Information for public emergency services

LOW CAB

Translation of the original document

Legal notice

Issued by	Designwerk Technologies AG Wülflingerstrasse 147 CH-8408 Winterthur www.designwerk.com Member of the Volvo Group
Date of issue	20.03.2023
Copyright	
Updates	Due to technical improvements to our products we reserve the right to make design changes. Any changes will be indicated in the individual manuals by replacing the respective pages or revision of the electronic data medium.

	**NOTICE** **Read and keep this document!** Read this document carefully and follow the information contained in it. Do not print out this document. Failure to follow this instruction may result damage to the unit and the surrounding area.

Validity

This manual only applies to the units listed in the following table:

Model	Code 1	Code 2
E-TRUCK	LOW CAB	3450 short wheelbase
E-TRUCK	LOW CAB	3900 long wheelbase

Table of content

1 Foreword

This E-Truck is a high-performance electronics product with dangerous voltages and currents, specific technical skills are required for the use and handling of the unit.
Please read this manual carefully – particularly the chapter Safety Notices and Warnings – before using or working on the vehicle.

1.1 Introduction

This document contains instructions on handling the LOW CAB truck in an emergency. The aim is to provide all blue-light organizations with the necessary information on the structure of the vehicle's high-voltage and low-voltage systems.

2 Safety Notices and Warnings

This chapter contains safety notices for this unit. These pertain to initial use and ongoing use in the vehicle. Please read and always observe these notices for safety reasons and to prevent loss of life and unit damage.

2.1 Symbols and their meanings

This manual uses various symbols. The following chart contains a list and their meanings:

Symbol	Designation	Symbol	Designation
	General warning of a danger zone		Caution mains voltage or supply voltage
	Warns of explosive environment		Warns of hot surface
	Warns of fire hazard		Atemschutz tragen
	Schutzkleidung tragen		Important information to avoid potential property damage
	Important information		Read the information

2.2 Safety notices and risk levels

	**DANGER** **Danger** To indicate an imminently hazardous situation which, if not avoided, will result in death or serious injury.
	**WARNING** **Warning** To indicate a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	**CAUTION** **Caution** To indicate a potentially hazardous situation which, if not avoided, could result in a minor or moderate injury.
	**NOTICE** **Notice** To indicate important information to avoid possible damage to property.
	**INFORMATION** **Information** To indicate important information for the reader.

2.3 Rescue Card symbols key

	High-voltage off switch
	High-voltage battery
	High-voltage components
	High-voltage line
	24V battery
	24V Battery disconnect switch
	Emergency disconnect cable (Cut Stripes)

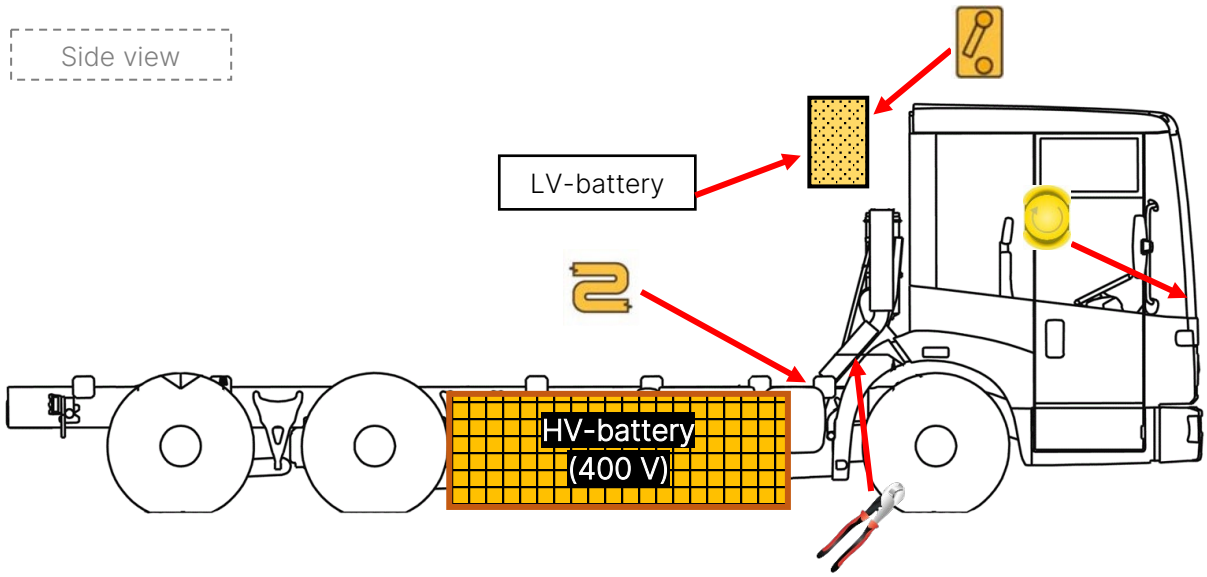
2.4 General safety notices

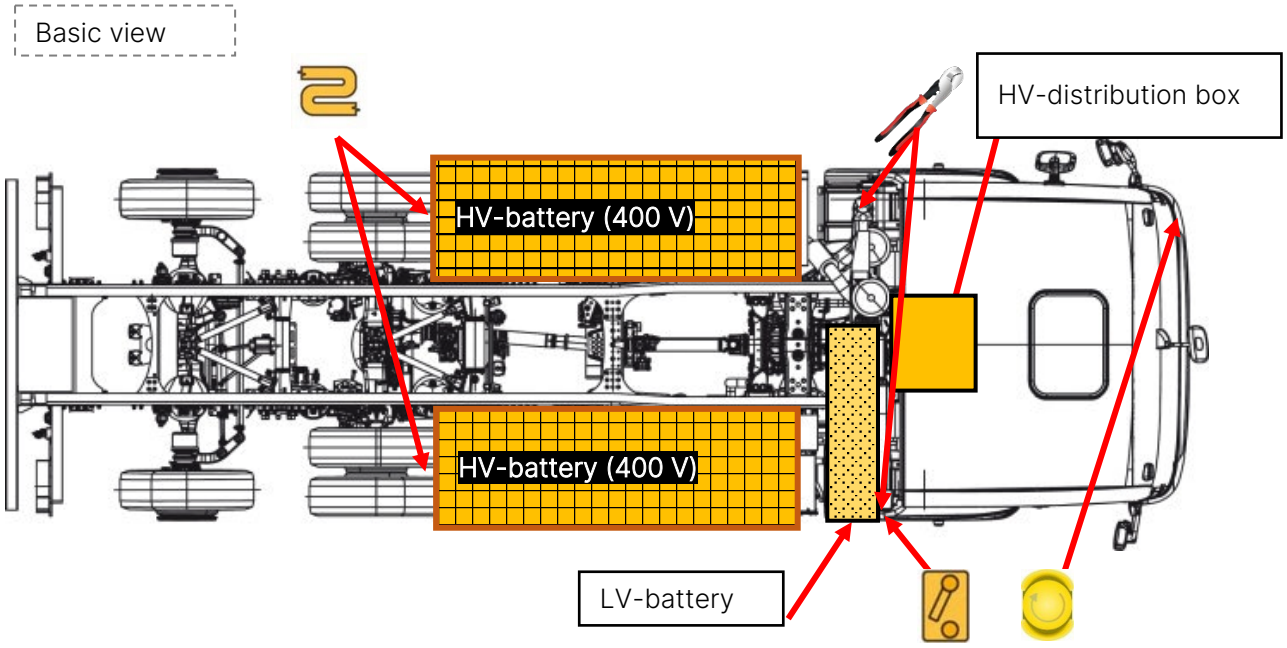
	**DANGER** **Explosive environment!** **Life threatening!** Do not store highly flammable substances or flammable liquids in the direct vicinity of the vehicle! Sparks at the unit connections may ignite these and result in explosions.

	**CAUTION** **Hot surfaces and hot exhaust air.** **Danger of burns!** The vehicle produces high temperatures during operation! Therefore, always be careful and cautious when handling it!

3 Schematic description of the vehicle

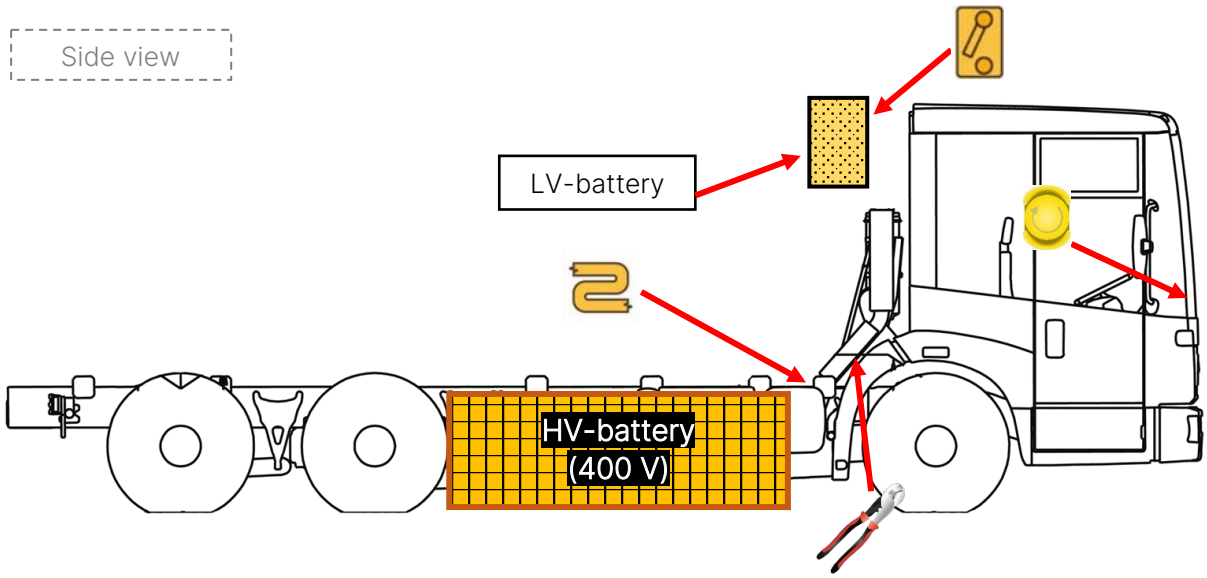
3.1 Short wheelbase (3450)



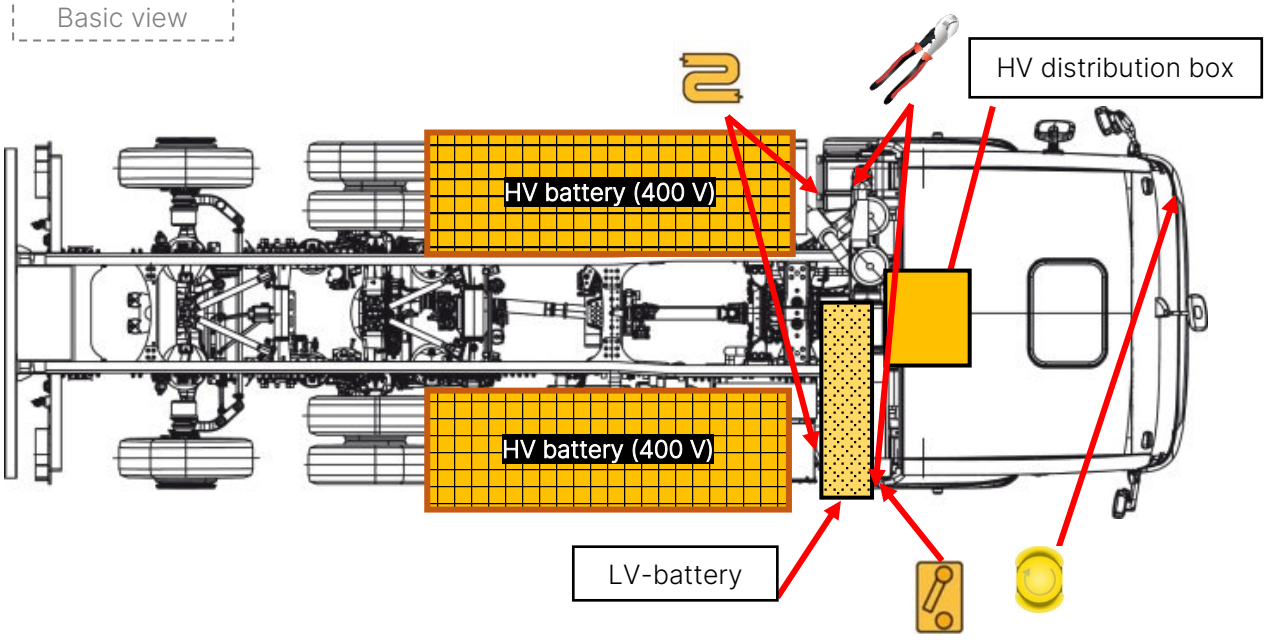


3.2 Long wheelbase (3900)

Side view



Basic view



4 Procedure in an emergency

4.1 De-energising the vehicle / EMERGENCY STOP switch

DANGER

High voltage / Danger to life

With any e-vehicle, it must be assumed that the vehicle is powered until it has been professionally disconnected from any power sources and inspected.

WARNING

The Swiss Fire Brigade Association (Schweizer Feuerwehrverband, SFV) states that deployments involving an electric vehicle, whether after an accident or a fire, must be carried out exclusively in complete protective equipment incl. respirator. Furthermore, insulation gloves must be worn until the high-voltage system is shut down safely. If there is a risk that the intrinsic safety of the vehicle can no longer be assured and there is a potential danger to the emergency workers, a qualified electrician must be called in.

In the case of an incident, the vehicle can be powered down as follows:

Case 1: Vehicle is parked and connected to a charging station.

- Switch off the connected charging station.
- Disconnect the charging cable at the feed point.
- Disconnect the fuse of the power supply.

Case 2: Vehicle has a breakdown/accident, high-voltage batteries and electrical wiring are undamaged.

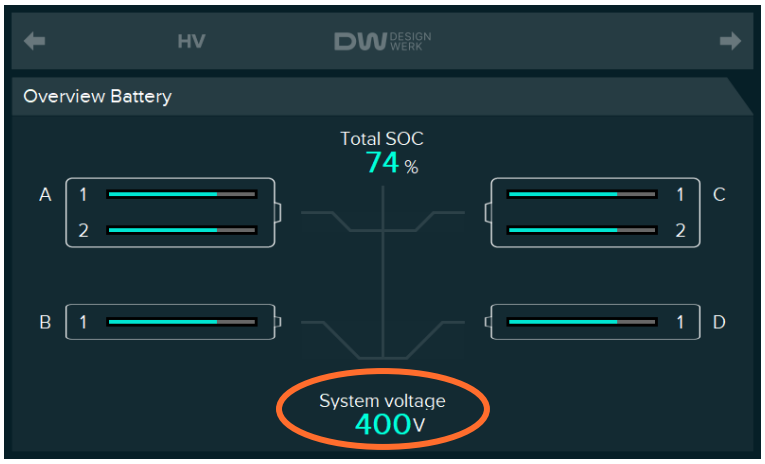
- Turn off the ignition.
- Press the “High voltage off” switch in the driver’s cab (if possible).
- Turn the LV-battery disconnect switch counterclockwise (see chapter 5.2).

Case 3: Accident, batteries and/or electrical wiring are damaged.

- Press the “High voltage off” switch in the driver’s cab (if possible).
- Cut the emergency disconnect cable (Cut Stripes).
- When wearing full protective equipment, disconnect the black, then the orange supply cables from the battery (see chapter 5.5).
- The HV batteries must be monitored with a thermal imaging camera. If a rise in temperature is registered, the batteries must be cooled with water (see chapter 4.3).
- It is essential to consult a professional electrician.

4.2 Checking the system voltage

The monitor must show a system voltage of "0 Volt".



4.3 Fire Call

4.3.1 General information

	**WARNING** **Electrical discharge hazard** In the event of a fire, assume the vehicle is live and DO NOT TOUCH any parts of the vehicle. There can still be a potential electrical hazard after a fire. It is essential to consult a professional electrician.

	**WARNING** **Re-ignition hazard of the battery** The battery can reignite any time! The battery must be monitored regularly!

Extinguish fires that do involve high-voltage batteries with typical vehicle fire-fighting measures. Powder extinguishers up to 1,000 Volt are permitted and declared on the extinguisher.

Avoid contact with any high-voltage components during repairs. The damage caused should only be repaired by a trained expert.

If a high-voltage battery catches fire, is exposed to high temperatures, a rise in the battery temperature is detected or it is twisted, bent, torn or even broken, cool down the battery with large quantities of water. Do NOT extinguish or cool with a small amount of water and always ensure sufficient water supply (request additional water supply).

Extinguishing battery fires may take up to 24 hours. You can leave the battery burning while protecting the vicinity or exposed areas.

Use a thermal imaging camera to make sure the high-voltage battery cooled down completely before leaving the site of the accident. The battery must be monitored for at least an hour after it is apparent that it has cooled down completely. Smoke or steam indicates the battery is still warm. Only hand over the vehicle to emergency services, e.g., authorities or towing services, when no heating has been detected for at least one hour.

4.3.2 High-voltage battery – fire damage

DANGER

Toxic fumes

A burning or heating battery releases toxic fumes.

- Sulphuric acid and oxides of carbon
- Nickel, copper and cobalt

Emergency services must protect themselves with full protective equipment, including respirators, and take appropriate measures to protect persons downwind from an accident. Use mist or positive pressure ventilation (PPV) fans to direct smoke and fumes.

The high-voltage battery consists of lithium-ion cells that are mainly made of aluminium, carbon, copper, nickel, manganese, and cobalt. If damaged, only a small amount of liquid can leak out. The fluid in the lithium-ion batteries is colourless.

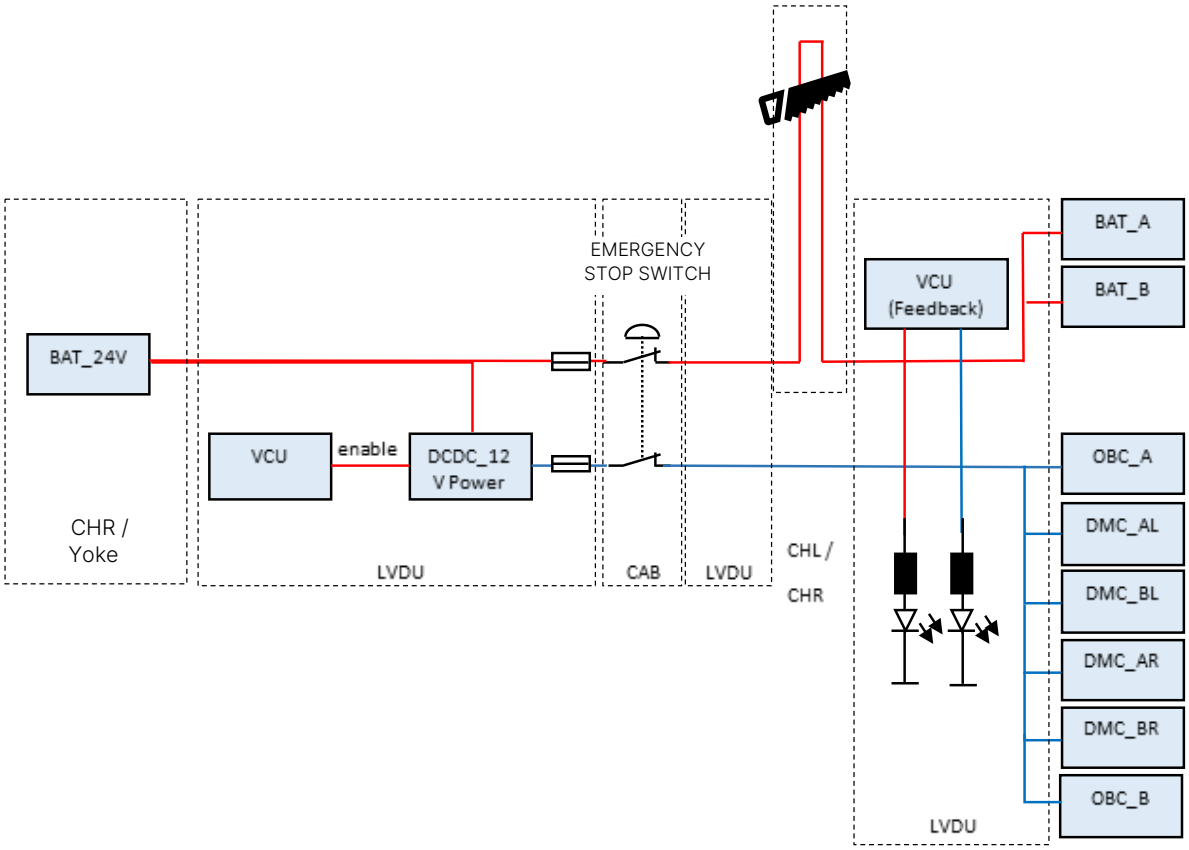
The high-voltage battery, drive unit(s), charge controller and DC converter are liquid-cooled with a yellow glycol- based coolant.

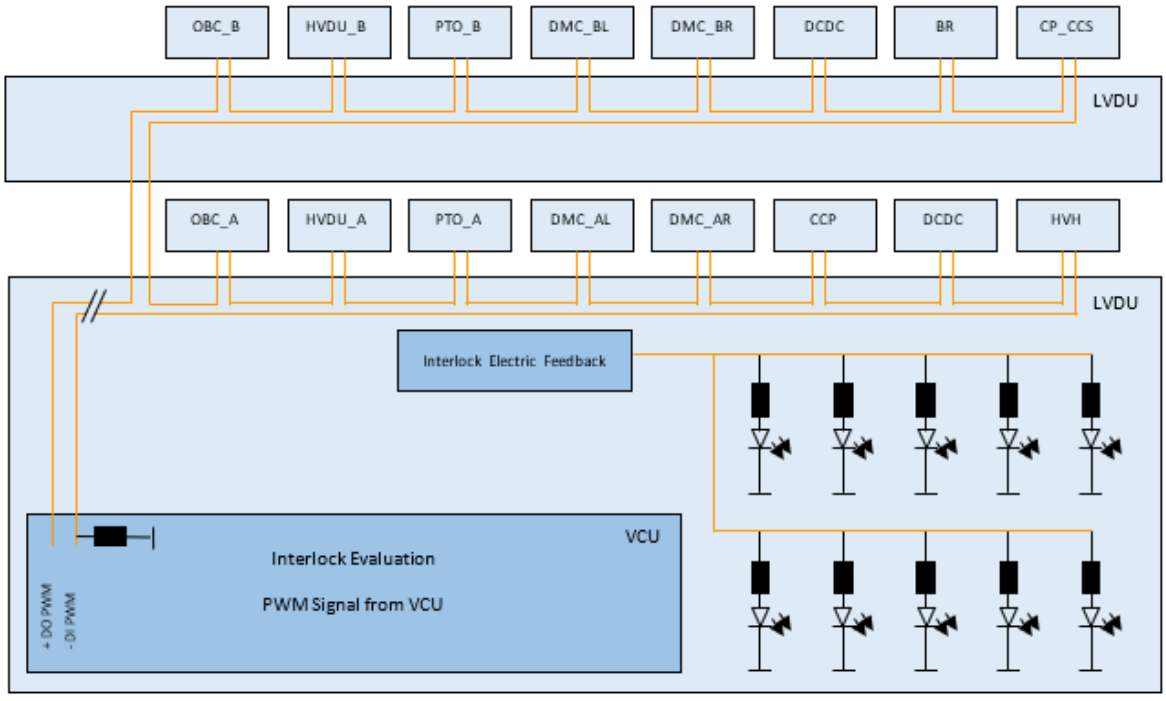
A damaged high-voltage battery can leak up to 35 litres of yellow coolant and the damage can cause rapid heating of the battery cells. If you notice smoke coming from the high-voltage battery, you can assume that it is heating up and you must take the appropriate fire-fighting measures.

5 Safety concept and safety components

The high-voltage components are protected by two safety circuits. If one of the two circuits is interrupted, the contactors (high power relays) in the batteries are opened immediately and the batteries are disconnected from the powertrain. One of these is the LV emergency power-off circuit, the other being the interlock circuit.

5.1 Diagram LV emergency power-off and interlock circuit





5.1.1 Active Discharge

If the interlock or the LV emergency power-off is interrupted, the contactors (relays) in the battery are opened. This discharges the high-voltage circuit to < 60 V within 1 second.

5.1.2 Regular shut-down

If the ignition lock is turned back, the high-voltage system shuts down as usual. This shut-down is slower and takes several minutes until the system is voltage-free.

5.2 High voltage off switch

In the event of an accident or if the vehicle has a breakdown, press the “High voltage off” switch in the driver’s cabin and turn off the ignition. This will disconnect the battery from the powertrain.

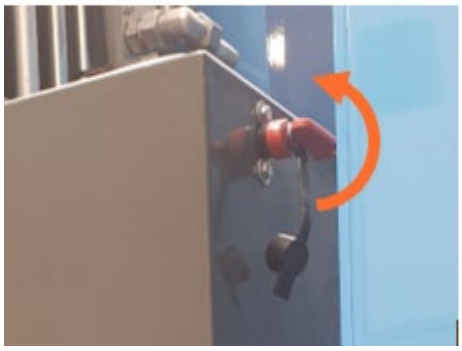
	CAUTION
	**“High voltage off” switch:** In the event of an emergency, the driver must be able to put the vehicle out of operation at any time by pressing the “High voltage off” switch. The driver assumes the safety function. The driver can deactivate the power supply to the drive as well as the drive inverters and the charger via the “High voltage off” switch. The “High voltage off” switch immediately interrupts the power supply to the HV contactors in the battery, without using software.

5.3 LV emergency power-off

Pressing the "High voltage off" switch disconnects the supply to the HV battery from the vehicle. The LV-EMERGENCY STOP circuit is interrupted, but the LOW CAB control continues to run.

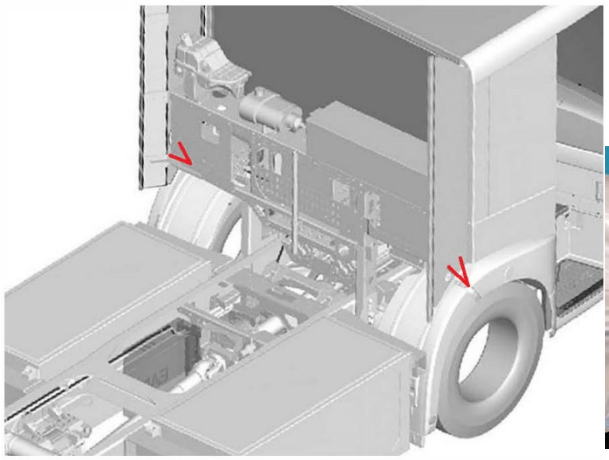
5.4 Battery disconnect switch (Low-voltage)

The LV power supply to the LOW CAB control unit is disconnected from the outside via a battery disconnection switch (illustration, arrow) mounted on the side of the vehicle. To do this, the battery disconnection switch must be turned anti-clockwise.
This interrupts the LV EMERGENCY STOP circuit.



5.5 Emergency disconnect cable (Cut Strips)

If the EMERGENCY STOP switch as well as the battery disconnect switch are not accessible or if there is a risk that the vehicle or parts of it are live, an emergency disconnect cable located behind the front axle mudguards can be cut with an insulated bolt cutter. The emergency disconnect cable should always be cut with two cuts to prevent renewed contact. As soon as the emergency disconnect cable is cut, the connection to the HV batteries is interrupted.



5.6 Disconnect HV battery supply cable

Only use these instructions in an emergency where the HV unit is defective.

DANGER

High voltage / Danger to life!

- Work on high-voltage cables may only be performed by trained authorised personnel!
- The cable plugs may only be disconnected wearing full personal protective equipment.
- Danger to life when touching live parts!
- Have damaged cables or housings inspected by qualified personnel immediately.

NOTICE

The Swiss Fire Brigade Association (Schweizer Feuerwehrverband, SFV) states that deployments involving an electric vehicle, whether after an accident or a fire, must be carried out exclusively in complete protective equipment incl. respirator. Furthermore, insulation gloves must be worn until the high-voltage system is shut down safely. If there is a risk that the intrinsic safety of the vehicle can no longer be assured and there is a potential danger to the emergency workers, a qualified electrician must be called in.

To completely disconnect the HV batteries, wearing full personal protective equipment, first the black LV cable (Figure right: 1x LV cable), then the high voltage cable plug (Figure left: 2x high voltage cable) can be disconnected. In both situations the interlock circuit will be interrupted. The procedure for case 3, chapter 4.1 must be strictly observed.

6 Further protective mechanisms

6.1 Thermal safety

All high-voltage components (NLG, DMC, DC/DC converters, motors, batteries) used have thermal monitoring. If the temperature is too high, power is first reduced and if there is an emergency, the system is then shut down completely.

6.2 Galvanic isolation AC power / high-voltage battery

The charger includes galvanic isolation so that no short-circuit current is transmitted to the mains side in the event of a short-circuit on the DC side.

6.3 Galvanic isolation LV electrical system / high-voltage battery

The HV electrical system (400 V) is galvanically isolated from the LV electrical system (24 V).

Additionally, an insulation monitoring device is fitted between the electric vehicle earth and the high-voltage circuit.

6.4 Insulation measurement

A built-in insulation sensor in the BMS continuously measures the resistance between the high-voltage system and the vehicle earth. If there is an error, a warning is displayed.

6.5 Potential equalisation

All exposed conductive parts of the high-voltage components (housing, brackets) are galvanically connected to the vehicle earth.

6.6 Automatic discharge

The units are equipped with active and passive DC link discharge. The passive DC link discharge takes place through the internal high-voltage feed and is therefore not controllable. The active DC link discharge takes place through a resistor chain.

6.7 Precharging circuit

There is a precharging circuit that charges the existing DC link capacities (especially in the inverter) with a reduced current within a defined time upon connecting the high-voltage system, thereby preventing excess current.

7 Towing

If the vehicle is towed in the event of a breakdown, the drive shaft must be dismantled.

The complete steps for towing and recovering the vehicle can be found in the Mercedes-Benz towing manual.

8 Abbreviations

Abbreviation	Designation	Description
ACP	Air Compressor	HV air compressor
BAT	HV Battery	HV battery
BMS	Battery Management System	Battery management system
BR	Break Resistor	Brake resistor
CCP	Climate Compressor	HV climate compressor
CP	Charging Port	Charging port
CPCCS	Charging Port CCS	CCS charging port
DC	Direct Current	Direct current
DCDC	DCDC Converter	HV to 24V converter
DMC	Digital Motor Controller	HV drive motor
HV	High Voltage	High voltage 400V
HVDU	High Voltage Distribution Unit	HV distribution unit with fuses
HVH	High Voltage Heater	HV heater
LV	Low Voltage	24V on-board voltage
LVDU	Low Voltage Distribution Unit	LV distribution unit
OBC	On Board Charger	ACDC on-board charger
PTO	Power Take Off	Body power take-off
SoC	State of Charge	HV battery current state of charge
VCU	Vehicle Control Unit	Main control unit in the vehicle