Chapter 6

Electrical system
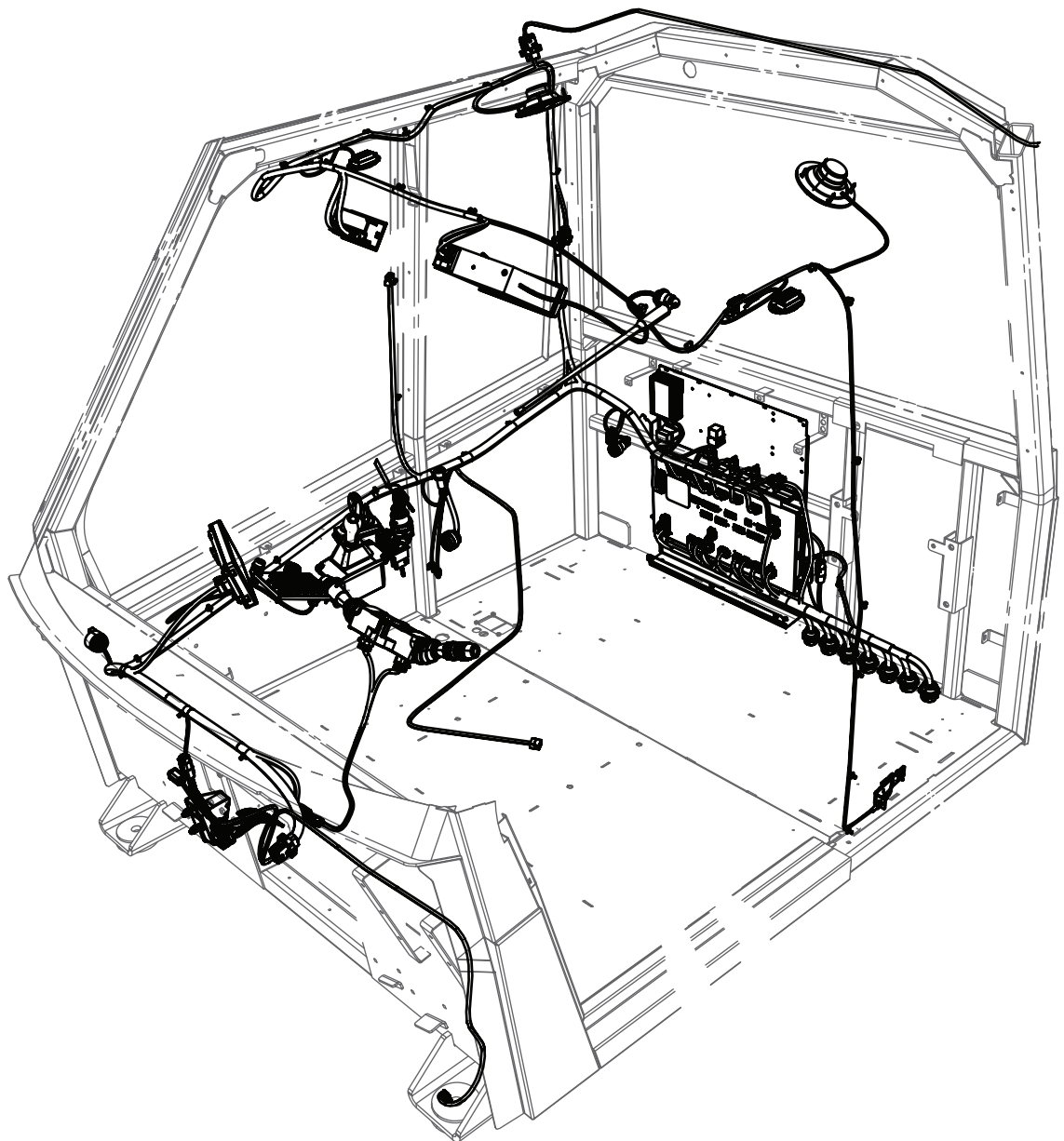
Electrical system

Safety instructions

Voltage
The trucks have a 24V system.
The battery ÷ is used as ground connection.

Supply
Two 12V/105Ah batteries are connected together in
serial connection to provide the system with 24V. The batteries
are located on the left hand side of the fender.
A 28V/100A alternator is used to charge the batteries. The
alternator is located on the front of the engine.

Battery main switch
A main switch is connected on the battery + supply cable.
The battery main switch is located in the left hand side fender.

Fuses
The fuses are located on the VCU3 inside the cab, behind the
cover on the back wall + "junction" box in front left fender.

⚠ **WARNING**

**Never turn off battery main switch when engine is running.
Never turn off battery main switch when ignition is on.
Leave battery main switch in ON position as long the
lamp (4) is on or flashing. When the lamp(4) is off the main
switch can safely be turned to OFF position.**
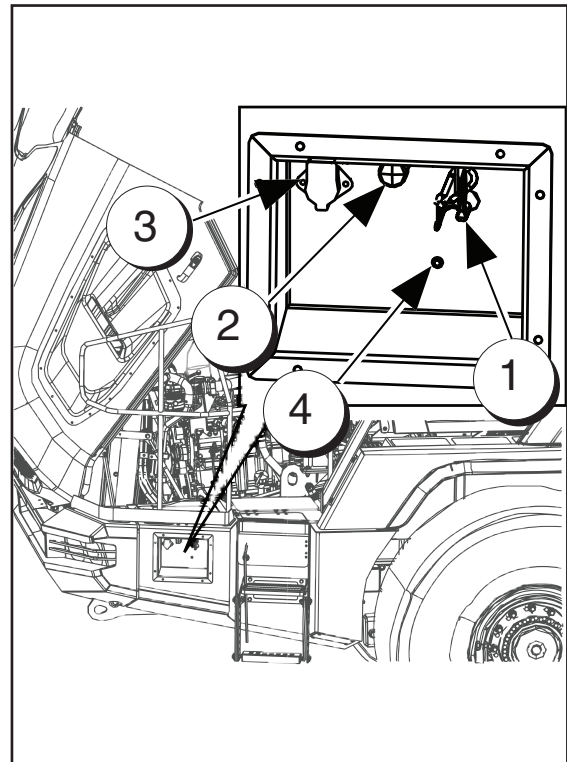
Figure 1
1. Main switch.
2. Emergency stop of engine.
3. External power supply output.
4. Indicator lamp.

Welding on the dump truck

The transmission and the engine are equipped with electronic
control units. Before welding on the dump truck:
1. Disconnect batteries.
2. Unplug the connector on the electronic control units for the
   engine and the transmission. The control units are located in
   the wall behind the seat.
3. Ground point should be less than 1 m from welding point.
4. There should not be sealings, bearings or wiring harness
   between the welding point and the ground point.

Battery hazard prevention

NOTE

- **Never shut off main switch when engine is running.**
- **Keep the batteries in good condition.**
- **Battery power assistance: see Operating and Maintenance manual.**
- **When exchanging electrical components always turn off the battery main switch.**
- **Remember that a open circuit symptom in a warning light circuit might be a broken bulb.**

⚠ **WARNING**

Never turn off battery main switch when ignition is on.
Leave battery main switch on for atleast 5 minutes after engine has completely stopped.
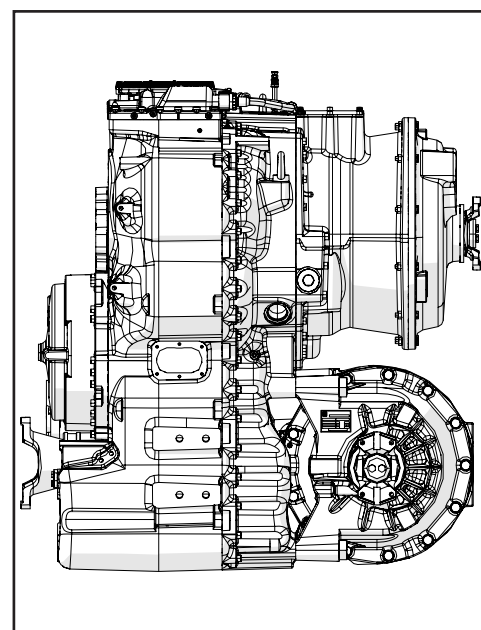
Figure 2

Battery electrolyte contains sulphuric acid and can quickly burn the skin and eat holes in clothing. If you spill acid on yourself, immediately flush the area with water.

Battery acid could cause blindness if splashed into the eyes. If acid gets into the eyes, flush them immediately with large quantities of water and see a doctor at once.

If you accidentally drink acid, drink a large quantity of water or milk, beaten egg or vegetable oil. Call a doctor or hospital immediately!

When working with batteries ALWAYS wear safety glasses. Batteries generate hydrogen gas. Hydrogen gas is very EXPLOSIVE, and is easily ignited with a small spark or flame.

Figure 3

Before working with batteries, turn the starter switch to the OFF- position, and the battery main switch must be turned OFF.

Avoid short-circuiting the battery terminals through accidental contact with metallic objects, such as tools, across the terminals.
When removing or installing, check which is the positive (+) and negative (-) terminal.

Removing the batteries:
1. Disconnect ÷ terminal connected to the earth point.
2. Disconnect the battery cable between the batteries.
3. Disconnect + terminal connected to the starter.

When installing the batteries, carry out the procedure in the opposite order, 3 - 2 - 1. Tighten the battery caps securely.

When removing any battery cap, wear rubber gloves to prevent electrolyte contact
with the skin.

Tighten the battery terminals securely, check that the terminals are not loose bytrying to move the battery cables by hand.
Loosened terminals can generate sparks and lead to an explosion.
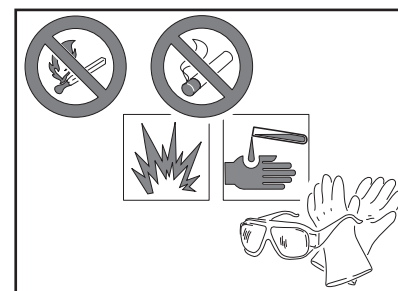
Diagnostic

Overview tools

CanPc

Installing CANPC

- Double-click the CANPC setup file to open the installation wizard.

- Choose if you want to have a desktop shortcut created.

- Click "**Next**" to proceed.

- Click "**Install**".

The program will by default be installed on the computers "C:/"Drive. Folder name will be CANPC.
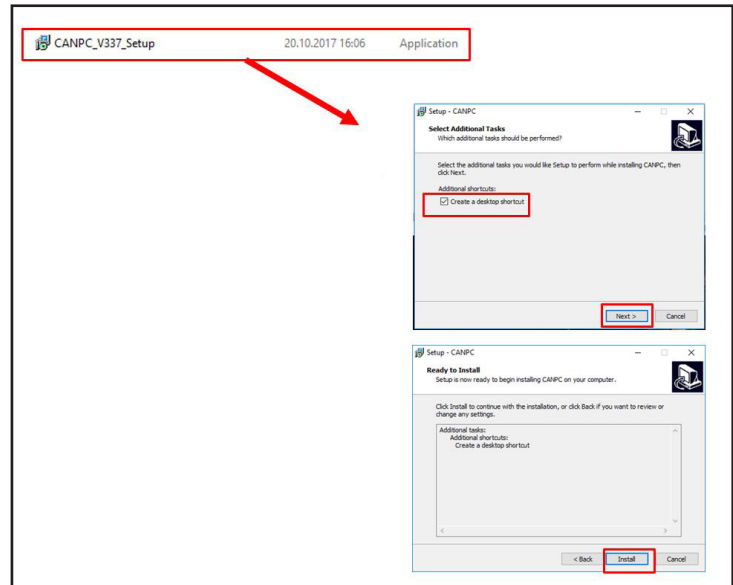
Figure 4

Complete the installation by clicking "**Finish**".
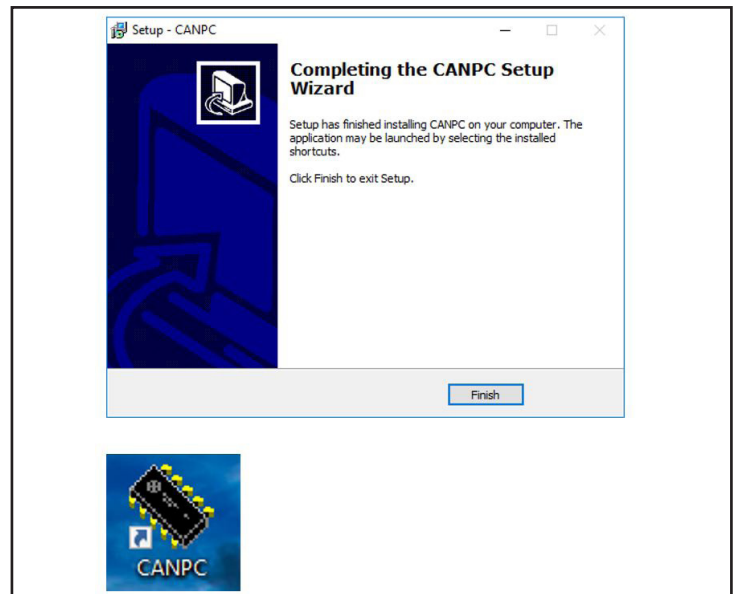
The CANPC program can now be launched from your desktop by double-clicking on the shortcut created.

Figure 5

CanPc setup

Before use it is recommended that the CANPC diagnostic program is set up to make sure that the connection, CANlogging and software updating are working properly.

1. Launch the CANPC diagnostic program from the shortcut on the computer desktop.

2. Click file and select "**Settings**" on the dropdown window that appears.
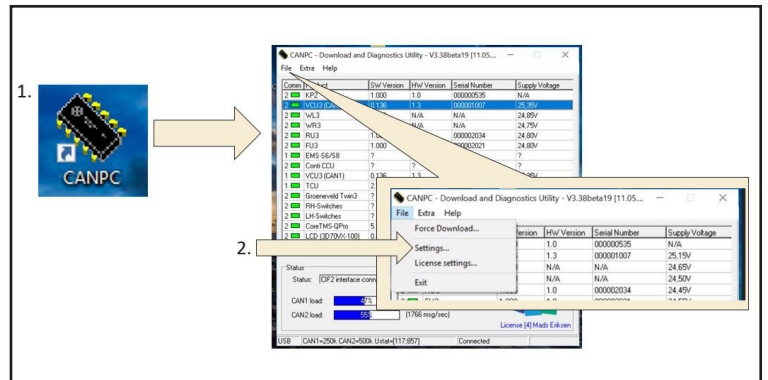
Figure 6

1. Interface selection.
   Select CANPC(comport) for old version CANPC interface with serial port connection to the laptop. Select USB for the CIF2 interface with USB connection to the laptop.

2. Comport selection.
   Only when CANPC(comport) is used.

3. Directory selections:
   Hex file directory:
   Chooses which folder the CANPC program will look for VCU software when performing a software update. (Recommend to use same folder destination as the CANPC program is installed on).
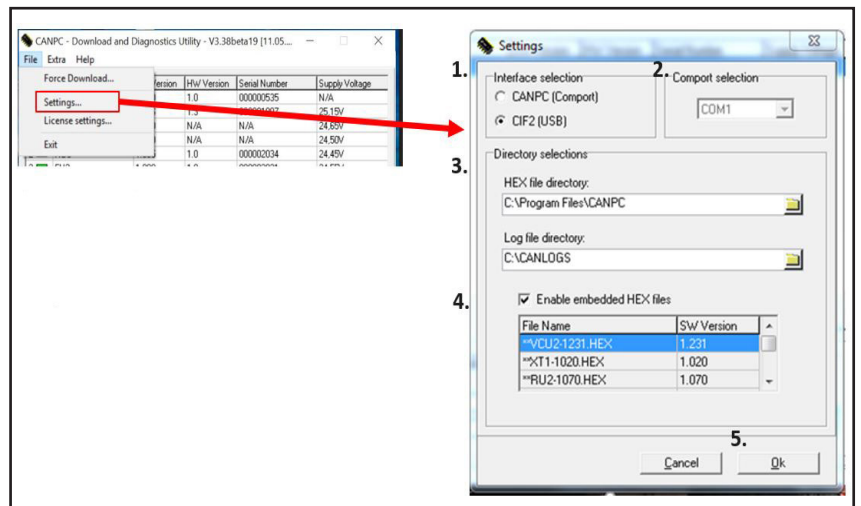
4. Log file directory:
   Select a folder where to store CANLOG files that are created when doing signal logging on the truck.

5. Select "Enable embedded HEX files". This enables you to use the software embedded in the CANPC program when performing software upgrades on the VCU.

6. Save settings by clicking the OK tab.

Figure 7

Adding additional VCU software.
- CANPC will always have the latest software VCU software embedded at the time of release. If new VCU software is released before it is included in the CANPC update version, it can be manually added.

- Right-click the VCU software you have received and select "copy".

- Locate the folder which the "CANPC.exe" file is installed on and paste the new VCU software directly into the same folder. (If this was the folder chosen on step 3 when setting up CANPC).

   The new VCU software file will now be found automatically by the CANPC program when using the "Download software" function to update the VCU.

Figure 8

CIF2 interface

1. Connect the CIF2 to diagnostic port. The CIF2 unit is made with a integrated OBDII plug and can be plugged directly into the OBDII diagnostic port in the cab.

   For earlier DA models, use the included OBDII to UMNL mini 12P cable. For MT - series use the UMNL mini 6P connector.

2. Connect the USB cable from the CIF2 into a free USB port on the computer.

3. Turn the ignition to ON.
   All 3 LED's on the CIF2 unit should illuminate. This indicates that the CIF2 has power and has a working connection to both CANbus lines (CAN1 and CAN2) on the truck.

Figure 9

With the CIF2 connected, launch the CANPC program from the shortcut created on the desktop. A new window will appear.
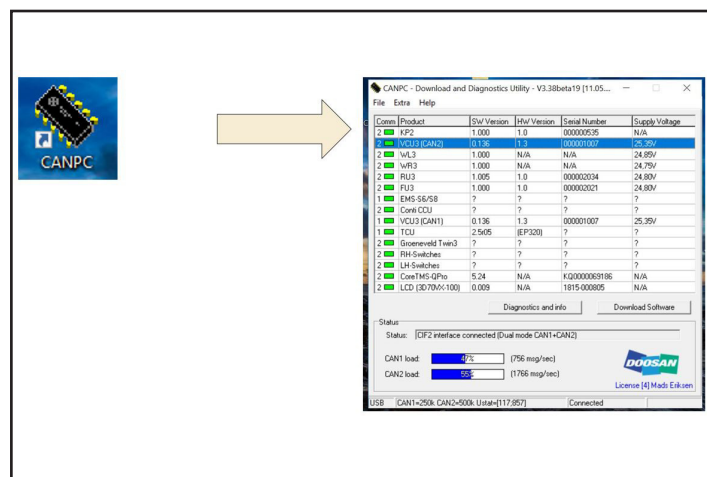
Figure 10

When properly connected the following will be visible:

1. All connected controllers/components will have a green square displayed in the first column.

2. Status symbol shows that the interface is connected.

3. CAN load is visible.

4. Bottom bar shows connection between computer and interface.
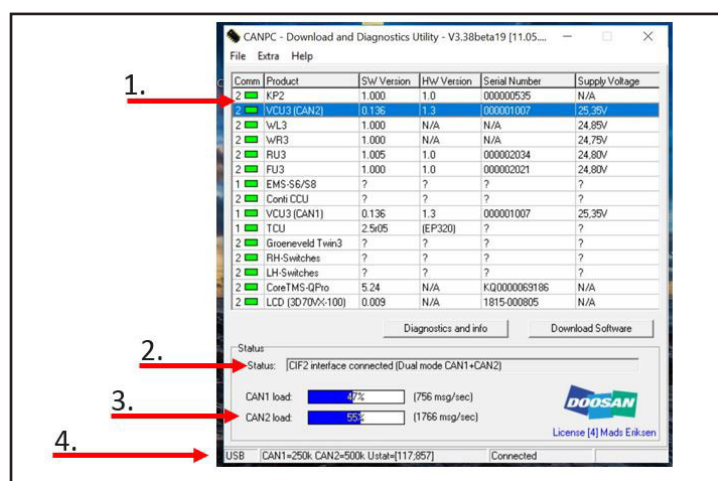
Figure 11

CIF2 firmware upgrade.

The firmware in the CIF2 interface should be checked and updated every time you receive a new version CANPC software. This is to ensure that you always have the latest functions available.
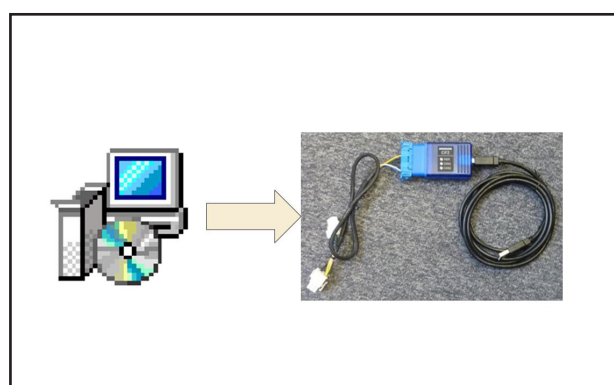
Figure 12

Update procedure:

Connect the CIF2 interface to the laptop with the USB cable.

⚠ WARNING

The interface must NOT be connected to the ADT diagnostic port when performing the firmware upgrade.

1. Open the CANPC program.

2. Open the Extra tab and select "CIF2 firmware upgrade".

3. Select the upgrade tab to install the newer version into the interface.

• Verify the update by confirming that the current and the new software are the same.

4. Finish by pressing the close button to exit.

(If the update should for some reason fail. Check the connection between the laptop and interface and try again).
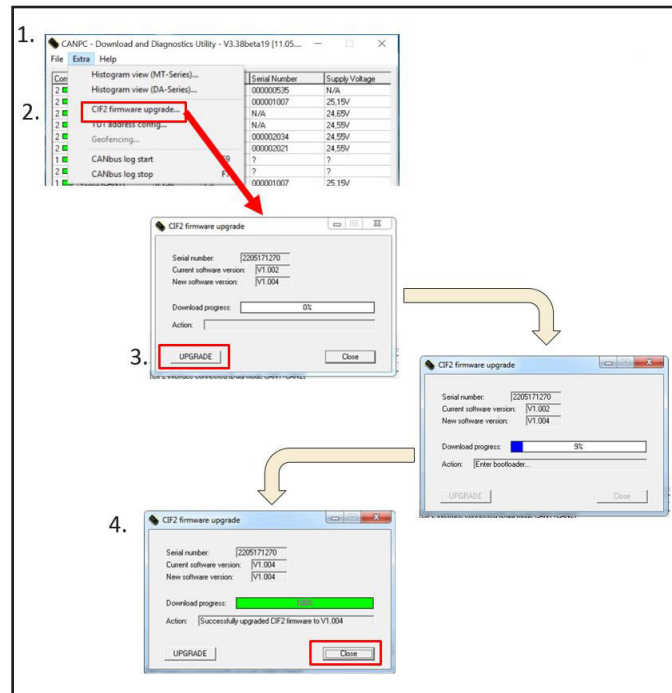
Figure 13

Software update

VCU software update procedure

Updating VCU software:
• Connect the CANPC interface.

1. Launch the CANPC program and select VCU CAN1 from the initial window.

• Click the "Download software" button.

2. A new window will appear. Select the desired software and click the "Download" button.

3. A warning will appear. Carefully read and select the "YES!" button to start or the "No,cancel" button to abort.
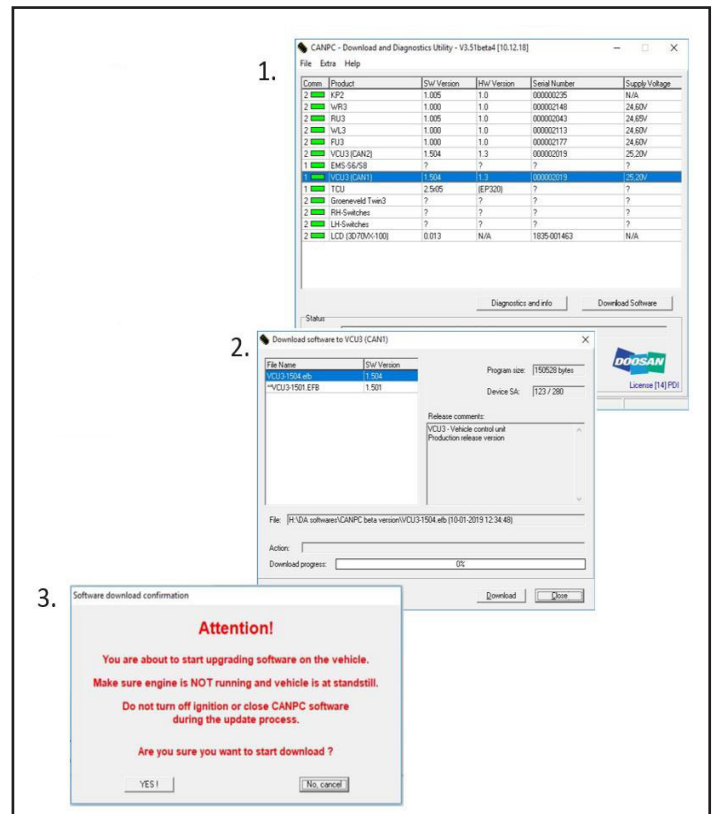
Figure 14

VCU software update procedure.

The status of the update can be seen on the progress bar.

When the status bar turns green and the text shows "Done" and "100%" the download is completed successfully.

Close the window to complete the update.
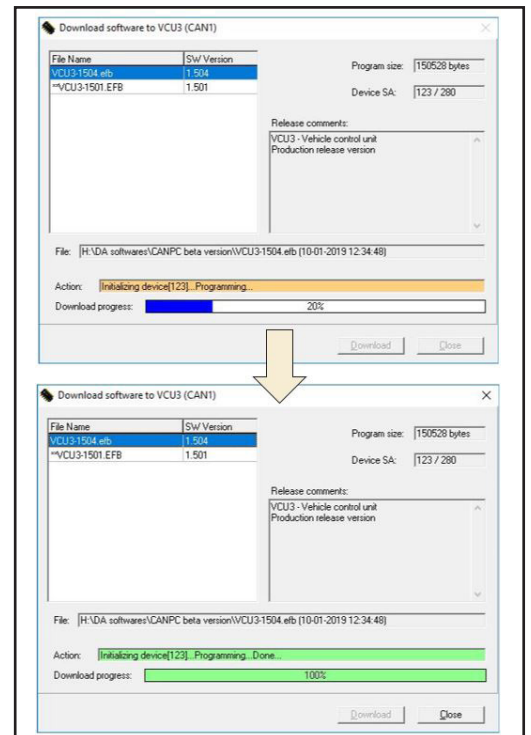
Figure 15

Failed update.

In case the update should fail because of reasons like laptop runs out of battery or lost connection.

The status bar will turn red and show "Error".

On the initial CANPC window all the devices will show a red symbol or not show at all.

The VCU symbol will show with a yellow symbol, indicating that no software is installed into it.

The truck will then be rendered useless until a succesful update is performed.

In case the failed update is caused by a corrupted software select a previous version to be installed instead and contact your Hyundai dealer for a new software file.
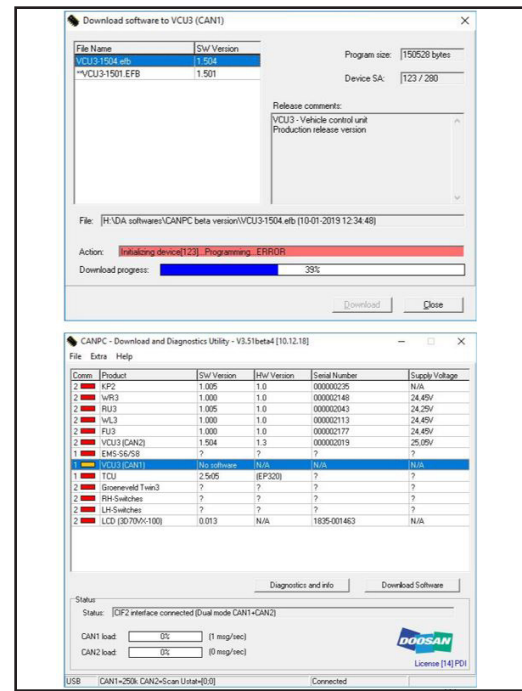
Figure 16

Transmission software update. With CANPC

From CANPC software version 3.37 together with the new CIF2 interface it is now possible to use the CANPC diagnostic tool to update the transmission software.

Requirements:
* For VCU3: CANPC version v3.50 or higher.
* CANPC interface firmware v1.003 or higher.
* The current TCU software must be v2.4.0 or higher.

NOTE
_____

It is not possible to use the old CANPC interface for this operation.
_____

NOTE
_____

If the CIF2 interface does not have the correct firmware installed when you attempt to update the TCU, you will receive a fault message telling that the function is not available and that you need to install a newer firmware version.
_____
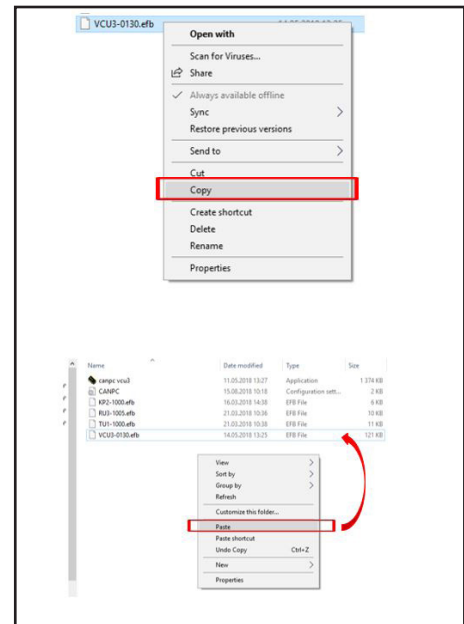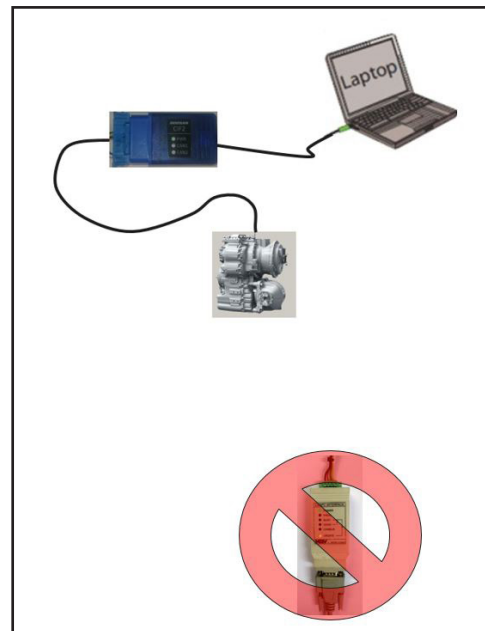

Figure 17

1. Connect the CIF2 to diagnostic port. The CIF2 unit is made with a integrated OBDII plug and can be plugged directly into the OBDII diagnostic port in the cab.

   For earlier DA models, use the included OBDII to UMNL mini 12P cable. For MT - series use the UMNL mini 6P connector.

2. Connect the USB cable from the CIF2 into a free USB port on the computer.

3. Turn the ignition to ON.
   All 3 LED's on the CIF2 unit should illuminate. This indicates that the CIF2 has power and has a working connection to both CANbus lines (CAN1 and CAN2) on the truck.

Figure 18

- Connect the interface to the laptop and turn the ignition to "ON".

- If the CANPC interface is properly connected, all 3 LED's will show a constant light. This means that the power supply and CANBUS are connected.

NOTE

Before starting the update the following must be checked:
- **Sufficient battery reserve on the laptop.**
- **Sufficient battery power on the truck.**
- **The computer screensaver/powersave mode must not be activated during the update.**
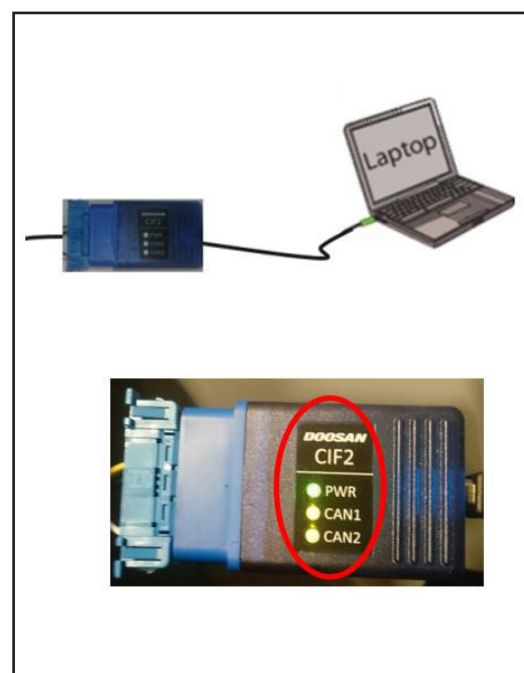
Figure 19

Updating transmission software:

1. Open the CANPC program.

2. Select the TCU by left-clicking it once.

3. Select the "Download software" button. This will open the update menu.
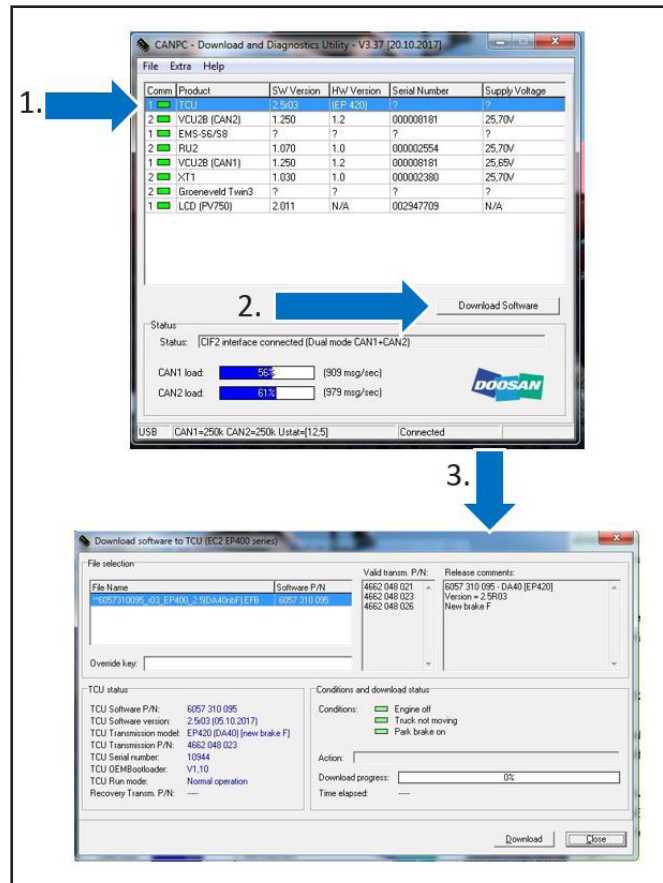
Figure 20

4. Select the software to install. Only the software valid for the actual type of transmission will be displayed.

NOTE

On some units both the current and new software will be available for download.

5. Make sure all the criterias for safe start of the download are fulfilled.

•   Engine Off.
•   Truck not moving.
•   Parking brake ON.
•   Select the download button to start the update.
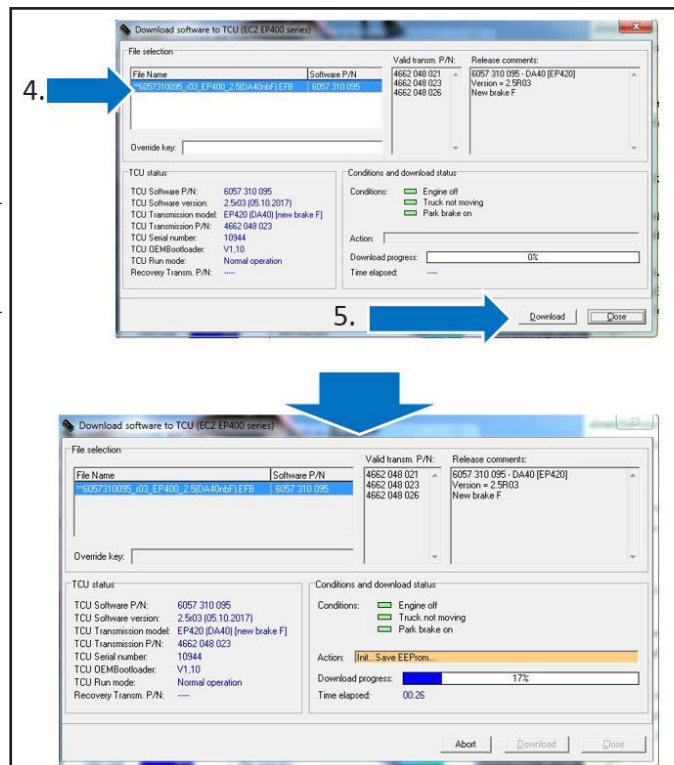
Figure 21

6.   When the download is complete, the action bar will display "Done" and the download progress bar will display 100%.

Select the close button to finish.
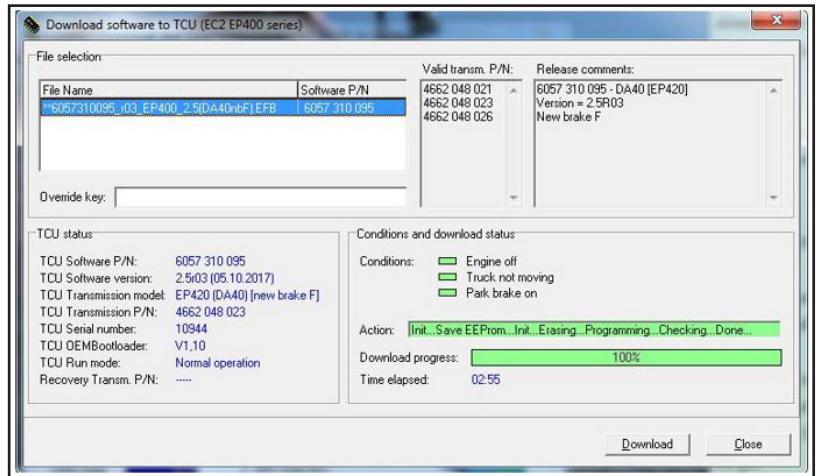
Figure 22

NOTE

If the update should for any reason fail, repeat the steps 1 to 6.

Components

Front wagon
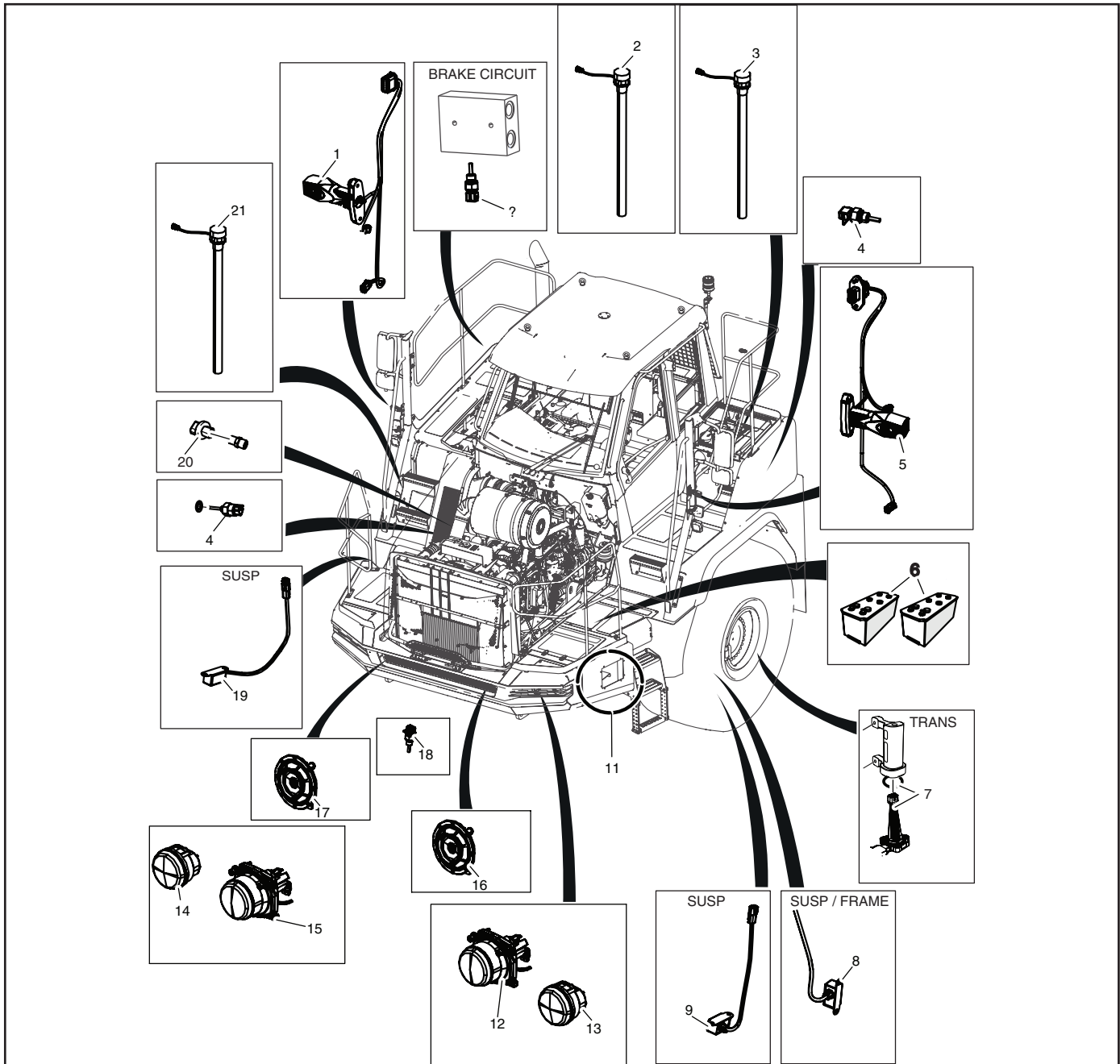
Figure 23

Position	Item	Position	Item
1	Marking light	12	Main light
2	Sensor (Cooling brake tank)	13	Direction light
3	Sensor (Hydraulic tank)	14	Direction light
4	Temperature sensor	15	Main light
5	Marking light	16	Horn
6	Batteries	17	Horn
7	Ultrasonic level sensor	18	Temperature sensor
8	Control unit front frame	19	Control unit wheel arm
9	Control unit wheel arm	20	Pressure sensor
10	Webasto	21	Sensor (Fuel tank)
11	Control module		

Rear wagon
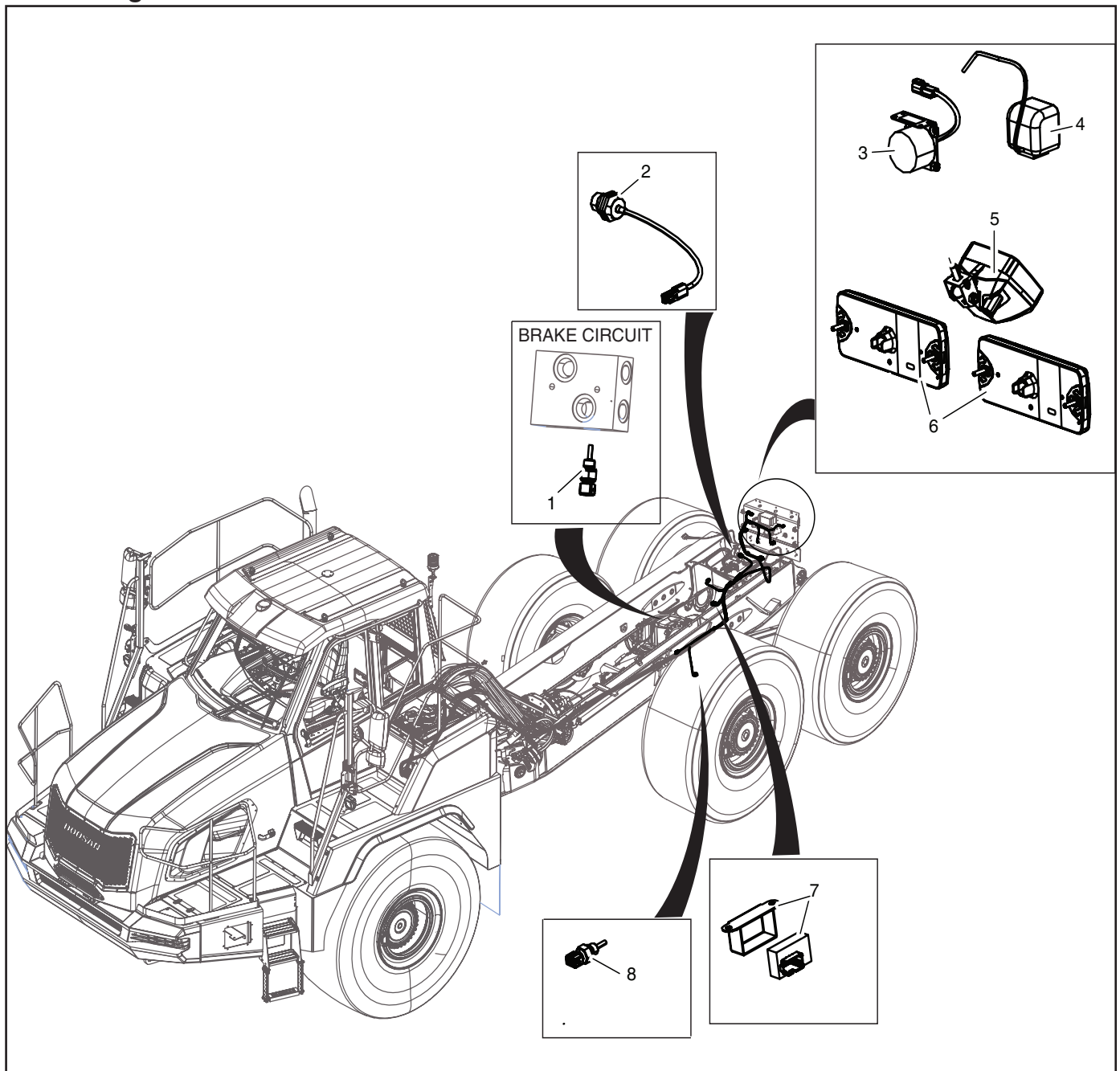
Figure 24

Position	Item
1	Temperature sensor
2	Body status indicator
3	Reverse alarm
4	Rear view camera
5	Work light rear
6	Led rear lamp
7	Tilting sensor
8	Temperature sensor

Overview on the inside of the cabin

Posision	Item
1	LCD display
2	Keypad
3	USB
4	Gear selector
5	Tip lever
6	Cigarette lighter
7	Switch
8	Switch
9	Throttle pedal
10	Electric park brake switch
11	Mirror adjustment switch
12	Buzzer
13	Ignition switch
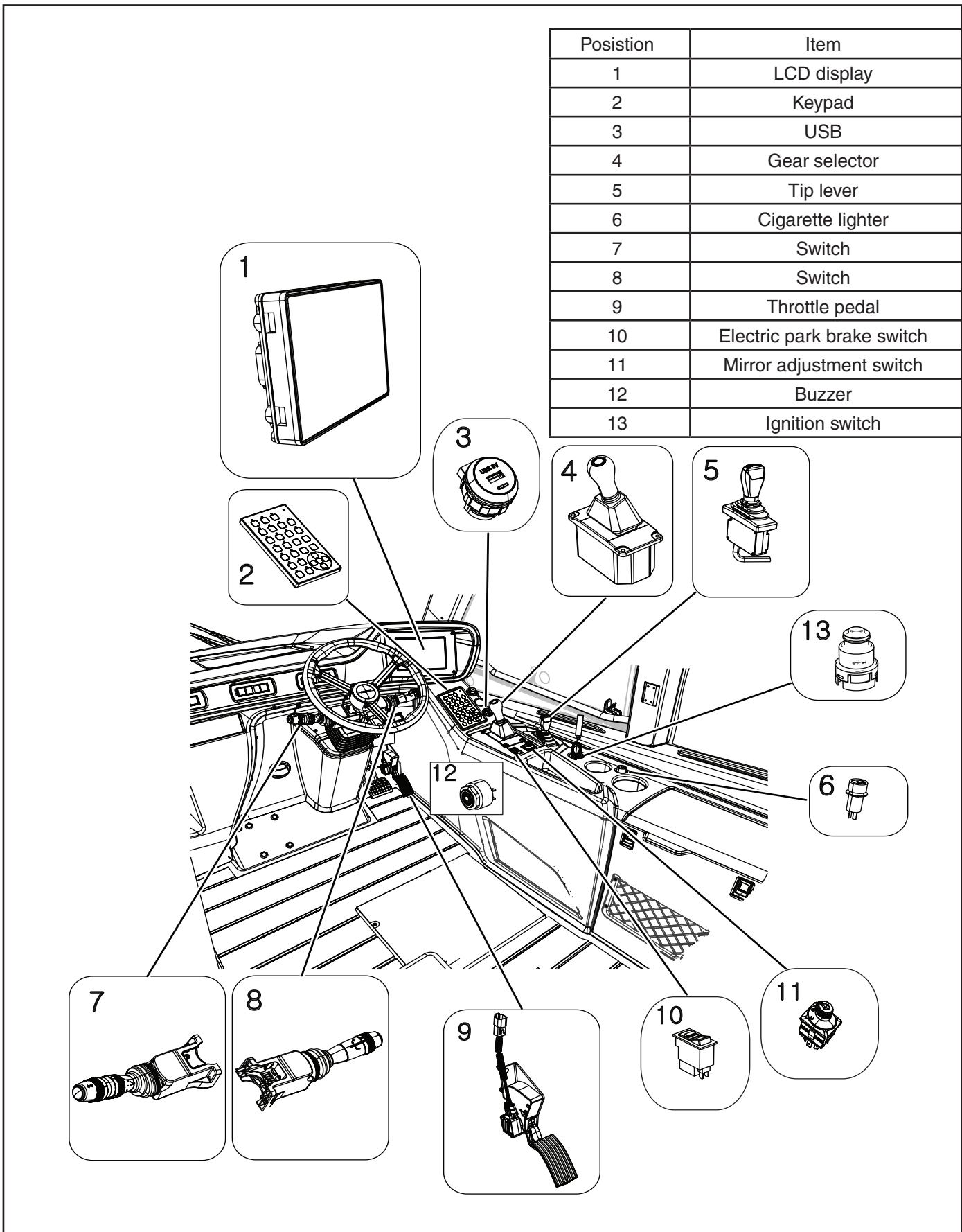
Figure 25

Overview on the outside of the cabin

Posision	Item
1	Interior light
2	HVAC control unit
3	Radio
4	Wiper motor
5	Rotating beacon
6	Speakers
7	Door switch
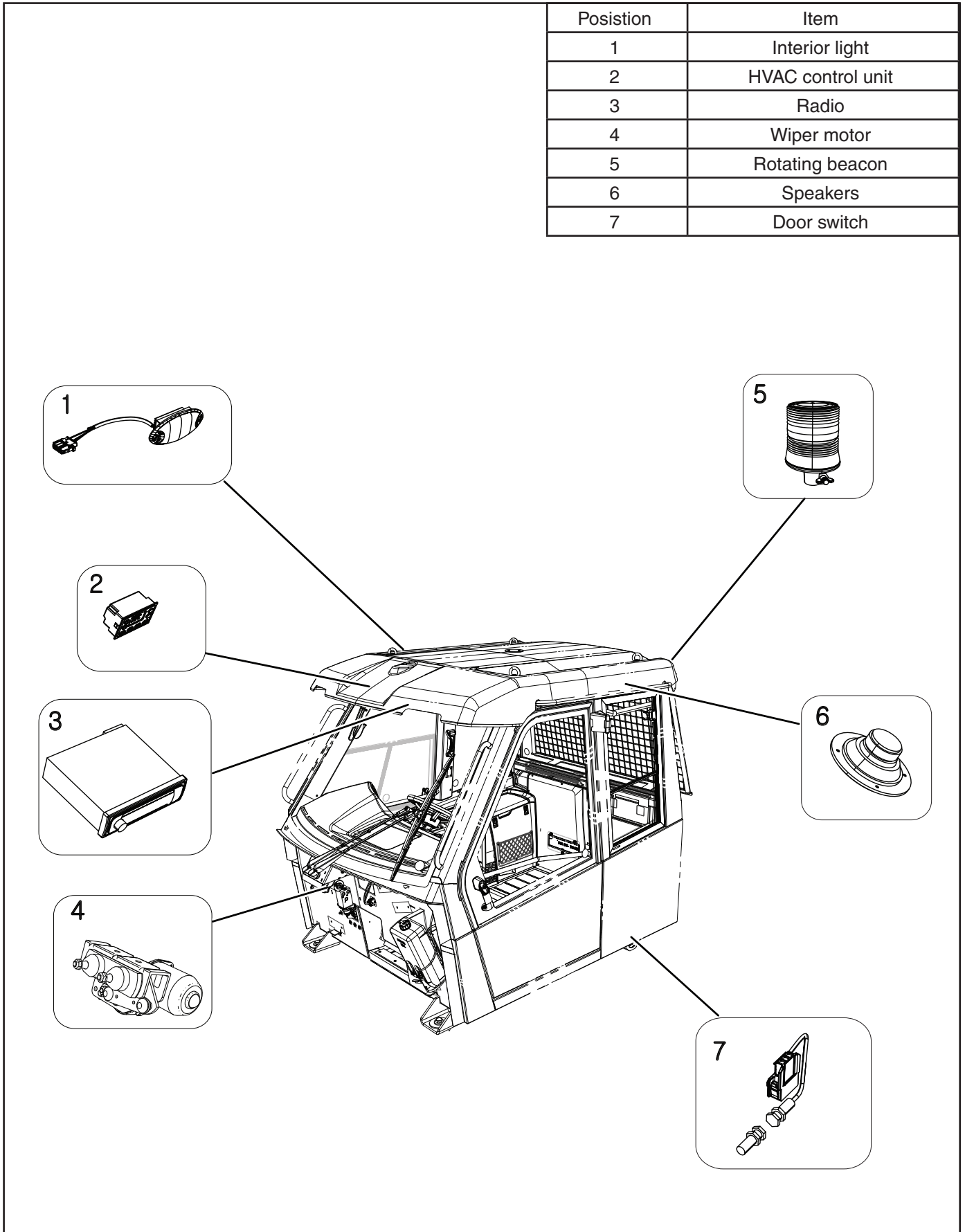
Figure 26

Battery

The truck has 2x EXIDE batteries installed.

PERFORMANCES	
Voltage (V):	12 V
C20 (Ah):	105.0 20 h
Rc (min):	0
Cranking (A)	950 EN
Vibration:	Manufactured Specific
Endurance:	VDA Requirement
Charge:	CHARGED
Technology:	AGM
Grid:	Ca/Ca
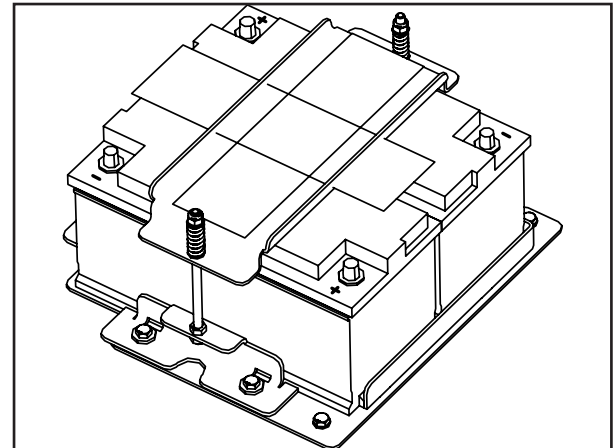
Figure 27

DIMENSIONS	
Battery Weight (kg):	28.8
Volume acid (l):	5.2
Length (mm):	392
Width (mm):	175
Height (mm):	190
Width (mm)	175
Height (mm)	190

COVER	
Type:	Double with IntegBLACK
Polarity:	ETN 0
Terminals:	EN taper post
Terminal Adapter:	No
SOCI:	No
Ventilation:	Central
Filter:	1 Filter at Right
Lateral Plug:	No

Cabin

VCU3

The VCU powers the control panel and the HVAC unit. It can also activate the A/C compressor clutch when the control panel signals this and both pressure and evaporator temperature allow it.

Fuse	Description	Rating
F10	VCU internal	5A
F11	TMS + Diag	5A
F12	LCD + Other	5A
F13	Keypad + Ign	5A
F14	Other instr	5A
F15	Extra #9 U30	10A
F16	Extra #8 U30	10A
F17	Extra #7 U30	10A
F18	Radio +12V	10A
F19	CB	10A
F20	Beacon + mark	15A
F21	Roof work light	15A
F22	Extra #6	7.5A
F23	Wiper + Washer	15A
F24	Adj. mirrors	5A
F25	Seat	15A
F26	HVAC system	7.5A
F27	HVAC fan	15A
F28	T/M + Other	7.5A
F29	T/M U30	10A
F30	PWM 1-4	7.5A
F31	Valve 9-10 + PWM 5-6	7.5A
F32	Valve 1-4	10A
F33	Valve 5-8	10A
F34	EMS + Other	7.5A
F35	Mirror heater	15A
F36	Mirror rear work light	15A
F37	Mirror front work light	15A
F38	Front park + Dir	7.5A
F39	Front low beam	10A
F40	Front high beam	5A
F41	Horn	10A
F42	Extra #2	7.5A
F43	Extra #3	7.5A
F44	Lubrication	10A
F45	Rear work light	15A
F46	A/C Clutch	5A
F47	Rear light + Other	7.5A

24V Main
24V Secondary
GND Main

Figure 28

HVAC

Figure 29

There are several electrical parts involved in controlling the temperature and air stream in the cabin. There are:

1. **HVAC unit**. Inside are the heater core, evaporator, water valve, re-circulation flap motor, blower + control, pressure sensors, temperature sensors and the A/C thermostat. The electrically operated water valve is used to regulate the amount of engine coolant coming into the heater core. In this way the amount of heat is controlled.

2. **Control panel (ATC)**. This commands the water valve, the blower speed, the re-circulation flap and gives command to activate the compressor. It reads the air temperature from sensors inside the HVAC unit.

3. **VCU**. This powers the control panel and the HVAC unit. It can also activate the A/C compressor clutch when the control panel signals this and both pressure and evaporator temperature allow it. A separate control is used to put the control panel in a preset mode. This is used in combination with an external engine heater (webasto).

4. **Ambient temperature sensor**. Used for the protection of the A/C compressor activation.

5. **A/C compressor clutch**. Electrical operated clutch that is part of the A/C compressor. When activated and the engine is running, the compressor will pump the coolant through the A/C system.

6. **Pressure sensors**, both placed on low and high pressure tubes going into the HVAC unit.

 A/C compressor

The control panel can decide that the A/C compressor should be activated. This can be either when the panel is operating in auto or manual mode. A signal called "Compressor Cmd" is pulled low (below 3V). This is passed to the VCU and will decide based on pressure, evaporator temperature if it can switch on the compressor.

The VCU will do several checks to see if it can activate the compressor. It uses several sensor signals for this. These are low and high pressure sensors, an ambient temperature sensor outside the cabin and a temperature sensor inside the evaporator.

The compressor will be activated by the VCU if all of the following conditions are met:

*   Low pressure is between 0.4 - 19 bar (5.8 - 276 psi).
*   High pressure is between 2.5 - 19 bar (36 - 276 psi).
*   Ambient temperature is higher than 3 °C (37 °F).
*   The engine is running.
*   A/C clutch has not been activated the last 15 seconds. This is to increase the lifetime of the compressor.

The pressures, temperature, engine rpm, AC clutch signals and evaporator temperature, can be viewed on the VCU diagnostic page on the display in the cabin.

There are a few items related to A/C on the diagnostic page, such as:

- **A/C LP**. Gives the pressure in the low pressure part of the A/C system.
- **A/C HP**. Gives the pressure in the high pressure part of the A/C system.
- **A/C clutch input**. Gives the status of the signal coming out of ATC to the VCU A/C clutch input (Y19,85). "On" means that the control panel asks for the activation of the compressor. Also shown is the voltage on the input pin of the VCU. "On" corresponds to 0 - 3 Volt on the input pin, "Off" when voltage is higher than 3 Volt.
- **A/C clutch output** (Y10,6 & Y10,10). This indicates if the compressor should be On or Off. Both wires of the compressor clutch or connected to the VCU.
- **Evaporator temperature**. The VCU uses this to decide if the compressor can be on. If the temperature is below 2 to 3 °C then this is not allowed, to prevent freezing of the evaporator.
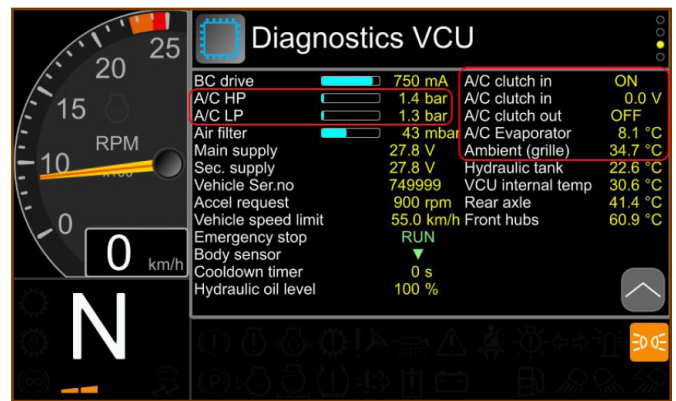
Figure 30

Blower control

The blower in the HVAC unit is connected to a speed controller unit mounted on top of the blower. The control panel gives a signal to the speed controller in the HVAC unit. This signal is between 0 - 5 V that corresponds with the speed of the blower.

Water valve

This valve controls the amount of coolant water that goes through the heater core of the HVAC unit. It uses a motor to set the valve opening and a potentiometer to report back the position of the valve to the control panel. The motor is controlled by supplying power to pins 4 & 6 on the valve connector. Applying 24 V to pins 6-4 will open the valve. Applying 24 V to pins 4-6 will close it.
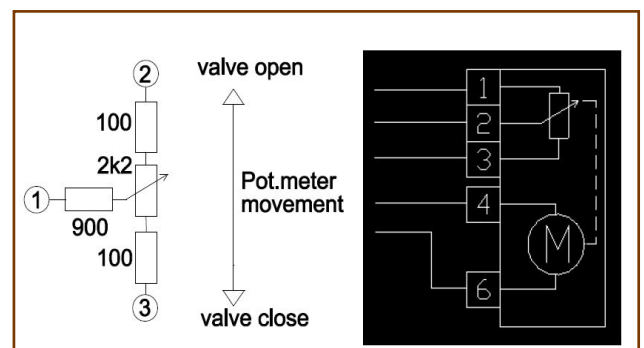
Figure 31

Flap motor

The flap motor is a reversal polarity electric motor. This is used to close the HVAC unit from the outside air when the recirculation button is pressed on the control panel. It is a two wire motor that uses two external switches and parallel diodes to limit the movement in both directions. When the flap is in one of the end positions, one switch will be open and the diode will make sure that only movement in the opposite direction is possible. Applying 24 V between pin B8 to pin B17 of the connector on the control panel will move the flap to the open position. Applying 24 V between B17 to pin 8 will put the flap into the recirculation position.
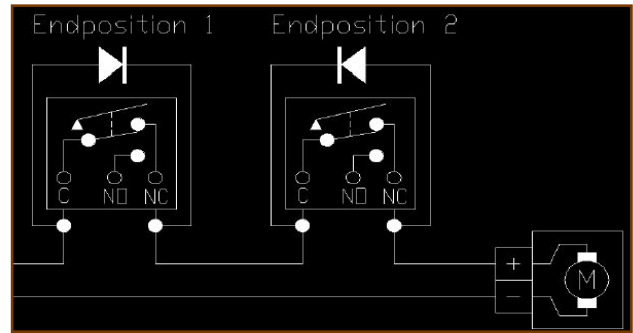
Figure 32

Temperature sensors

There are three sensors used inside /around the HVAC unit. They are used to measure the temperature inside and outside the unit. Also one measures the mixed air temperature. These are NTC resistors. Measured resistance is 13K Ohm at around 18 °C (64 °F). At 9 °C it is around 21k Ohm.
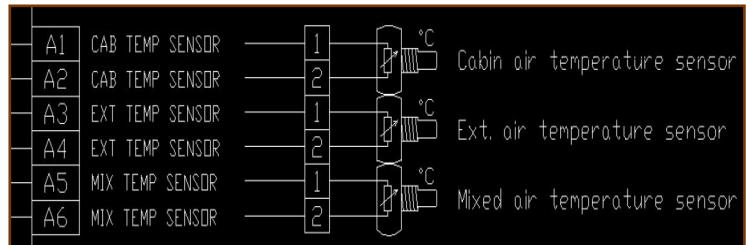
Figure 33

Evaporator temperature sensor

This is a PT1000 sensor which is installed into the evaporator. The resistance is around 1000 Ohm at 0 °C.
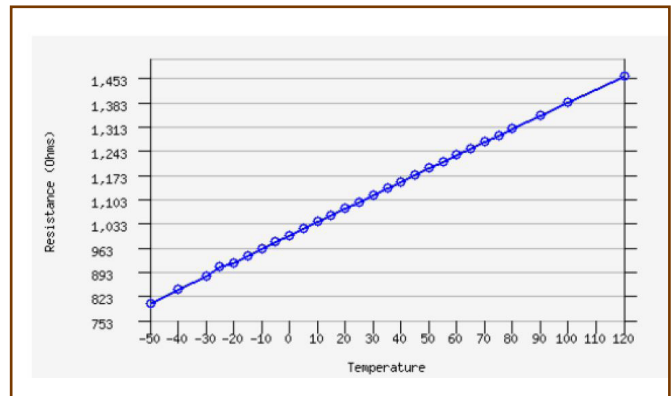
Figure 34

Pressure sensors

These sensors are used to measure the pressure in both high and low pressure parts of the A/C system. The pressures are used by the VCU to determine if the compressor is allowed to run. These two sensors are mounted on the outside of the HVAC unit. They have a current output between 4 and 20 mA that corresponds to 0 - 30 bar (425 psi).
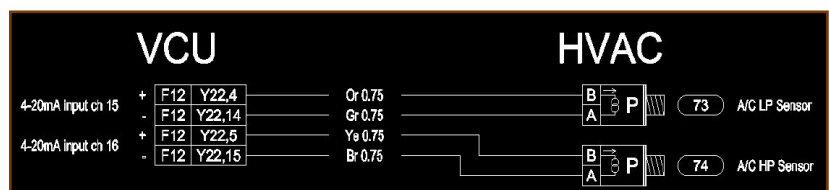
Figure 35

Radio

Radio installed on the ADT:

- Continental TR7412UB-OR. FM(Standard)
- Continental TRD7412UB-OR DAB(Option)

Figure 36

General	
Power supply	
Maximum power output	4 x 41 W
Suitable speaker imped-ance	4 ohm
Fuse spec	10 A
Weight	0.7 kg
Dimensions (WxDxH)	188x116.3x58.5 mm
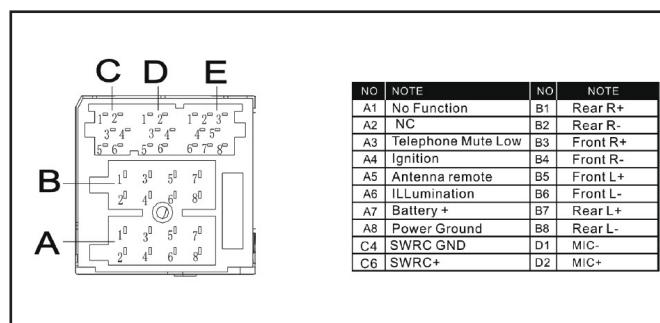
Figure 37

TROUBLESHOOTING		
Problem	Possible cause	Solution
General		
The unit will not switch on.	Car ignition is not on. Cable is not properly connected. Fuse is burnt.	Turn your car key in the ignition. Check cable connection. Replace fuse with a new fuse of the same capacity.
No sound	Volume is set at minimum or the mute function is on.	Check the volume or switch the mute function off.
The unit or screen does not work normally.	The unit system is unstable.	Press the RESET button.
Mode TUNER		
Unable to receive stations.	The antenna is not connected properly.	Connect the antenna properly.
Poor quality reception of radio station.	The antenna is not fully extended, or it is broken.	Fully extend the antenna and if broken, replace it with a new one.
Mode USB		
Unable to insert USB	The USB device has been inserted the wrong way round.	Insert it the other way around.
The USB device cannot be read.	NTFS format is not supported.	Check that the file system is in FAT or FAT32 format. Due to different formats, some models of storage devices or MP3 players may not be read.

Interior light

MiniOval LED 24V.
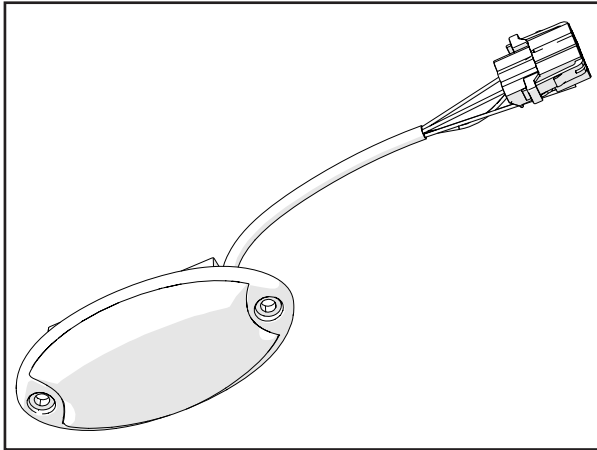
Figure 38
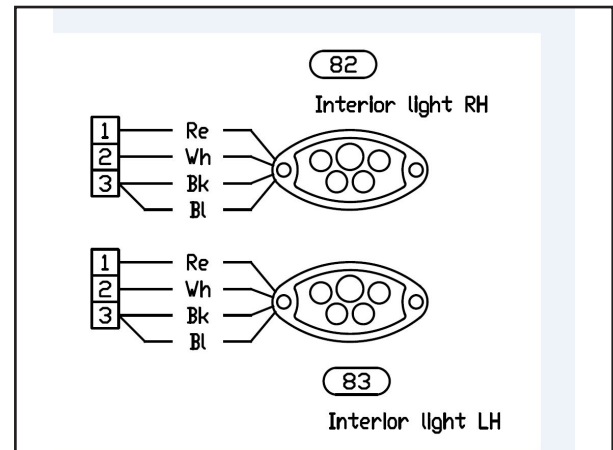
Figure 39

Cigarette lighter
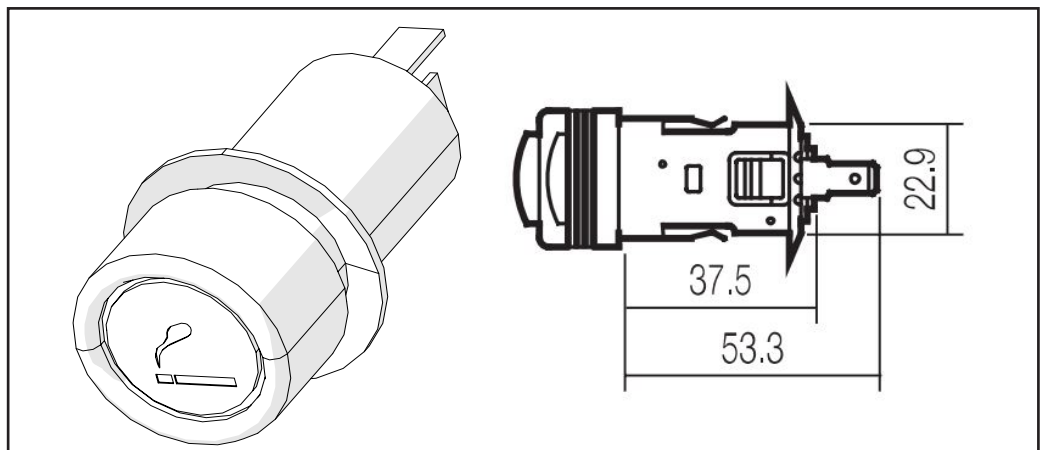
Figure 40

12V Universal cigarette lighter.

- Type of connection: blade coupling 6.3mm.

- Installation opening: Ø23.5 mm

- Control panel thickness: max. 2.5 mm.

Speakers

Dual Blaupunkt Performance GTx 402 SC
speakers are installed in the truck cabin.
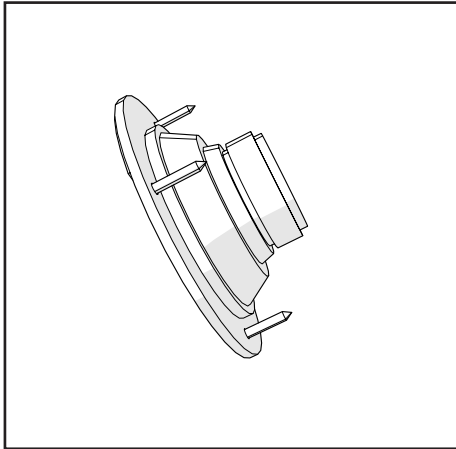
Figure 42
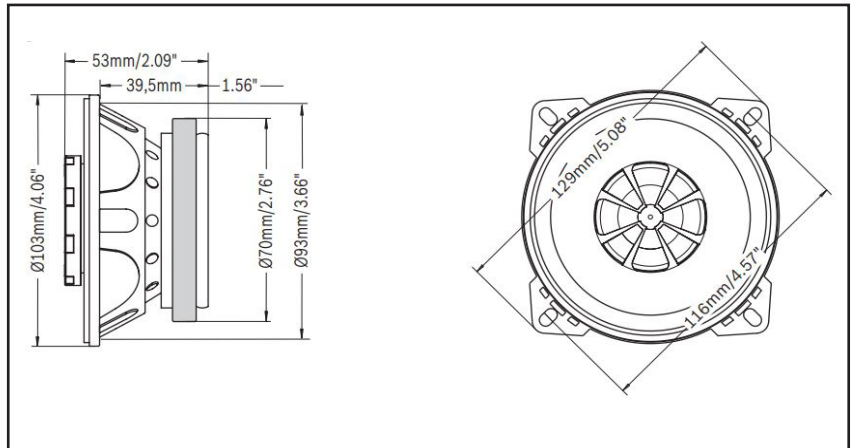
Figure 41

Peak power handling	140 W
RMS power handling	30 W
Impedance	4 Ohms
Frequency response	90 - 20.000 Hz
Sensitivity	90 dB (2.83 V/m)

Doorswitch

Proximity door switch from Assemtech Europe.

Switching capacity	Max. 10 W/VA
Switching voltage	max. 200 VDC/AC
Switching Current	Max. 0.5 A
Contact resistance	Max. 200 mOhms
Switching distance	Min. 10 mm
Operating temperature	-20°C to 85°C
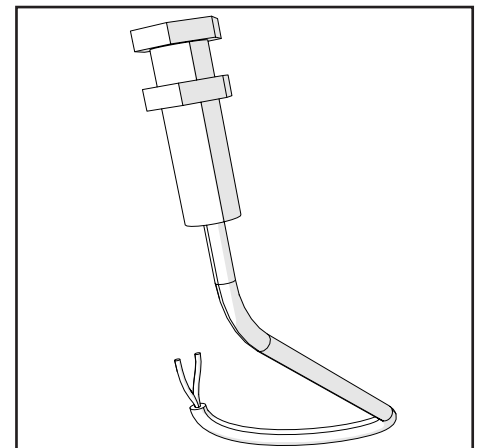
Figure 43

Tip lever

Parker IQAN-LSL tip lever is a single-axis joystick, 0.5 - 4.5 Vdc, intended for the proportional control of one doubleacting hydraulic function. The lever has several options including a manual neutral detent and a switch in the top of the handle.

The IQAN-LSL is a spring centered, dual sensor device. The optional switch in the top of the handle can be used to detect operator presence. The dual sensors provide 0.5 - 4.5 Vdc and 4.5 - 0.5 Vdc outputs which allows error checking to meet high safety requirements.

Figure 45

Weight	0.22 kg
Rated power supply	5 Vdc
Current consumption	16 mA
Analog outputs	Active range: 10%-90% Resolution: <2mV
Digital output option	12V and 24V
Max load current	200 mA
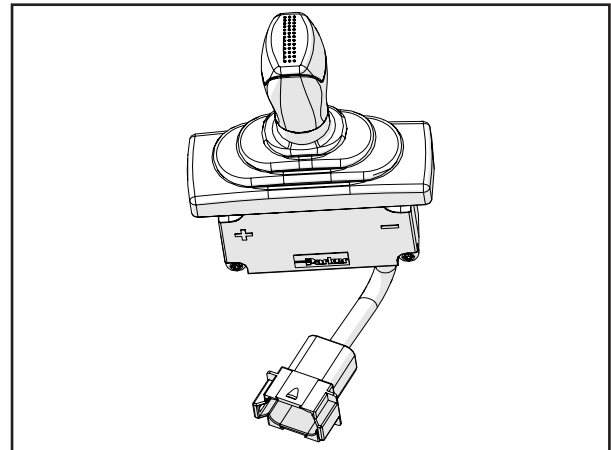
Driver seat

Sears deluxe 8000 series.
Use 25 amp fuse for 12 V air suspension and 20 amp for 24 V.
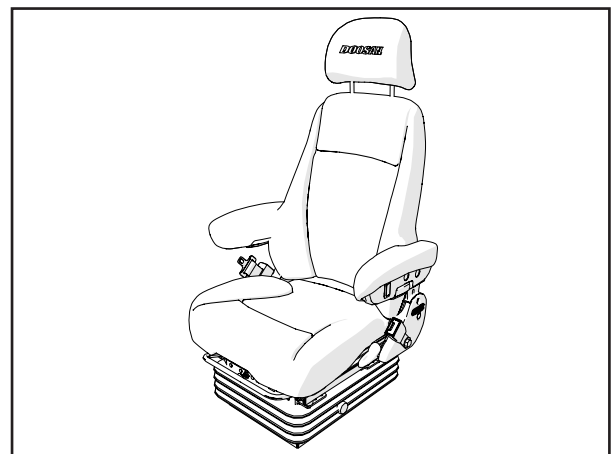
Figure 44

Gear selector

Gear selector from ZF.

Nominal Voltage	24 V
Operating Voltage	20 - 32 V
Testing Voltage	28 ± 0.5 V
Max. Supply Current	4 A max.
Output Current	1 A max.
Operating Temperature	-40°C - +80°C
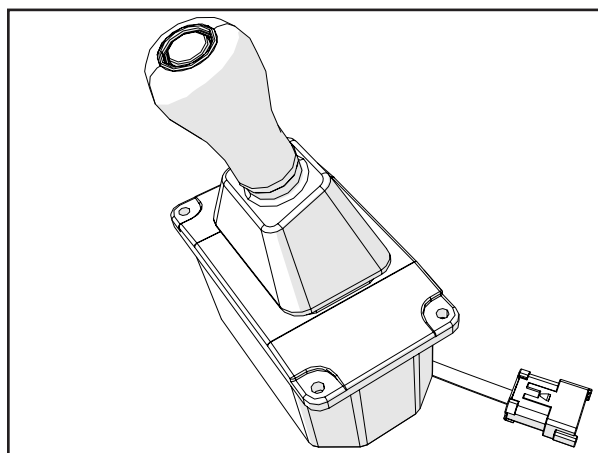
Figure 46

Wiper motor

DOGA wiper motor.
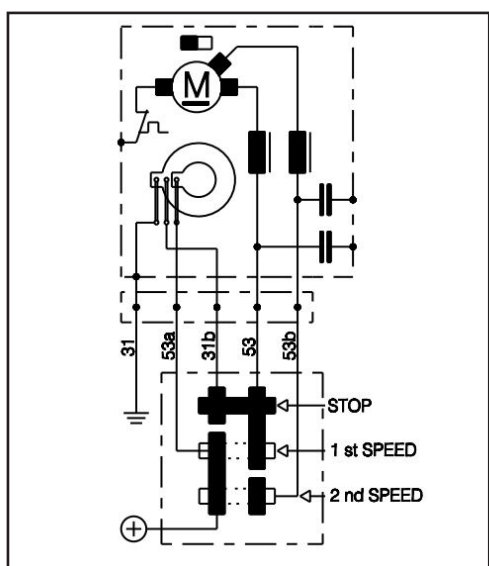
Figure 47
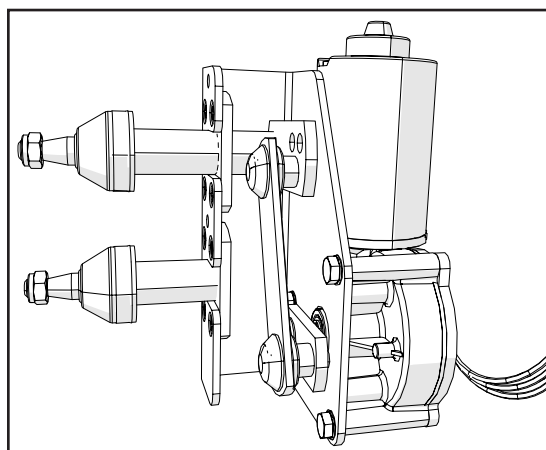
Figure 48

Connector pin	Terminal	Color	Electrical wiper function.
1	53	Red	Positive Speed n1 feed switch.
5	31	Black	Negative, earth.
6	31b	Green	Park feed.
3	53a	Yellow	Park (auxiliar feed).
2	53b	Blue	Positive Speed n2 feed switch.

Motor performance type 111						
No load performance				Starting torque	Stall current	Testing Voltage
Speed	V	Current	RPM			
n1	24V	<0.9 A	34 ± 3	≥ 25Nm	10 A	27 V
n2		<1.5 A	52 ± 5		12 A	

Throttle pedal

This is a throttle pedal assembly with a solid-state rotary position sensor that provides a dual linear output voltage proportional to absolute shaft rotation in either direction from a reference angle. It operates from +5V power typically supplied by a vehicle engine control unit (ECU). This device's two outputs are independent and electrically isolated, supporting the implementation of highly fault tolerant and reliable systems.

PIN	FUNCTION	WIRE COLOR
1	GND1	BLACK
2	VCC1 (+5V)	RED
3	APS1	GREEN
4	APS2	WHITE
5	GND2	BLUE
6	VCC2 (+5V)	YELLOW

Figure 49

Supply Voltage	5±0.5V
Output Current	10 mA
Operating Temperature	-40°C to +85°C
APS1,2 short circuit duration to ground	20 minute max
APS1,2 short circuit duration to VCC	20 minute max

LCD Display

Grayhill 3D70 7-inch display.

Operating voltage	8VDC to 32VDC
Power Consumption	7 W
Standby Current	<1ma
USB	2.0 host
CAN	(2) CAN 2.0B
Inputs	(4) 0-32 VDC discrete digital; Freq Meas. to 20KHz, Pulse Width Meas down to 50uS
Outputs	(4) digital 200 mA switched high side
Analog	(2) 0-5V, 0-10V, 4-20mA, 0-5000 Ohm
Operating temperature	-30°C to +65°C
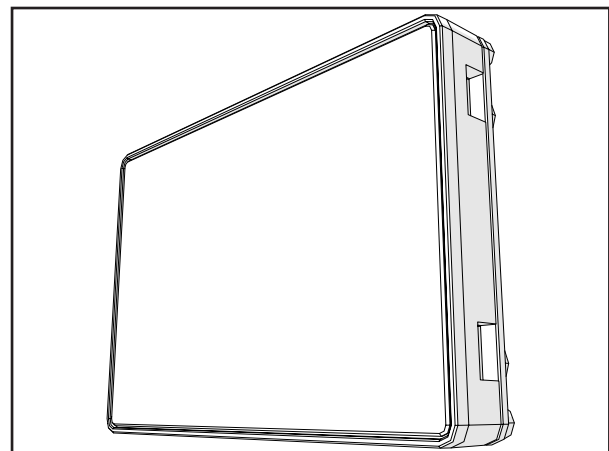
Figure 50

REAR CONNECTOR A & B
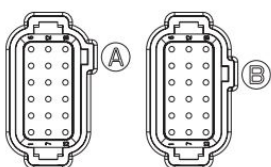
Mating Connector:
CON. A: DEUTSCH DT16-18SA-K004
CON. B: DEUTSCH DT16-18SB-K004

CONNECTOR A

Pin	Function	Pin	Function	Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	VIN Positive	2	VIN Return	3	VIN Switched	4	Digital In 1	5	USB +	6	USB -
7	VIDEO1+	8	VIDEO1-	9	VIDEO2+	10	VIDEO2-	11	USB 5V	12	USB 5V RET
13	CAN1 HI	14	CAN1 LO	15	CAN2 HI	16	CAN2 LO	17	RS232Tx	18	RS232Rx

CONNECTOR B

Pin	Function	Pin	Function	Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	AUDIO OUT	2	AUDIO RET	3	Analog IN 1	4	Analog IN 2	5	VIDEO3 -	6	VIDEO3+
7	Analog RET	8	Digital IN 2	9	Digital IN 3	10	Digital IN 4	11	Digital OUT 1	12	Digital OUT 2
13	Digital OUT 3	14	Digital OUT 4	15	ETH TPO+	16	ETH TPO-	17	ETH TPI+	18	ETH TPI-

TMS

The Q-Pro is a small, rugged, enviromentally-sealed module with numerous customization options including operating network, inputs/outputs, memory, CAN bus and antenna detection.
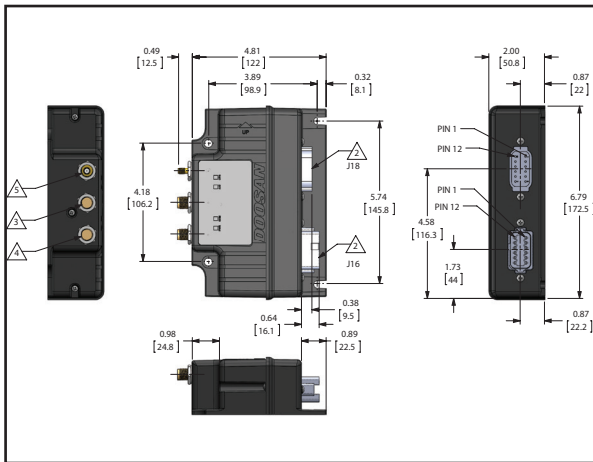
Figure 51

Transmit Freq.	148.000 to 150.050 MHz
Receive Freq.	137.000 to 138.000 MHz
Transmit Power	5W min. - 10W max.
Data Rates	2400 bps Uplink/ 4800 bps Downlink
Input/Output	2 Analog Inputs. Up to 8 digital outputs(RELAY). ORBCOMM/GSM/GPS Antenna detection.
External Power Source	6-32 VDC
Power Consumption	12V
Transmit ORBCOMM	1.8A (Nominal)
Transmit GSM	0.2A (Nominal)
Transmit Globalstar	800 mA (Nominal)
Transmit Iridium	550 - 850 mA (Nominal)
Operating Temperature	-40 °C to +85 °C

Figure 52

TABLE 1 - PINOUT CONFIGURATION JOR J16		
PIN	DESCRIPTION	SIGNAL NAME
1	Vehicle Battery (+)	VBAT +
2	Vehicle Battery (-)	VBAT -
3	Alternator input	ALT
4	Key input	KEY
5	Primal serial RX	PRI SER RX
6	Primal serial TX	PRI SER TX
7	Serial ground (-)	DGND
8	CAN Bus High	CAN H
9	CAN Bus Low	CAN L
10	Security Output 3.5V	SECURITY
11	Reserved	N/C
12	Ground (-)	GND

Figure 54

TABLE 2 - PINOUT CONFIGURATION JOR J16		
PIN	DESCRIPTION	SIGNAL NAME
1	Analog Ground (-)	AGND
2	Fuel Sensor 1	FUEL 1
3	Fuel Sensor 2	FUEL 2
4	Starter Relay	ST RLY
5	Solenoid Control	SOL
6	Magnetic sensor 1	MAG SENS 1
7	Magnetic sensor 2	MAG SENS 2
8	General purpose I/O	GPIO
9	Emergency	EMERGENCY
10	Serial Ground (-)	SGND
11	Secondary Serial RX	SEC SER RX
12	Secondary Serial TX	SEC SER RX

Figure 53

Electric mirrors (optional)

Glass size (WxH)	185 x 363,5 mm
Radius of curvature	1200mm
Heating system	Unheated or heated 12 or 24V
Adjustment	Manual or electrical, 12 or 24V
Adjustment range	up/down: > ± 7°C and left/right: > ± 13°C
Mirror mounting bracket interface	Clamp for 18-28mm tube diameter
On-board power supply connection	2- or 6-lead flange socket, direct contacting upon request
Material	Shock-proof ABS plastic, black, UV resistant
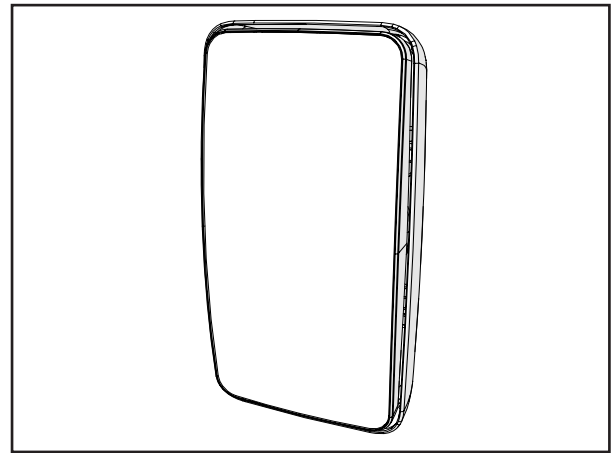
Figure 55

Buzzer

Supertone horn 24V (375Hz)

Voltage (V)	24
Frequency (Hz)	375
Sound level (dB)	118
Power consumption (W)	84
Diameter (mm)	123
Temperature range (°C)	-40 to +75
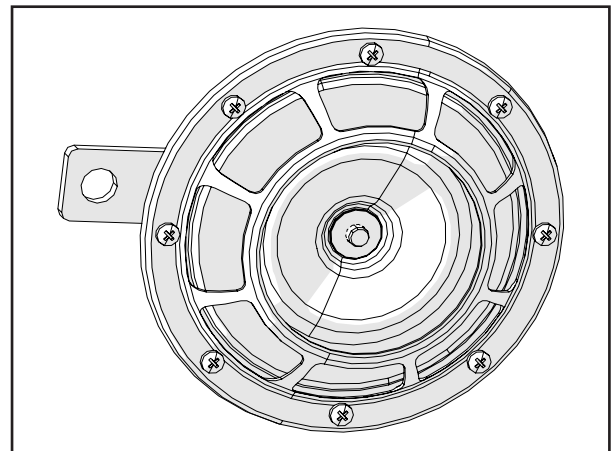
Supertone horn 24V (500Hz)

Voltage (V)	24
Frequency (Hz)	500
Sound level (dB)	118
Power consumption (W)	84
Diameter (mm)	123
Temperature range (°C)	-40 to +75

Figure 56

DC - DC converter

Part number	PV12s
Cont/Int Power	12A/18A non-isolated
Nominal Voltage	24Vdc input, 12Vdc output
Dimensions	127 x 87 x 50 mm
Weight	405g
Input voltage range	17-32 Vdc
Output voltage	13.6 Vdc +15% -20% at extremes of temperature, load and input tolerance.
Operating temperature	-25 °C to +30 °C +30 °C to +80 °C de rate linearly to 0A
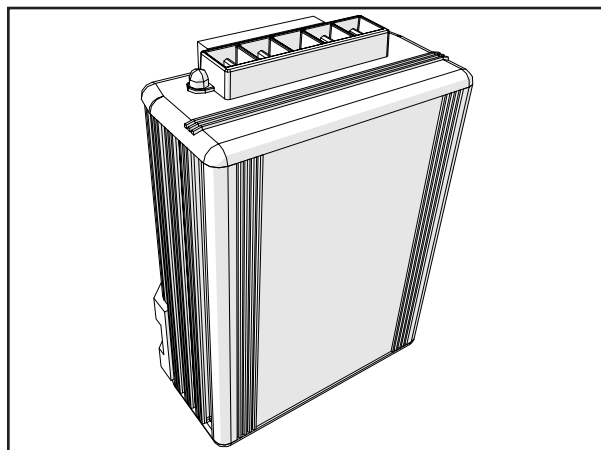
Figure 57

USB charger

AlfaTronix PVPro-S

Dimensions	Ø37 x 33, hole Ø30 mm
Weight	20g
Input voltage	9 - 32 Vdc
Output Voltage	5Vdc ± 0.2V
Output Power	2.1A (single) 3.0A(double) - max 1.5A per socket
Offload current	<1.5 mA
Power conversion efficiency	90%
Operating temperature	-25°C to +50°C
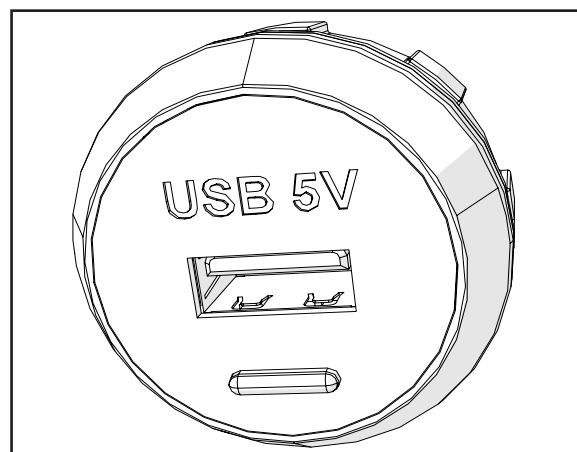
Figure 58

Park brake switch

HELLA ignition switch with lock 6.pole.
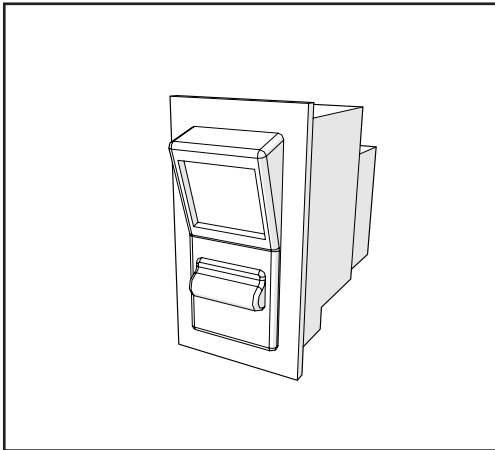
Figure 59
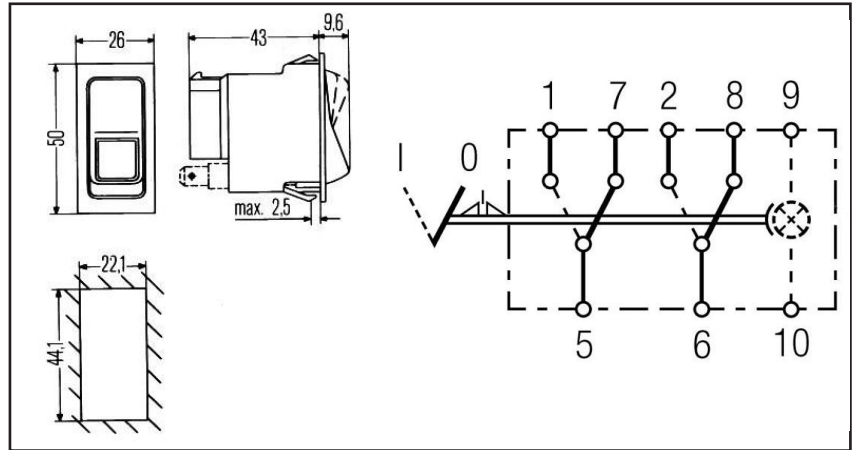
Figure 60

Mirror adjustment switch

Mekra mirror adjustment switch with LED.

Rated voltage	DC 12/24 V
Test Voltage	DC 14/28 V
Operating voltage	DC 10 - 30 V
Max. excess voltage	DC 36V/2h DC 48V/2min
Contact resistance	R < 1 Ohm
Illumination	LED, not exchangeable
Operating temperature	-40°C - to 85°C
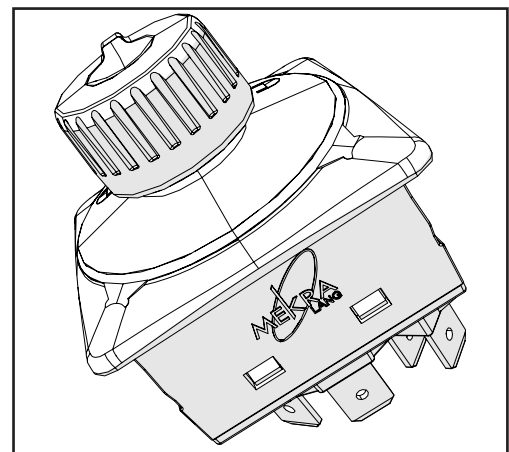
Figure 61

Steering column switch

This column switch is a multi-functional switch for main lights, horn, direction indicators and windscreen wiper/washer.
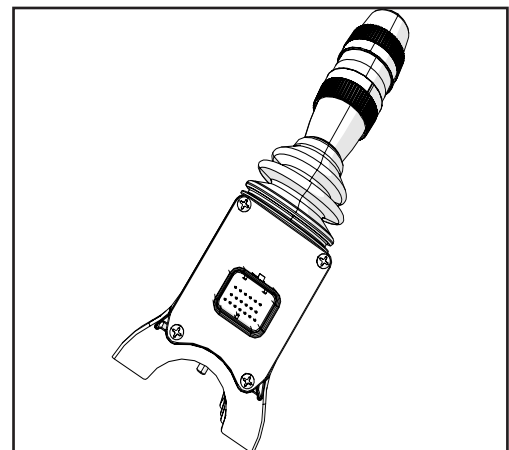
Figure 62

Retarder lever

Standard retarder setting is 100 % and can be reduced by the retarder lever (up or down) from 100% to 25%.

Figure 63

Diagnostic connector

4.0 mm pitch, OBD-II wire-to-wire receptacle housing panel mount.

Rated Voltage	Max. 30 V
Ambient temperature range	-40 °C to 85 °C
Circuits	Max. 16
Number of rows	2
Ports	1

Figure 64

Electrical parts involved in hydraulic control

Test block

145 - Tilt Cylinder
Pressure

144 - Park Brake
Pressure

143 - Rear Brake
Pressure

142 - Front Brake
Pressure

140 - Pump 1
Pressure

Inside cabin | Outside cabin

VCU3

Hydraulic pressure sensors

					A	B				
4-20mA input ch 1	+	Y2,5	Wh 0.75		S5,7		Wh 0.75	3 / 2 8 P	(140)	P1 (pump 1)
	−	Y2,15	Gn/Br 0.75		S5,8		Gn/Br 0.75			
4-20mA input ch 2	+	Y2,6	Gn 0.75		S5,9		Gn 0.75	3 / 2 8 P	(141)	B (body down)
	−	Y2,16	Ye/Br 0.75		S5,10		Ye/Br 0.75			
4-20mA input ch 3	+	Y2,7	Bl 0.75		S5,11		Bl 0.75	3 / 2 8 P	(142)	ACC1 (front)
	−	Y2,17	Br/Bk 0.75		S5,12		Br/Bk 0.75			
4-20mA input ch 4	+	Y2,8	Ye 0.75		S5,13		Ye 0.75	3 / 2 8 P	(143)	ACC2 (rear)
	−	Y2,18	Br/Gr 0.75		S5,14		Br/Gr 0.75			
4-20mA input ch 5	+	Y2,9	Or 0.75		S5,15		Or 0.75	3 / 2 8 P	(144)	ACC3 (common)
	−	Y2,19	Br/Wh 0.75		S5,16		Br/Wh 0.75			
4-20mA input ch 6	+	Y2,10	Vi 0.75		S5,17		Vi 0.75	3 / 2 8 P	(145)	A (body lift)
	−	Y2,20	Bl/Br 0.75		S5,18		Bl/Br 0.75			
4-20mA input ch 7	+	Y1,1	Ye/Vi 0.75		S5,19		Ye/Vi 0.75	3 / 2 8 P	(146)	Park brake output
	−	Y1,9	Br/Or 0.75		S5,20		Br/Or 0.75			
4-20mA input ch 8	+	Y1,2	Or/Wh 0.75		S5,21		Or/Wh 0.75	3 / 2 8 P	(147)	Em. steering
	−	Y1,10	Br/Pk 0.75		S5,22		Br/Pk 0.75			
4-20mA input ch 13	+	Y1,7	Wh 0.75		S3,24		Wh 0.75	3 / 2 8 P	(148)	FB (front circuit)
	−	Y1,15	Br/Wh 0.75		S3,25		Br/Wh 0.75			
4-20mA input ch 14	+	Y1,8	Or 0.75		S3,26		Or 0.75	3 / 2 8 P	(149)	RB (rear circuit)
	−	Y1,16	Br/Or 0.75		S3,27		Br/Or 0.75			

Figure 65

Steering valve

147 - Emergency steering

			Inside cabin	Outside cabin			
			A	B			
4-20mA input ch 1	+	Y2,5	Wh 0.75	S5,7	Wh 0.75	3 2 P	140 P1 (pump 1)
	−	Y2,15	Gn/Br 0.75	S5,8	Gn/Br 0.75		
4-20mA input ch 2	+	Y2,6	Gn 0.75	S5,9	Gn 0.75	3 2 P	141 B (body down)
	−	Y2,16	Ye/Br 0.75	S5,10	Ye/Br 0.75		
4-20mA input ch 3	+	Y2,7	Bl 0.75	S5,11	Bl 0.75	3 2 P	142 ACC1 (front)
	−	Y2,17	Br/Bk 0.75	S5,12	Br/Bk 0.75		
4-20mA input ch 4	+	Y2,8	Ye 0.75	S5,13	Ye 0.75	3 2 P	143 ACC2 (rear)
	−	Y2,18	Br/Gr 0.75	S5,14	Br/Gr 0.75		
4-20mA input ch 5	+	Y2,9	Or 0.75	S5,15	Or 0.75	3 2 P	144 ACC3 (common)
	−	Y2,19	Br/Wh 0.75	S5,16	Br/Wh 0.75		
4-20mA input ch 6	+	Y2,10	Vi 0.75	S5,17	Vi 0.75	3 2 P	145 A (body lift)
	−	Y2,20	Bl/Br 0.75	S5,18	Bl/Br 0.75		
4-20mA input ch 7	+	Y1,1	Ye/Vi 0.75	S5,19	Ye/Vi 0.75	3 2 P	146 Park brake output
	−	Y1,9	Br/Or 0.75	S5,20	Br/Or 0.75		
4-20mA input ch 8	+	Y1,2	Or/Wh 0.75	S5,21	Or/Wh 0.75	3 2 P	147 Em. steering
	−	Y1,10	Br/Pk 0.75	S5,22	Br/Pk 0.75		
4-20mA input ch 13	+	Y1,7	Wh 0.75	S3,24	Wh 0.75	3 2 P	148 FB (front circuit)
	−	Y1,15	Br/Wh 0.75	S3,25	Br/Wh 0.75		
4-20mA input ch 14	+	Y1,8	Or 0.75	S3,26	Or 0.75	3 2 P	149 RB (rear circuit)
	−	Y1,16	Br/Or 0.75	S3,27	Br/Or 0.75		

VCU3

Hydraulic pressure sensors

Figure 66

Main valve

146 - Park brake output

184 - Brake charge valve

182- Fan drive

Inside cabin | Outside cabin

VCU3

Channel	Terminal	Wire	Conn A	Wire	Conn	Device
4-20mA input ch 1	+ Y2,5 / − Y2,15	Wh 0.75 / Gn/Br 0.75	S5,7 / S5,8	Wh 0.75 / Gn/Br 0.75	3 8 P / 2	140 P1 (pump 1)
4-20mA input ch 2	+ Y2,6 / − Y2,16	Gn 0.75 / Ye/Br 0.75	S5,9 / S5,10	Gn 0.75 / Ye/Br 0.75	3 8 P / 2	141 B (body down)
4-20mA input ch 3	+ Y2,7 / − Y2,17	Bl 0.75 / Br/Bk 0.75	S5,11 / S5,12	Bl 0.75 / Br/Bk 0.75	3 8 P / 2	142 ACC1 (front)
4-20mA input ch 4	+ Y2,8 / − Y2,18	Ye 0.75 / Br/Gr 0.75	S5,13 / S5,14	Ye 0.75 / Br/Gr 0.75	3 8 P / 2	143 ACC2 (rear)
4-20mA input ch 5	+ Y2,9 / − Y2,19	Or 0.75 / Br/Wh 0.75	S5,15 / S5,16	Or 0.75 / Br/Wh 0.75	3 8 P / 2	144 ACC3 (common)
4-20mA input ch 6	+ Y2,10 / − Y2,20	Vi 0.75 / Bl/Br 0.75	S5,17 / S5,18	Vi 0.75 / Bl/Br 0.75	3 8 P / 2	145 A (body lift)
4-20mA input ch 7	+ Y1,1 / − Y1,9	Ye/Vi 0.75 / Br/Or 0.75	S5,19 / S5,20	Ye/Vi 0.75 / Br/Or 0.75	3 8 P / 2	146 Park brake output
4-20mA input ch 8	+ Y1,2 / − Y1,10	Or/Wh 0.75 / Br/Pk 0.75	S5,21 / S5,22	Or/Wh 0.75 / Br/Pk 0.75	3 8 P / 2	147 Em. steering
4-20mA input ch 13	+ Y1,7 / − Y1,15	Wh 0.75 / Br/Wh 0.75	S3,24 / S3,25	Wh 0.75 / Br/Wh 0.75	3 8 P / 2	148 FB (front circuit)
4-20mA input ch 14	+ Y1,8 / − Y1,16	Or 0.75 / Br/Or 0.75	S3,26 / S3,27	Or 0.75 / Br/Or 0.75	3 8 P / 2	149 RB (rear circuit)
PT1000 input ch 1	+ Y2,1 / − Y2,11	Bl 0.75 / Bk 0.75	S2,25 / S2,26	Bl 0.75 / Bk 0.75	1 °C / 2	160 Ambient (at cooling pack)
PT1000 input ch 2	+ Y2,2 / − Y2,12	Gn 0.75 / Bk 0.75	S4,1 / S4,2	Gn 0.75 / Bk 0.75	1 °C / 2	165 WDB front hubs
PT1000 input ch 3	+ Y2,3 / − Y2,13	Gr 0.75 / Bk 0.75	S4,3 / S4,4	Gr 0.75 / Bk 0.75	1 °C / 2	162 Hydraulic tank
PWM output ch 1	+ F30 Y3,1 / − Y3,7	Re 0.75 / Gr 0.75	S5,23 / S5,24	Re 0.75 / Gr 0.75	1 / 2	180 Body tip up
PWM output ch 2	+ F30 Y3,2 / − Y3,8	Or 0.75 / Gr 0.75	S5,25 / S5,26	Or 0.75 / Gr 0.75	1 / 2	181 Body tip down
PWM output ch 3	+ F30 Y3,3 / − Y3,9	Ye 0.75 / Gr 0.75	S5,27 / S5,28	Ye 0.75 / Gr 0.75	1 / 2	182 Fan drive
PWM output ch 4	+ F30 Y3,4 / − Y3,10	Wh 0.75 / Gr 0.75	S5,29 / S5,30		1 / 2	
PWM output ch 5	+ F31 Y3,5 / − Y3,11	Bl 0.75 / Gr 0.75	S5,31 / S5,32	Bl 0.75 / Gr 0.75	1 / 2	184 Brake charge valve

Hydraulic pressure sensors

Figure 67

Parking brake sensor

191 - Park brake valve

PT1000 input ch 1	+ Y2,1 − Y2,11	Bl 0.75 Bk 0.75	S2,25 S2,26	Bl 0.75 Bk 0.75	1 2 °C	(160) Ambient (at cooling pack)
PT1000 input ch 2	+ Y2,2 − Y2,12	Gn 0.75 Bk 0.75	S4,1 S4,2	Gn 0.75 Bk 0.75	1 2 °C	(165) WDB front hubs
PT1000 input ch 3	+ Y2,3 − Y2,13	Gr 0.75 Bk 0.75	S4,3 S4,4	Gr 0.75 Bk 0.75	1 2 °C	(162) Hydraulic tank
PWM output ch 1	+ F30 Y3,1 − Y3,7	Re 0.75 Gr 0.75	S5,23 S5,24	Re 0.75 Gr 0.75	1 2	(180) Body tip up
PWM output ch 2	+ F30 Y3,2 − Y3,8	Dr 0.75 Gr 0.75	S5,25 S5,26	Dr 0.75 Gr 0.75	1 2	(181) Body tip down
PWM output ch 3	+ F30 Y3,3 − Y3,9	Ye 0.75 Gr 0.75	S5,27 S5,28	Ye 0.75 Gr 0.75	1 2	(182) Fan drive
PWM output ch 4	+ F30 Y3,4 − Y3,10	Wh 0.75 Gr 0.75	S5,29 S5,30			(184)
PWM output ch 5	+ F31 Y3,5 − Y3,11	Bl 0.75 Gr 0.75	S5,31 S5,32	Bl 0.75 Gr 0.75	1 2	(184) Brake charge valve
Solenoid output ch 1	+ F32 Y4,2 − Y4,10	Dr 0.75 Bk 0.75	S5,33 S5,35	Dr 0.75 Bk 0.75	1 2 3	(191) Park brake valve
Solenoid output ch 2	+ F32 Y4,3 − Y4,11	Bl 0.75 Bk 0.75	S5,36 S5,37	Bl 0.75 Bk 0.75	1 2 3	(192) Float valve
Solenoid output ch 3	+ F32 Y4,4 − Y4,12	Vi 0.75 Bk 0.75	S5,40 S5,41	Vi 0.75 Bk 0.75	1 2 3	(194) Fan stop valve

Hydraulic valves

Figure 68

Body float sensor

192 - Body Float

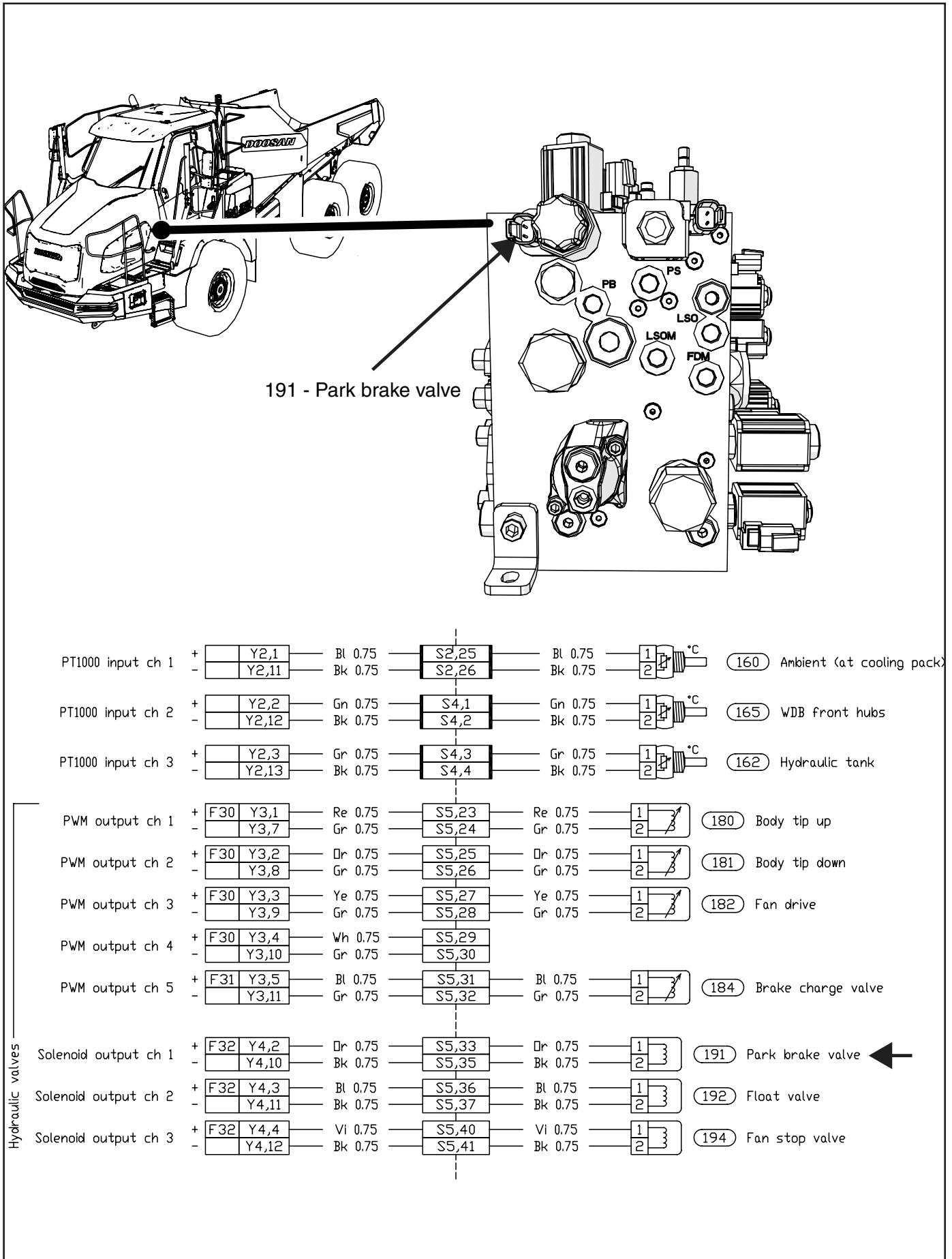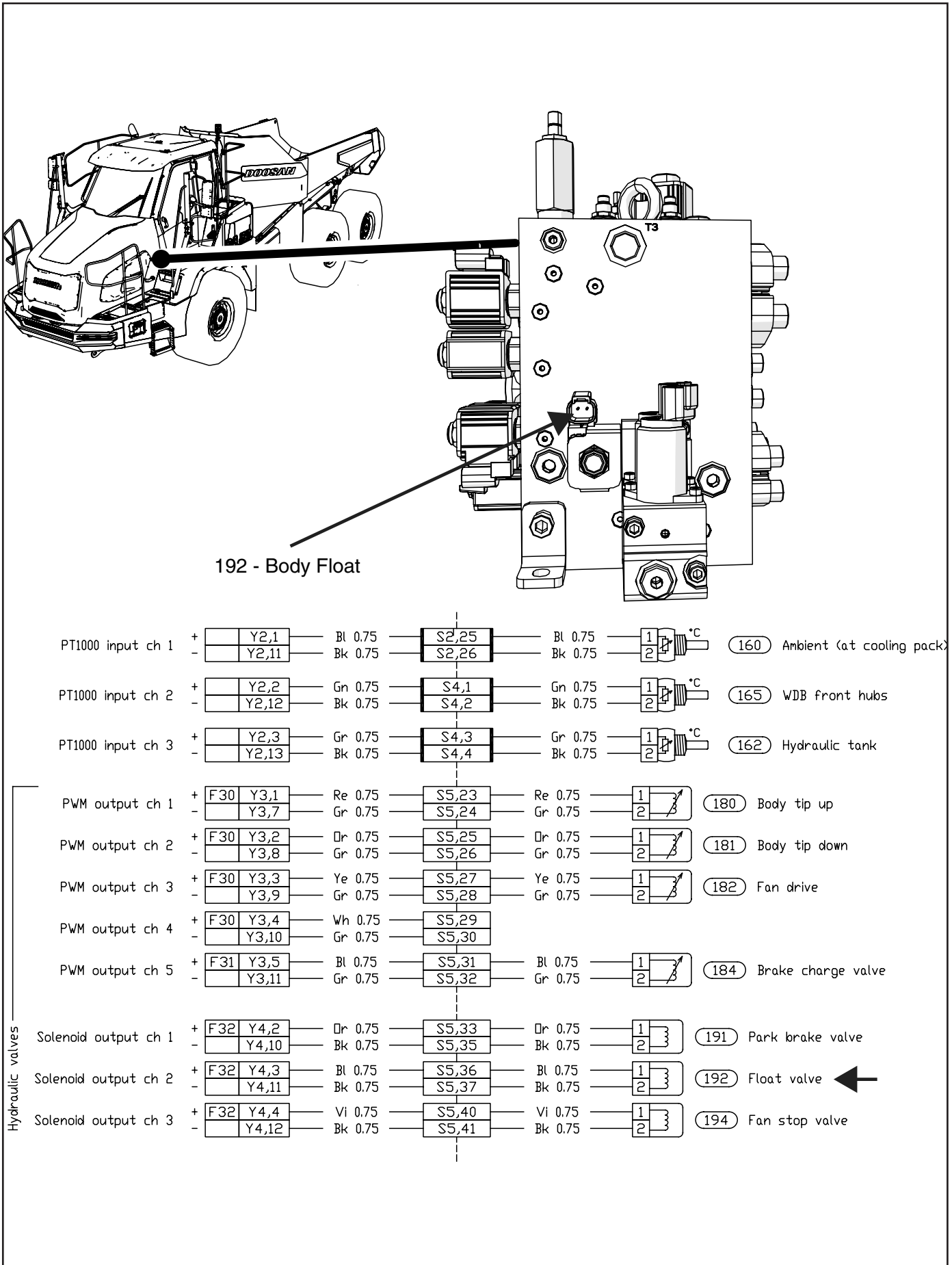|							
PT1000 input ch 1	+ Y2,1	Bl 0.75	S2,25	Bl 0.75	1	160	Ambient (at cooling pack)
	− Y2,11	Bk 0.75	S2,26	Bk 0.75	2		
PT1000 input ch 2	+ Y2,2	Gn 0.75	S4,1	Gn 0.75	1	165	WDB front hubs
	− Y2,12	Bk 0.75	S4,2	Bk 0.75	2		
PT1000 input ch 3	+ Y2,3	Gr 0.75	S4,3	Gr 0.75	1	162	Hydraulic tank
	− Y2,13	Bk 0.75	S4,4	Bk 0.75	2		
PWM output ch 1	+ F30 Y3,1	Re 0.75	S5,23	Re 0.75	1	180	Body tip up
	− Y3,7	Gr 0.75	S5,24	Gr 0.75	2		
PWM output ch 2	+ F30 Y3,2	Or 0.75	S5,25	Or 0.75	1	181	Body tip down
	− Y3,8	Gr 0.75	S5,26	Gr 0.75	2		
PWM output ch 3	+ F30 Y3,3	Ye 0.75	S5,27	Ye 0.75	1	182	Fan drive
	− Y3,9	Gr 0.75	S5,28	Gr 0.75	2		
PWM output ch 4	+ F30 Y3,4	Wh 0.75	S5,29				
	− Y3,10	Gr 0.75	S5,30				
PWM output ch 5	+ F31 Y3,5	Bl 0.75	S5,31	Bl 0.75	1	184	Brake charge valve
	− Y3,11	Gr 0.75	S5,32	Gr 0.75	2		
Solenoid output ch 1	+ F32 Y4,2	Or 0.75	S5,33	Or 0.75	1	191	Park brake valve
	− Y4,10	Bk 0.75	S5,35	Bk 0.75	2		
Solenoid output ch 2	+ F32 Y4,3	Bl 0.75	S5,36	Bl 0.75	1	192	Float valve
	− Y4,11	Bk 0.75	S5,37	Bk 0.75	2		
Solenoid output ch 3	+ F32 Y4,4	Vi 0.75	S5,40	Vi 0.75	1	194	Fan stop valve
	− Y4,12	Bk 0.75	S5,41	Bk 0.75	2		

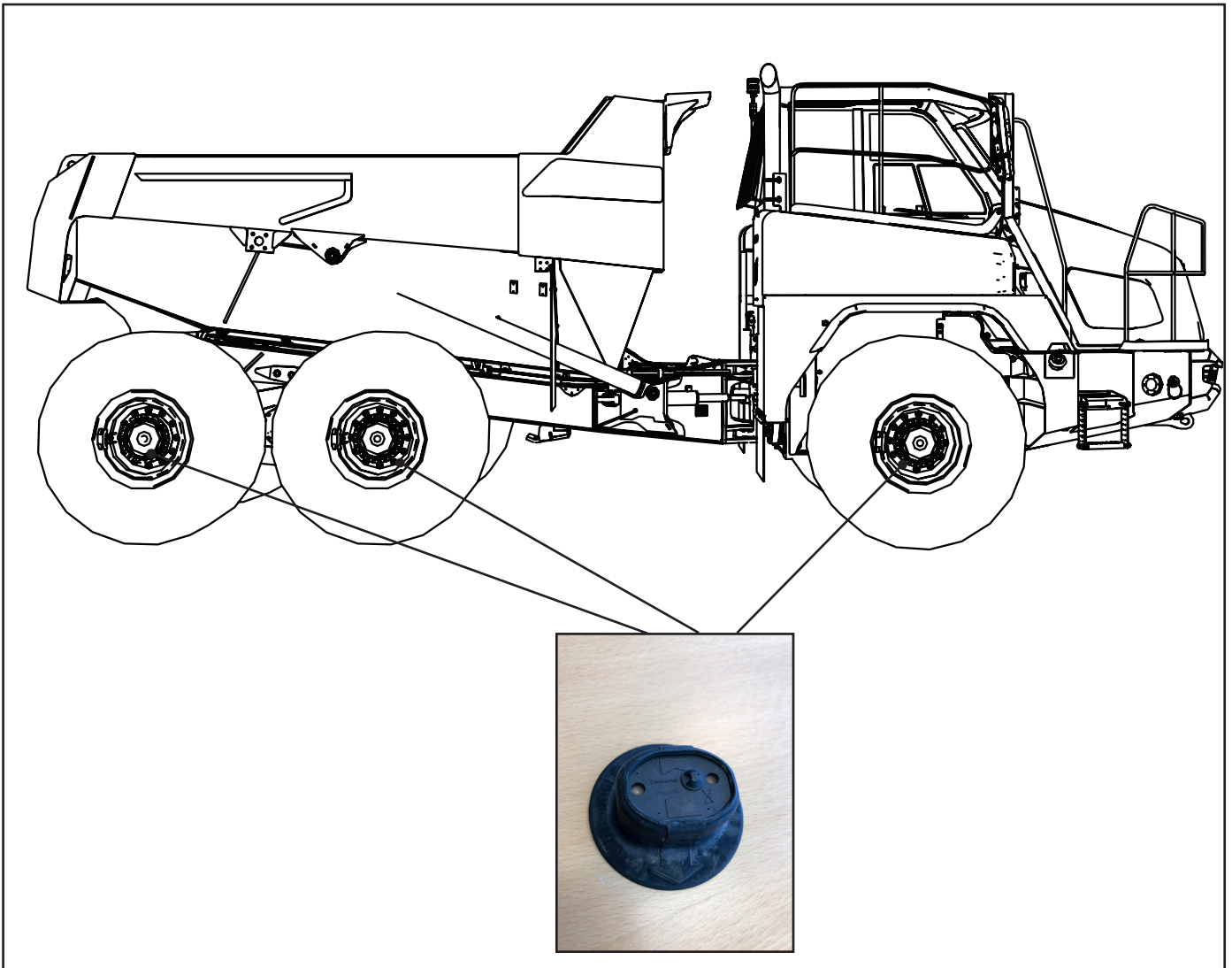Hydraulic valves

Figure 69

TPMS (optional)

Tire sensor

Figure 70

Continental tire pressure sensor.

All 6 wheels got a tire pressure sensor installed on the inside of the rims.

Heater (Optional Webasto)

Webasto Thermo Pro 90

The webasto heats up the engine very quickly to optimum starting temperatures. Both fuel consumption and exhaust emissions are therefore reduced in the starting phase. This webasto has automatic altitude compensation as standard.
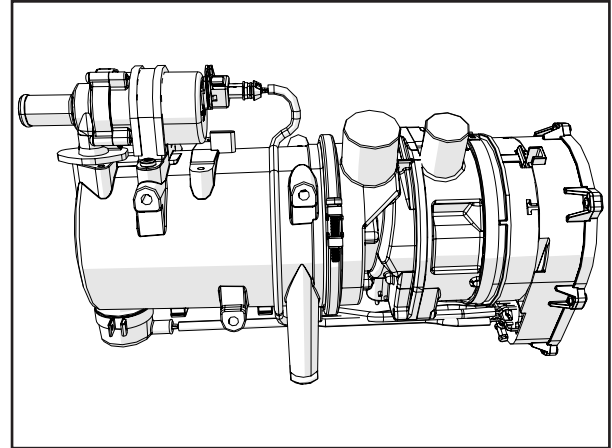

Figure 71

Heat output max.	9.1 kW
Heat output control range	1.8 - 7.6 kW
Rated voltage	12/24 V
Operating voltage range	10.5 - 14.7 V (at 12V) and 20 - 29 V (at 24V)
Nominal powerconsumption with circulation pump ± 10% (without vehicle fan)	Max. ≤ 90 W Control range: 37 - 83 W
Dimensions L x W x H (mm)	355 x 131 x 232 mm

Lubrication pump

Groeneveld automatic Twin-3 greasing system. The system keeps all greasing points of the machine greased automatically at the correct time with the correct dose.
Optimum grease distribution over the hole greasing surface is achieved because the greasing takes place while the machine is in operation.
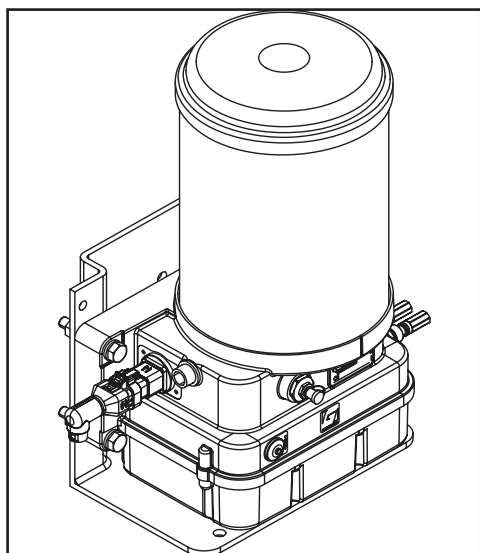

Figure 72

Supply Voltage	24Vdc
Capacity reservoir	4 L
Grease delivery	12 cc
Maximum pressure	250bar

Figure 73

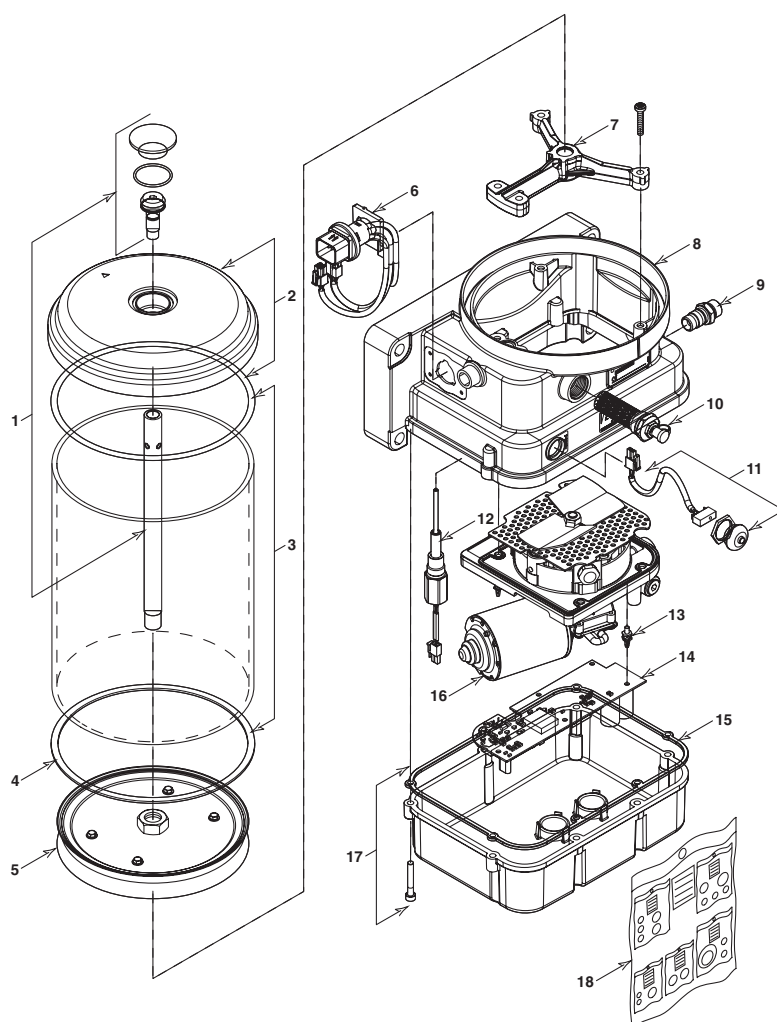|	
1	Shaft kit reservoir
2	Cover + O-ring
3	Reservoir kit
4	O-ring
5	Follower plate
6	Cable harness kit
7	Reservoir Y-support kit
8	Pump body
9	Outlet M16x1.5
10	Grease filter kit
11	Test switch kit
12	Low level switch
13	Timer clip
14	Timer 12 - 24 Vdc
15	Gasket cover
16	Pump unit 24 Vdc
17	Bottom cover kit
18	Sealing kit

PM1

Main switches panel

1. Main switch on battery.

   To disconnect the battery turn the switch to OFF position

   To connect the battery turn the switch to ON position.

- **Never turn off battery main switch when engine is running.**

- **Never turn off battery main switch when ignition is on.**

- **Leave battery main switch in ON position as long the lamp (4) is on or flashing. is on or flashing. When the lamp(4) is off the main switch can safely be turned to OFF position.**

2. Emergency stop of engine.

   In case of danger situation push the button to emergency stop the engine.

   To unlock the switch turn it clockwise.

3. External power supply output.

   External equipment (pump, lights, etc.) can obtain power from this connection. Voltage is 24V. Maximum load is 16A.
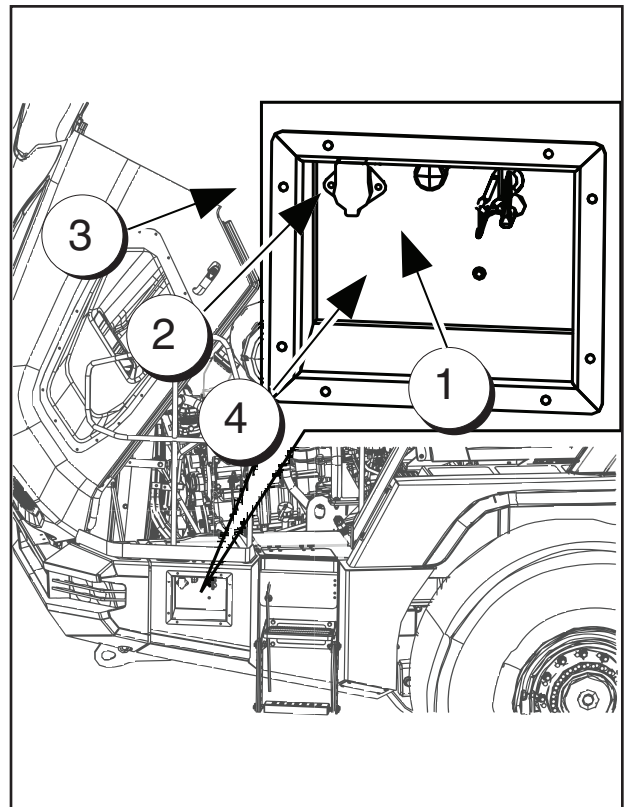

Figure 74

⚠ **WARNING**

- **Never turn off battery main switch when engine is running.**
- **Never turn off battery main switch when ignition is on.**
- **Leave battery main switch in ON position as long the lamp (4) is on or flashing. is on or flashing. When the lamp(4) is off the main switch can safely be turned to OFF position.**

Sensors

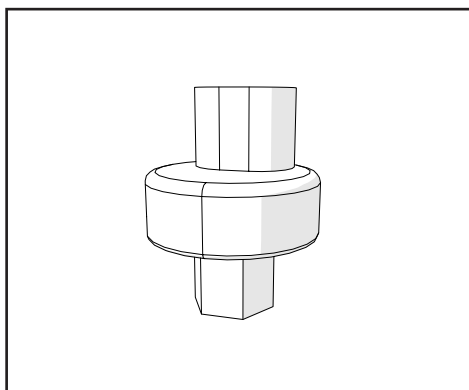### Clogged air filter sensor

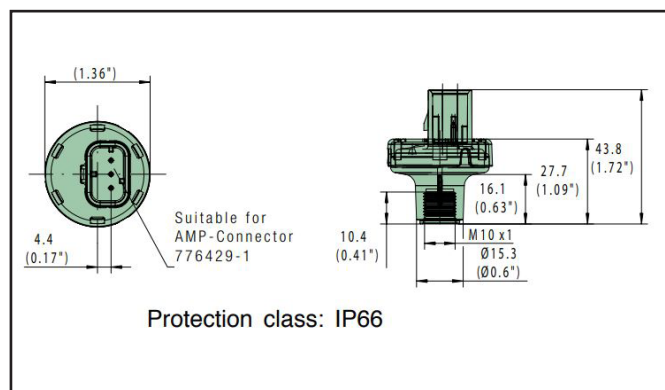Air cleaner sensor from Mann + Hummel.

Figure 75

Figure 76

Operational pressure range	0 - 100 mbar (0 - 10 kPa)
Media	Air
Supply voltage	Normal 5 - 30 Vdc, sensor can be powered directly from vehicle up to 30 Vdc.
Accuracy	± 2.5%
Output voltage	0.5 - 4.5 Vdc
Over-voltage protection	45 V, forward voltage
Reverse polarity protection	36 V, misconnect 16 V
Storage temperature	-40°C to 125 °C

Hydraulic level sensor

BEDIA intelligent tanksensor ITS-65.

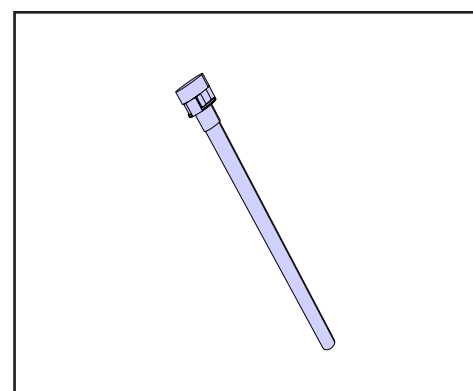|	
Supply voltage	12 Vdc / 24Vdc (-25% / 50%)
Sensor outputs	Voltage output. All outputs are short circuit protected.
Pressure resistance	5 bar
Operating temperature	-40 °C to +125 °C
Medium temperature	-40 °C to +150 °C
El. connection	4 wire cables
Length	1200 mm

Figure 77

Level sensor

Packed ultrasonic level sensor

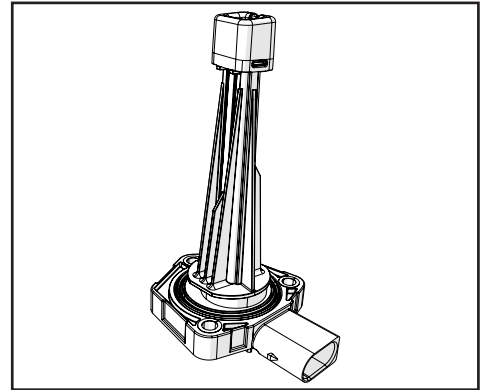|	
Operating voltage (oil level measurement)	9 - 16V
Operating voltage (temperature measurement)	6 - 16V
Reverse-polarity voltage	-14 V / 60s
Overvoltage	15s at 28V 250ms at 32V
Measurement range (static and dynamic)	18 - 118.8mm
Operating temperature	-40°C to +160°C
Current consumption	4 mA
Max.current consumption during measuring	50 mA
Weight	76g ± 3%

Figure 78

Proximity sensor

Omron proximity sensor.

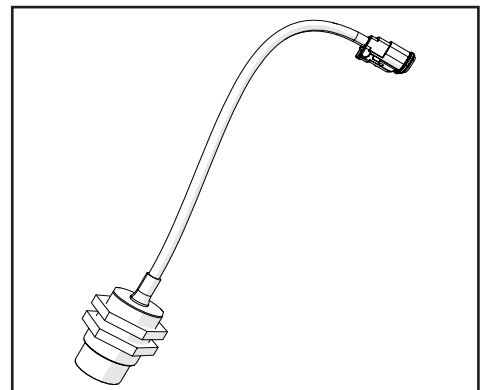| Size	M30	
Shielded	Shielded	Unshielded
Sensing distance	10 mm ± 10%	20 mm ± 10%
Set distance	0 to 8 mm	0 to 16 mm
Differential travel	10% max. of sensing distance	
Detectable object	Ferrous metal	
Standard sensing object	Iron 30x30,1mm	Iron 54x54x1mm
Response frequency	0.4 kHz	0.1 kHz
Power supply voltage	12 - 24 V	
Leakage current	0.8 mA max.	

Figure 79

Temperature sensor

M14 PT1000 JTcon temperature sensor

Measuring resistor	PT 1000
Accuracy temperature range: -50°C to 15°C 15° to 125° 125°C to 150°C	±3°C ±1,5°C ±3°C
Resistance value	0°C: 1000 ohm 100°C: 1385 ohm
Measuring current	≤ 1,0 mA
Power supply	constant current or constant voltage
Dielectrical strength	per VDE 0160/500 VAC, 50Hz, 1 min
Insulation resistance with respect to housing	per VDE 0100/ > 10 Mohm/500 VDC
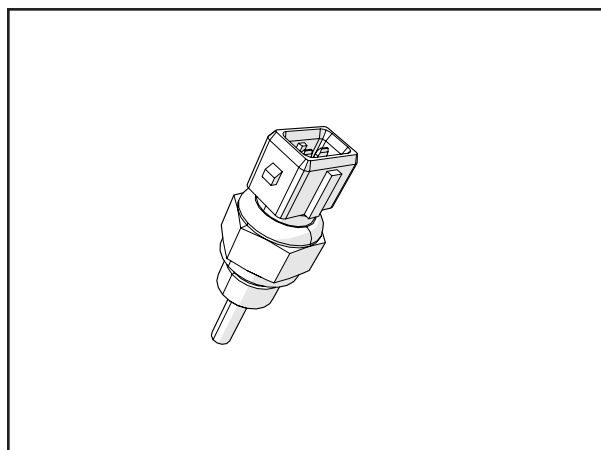
Figure 80

Rear view camera

Mekra MCC 5025 color camera with 120° horizontal lens angle and low distortion.

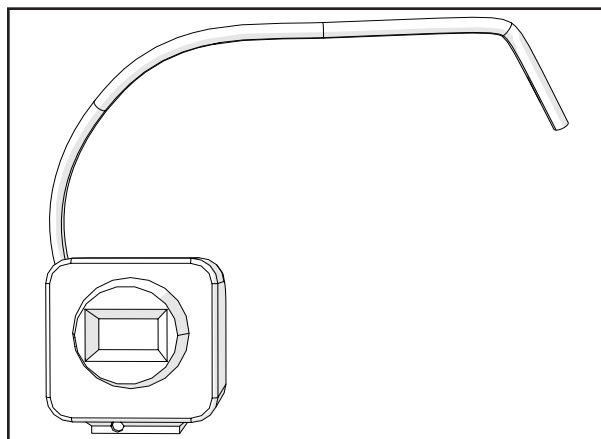| Operating voltage	5 - 36 V
Power consumption	Heater off: approx. 1.2 W
Heating system	Heater on: approx. 4.6 W
Operating temperature	-40°C to 85°C
Cables	Mekra custom cable 6mm dia
Connectors	Mekra custom connector
Dimensions	65mm x 59mm x 50mm (W x H x D)
Weight	180 g

Figure 81

Lights

Main lights

Bi-halogen Hella

Halogen low beam and high beam in one headlight.
Right-hand traffic, H7 bulb, 24 Volt.
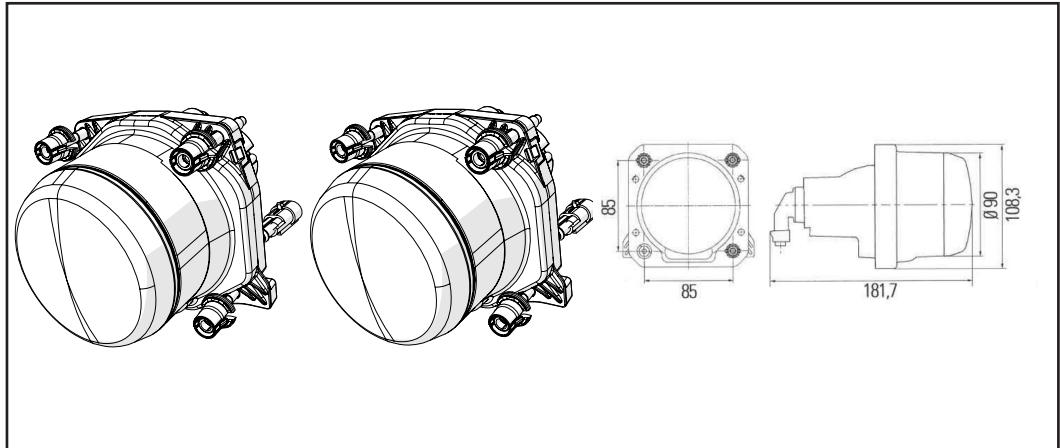
Figure 82

Rear lights

DureLED Combi Hella
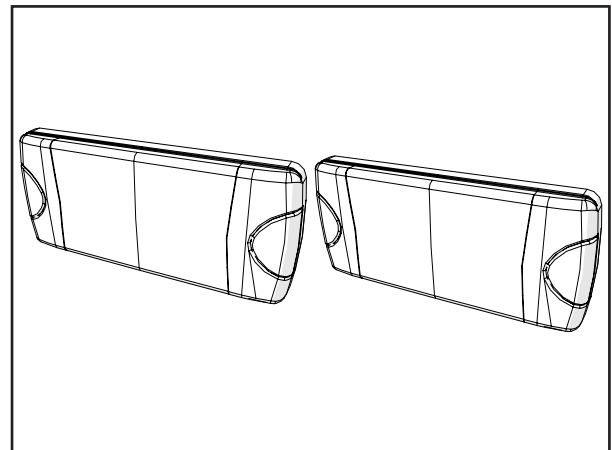
Figure 83

		Design Voltage	Nominal Voltage	Nominal Power
Rear Position Lamp	8 LEDs	13.5V/28.0V	8.0V - 28.0V	1.5W
Stop Lamp	24 LEDs	13.5V/28.0V	8.0V - 28.0V	5.0W
Direction Indicator	16 LEDs	13.5V/28.0V	8.0V - 28.0V	3.0W

Beacon light
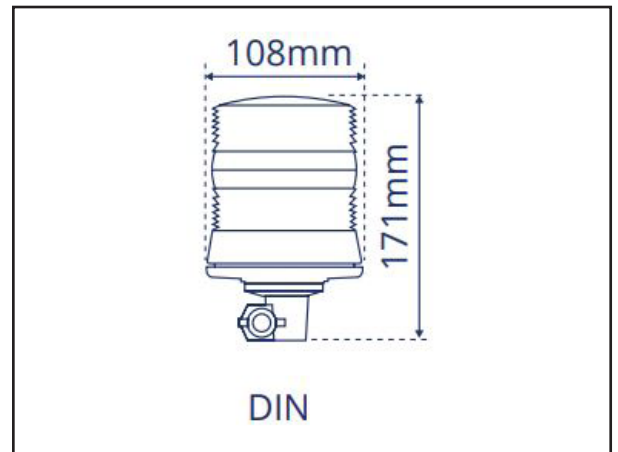
Figure 84

Voltage	Action	Current Consumption 12/24V	Flash Rate (per min)	Mounting	Weight(kg)
10-30VdC	Double Flash	0.6/0.3 A	80	DIN	0.50

Direction/Marking Lights
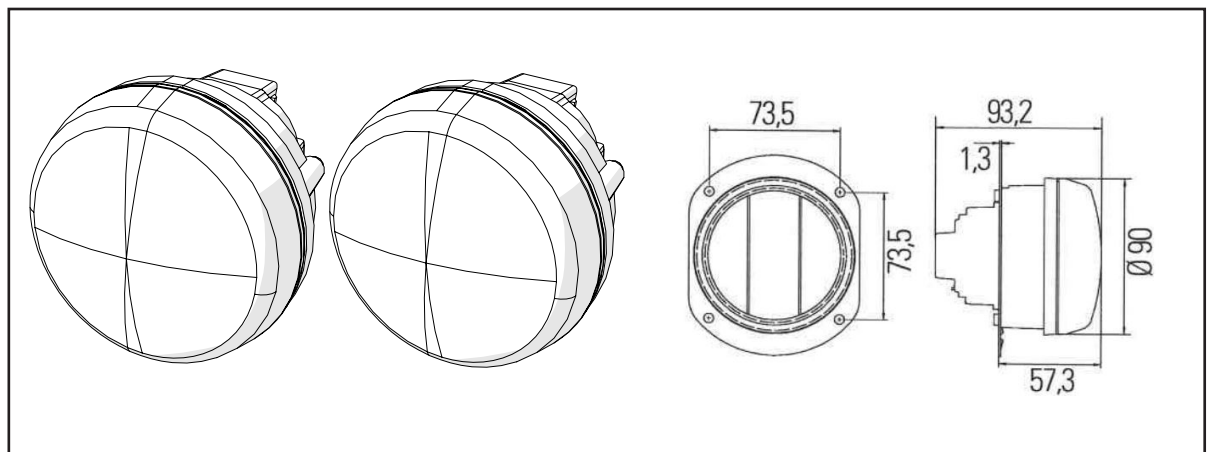
Figure 85

Diameter (mm)	90
Consumption	12V 0.4W = approx. 0.03A

Work lights

4x Ultra Beam LED Gen. II
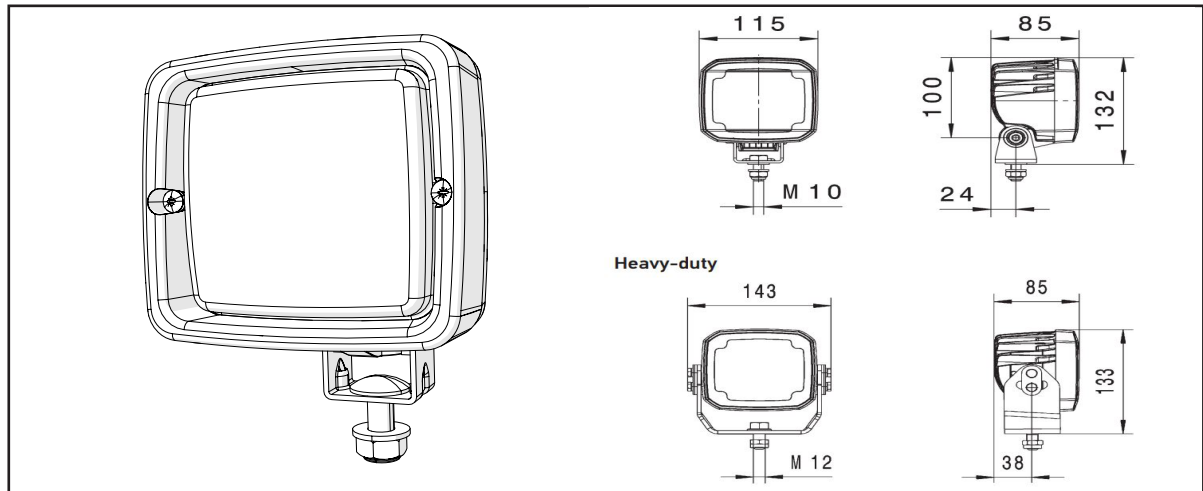
Figure 86

Technical data:

Operating voltage/Rated voltage	9 - 33 V
Recommended angle of inclination	Close-range: 12°, long: 5°
Light source type	8 high-power LEDs
Power consumption	56 W
Light output	4.000 lm
Color temperature	6.500° Kelvin
Protection class	IP 6K9K and IP 6K8
Type approval	ECE-R10
Housing	Aluminium die cast
Light exit area	105 x 95 mm
Weight	1.040 g / 1.220 g (HD)

Marking light for mirrors
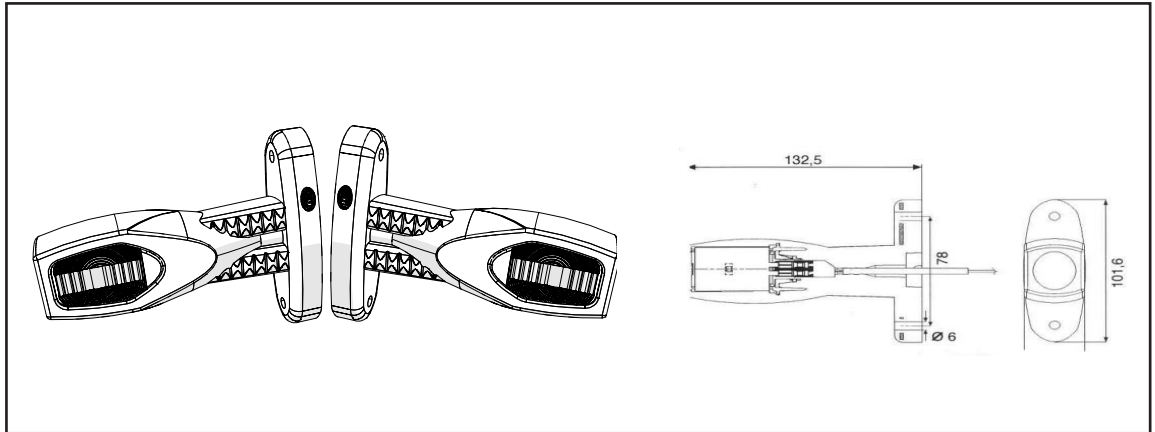
Figure 88

HELLA LED clearance light with integrated side marker light in short rubber arm. Can be used on both left and right-side, for side mounting on vertical surfaces, clear lens, on side with interior amber cover lens, 2 white LEDs for position light, 1 red LED for clearance light and 2 amber LEDs for side marker light.

24V / 1.5W, current consumption = approx.0.05A.

Electrical circuits

CAN bus
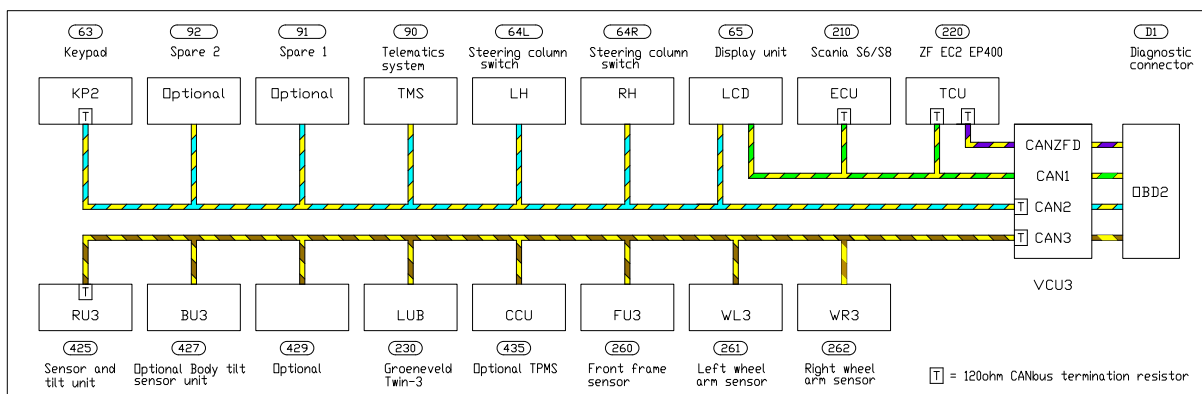
Figure 87

Wiring routing

Front frame

UNDER CONSTRUCTION

Figure 89

Position	Item	Position	Item
1	Cable set	10	Module control
2	Cable set	11	Battery
3	Cable set	12	Cable
4	Cable set	13	Cable
5	Cable set for mirror arm	14	Battery cable
6	Cable set	15	Cable
7	Cable set	16	Cable set for mirror arm
8	Cable set	17	Marking light assembly
9	Cable set	18	Cable set

Rear frame
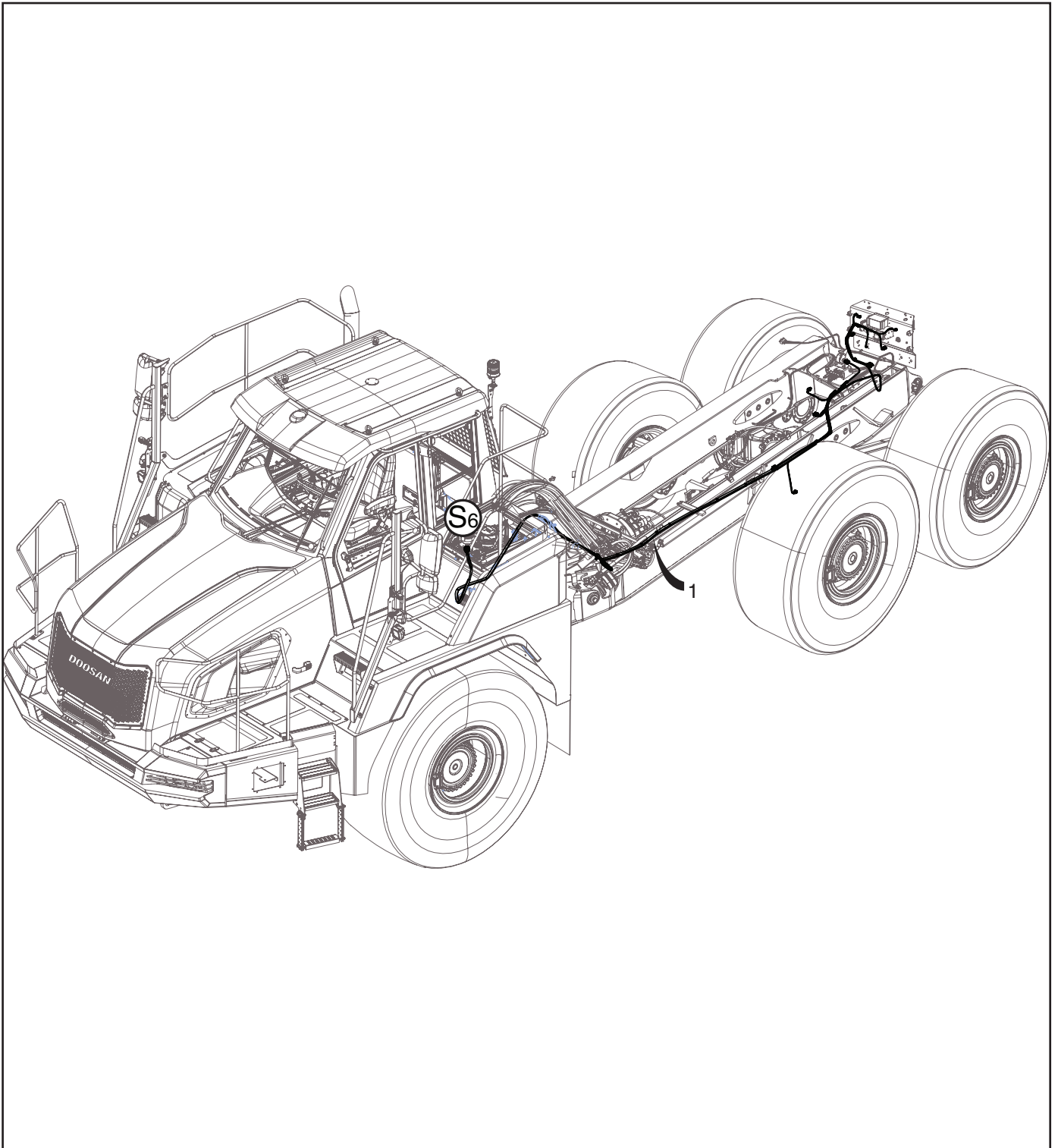
Figure 90

Position	Item
1	Cable set

Cabin
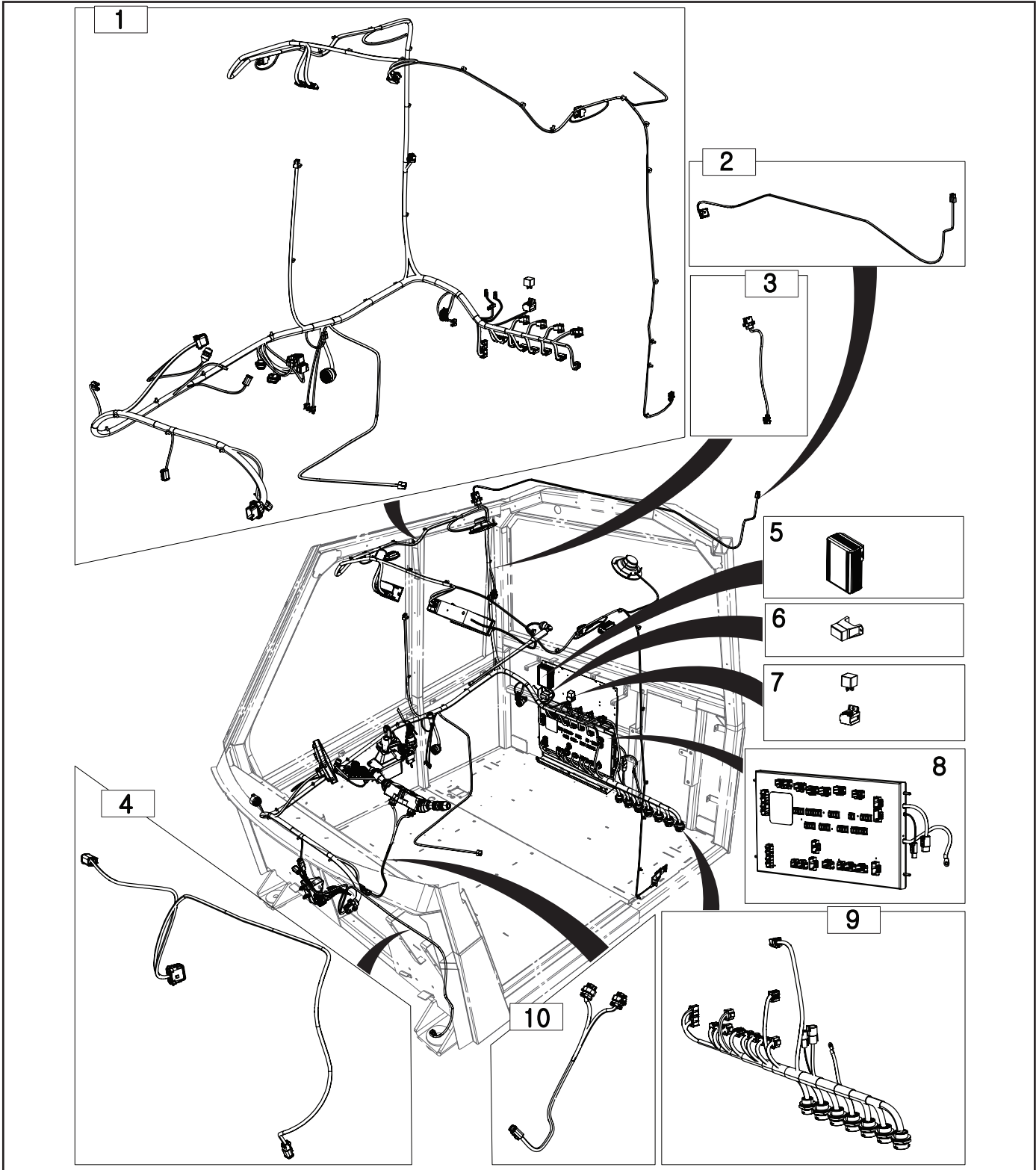
Figure 91

Position	Item	Position	Item
1	Main cable set cabin	6	Fusebox
2	Cable set roof top	7	Relay
3	Cable set split	8	VCU3
4	Cable set front wall	9	Cable set cabine floor
5	DC - DC converter	10	Cable set steering

Electrical diagrams

Cabin

CANBUS LEGEND

CAN1_H		Gn
CAN1_L		Gn
CAN2_H		Ye
CAN2_L		Bl
CAN3_H		Br
CAN3_L		Br
CANZFD_H		Vi
CANZFD_L		Vi

WIRE DESCRIPTION

Re 1.5

COLOR		GAUGE
Wh	White	mm²
Bk	Black	
Re	Red	
Bl	Blue	
Ye	Yellow	
Or	Orange	
Gn	Green	
Gr	Gray	
Br	Brown	
Vi	Violet	
Pk	Pink	
Be	Beige	
Tr	Transp.	

REVISION	DATE	SIGN	COMMENT
B	07.06.2019	NAH	Changed title DA40->DA45.
A	03.12.2018	NAH	Initial version based on 1058025/D.

Date	Designed	Checked
07.06.2019	NAH	NAH

DOOSAN

30-45 TS2 El. schematic cabin (xx1700-)

Doc no/Rev: 1073751/B Size: A3

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| = Twisted 30-40 turns/m | = Denotes gold connection |

Position/Artno Description list:

POSITION	ARTNO	DESCRIPTION
42	527175	Parker IQAN-LSL joyst w/Hold+Button
45D	522575	HVAC main unit (Deutsch connector + PT1000)
46		P6000 Accel pedal (Teleflex)
47		Park brake switch w/ lock & pole
48	508316	Gear Selector ZF F-N-R
49		Ignition key switch
50		Piezo buzzer KPEG650 (continuous/DC)
51		12V Cigarette lighter
53		Converter KPEG650 24V/12V 12-18A
55		CB unit (optional)
56		Seat
57		Windscreen washer pump
59		12V outlet rear storage
63	534991	KP2 - Keypad
64L		Steering column switch LH
64R		Steering column switch RH
65		Grayhill 3070 7" display
66		Optional: Alfatronix PV6s 24V/12V 6-10A
67		Optional: Mirror control switch
68		Washer tank level sensor
69		Alfatronix USB charger
73		A/C Low pressure gas sensor
74		A/C High pressure gas sensor
80		Radio/CD
81		HVAC control panel
82		Interior light RH
83		Interior light LH
84	534460	Proximity switch for cab door
85		Wiper motor
86		LH speaker
87		RH speaker
88		Relay - preset operation for Webasto option

POSITION	ARTNO	DESCRIPTION
100		Antenna (Radio/CD)
101		Roof LH high beam
102		Roof RH high beam
103		Roof beacon
104		Telematics Bar antenna
105		Roof marker light
106		Load weighing indicator
250		Extra camera
430		Rear view camera
D0		Wire splice (crimp or welded)
D1		Diagnostic connector (16p OBD2)
D2		LCD USB connector
F10-47		Mini fuses
F60-63		ATO fuses
S2		Cab split - Deutsch HDP20 24-29 (29-pin)
S3		Cab split - Deutsch HDP20 24-35 (35-pin)
S7		Cab split - Deutsch HDP20 24-23 (23-pin)
S64		Harness split for steering column switches
S70		Harness split for torpedo wall (12p Deutsch)
S90		Harness split for Telematics (6p MCP2.8)
S91		Harness split for Spare 1 (6p MCP2.8)
S92		Harness split for Spare 2 (6p MCP2.8)
S99		Harness split for Video+Misc (12p MCP2.8)
S110		Harness split for roof top (12p Deutsch)
S111		Harness split for ceiling/roof (12p MCP2.8)
Y1-22	534460	VCU3 - Vehicle control unit

Front and rear

Power, engine and options

HVAC unit VCU3

VCU3

PT1000 input ch 1 — Y2,1 / Y2,11 — Bl 0.75 / Bk 0.75 — S2,25 / S2,26 — Bl 0.75 / Bk 0.75 — 160 Ambient (grill)

A/C Clutch 24V F46 Y10,6 / GND Y10,10 — Vi 1.5 / Bk 1.5 — S2,16 / S2,17 — Vi 1.5 / Bk 1.5 — 350 A/C Compressor clutch

4-20mA input ch 15 F12 Y22,4 / Y22,14 — Or 0.75 / Gr 0.75 — 73 A/C LP Sensor

4-20mA input ch 16 F12 Y22,5 / Y22,15 — Ye 0.75 / Br 0.75 — 74 A/C HP Sensor (white marked)

88 Preset relay

Wh 0.75

Climate Preset output 24V F14 Y18,4 / Climate Preset output GND Y18,14 — Br 0.75 / Bk 0.75

81 Climate control panel

A/C Clutch Input F12 Y19,8
Climate control 24V F26 Y14,1
Climate control GND Y14,9

A11 PRESET OP/MODE
A4 PRESET OP/MODE
A14 CAB TEMP SENSOR
A7 CAB TEMP SENSOR
A13 EXT TEMP SENSOR
A6 EXT TEMP SENSOR
A12 MIX TEMP SENSOR
A5 MIX TEMP SENSOR
A9 HEATER VALVE 1
A8 HEATER VALVE 2
A1 HEATER VALVE 3
B5 HEATER VALVE 4
B14 HEATER VALVE 6
B8 FLAP MOTOR+
B17 FLAP MOTOR-
B4 COMPRESSOR CMD
B13 BLOWER SPEED
B11 24V
B12 GND

45D HVAC unit

H CAB TEMP SENSOR — Cabin air temperature sensor
J CAB TEMP SENSOR
K EXT TEMP SENSOR — Ext. air temperature sensor
L EXT TEMP SENSOR
M MIX TEMP SENSOR — Mixed air temperature sensor
N MIX TEMP SENSOR
P HEATER VALVE 1
R HEATER VALVE 2
S HEATER VALVE 3 — Electric water valve
T HEATER VALVE 4
U HEATER VALVE 6
A FLAP MOTOR+ — Flap motor
C FLAP MOTOR-

Switch1 on flap — Open when flap fully open
Switch 2 on casing — Open when flap closed

B 24V (fan)
Bk 2.5 GND
F BLOWER SPEED — A/C blower

Climate fan 24V F27 Y14,7 / Climate GND Y14,8

PT1000 input ch 4 Y22,1 / Y22,11 — W EVAP. TEMP / X EVAP. TEMP — Evaporator temperature sensor (PT1000)

24V Main — Re 16 — S37 — Re 16 — S1,3 — Re 16
24V Secondary — Re 2.5 — S38 — Re 2.5 — S1,5 — Re 2.5
GND Main — Bk 16 — S39 — Bk 16 — S1,4 — Cab GND stud

244 Fuse box
243 Fuse holder
245 Fuse and relay box (F70-79 + K1 + K2)

F1 Main fuse 150A
F2 Sec. fuse 15A
50A

Engine

VCU3 FUSE CHART

Starter
130 Main switch
Frame GND
GND
131 Battery bank

B / A

81 Climate control panel (backview)
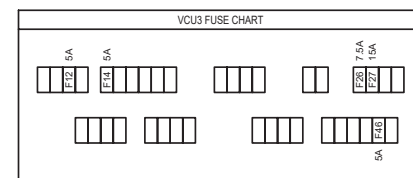
Deutsch HDP24-24-21PE connector on HVAC
Deutsch HDP26-24-21SE connector on the harness
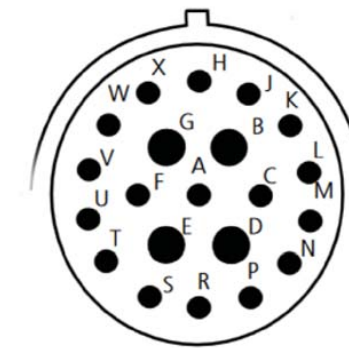
24-21
4 size 12
& 17 size 16

WIRE DESCRIPTION
Re 1.5
COLOR / GAUGE
Wh White
Bk Black
Re Red
Bl Blue
Ye Yellow
Or Orange
Gn Green
Gr Gray
Br Brown
Vi Violet
Pk Pink
Be Beige
Tr Transp.

POSITION	ARTNO	DESCRIPTION		POSITION	ARTNO	DESCRIPTION

A	19.09.2019	HDJ	Initial version
REVISION	DATE	SIGN	COMMENT

Date 19.09.2019 | Designed HDJ | Checked NAH

DOOSAN

30-45 TS2 El.schematic HVAC unit VCU3

Doc no/Rev 1085228/A | Size A3

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