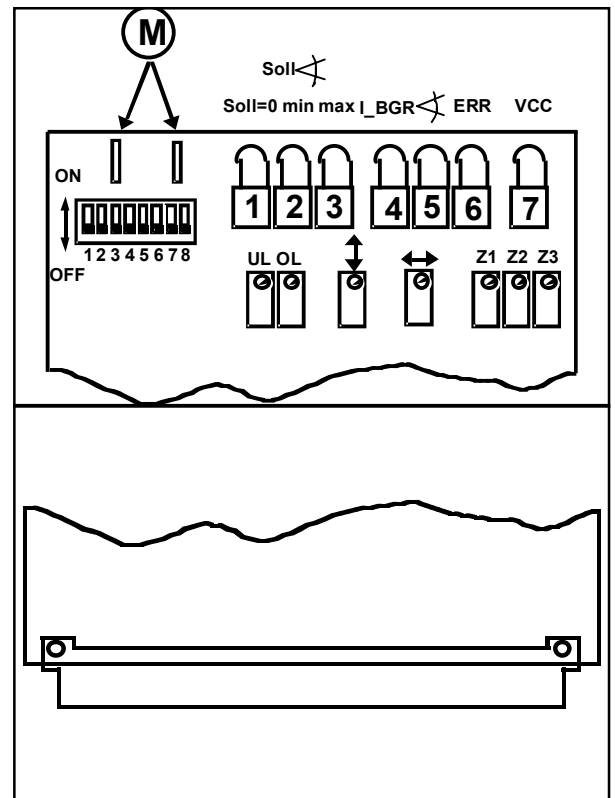
Servomotor 3A2

Electronic controller

P.c.b. 3A2 'servomotor'**Basic linkage adjustment (VW engine)**

(Continuation) (Turn the keyswitch S1 'ON')

7. Bring injection pump control lever into „A“ position (the clearance between control lever and stop should be 3 mm). The lever remaining in this position, adjust actuating rod until the actual value of position amounts to something between 0.9 and 1.0 volts.
8. Bring injection pump control lever into „B „ position (ensure there is a clearance of 3 mm between control lever and stop). The actual value of position should now be 3.3 - 3.9 volts.
 - If reading is lower than 3.3 volts, slightly reduce L length and readjust in accordance with instructions given from paragraph 7.
 - If reading is higher than 3.9 volts, increase 'L' length slightly and readjust from paragraph 7.
9. Move DIP switch 6 (actual value of position) to 'OFF' position.
10. Turn the keyswitch **OFF** and disconnect the multimeter.
11. Carry out adjustment of engine speeds as per instructions.

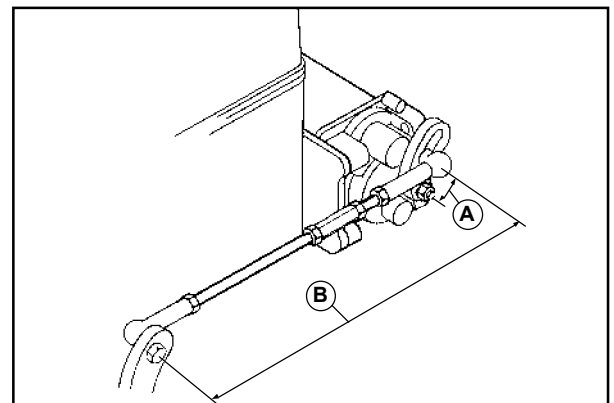
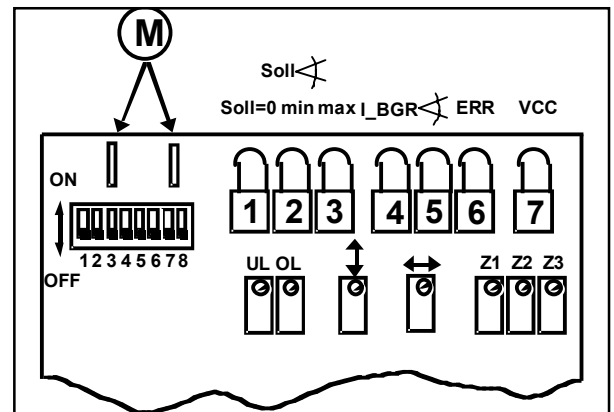


Electronic controller

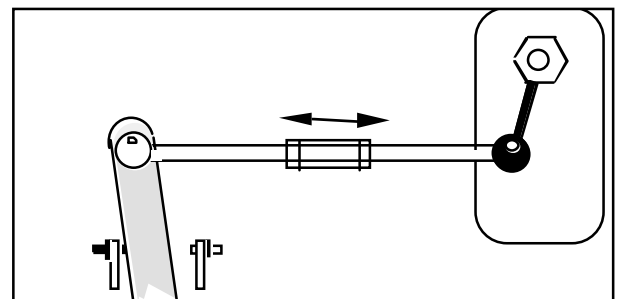
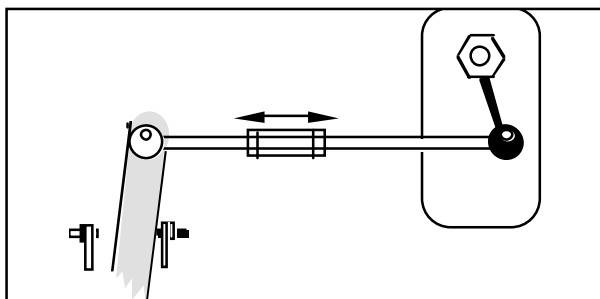
P.c.b. 3A2 'servomotor'

Basic linkage adjustment (MB engine):

1. Set spacing „A” between centre of servomotor axis and centre ball head to
 $A = 34 \pm 0.5 \text{ mm}$.
2. Turn keyswitch S1 **ON**.
3. Move DIP switch 6 (actual value of position) to **ON** position.
4. Connect multimeter to test terminals **M**.
5. Disconnect then reconnect connector at servomotor. (This will simulate a fault in the electronic circuit which fault is memorized LED 5 goes on - and power board of p.c.b. 3A2 is cut out. The servomotor can now be adjusted by hand).
6. Move injection pump control lever until it lies against the idle stop of the injection pump (neutral position). Adjust length „B” of linkage so the meter reading obtained (actual value of position) is something between 0.7 and 0.9 volts.
7. Move injection pump control lever until it lies against the full throttle stop on injection pump. The meter reading recorded must equal 4.1 to 4.3 volts (actual value).
 - If reading is lower than 4.1 volts, reduce distance 'A' slightly and readjust in accordance with instructions given in paragraph 6.
 - If reading is higher than 4.3 volts, increase the distance slightly and readjust as described in paragraph 6.
8. Move DIP switch 6 (actual value of position) to **OFF** position.
9. Turn keyswitch S1 **OFF** and disconnect multimeter.
10. Carry out adjustment of engine speeds as per instructions.



Performed at the factory, the basic adjustment of the stop screws to
 800 + 30 rev/min idle speed 3000 + 50 rev/min full throttle
 should under no circumstances be altered!



Electronic controller

Design of controllers on trucks fitted with a DEUTZ engine

Since early November 1995 truck models R70-35 to 45, 7048-50 (with DEUTZ engine) are fitted as standard with a newly designed electronic controller whose function is to automatically regulate the lower rpm. Two controller designs are thus available for the a.m. trucks, viz.:

- A . With digital regulation of the low idle**
- B. Without digital regulation of the low idle**
(equipment of the first 300 trucks)

The two controller designs are distinguished by different identification or parts numbers.

Design A is identified by an additional p.c.b. on p.c.b. 3A2 'servomotor'.

From the technical aspect the controllers are distinguished by these components:

- p.c.b. 3A2 'servomotor'
- p.c.b. 9A4 'engine starting via generator'
- master board (comprising the p.c. boards)

NOTE: On no account should these p.c. boards be interchanged or combined at random.

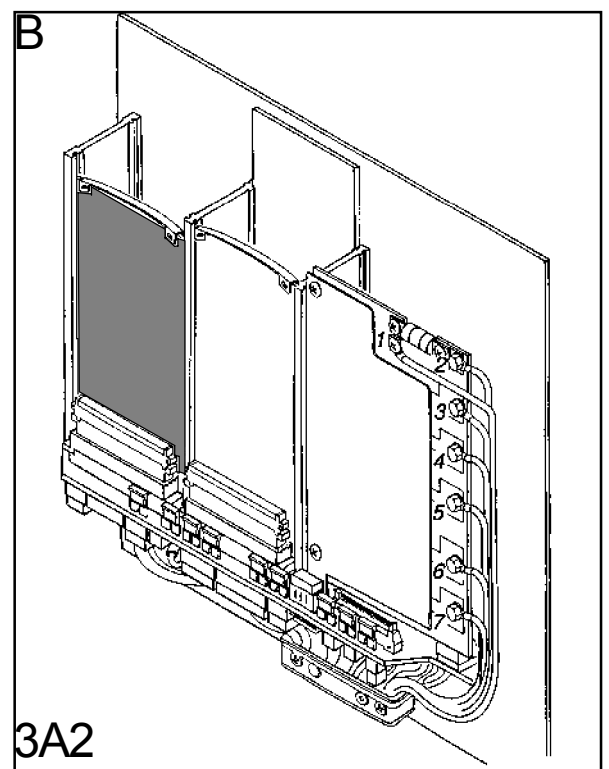
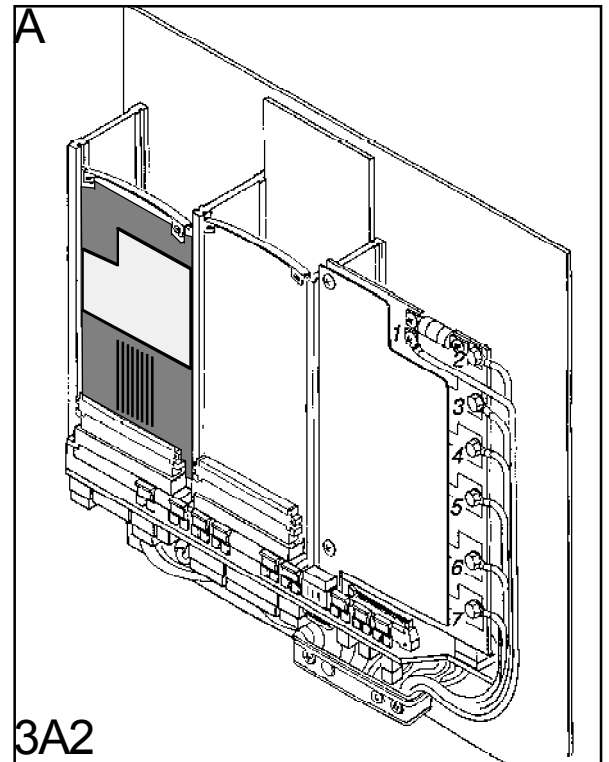
However, by exchanging all three p.c. boards it is possible to change a controller from design **B** to design **A**.

The digital regulation operates in the speed range between 800 and 1200 rev/min. No measuring operation is performed above 1200 rpm because the speeds for the hydraulic functions are within that range and should not be affected by the regulating system.

IMPORTANT On controller design B Dip switch 7 on p.c.b. 3A2 has been moved to the 'ON' position in order to enable the full throttle position during starting.

On controller design A Dip switch 7 has been moved to 'OFF', enabling the digital regulation to work.

Changing the low rpm through adjusting potentiometer UL will by no means produce a permanent change. Any change will always be reset automatically to the programmed speed.

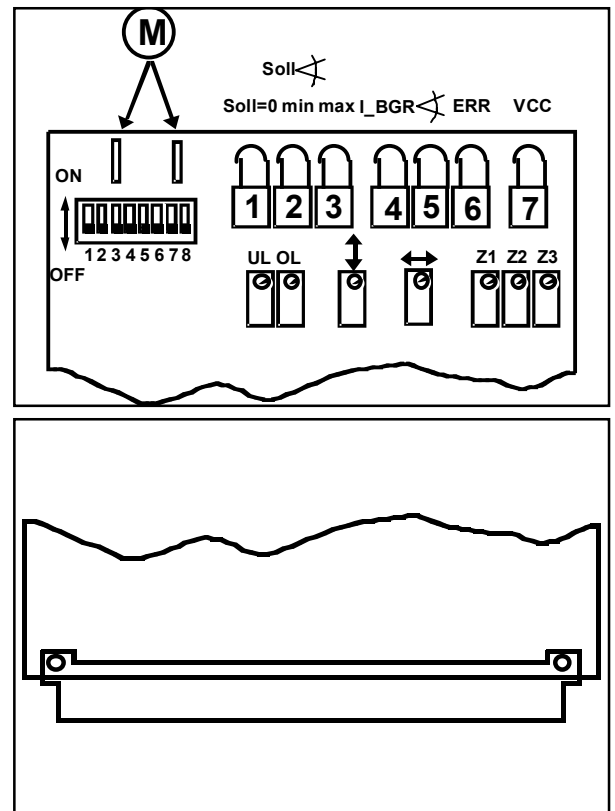


Electronic controller

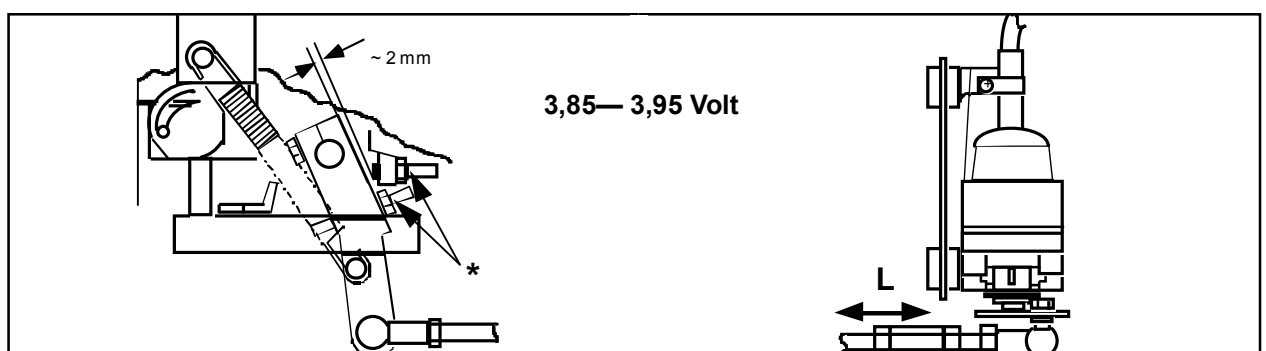
P.c.b. 3A2 'servomotor' digital regulation of low idle speed „UL“**Linkage adjustment (DEUTZ engine):**

1. Fit the ball head to stop (servomotor lever axis end) of slotted hole.
2. Turn keyswitch S1 'ON'; do not start the engine at this stage.
3. Connect multimeter to test terminals **M**.
4. Move dip switch 6 (actual value of position) to **ON**.
5. Disconnect then reconnect connector at servomotor. (This will simulate a fault in the electronic circuit which fault is memorized - LED 5 comes on - and power board of p.c.b. 3A2 is cut out. The servomotor can now be adjusted by hand).
6. Adjusting the upper or high idle :
Bring lever of control rod into 'full throttle' position (ensure there is a clearance of ~2mm between lever and stop). The actual value of position should now be
approx. 3.9 ± 0.05 volts.
-If the meter reads below 3.85 volts, reduce „L“ length slightly.
-Should the meter read above 3.95 volts, increase „L“ length slightly.

Continued --->



**Performed at the factory, the basic adjustment of the stop screws * to
750 rev/min idle speed 2300 rev/min full throttle
should under no circumstances be altered !**



Electronic controller

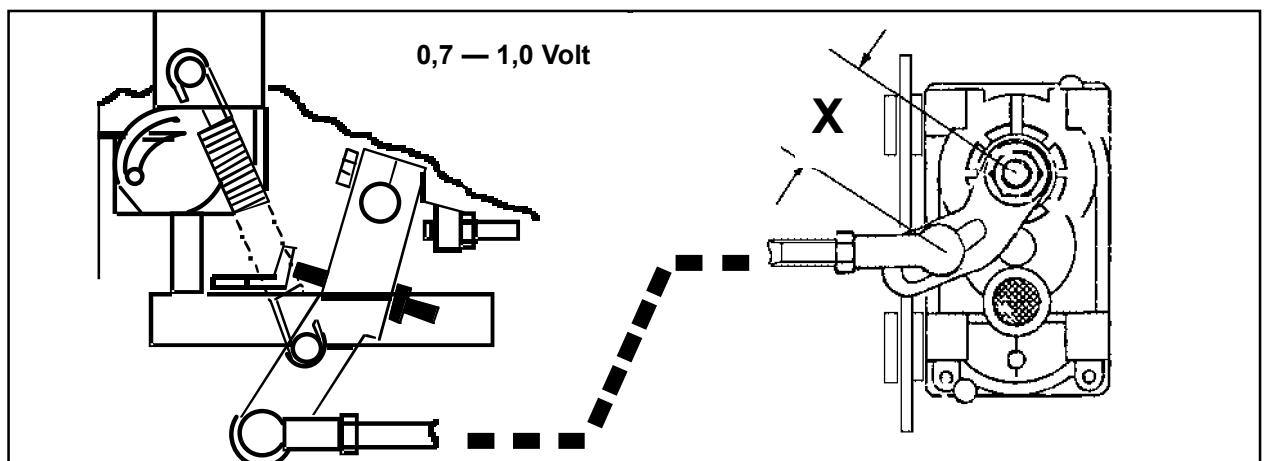
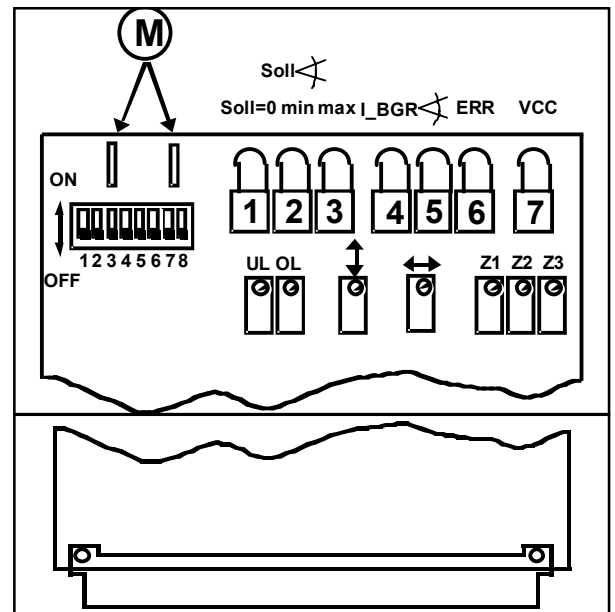
**P.c.b. 3A2 'servomotor',
digital regulation of low idle speed „UL“**

Linkage adjustment (DEUTZ engine):

(Continuation - Keyswitch S1 'ON')

7. Bring lever of control rod into 'idle position' (lower stop) and modify dimension 'X' provided for the ball head in slotted hole of servomotor lever until the actual value of position amounts to something between 0.77 and 0.83 volts.
8. Move DIP switch 6 (actual value of position) to **OFF**.
Disconnect multimeter.
9. Turn keyswitch S1 OFF.

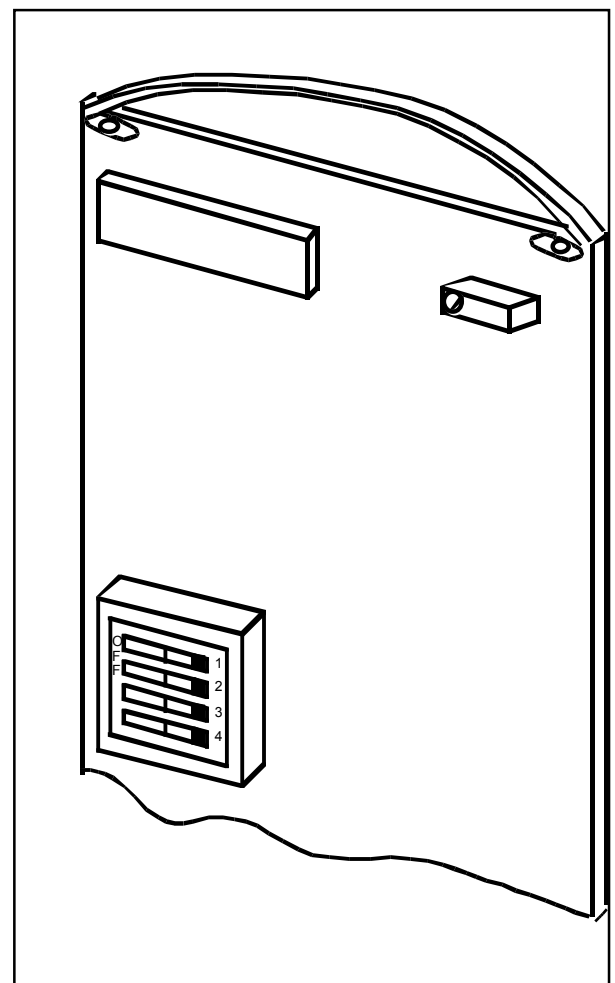
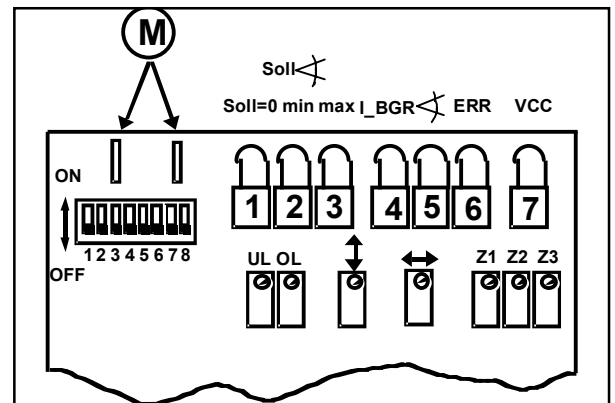
Carry out adjustment of engine speeds as per instructions on next page ---->



Electronic controller

Instructions for adjusting the digital regulation of low idle 'UL' on DEUTZ engine

1. P.c.b. 3A2 'servomotor' :
Move DIP switch 7 to 'ON'
2. P.c.b. 9A4 'engine starting via generator' :
Move DIP switch 2 to 'ON' Move DIP switch 3 to 'ON'
3. Turn keyswitch S1 'ON', LEDs 7 (VCC) und 1 (set-point=0) on 3A2 are illuminated; the remaining light-emitting diodes do not light
4. Start the engine
5. Adjust **UL** potentiometer to obtain an engine idle speed (low idle) of 800 ± 25 rpm,
- p.c.b. 3A2 'servomotor' :
Move DIP switch 7 to 'OFF' and
- p.c.b. 9A4 'engine starting via generator' :
Move DIP switch 2 to 'OFF'
(speed regulating governor switched on)
6. Run the engine for approx. 3 minutes on idle.
The idle speed will due to the digital regulation increase during that time to reach 900 ± 25 rpm
7. Depress accelerator fully (full throttle), or move DIP switch 8 to 'ON', then set the high idle to 2200 ± 50 rpm by operating on potentiometer 'OL'
8. Release accelerator pedal or move DIP switch 8 to 'OFF'
9. Check engine speeds for hyd. functions, readjust if necessary
10. Allow the engine to idle for approx. 1 minute, p.c.b. 9A4 'engine starting via generator':
Move DIP switch 3 to 'OFF' (the regulation value is stored in the memory)
11. Shut the engine off
12. Turn keyswitch S1 'ON', but do not start the engine,
p.c.b. 3A2 'servomotor':
LED 7 (VCC) is illuminated, the remaining LEDs do not light
13. Start the engine,
check the engine idle speed:
set-point 900 ± 25 rpm

END of adjustment

Electronic controller

Digital regulation of low idle 'UL' on DEUTZ engine**Resetting basic engine speed.**

(If a modification of the set-point value should become necessary, proceed in accordance with the following instructions).

The set-point value for low idle which is achieved by the digital regulation on the DEUTZ engine has been preset by the software to 900 rpm. In the event of a requirement, e.g. special truck application, set-point values differing from the specifications and ranging from 850 to 1000 rpm can be preset.

Prior to starting the engine:

- Securely chock the truck into position
- Set the parking brake
- Connect a tachometer to the engine
- Connect multimeter to test terminals **M** on p.c.b. 3A2 'servomotor' (actual value of position)

Engine rpm setting:

1. Turn keyswitch S1 'ON'
Start the engine and allow it to warm up
2. P.c.b. 3A2 'servomotor':
Move DIP switch 6 to 'ON'
P.c.b. 9A4 'engine starting via generator':
Move DIP switch 3 to 'ON'
3. If rpm must be increased, place the directional control lever into 'forward'; into neutral if rpm must be reduced
4. P.c.b. 9A4 'engine starting via generator':
Move DIP switch 1 to 'ON'

Once the desired idle speed has been adjusted (the voltage of the actual value of position is stabilized), the engine speed can be modified in steps of 10 revs.

Increasing rpm:

- 5.1 Move directional control lever from forward into neutral, wait around 3 secs before moving directional control lever into forward again; repeat the procedure as many times as are necessary to increase engine rpm in steps of 10 revs.

- 5.2 Wait until the new engine rpm setting is definite. (The voltage of the actual value of position does no longer rise).

Reducing engine speed:

- 5.3 Move directional control lever from neutral to reverse, wait around 3 secs before moving directional control lever to neutral again; repeat the procedure as many times as are necessary to decrease engine speed in steps of 10 revs

- 5.4 Wait until the new engine rpm setting is definite.

(The voltage of the actual value of position does no longer decrease))

The step-by-step modification of engine rpm can be repeated until the limits are reached. Once the limits are reached (850 or 1000 rev/min), operation of the directional control lever will no longer affect engine speed.

After the desired engine speed is reached, the new set-point value must be stored in the memory.

Storing engine rpm in the memory:

6. Allow engine to run on idle for yet another one minute, then move DIP switch 1 on p.c.b. 9A4 'engine starting via generator' to 'OFF' (the new set-point value is transmitted).
move DIP switch 3 to 'OFF' (the new set-point value is stored in the memory)

Checking engine rpm:

7. Stop the engine
8. Move directional control lever to neutral
9. Turn keyswitch S1 'ON'
10. Start the engine again
11. Check new low idle 'UL'
(the voltage of the actual value of position will no longer rise)
12. Turn the engine off
13. P.c.b. 3A2 'servomotor':
Move DIP switch 6 to OFF,
Disconnect multimeter

If the adjustment has been carried out incorrectly or has been interrupted, the procedure can be stopped by turning keyswitch S1 'OFF'.

Before repeating the procedure, DIP switches 3 and 6 on p.c.b. 3A2 'servomotor' and DIP switch 1 on p.c.b. 9A4 'engine starting via generator' must always be moved to 'OFF'.

The adjustment procedure can then be re-started beginning with **point 1**.

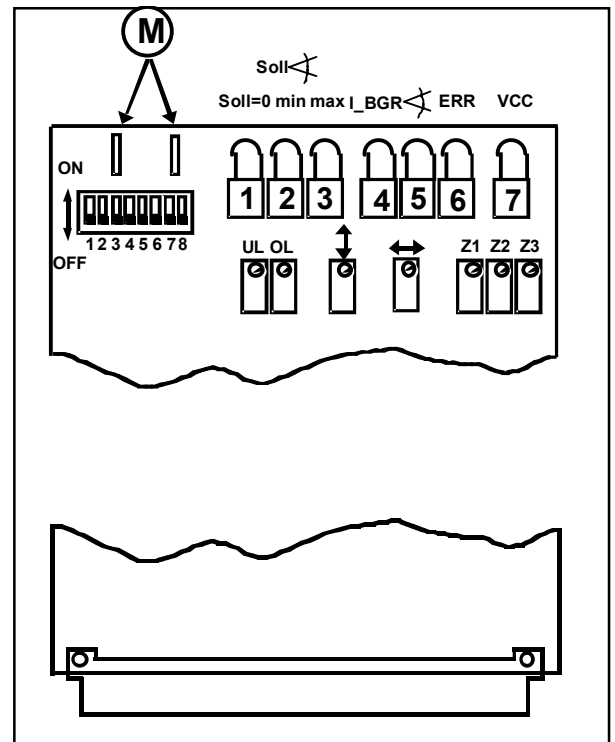
Electronic controller

P.c.b. 3A2 'servomotor' without digital regulation of idle speed

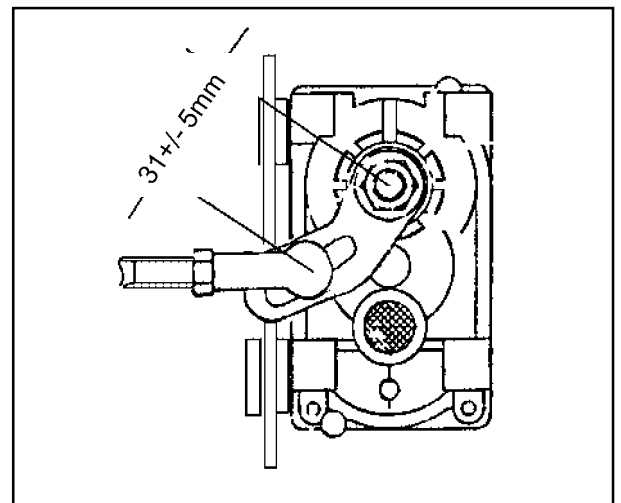
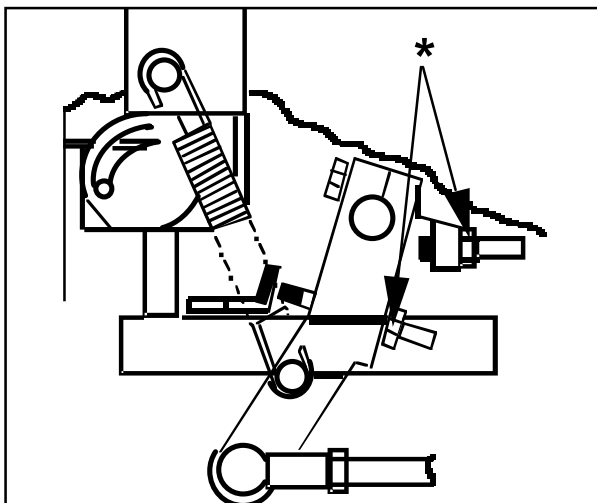
Linkage adjustment on KHD engine:

1. Fit the ball head to servomotor lever, ensuring there is a spacing of 31 ± 0.5 mm between centre of servomotor axis and centre ball head.
2. Turn keyswitch S1 'ON'.
3. Move DIP switch 6 (actual value of position) to **ON**.
4. Connect multimeter to test terminals **M**
5. Disconnect then reconnect connector at servomotor. (This will simulate a fault in the electronic circuit which fault is memorized - LED 5 goes on - and power board of p.c.b.3A2 is cut out. The servomotor can now be adjusted by hand).
6. Bring lever of control rod into 'idle' position and ensure there is a clearance of ~ 1 mm between lever and stop. The lever remaining in this position, adjust actuating rod until the actual value of position amounts to something between 0.7 and 1.0 volts.

Continued --->



Performed at the factory, the basic adjustment of the stop screws * to 750 rev/min idle speed 2300 rev/min full throttle should under no circumstances be altered !



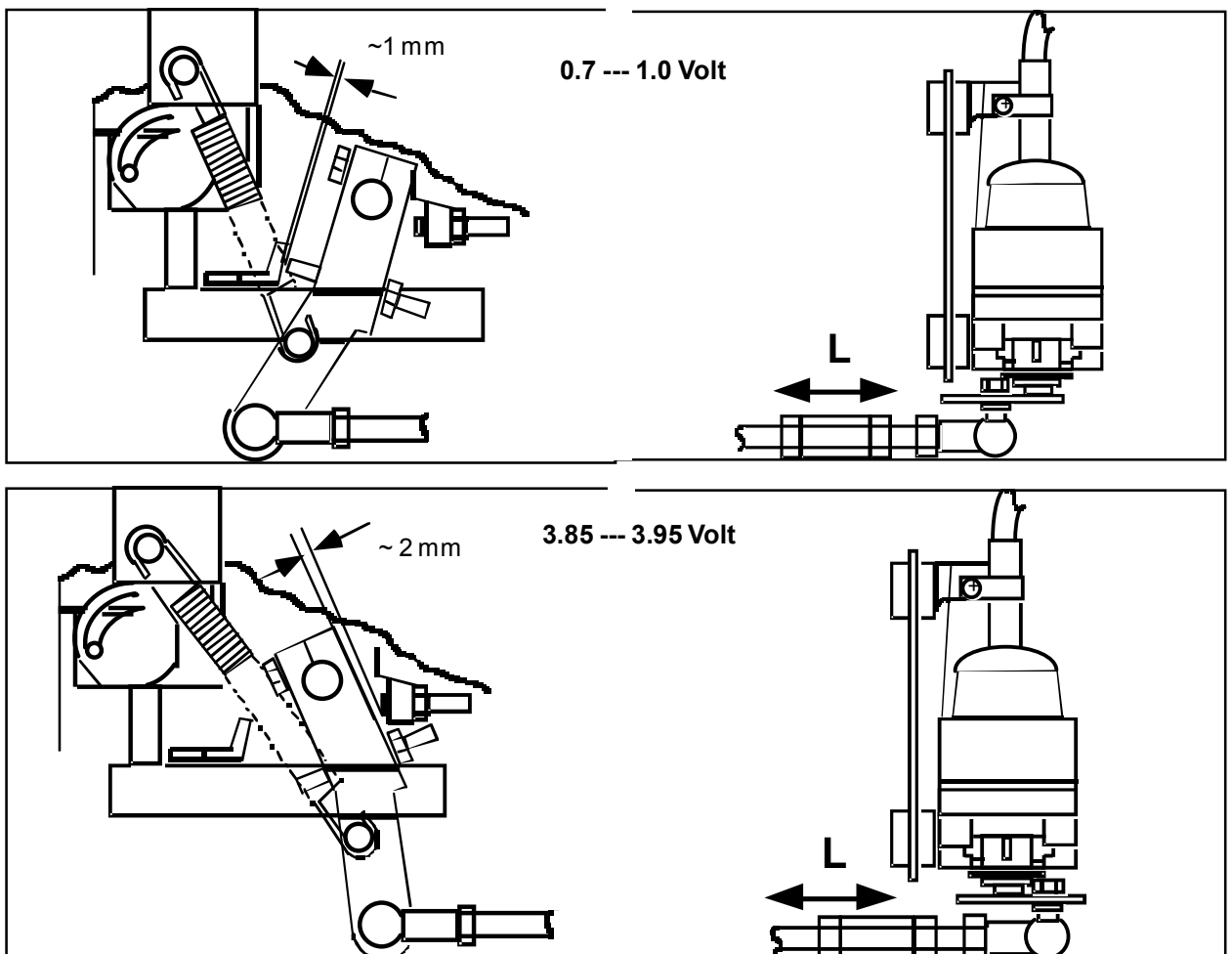
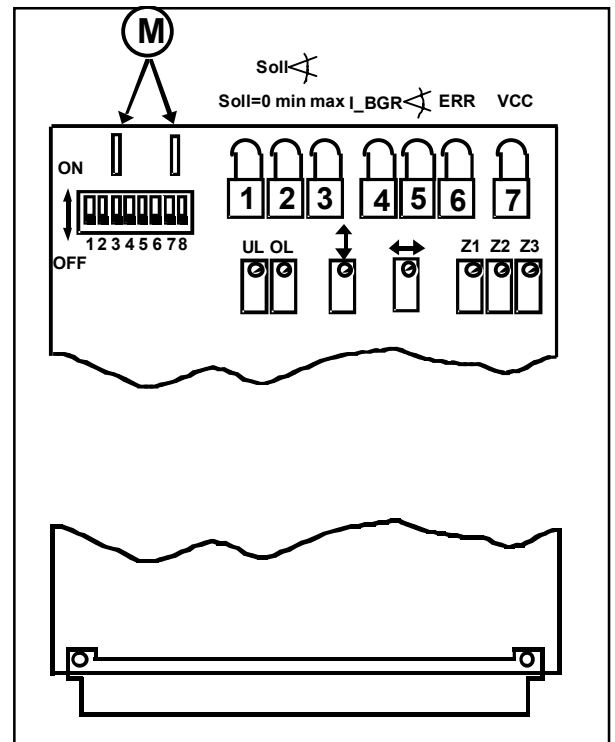
Electronic controller

Actuating motor PCB 3A2 without digital idling control

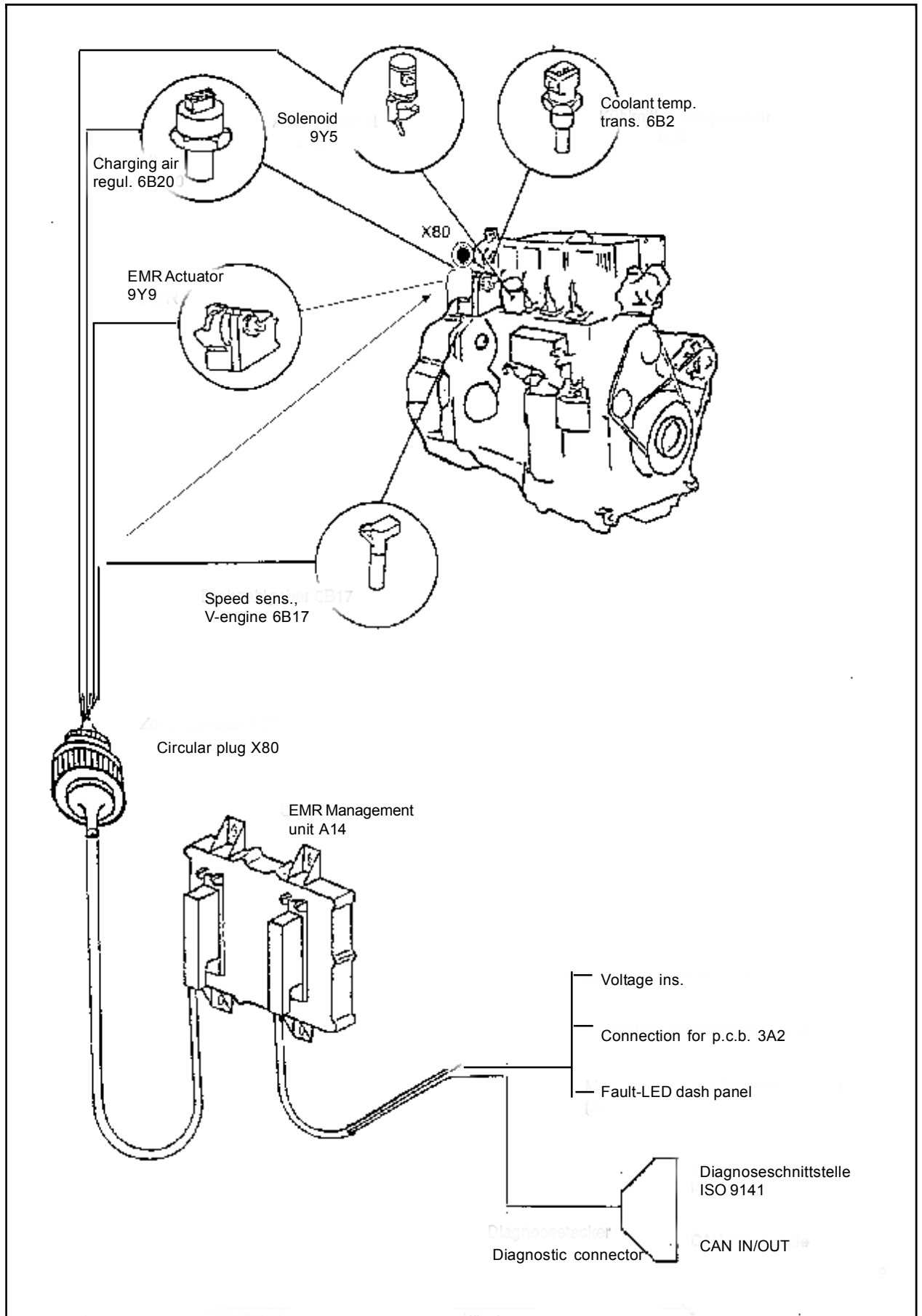
Linkage adjustment, DEUTZ engine:

(Continuation - key switch S1 in position ON)

7. Move the lever of the regulator bar to the „full throttle“ position (check the distance of 2 mm from the end top). The actual position signal must now be approximately 3.9 volts.
-If the actual position signal is less than 3.85 Volts, shorten the length „L“ slightly and then repeat the adjustment.
-If the actual position signal is greater than 3.9 volts, slightly increase the length „L“ and repeat the adjustment.
8. Switch **6** (actual position signal) should be set to **OFF**.
9. Key switch S1 in position OFF, disconnect multi-meter
10. Set engine speeds in accordance with setting instructions
 - lower idling speed **UL** = 900 ± 25 rpm
 - upper idling speed **OL** = 2200 ± 50 rpm.



Electronic Engine Managment Unit EMR



Electronic Engine Management Unit EMR

Electronic Engine Management Unit (EMR)

Vehicles R 7048 , R7049 and R7050 are equipped with an electronic regulator for the DEUTZ internal combustion engine as standard. The mechanical part for the **EMR** is attached to the V engine in the same manner as before. No actuating motor is required.

Instead, a valve (pressure transducer) in the regulator operates the regulator bar.

A large circular plug X80 with bayonet closure connects the following components with the EMR Engine Management Unit A14.

6B2	—	Coolant temp. trans.—	8 , 9/X80
6B17	—	Speed sens., V eng —	12 , 13/X80
6B20	—	Charging air regul. —	23-25/X80
9Y5	—	Solenoid —	2 , 3/X80
9Y9	—	Actuator —	14-19/X80

The speed sensor 6B17 is connected directly to the V engine in the area of the pump take-off.

Not to be confused with the speed sensor 6B9 of the hydraulic pump.

A diagnostic connector X90 for SERDIA (see below) is located below the multi-pin XAD plug of the V engine.

If necessary, the SERDIA interface can be connected to this X90 socket.

EMR management unit A14

The EMR management unit A14 consists of a sealed aluminium die cast housing with two multi-way plugs X141 and X142. The unit is mounted on the front of the forward superstructure, on the left.

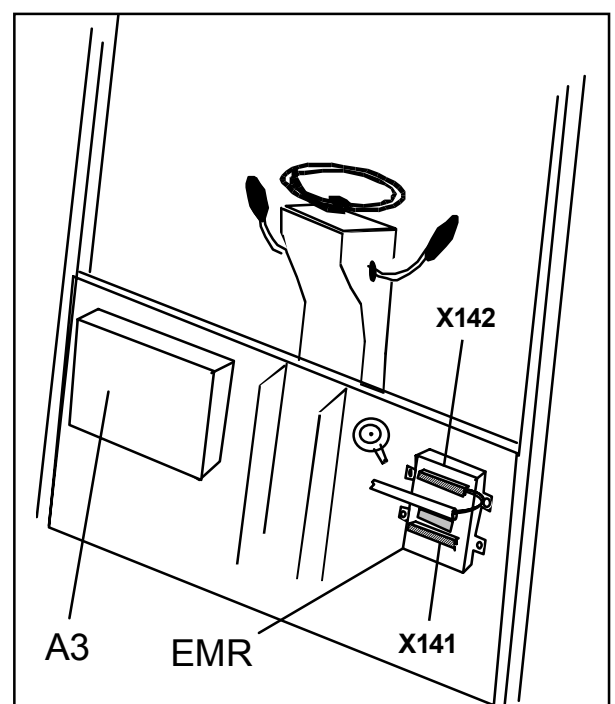
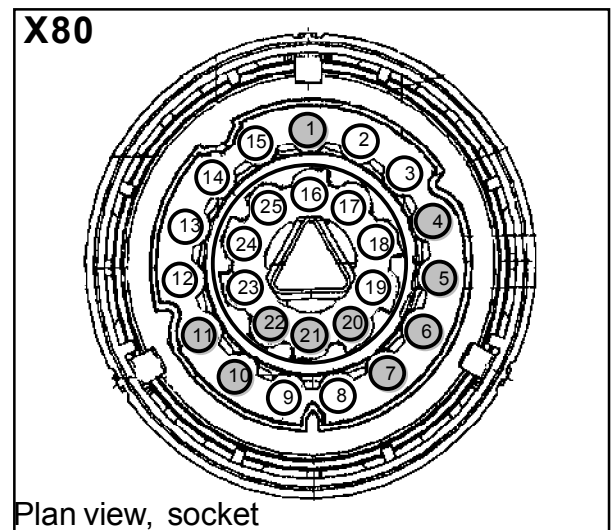
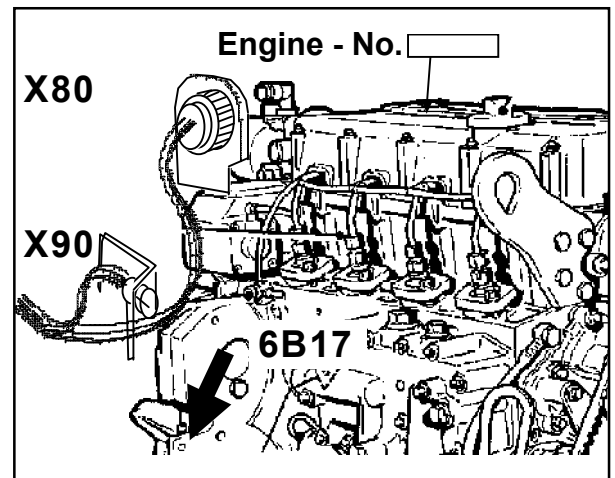
X141—Connection for plug X80

X142—Connection for PCB 3A2 and control lamp 6H20.

IMPORTANT

Do not open the unit - your guarantee will be invalidated!

The unit can only be serviced by replacement through DEUTZ service, stating the engine number. The EMR management unit and the V engine must have the same serial number. The EMR management unit TN 02111846 is replaced with 02111910 if required. If an engine management unit not belonging to this engine is used, this can lead to serious problems and engine damage.



Electronic Engine Management Unit EMR

Electronic Engine Management Unit (EMR)

SERDIA **S**ervice **D**iagnose (SERDIA) is a diagnostic program for the EMR used for DEUTZ engines series 1012 /1013 with the engine management unit TN 02111846. Together with an interface and a PC/Notebook, SERDIA forms a complete special tool. The interface forms the connection between the diagnostic plug and PC/ Notebook.

SERDIA comprises:

- SERDIA software 1.0 (or abover)
(3.5" installation diskette)
- Diagnostic interface with implemented user facilities
- Abbreviated installation instructions
- Case Order Number 158630
(To be obtained from the Central STILL Spare Parts Service Department)

EMR fault indicator lamp 6H20

This is briefly illuminated when the key switch is turned to the ON position (lamp check) and is immediately extinguished again.

Constant illumination or flashing after the V engine has been started signals a defect to the EMR unit and means:

Carry out diagnostics with SERDIA.

Line connections to X142 :

Fault lamp: K/6H20 — 6/X33 — 4/X142 (A14)

Supply voltage 24 V:

10A fuse 1F21 — 4,5/X94 — 14/X142

Set point transmitter PCB 3A2:

1,4,5/X78 — 23,18,24/X142

Set point transmitter PCB 3A2 for the EMR

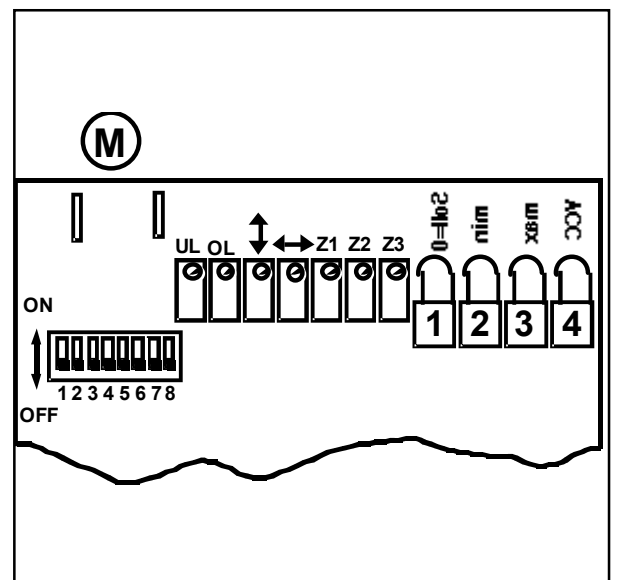
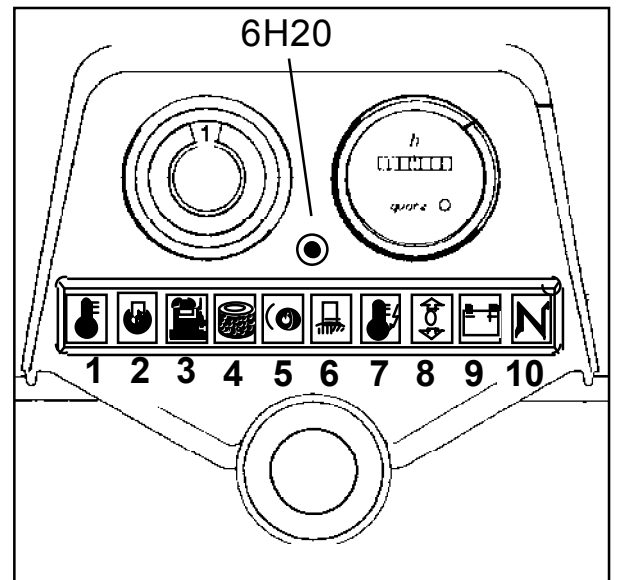
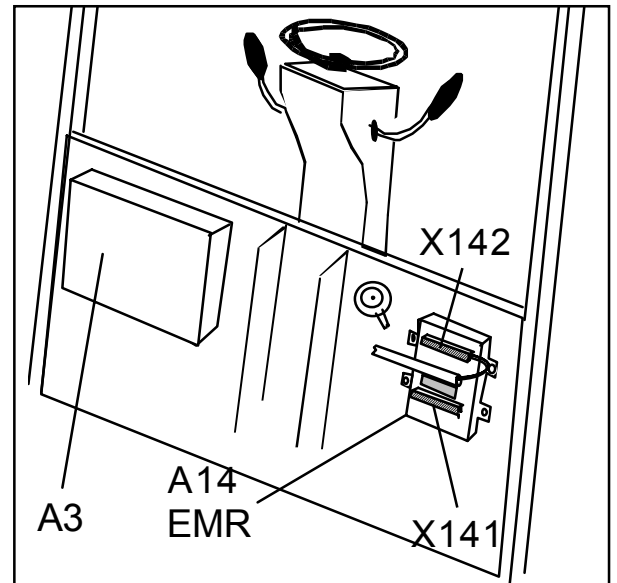
The actuating motor PCB 3A2 has been replaced with a PCB matched to the EMR which functions as a so-called **set point transmitter**.

The other part of the PCB is virtually identical with the arrangement of the known actuating motor PCB.

Service switch:

LED and potentiometer are virtually in the same position.

- Potentiometer for all speed settings
- Four LEDs for set point, speed min./max. and supply voltage.
- Service switches 1-8 for checking signals at measuring point **M**.



Electronic Engine Management Unit EMR

Set point transmitter circuit board 3A2 for EMR**Setting instructions:**

The setting of the combustion engine speeds for driving, lifting, tilting and operation of the supplementary hydraulics are effected on the set point transmitter p.c.b. 3A2

Potentiometer functions

- | | | |
|----------|---|-------------------------------|
| „UL“ | → | Lower idling speed adjustment |
| „OL“ | → | Upper idling speed adjustment |
| ↕ | → | Speed - lift |
| ↕ | → | Speed - tilt |
| Z1,Z2,Z3 | ↔ | → Supplementary hydraulics |

The adjustment of the set point adjustment is aided by means of LEDs.

LED messages:

1(Nom = 0) off: This is for a nominal speed value (drive pedal, hydraulic lever or current sensor operated or incorrectly set).

2 (min) on: The signal has fallen below the limit for the lower idling speed adjustment range **UL** of the V engine.

3 (max) on: The signal has fallen below the limit for the higher idling speed adjustment range **OL** of the V engine.

4(VCC)off: No supply for or on the PCB.

If the set point transmitter on the p.c.b. is replaced, the following steps and checks need to be made in the sequence indicated:

Key switch ON

The control lamp **EMR** on the dashboard briefly lights and is then extinguished again (lamp test).

LED VCC illuminated,

drive pedal not operated

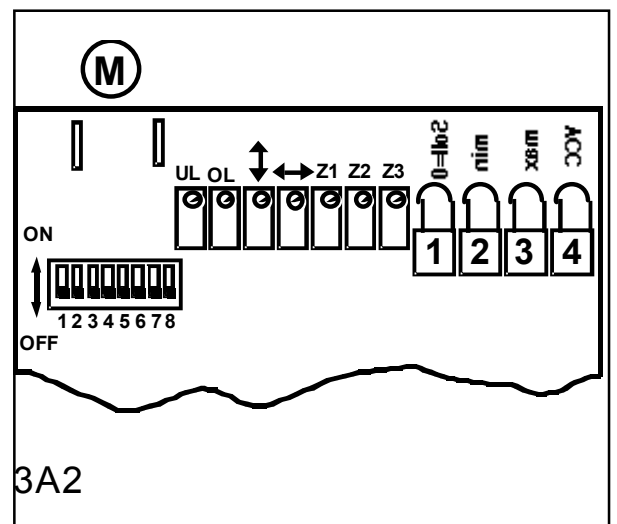
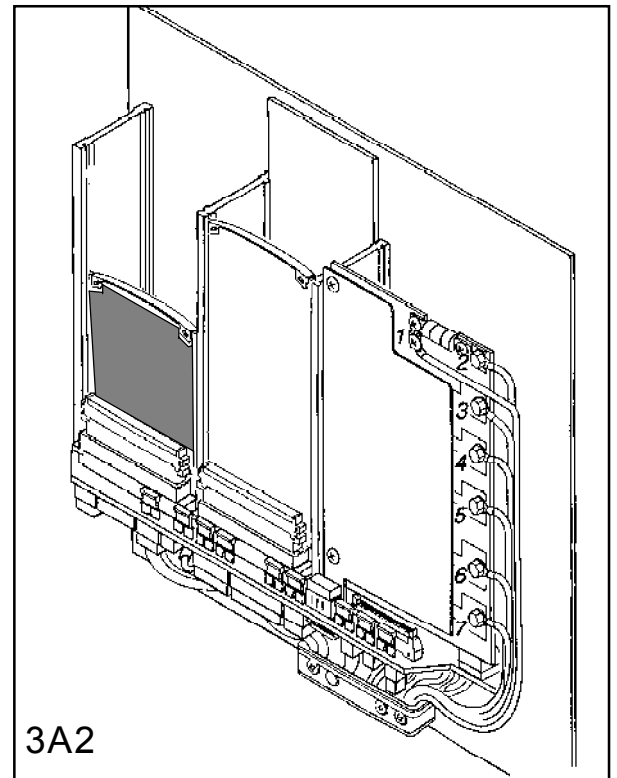
LED NOMINAL=0 illuminated.

Select directional selector to NEUTRAL

Firmly apply parking brake

Start combustion engine and allow to run for a short time until the speed has stabilised.

If the EMR lamp is illuminated or flashes, the EMR is faulty



Electronic Engine Management Unit EMR

Set point transmitter PCB 3A2 for EMR

Setting instructions:

Use **UL** to set the „lower idling speed“

900 ± 25 rpm

LED min must not be illuminated.

If LED min is illuminated, then the idling speed is below the lower limit

Fully press down drive pedal.

Use **OL** to set the „upper idling speed“:

2200 ± 50 rpm

LED max must not be illuminated.

If the LED max is illuminated, then the speed is above the upper idling speed limit

If the idling speed cannot be reduced, then the EMR is in „Emergency Operation“ condition. Disconnect V engine, repeat start, correct settings.

Release drive pedal after setting

Adjust **LIFT** to 2000 ± 50 rpm

Adjust **TILT** to 1250 ± 50 rpm

and where appropriate, adjust

SUPPLEMENTARY HYDRAULICS to 1200 ± 50 rpm

After adjustment, lock potentiometer settings by applying sealing wax.

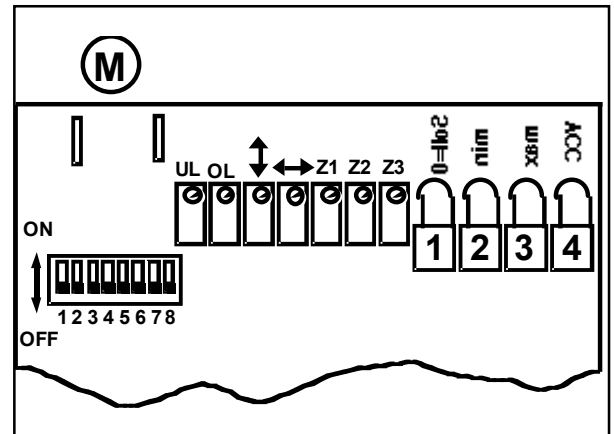
If there is no set point signal from the **Set point transmitter PCB 3A2**, the LED 6H20 is continuously illuminated. The V engine then starts to run at higher idling speeds (emergency operation).

The following faults require a diagnostic run with SERDIA, if the LEDs on the 3A2 PCB do not show a fault, but if LED 6H20 flashes.

V engine fails to start

V engine starts, but fails to run

V engine starts, but fails to respond to the transmitter.



Function of the service switches:

1 ON: Set point valve switch (12 Volts)

The valve switches connect 12 Volts to the measuring connection **M** when operated.

2 ON: Set point drive(+0,2 V to- 5,7 V)

This switch connects the proportional signal generated by the 1A1 drive control PCB which is proportional to the transmitter deflection to measuring point **M**

3 ON: Set point lift (0.3 V to 4,8 V)

This switch connects the output voltage of the rotary angle transducer lift 2R2 to the measuring connection **M**

4 ON: Armature current (approx..5.1V ± 0,4V / 100A) This switch connects the signal produced by the armature current to measuring connection **M**

5 ON: analog set point (approx.0.8- 3.8 Volts) This switch connects the analog speed signal to the EMR management unit to measuring connection **M**

6 ON: digital set point (approx. 2.5-10.5 Volts) This switch connects the digital speed signal to the EMR management unit to the measuring connection **M**

7 —: Do not use

8 ON: Maximum set point

This switch provides the maximum set point (2200 rpm). It is intended for setting the upper idling speed.

Note

OL 2200 rpm should only be checked via the **drive pedal** in the **full throttle** position as a matter of principle.

Electronic Controller

P.c.b. A3 'throttle valve regulator'
(LPG-powered engine)

Engine rpm is regulated by p.c.b. A3.

The speed control system consists of the following circuit:

Required value processing

- Rpm processing
- Electronic speed control unit
- Actuator and current regulator
- Monitoring functions

A **plug-in type module** allows the electronic circuit to be adapted to the various functions.

Voltage supply

P.c.b. A3 is supplied by power section 1A2 with a voltage of 5 volts and 15 volts respectively, generating a reference voltage of 5 volts for feeding voltage to potentiometer 2R2 provided for the hoist function.

Required value production*- Required value, driving*

P.c.b. 1A1 'traction control circuit' generates a signal proportional to accelerator pedal position. This control signal is transformed by the electronic speed control unit into a required value. The adaptation of the signal to the relevant function processed on the p.c. board is effected via resistors arranged on the module.

- Armature- dependent required value

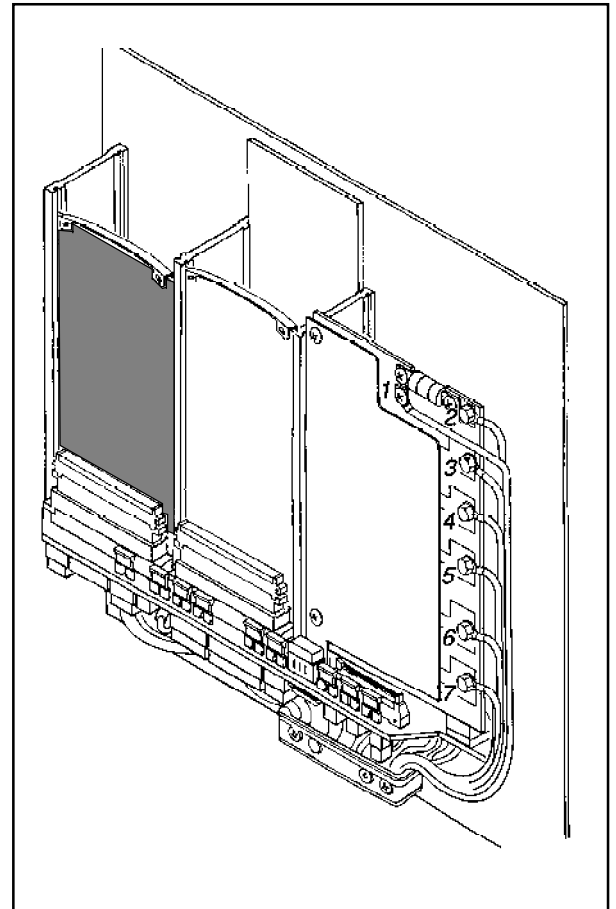
The starting characteristics of a truck parked on an incline are substantially improved if engine rpm is not reduced to attain low idle speed. The electronic speed control unit therefore increases the required value from a threshold of $I_A = \text{abt. } 150 \text{ A}$, proportional to the armature current flowing in the drive motor. An electronic circuit limits engine rpm to a maximum value.

- Required value, hydraulics

Regarding the required rpm values when operating one of the hydraulic control valve levers, the signals for hoist & tilt functions are processed. Resistors on the plug-in module limit the required values to a maximum reading.

- Increased idle speed

When the accelerator pedal is released, idling speed rises momentarily. This feature prevents stalling of the engine due to a sudden load surge (e.g. moving the tilt control lever bypass pressure).

**Rpm sensing**

The signal from the rpm sensor 6B9 is processed by p.c.b. 9A4 'engine starting via generator' and supplied to p.c.b. A3 'throttle valve regulator'.

Power board for throttle positioning solenoid 9Y3

The 24-volt power source (battery voltage) feeds the throttle positioning solenoid 9Y3 (throttle valve adjusting solenoid) with current whose intensity is controlled. To protect the power board transistors from damage, the power board is cut out immediately when the current intensity reaches 7 amps.

Power to the power board is automatically cut off if the battery voltage drops below a minimum value of 10 volts, or the 15-volt supply of the p.c. board drops below a value of 5 volts.

Throttle positioning solenoid-release

No control current is applied to the throttle positioning solenoid 9Y3 and the power board control circuit on logic card A3 is not energized unless a minimum speed of around 10 rpm is reached. This feature prevents an unnecessary load on the battery when keyswitch S1 is turned on and the engine is not started.

Electronic Controller

**P.c.b. A3 'throttle valve regulator'
(LPG-powered engine)****Adjustment of engine speeds**

see section 'Angle of rotation sensor/Control valve switches'

- **HOISTING. 2600±50 rev/min** - No adjustments are possible.
Engine rpm is regulated as the spool controlling the hoist function is moved to a small degree by operation of the hoist lever. Further movement of the hoist control valve lever causes engine speed to rise abruptly before being regulated again until rising to the maximum value to which it is limited by a resistor arranged on the module.
- **TILTING: 1400± 150 rev/min** - No adjustments are possible.
Initial operation of the tilt lever causes engine rpm to rise abruptly up to a certain limit as engine speed is limited by a resistor arranged on the module.
- **3rd & 4th HYDRAULIC FUNCTIONS:** variations of operating speeds.
The engine speed can be pre-set for each function by operating on pot. Z1 - Z2 - Z3.

Order of preference of engine speeds

Tilt and Z1 (group A) have priority over hoist and Z2, Z3, (group B).

Example: The tilt lever is moved during the hoist operation - engine speed will drop from 2600 to 1400 rev/min.

Diagnosis

For checking purposes the required inputs can be applied via the DIP switch to the test terminals 'M' located on the logic card.

LED VCC lights to indicate the presence of the 15 volts supply and the internal 5 volts reference voltage.

LED MAG lights to indicate that the power board is released, i.e. engine speed exceeds 10 rev/min, current draw of power board transistors not being higher than 7 A.

LED I-MAG lights to indicate the function of the power board for the throttle positioning solenoid 9Y3. LED 1-MAG changes the intensity of its brightness parallel to the output voltage variations of the power board. Full brightness will be reached when the throttle positioning solenoid is modulated even to a small degree only.

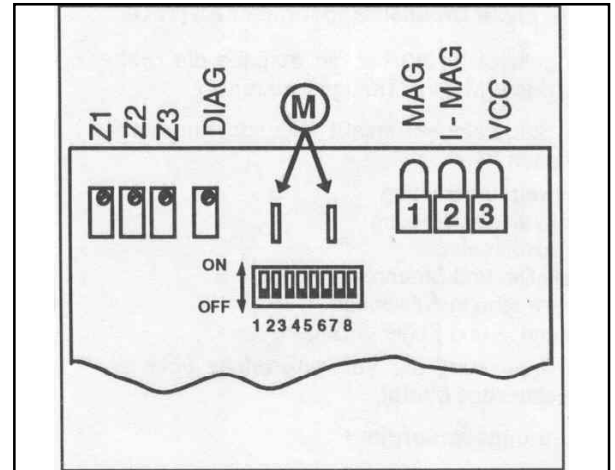
The LED does not go on if the rpm actual value exceeds the required value:

Example A:

- Open throttle valve by hand (the rpm actual value increases)
- **LED 1-MAG** goes off because the power board tends to reduce engine speed via the throttle positioning solenoid.

Example B:

- With engine idling, close throttle valve by hand
- **LED I-MAG** goes on to indicate that the power board tends to increase engine speed via the throttle positioning solenoid.

**Operation of the DIP switches****1 ON: Required value - driving**

(+0.2 V to -7V, n=2600 rev/min)

(+0.2 V to -5.7 V, n=2450 rev/min)

This DIP switch applies the signal (generated on p.c.b. 1A1 in proportion to accelerator transmitter modulation) to test terminals 'M' on p.c.b. A3 'throttle valve regulator'.

2 ON: Required value - hoisting

This DIP switch applies the output voltage of pot. 2R2 for hoist function to test terminals 'M'.

3 ON: Required value - tilting

This DIP switch applies the output voltage of microswitch 2S2 for tilt function to test terminals 'M'.

4,5,6 ON: Required value - 3rd & 4th hyd. functions Z1, 2, 3.

This DIP switch applies the output voltage of the relevant microswitch to test terminals PIV1%

7 ON: Armature current

This DIP switch applies the signal corresponding to the armature current to test terminals 'M'.

8 ON: Modulation of throttle positioning solenoid

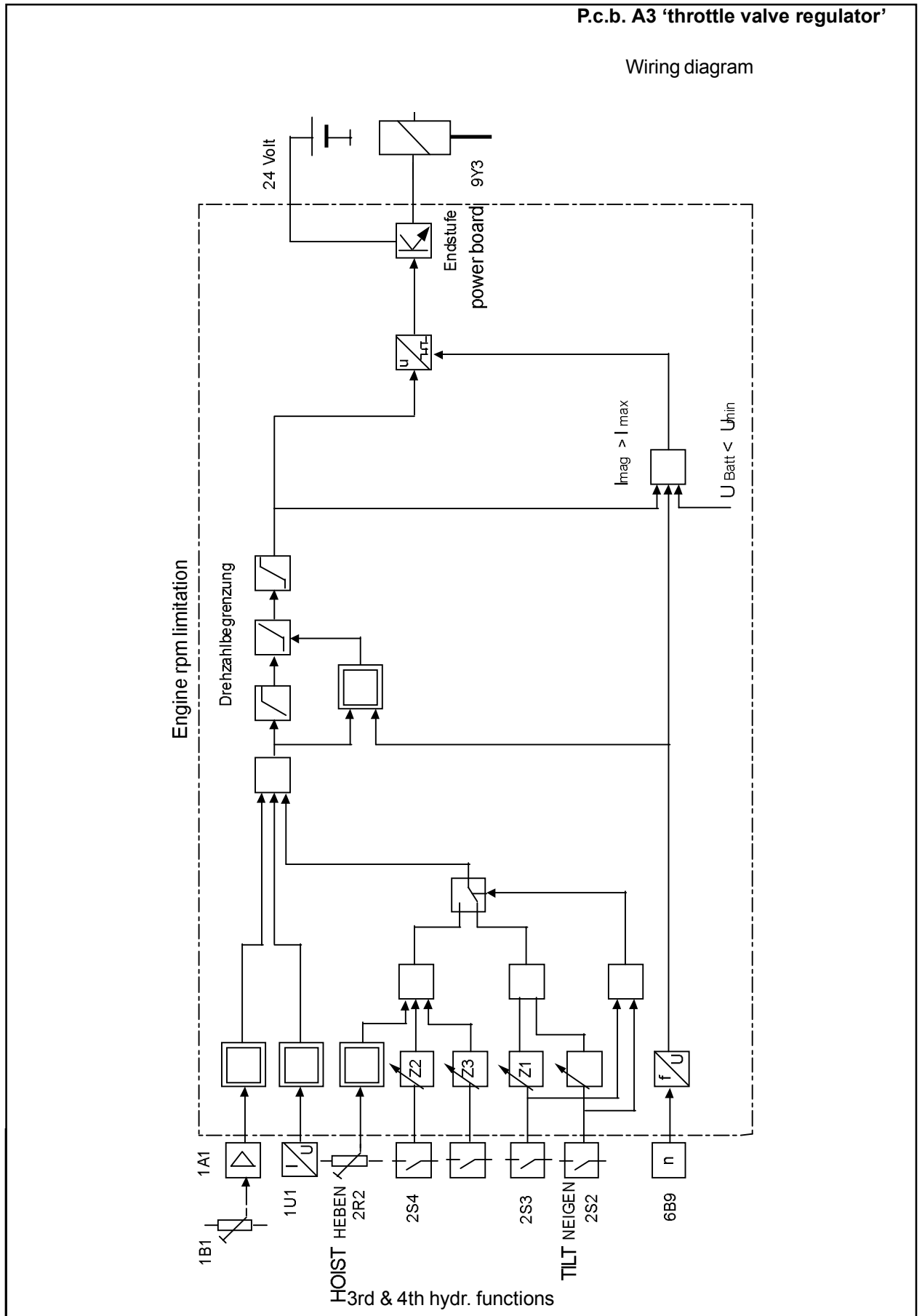
Once the contact has been established via switch 8, the modulation of throttle positioning solenoid 9Y3 can be effected by hand, by means of pot. DIAG. Engine rpm can be varied by approx. 30 rev/min.

After completing checks, move all DIP switches to the 'OFF' position.

Electronic Controller

P.c.b. A3 'throttle valve regulator'

Wiring diagram



Electronic Controller

Pc.b. A1 'electronic charge compensator'
(fitted to LPG powered units only)**Duration of operation**

Pc. board A1 becomes operative when the keyswitch is turned on. The trans-charge procedure sets in as soon as the voltage of battery G2 exceeds that of battery G1. The trans-charge current whose value depends on the difference in voltage between the two batteries is controlled by a voltage regulator. The current is limited to a maximum value of 5 amps.

When the keyswitch is turned off, the electronic charge compensating circuit will yet remain operative for about 60 minutes in order to subsequently compensate for high loads on battery G1, especially in the event of short duty cycles. After that the power section, except for the negative connection (GND), is isolated from the battery

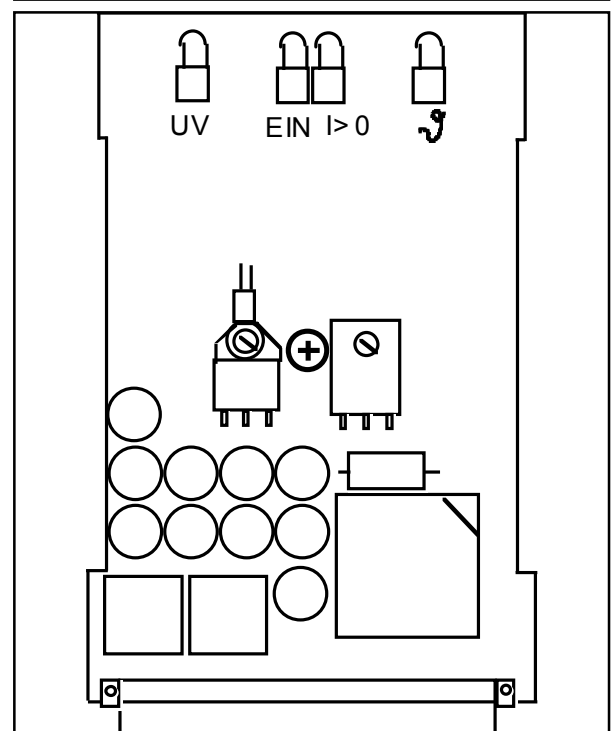
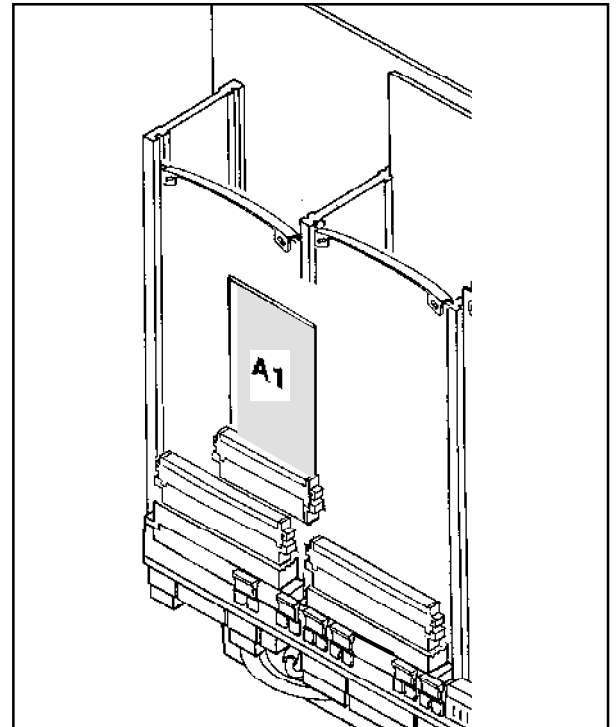
Wire connections

Power section and regulating unit of charge compensator are connected via separate current conducting and test leads to battery terminals. This feature prevents wrong battery voltage readings due to voltage drops caused by load currents.

Current conductors:	Test leads:
1/X46---1/X72 GND	9/X43---3/X71 GND
2/X46---2/X72 +24V	7/X43---1/X71 +24V
3/X46---3/X72 +12V	8/X43---2/X71 +12V

Temperature monitoring

Pc. board A1 'charge compensator' has no heat sink of its own. The power semi-conductors are mounted on a card which after being plugged into the card holder is bolted to the base plate. In order to forestall deterioration of the semi-conductors due to overheating in the case of a faulty installation, the electronic charge compensator board A1 has been provided with a temperature monitoring facility. This facility blocks the transistor should the temperature rise in excess of 95°C. This excess temperature is signalled by lighting of red LED _{delta}.



Electronic Controller

P.c.b. A1 'electronic charge compensator'**Fuses**

The 12-volt and 24-volt connections on p.c.b. 1A6 'current sensor' are protected by fuses.

F2-20A: electrical current conductor +24 V-21X46
 F3- 1 A: * test lead +24 V-71X43
 F4- 1 A: * test lead +12 V-81X43
 F5-20A: electrical current conductor +12 V-31X46
 F6-30 A: ignition 12 V / **LPG version**

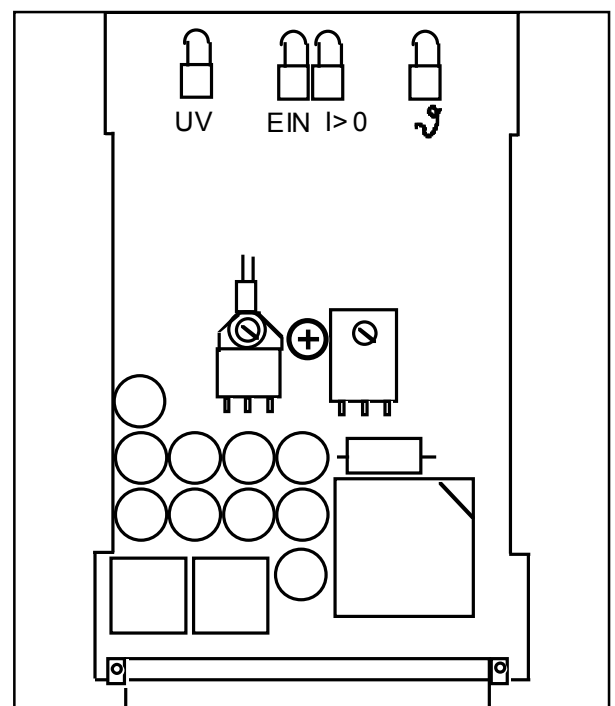
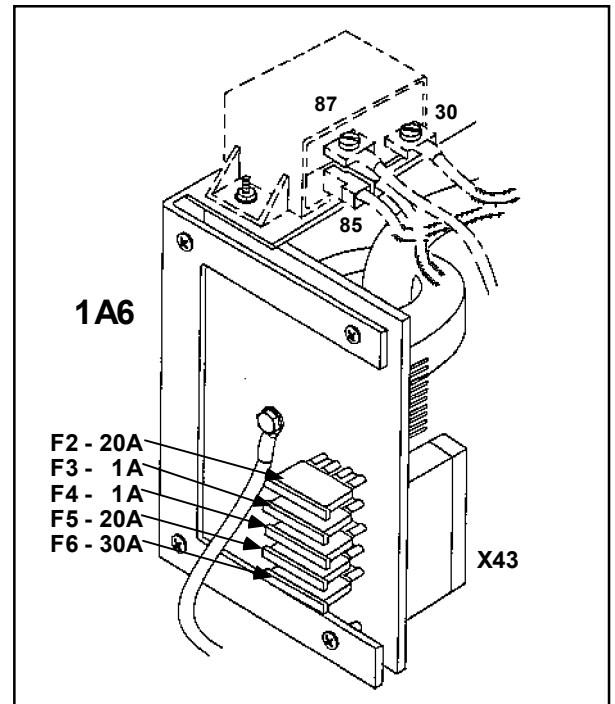
*serves also as test point for p.c.b. 9A4 'engine starting via generator'

Checking the charge compensating circuit

Turn keyswitch S1 on. Light-emitting diodes 'UV' and „EIN“ must come on after 30 sec. at the latest. If the charge level differs from one battery to the other, LED 'I>0' must come on too.

Removal of printed circuit board

Before removing p.c.b. A1 'electronic charge compensator', cut electrical connections to batteries G1, and G2. This can best be done by disconnecting the battery terminals or connectors X71 and X72 on electronic control unit.



Electronic Controller

Power board 1A2

The power board consists of the following components:

- Main circuit fuse 1 F3 (refer to section 'Fuses') - Power section
- Power supply module
- Interface to p.c.b.'s 1A1 'traction control circuit' and 9A4 'engine starting via generator' - Safety relay K1
- Control circuit for safety relay K1
- P.c.b. 9A2 'diesel engine shut down controller' (diesel powered model)
- P.c.b. 'control circuit fuse' (LPG-powered model)

Depending on the demand, the **excitation field** of both generator and drive motor is controlled by the power section of the power board.

**Never swap leads 4/1A2 and 5/1A2
Otherwise wrong direction of
rotation during starting**

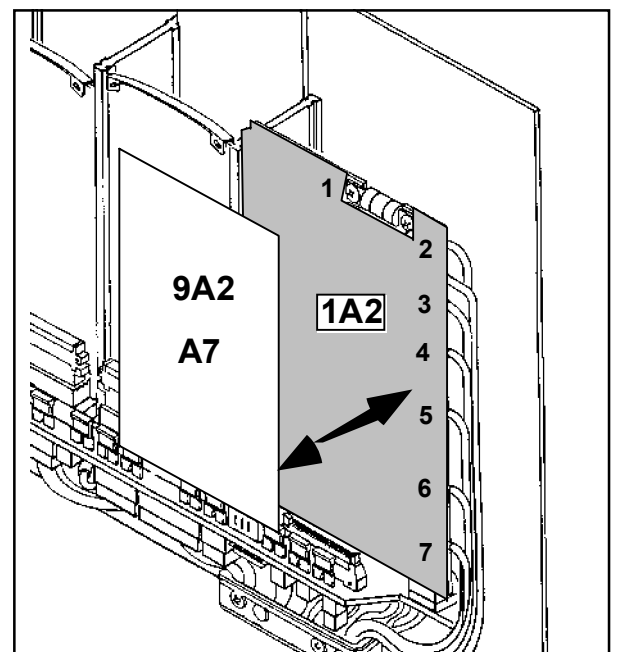
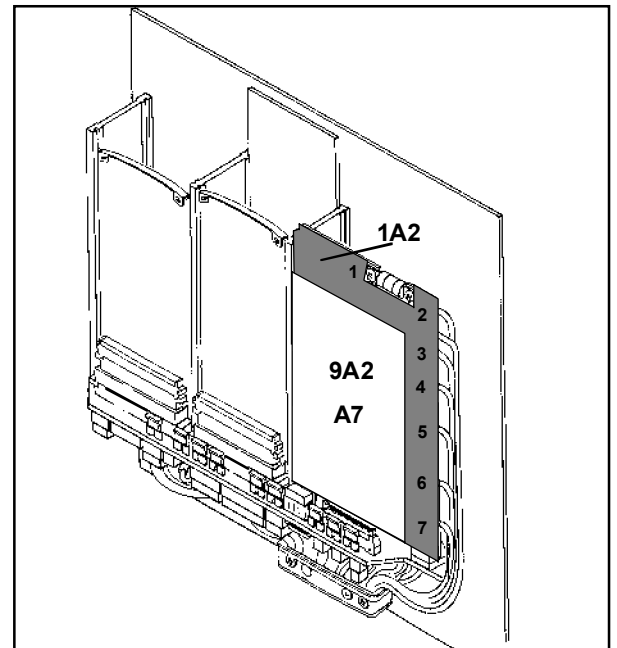
The controlled **power supply module** generates the supply voltage for the power board, and also two external supply voltages (+5 V and +15 V) required for the p.c. boards 9A4 'engine starting via generator' and 3A2 'servomotor' or A3 'throttle valve regulator', depending on truck model. The power supply module is supplied with 24 volts battery voltage by operation of keyswitch S1.

The **interface** serves to adapt the power board to p.c.b. 9A4 'engine starting via generator' or p.c.b. 1A1 'traction control circuit' by which it is controlled. In the event of an absence of the pilot signal, the power board will be blocked automatically

The battery voltage is placed via **safety relay** K1 across the terminals of the power section of the power board. The total motor and generator field current will flow across the operating contacts of the relay (permanent load of 70 A at the maximum).

To energize the relay, the following conditions must be fulfilled:

- Keyswitch S1 ON
- Parking brake released
- Release through logic card 1A1
- Voltage applied to D+/9G2 = positive (Engine started)



Electronic Controller

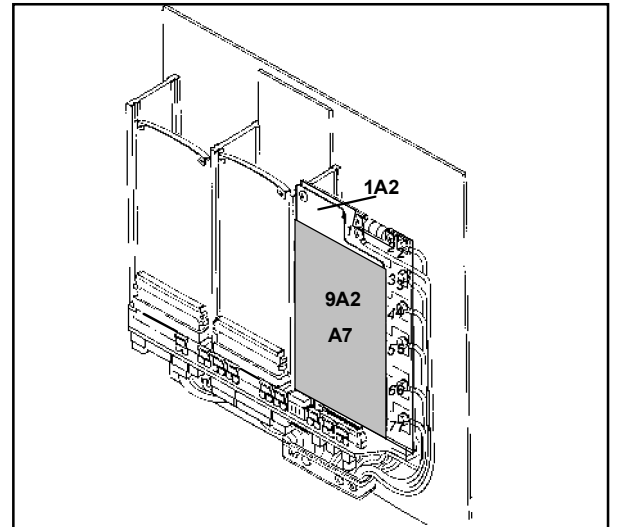
P.c.b. 9A2 'diesel engine shut down controller' (solenoid stop control) (on diesel powered models)

or

P.c.b. A7 'control circuit fuse' (on LPG powered models)

One or the other version of the p.c. board is in each case mounted on power board 1A2, depending on truck model. The p.c. board and the power board form a bolted assembly thus assuring the positive connection also to this printed circuit board.

Both p.c. boards are fitted with control circuit fuses for dash mounted instruments and optional electrical equipment.



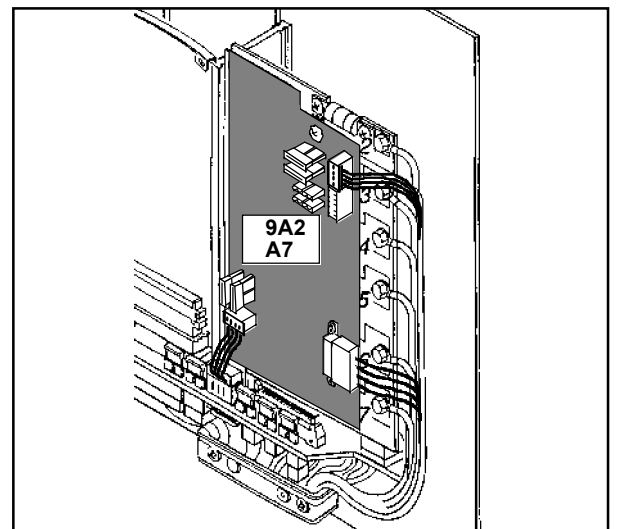
P.c.b. 9A2 'diesel engine shut down controller'

The circuit of p.c.b. 9A2 controls the attraction of shut-down solenoid 9Y5, providing a pull-in current of approx. 30 A for 200 ms, then providing a hold-in circuit of about 0.5 amps for the solenoid to maintain the latter in the actuated state.

The 15-amp. protection provided by fuse 1F16 is sufficient since the turn-on period only amounts to around 200 milliseconds.

P.c.b. A7 'control circuit fuse'

This p.c. board merely incorporates the control circuit fuses as it has no additional functions.



Control circuit fuses arranged on p.c.b. 9A2 'diesel engine shut down controller' (diesel model)
p.c.b. A7 'control circuit fuse' (LIDG model)

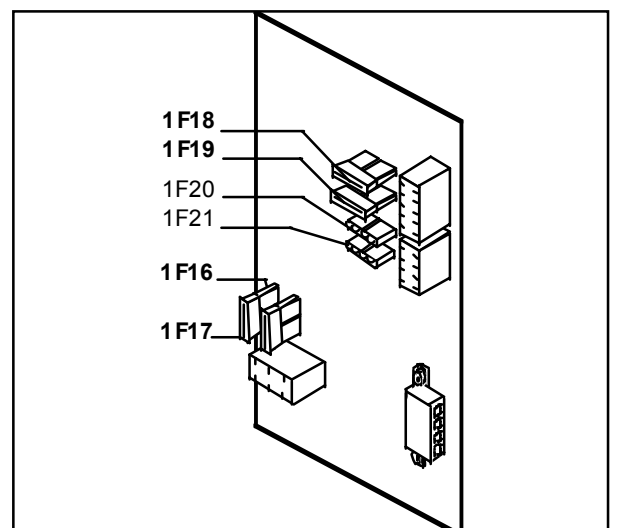
1F16-15A shut-down solenoid (MB engine)
 1F17- 5A p.c.b. 1 A1 'traction control circuit' p.c.b. 9A4 'engine starting via generator'

1F18 -20A protecting dash mounted instruments via keyswitch 30/S1

1F19-20A protecting lighting equipment

1F20-20 A protecting additional fan motor 9M5

1F21-10 A protecting engine shutoff valve 9Y2 (VW engine)



Electronic Controller

Base plate or panel

Arranged on a base plate, the p.c. boards and the power board (final stage) are interconnected by connectors, at the same time being connected to the remainder of the truck electrical system.

- X3 - p.c.b. 'traction control circuit'
- X5 - power board connection
- X6 - p.c.b. 'throttle valve regulator' (LPG model)
p.c.b. 'servomotor' (diesel model)
- X7 - p.c.b. 'engine starting via generator'
- X70 - p.c.b. 'electronic charge compensator' (LPG model)
- X66 - negative -ground- (-) battery terminal
- X22 - p.c.b. 'control circuit fuse' (LPG model)
- p.c.b. 'diesel engine shut down controller' (diesel model)

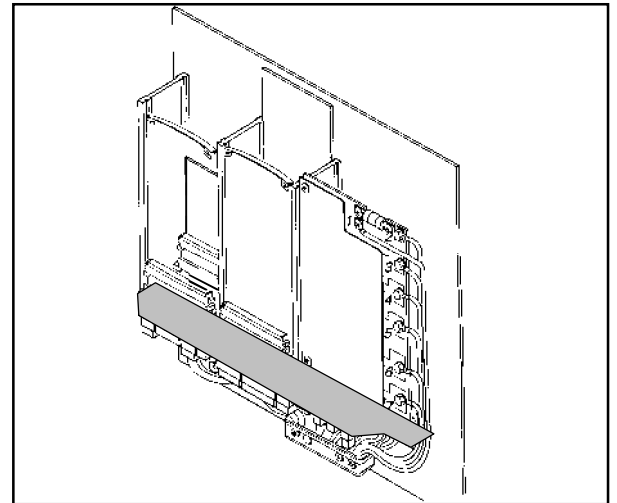
Mounted on the base plate are in addition control circuit fuses (7 fuses) and

- only on truck model operating on LPG gas fuel system relay 9K4 for ignition.

Relay 9K4

Relay contact 30-87/9K4 applies 12 volts!! via fuse F6 and fuse 9F2 to ignition coil 9T1 and controller for ignition 9A1.

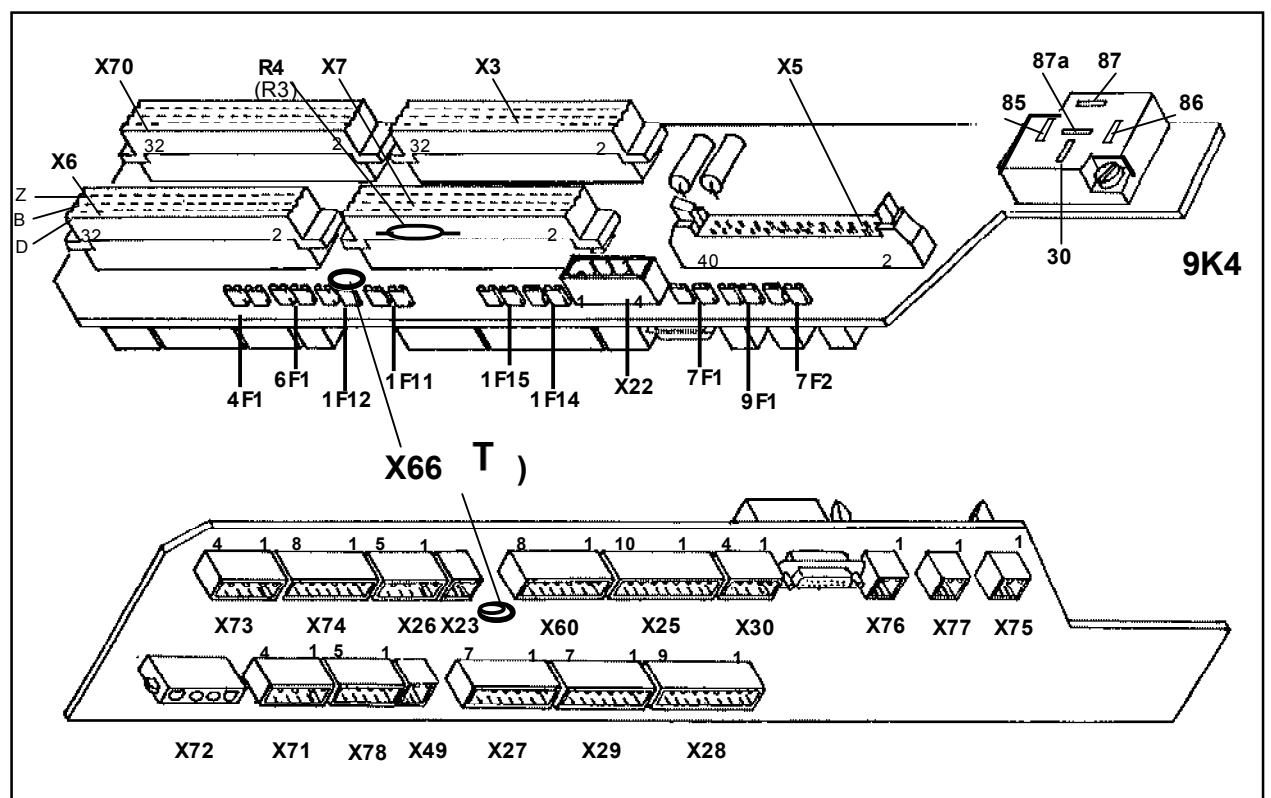
Connection 85 of relay coil 9K4 is supplied with 24 volts voltage by two different sources because the engine with which the LP---gas operated fork truck is



fitted is not allowed, after being switched off, to stop unless the gas remaining in the mixer (carburettor) is burnt.

When keyswitch S1 is turned on, voltage is applied via fuse 1F11 and diode 9V1 to relay coil 9K4.

When the engine is shut off - keyswitch S1 turned to OFF - the engine shut-off valve 9Y2 cuts off the fuel supply. As the engine at this stage continues rotating because of the residual quantity of gas, alternator 9G2 supplies voltage via fuse 1F15 and diode 9V2 to relay coil 9K4. Ignition, therefore, remains on until the gas remaining in the mixer is burnt and the engine stopped.



Electronic Controller

Table of p.c.b.

TABLE OF P.C.B FOR DFG/GPL R7032-34/38-40/48-50 with current limit of drivemotor									
MODEL	ENGINE	ENGINE REVS	P.C.B.	MODULE	item.	MODULE	MODULE	CONTROLLER	
R70 - 20 bis 45	VW;MB; DEUTZ	low idle UL 1/rpm high idle OL 1/rpm	traction control 1A1	Traction		Speed limitation	Zero braking	ONE-PEDAL TWO-PEDAL	
STANDARD TRUCK DESIGN FROM JUN 98									
DFG 7032 - 34	VW	UL 1150 OL 2450	NT 375 338 AT 148 998	603 098	B	606 700	609 098	396 644 396 646	
LPG 7038 - 40	VW	UL 925 OL 2450	NT 375 338 AT 148 998	603 099	A	606 735	609 699	396 649 398 400	
DFG 7048 - 50	DEUTZ	UL 900 OL 2200	NT 375 338 AT 148 998	603 099	B	606 742	609 950	389 274 391 578	
DFG 7032 - 34	MB	UL 970 OL 2450	NT 375 338 AT 148 998	603 098	A	606 700	609 098	396 647 396 648	
VARIANT FROM MAY 93 TO MAY 98									
DFG 7032 - 34	VW	UL 1150 OL 2450	NT 375338 AT 148 998	375339	B	372 609	383770		
LPG 7038 - 40	VW	UL 925 OL 2450	NT 375338 AT 148 998	375341	A	361 064	383770		
DFG 7048 - 50	DEUTZ	UL 900 OL 2200	NT 375338 AT 148 998	375341	B	372 609	383776		
DFG 7032 - 34	MB	UL 970 OL 2450	NT 375 338 AT 148 998	375339	A	372609	383770		

Electronic fan

Operation

The 9M5 designated electric fan promotes heat dissipation in the event of high thermal loads. Located on the outer part of the radiator within the counterweight, the fan draws the air from the engine compartment.

The electric fan is directly supplied with 24 volts battery voltage via fuse 1F20, at the same time being connected to the body across the coolant temperature sensor 6B14.

Screwed into the radiator, the coolant temperature sensor 6B14 turns on the fan when the coolant temperature reaches 85° C turning it off the instant the coolant temperature drops below 80° C.

Wiring

wire connection

1,2 / X94 (SCR controller)-----1,2 / X110 (fan)
is designed as a double lead 0.75 qmm.

2 - pole flat connector -X110

9M5 - electric fan

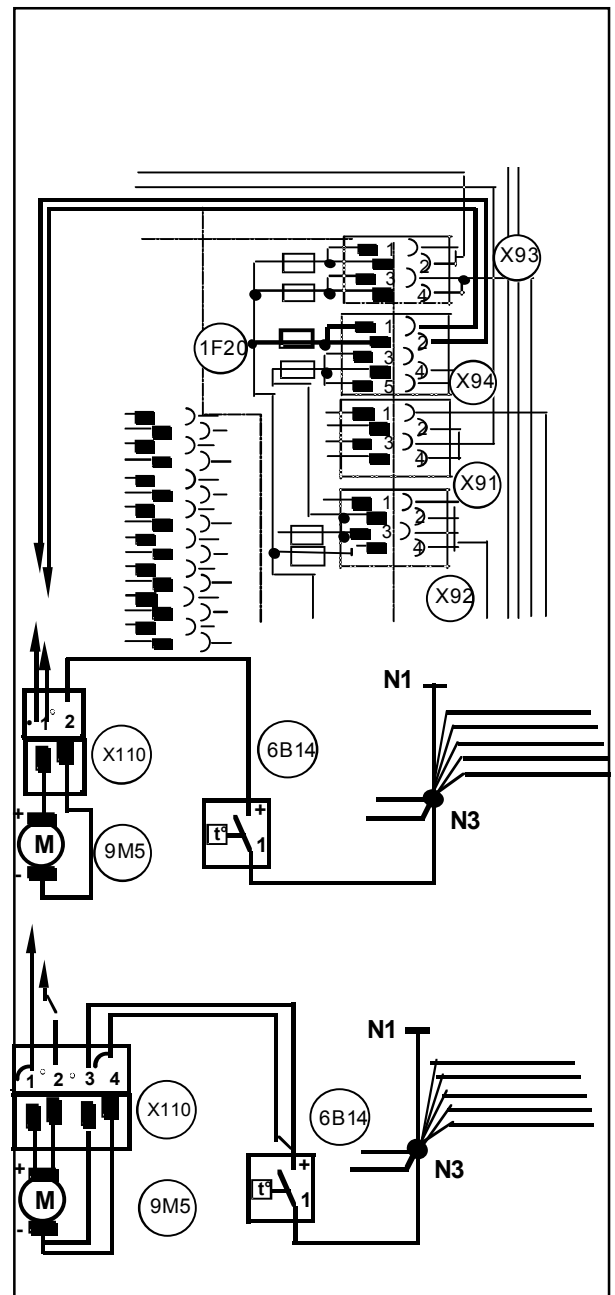
6B14- coolant temperature sensor

1F20- fuse rated at 20 amps

4 - pole MARK II + connector - X110

wire connections :

1,2 / X94 (SCR controller)-----1,2 1 X1 10 (fan)
3,4 1 X1 10 (fan) ----- + / 6B1 4 (sensor)
are designed as a double lead 0.75 qmm.



Connectors

The following components are interconnected by means of Connectors with insulation displacement contacts:

- Electronic control unit, base plate
- Steering column, instruments
- Contactor panel

This technology provides these benefits:

Each contact is fitted on its reverse side with a knife blade in a fork type arrangement.

With the aid of a tool, the single wire or conductor is forced into the knife blades, while being automatically stripped of its insulation.

In this operation the knife blade contacts penetrate the insulation providing contact to wires.

Below you will find a description with accompanying illustrations on the various steps to be performed in connection with assembling male and female connector halves (plug and receptacle connectors) with their respective leads.

Connectors ranging from 2 to 12 position design are used on the R70-20 to 80 trucks.

Important:

Use wire **369388** only!
(the wire is available in random lengths and must be cut to the length required)

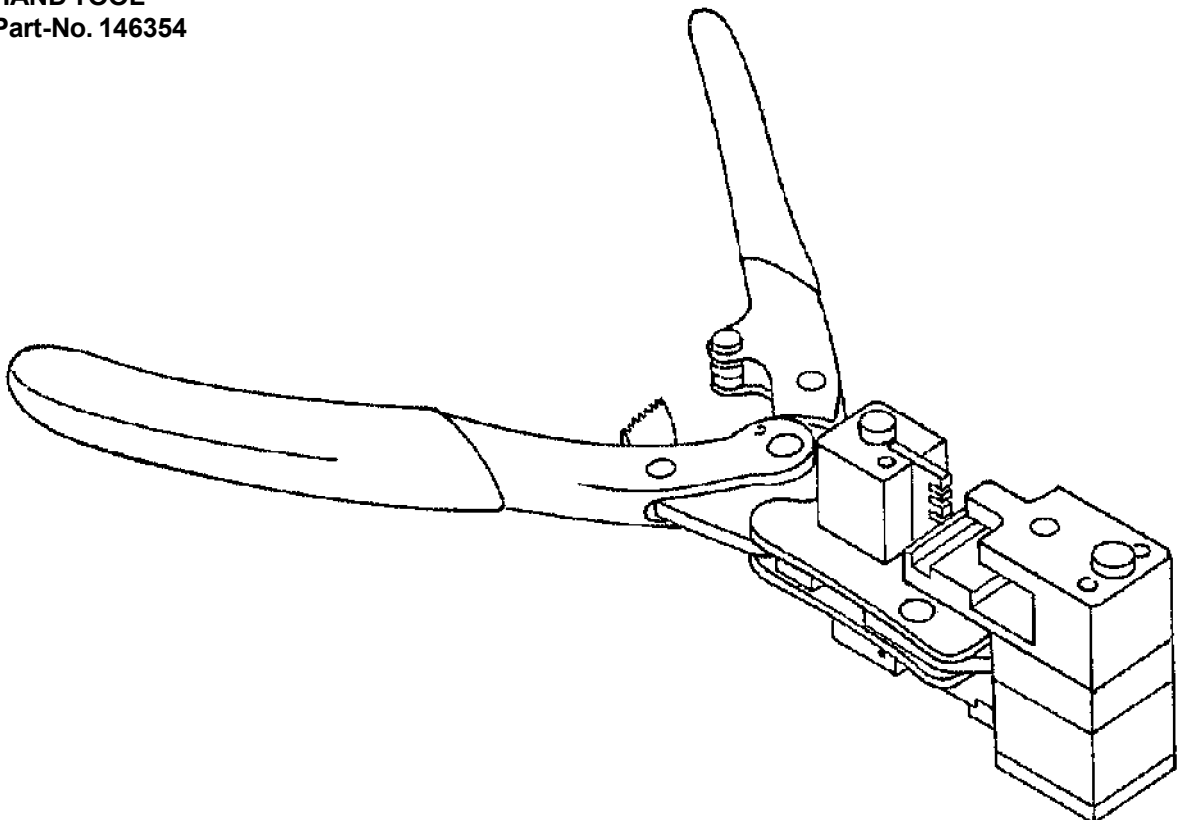
Should different wires be used, the contacts will either get bent or the clamping effect will be too small.

In both cases this will lead to a malfunction which will be hard to locate.

Therefore: Use only the genuine wire!
(16 strands 0.75 mm Dia.)

Part No. 369388

HAND TOOL
Part-No. 146354



Connectors

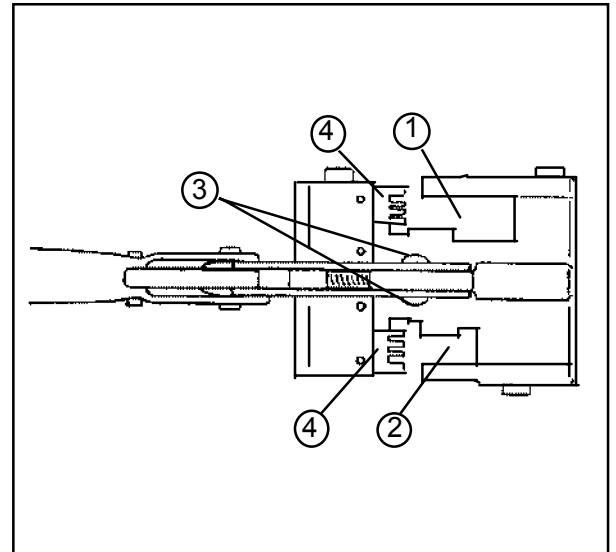
In the event of repairs, replacement connector and wires must be assembled with the aid of the hand tool

Part. No. 146 354.

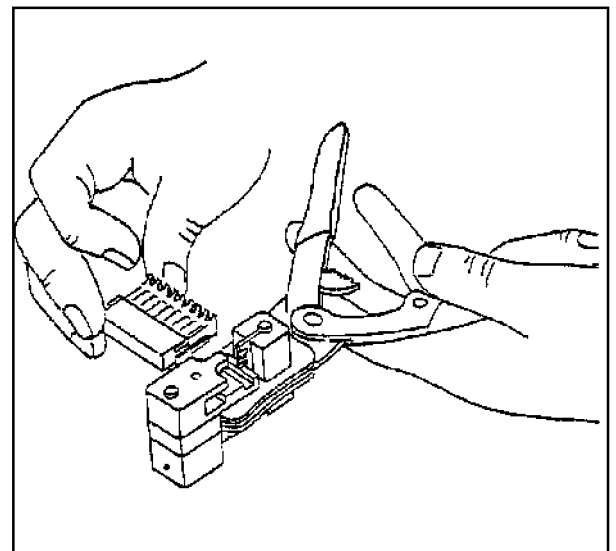
The head of the tool is provided with two different openings for the accommodation of

- (1) pin half of connector
- (2) socket half of connector

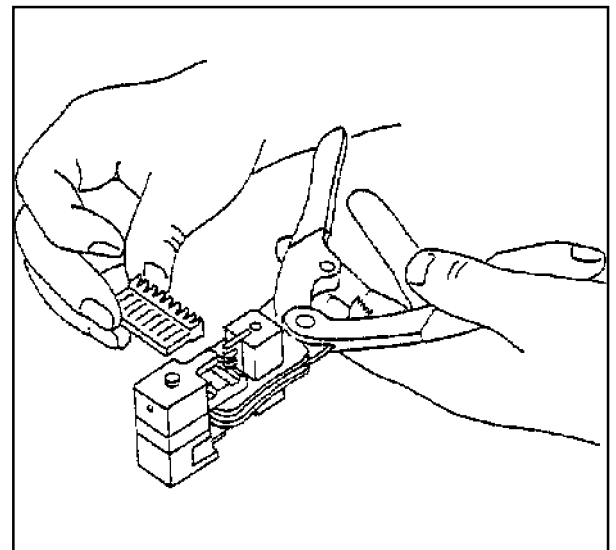
When sliding the pin or socket connector half into the opening, a spring-loaded ball (3) will maintain the connector housing in the correct position, the individual contact will snap into place with accuracy in front of the slider (4).



Sliding the pin housing into position --->



Sliding the socket housing into position --->



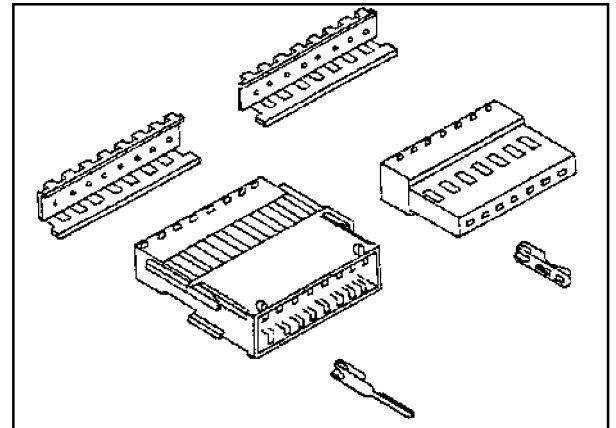
Connectors

Processing

With no need to strip it beforehand, the wire is inserted from the top into the open tool between slider and contact housing.

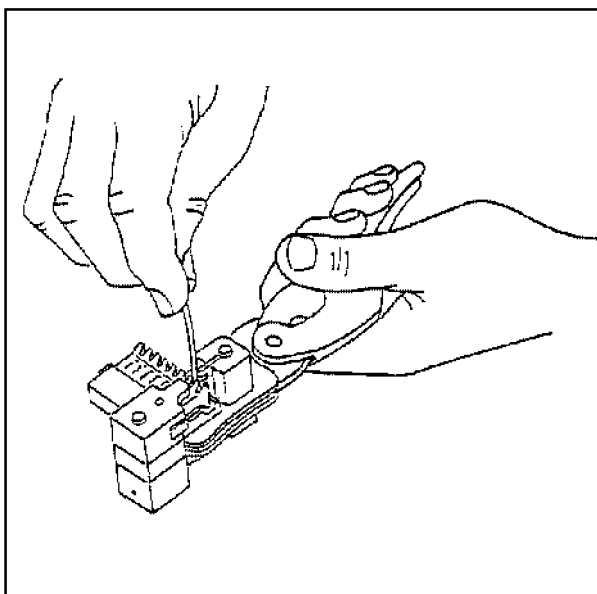
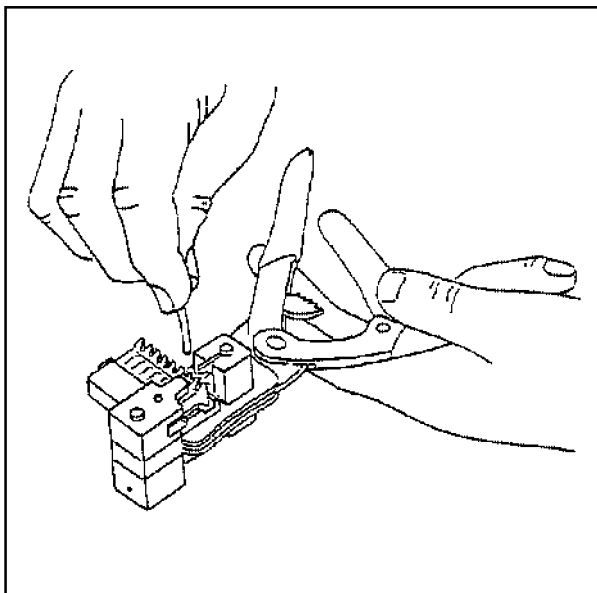
By closing the tool the slider will push the wire into the knife blades of the contact.

The tool can only be opened again provided it is completely closed by squeezing it with the hand which will unlock it.

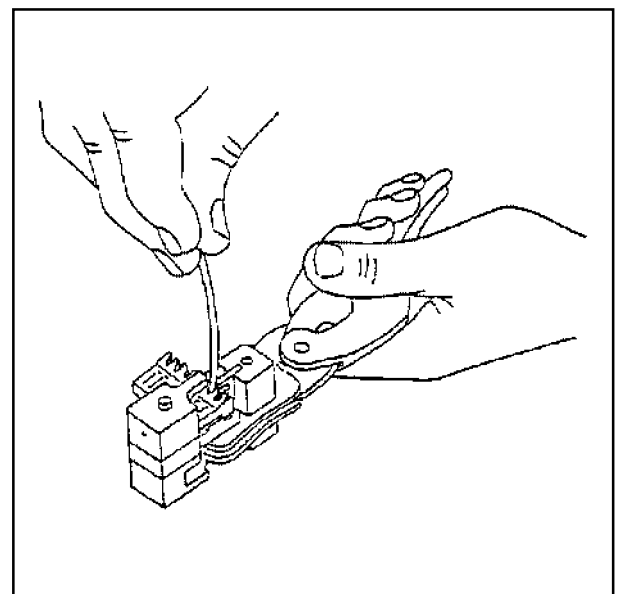
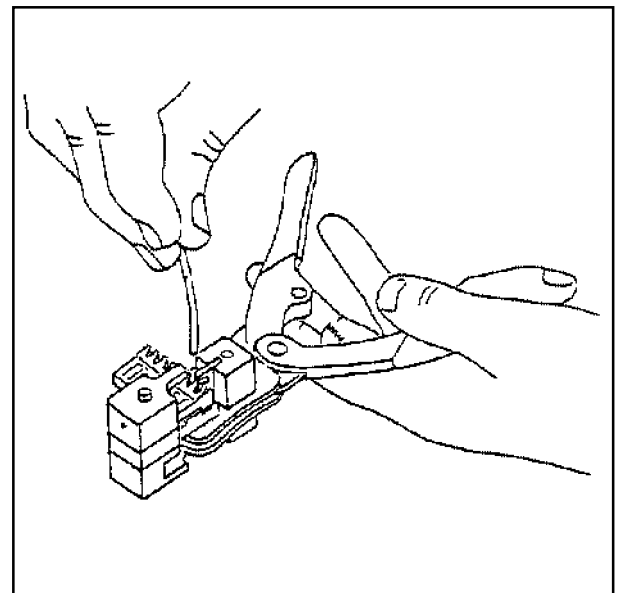


Single parts

Pin housing



Socket housing



Connectors

Repair

First remove the cover on wire end to which end the edge of the cover is spread and lifted .

To remove a defective contact, the locking tongue must be pushed towards the inside with the extraction tool

Part. No. 143 432.

after which the contact at the end of conductor must be pulled out from the rear

- Pull with force on the contact as the conductor is maintained in the housing by the strain relief

The defective contact is cut off at the conductor end and a new contact is installed as described under section „Processing“. Next, press lid or cover on again. The cover has two edges of different height.

The high side must point to the conductor end thus preventing the conductor from snapping at the contact.

