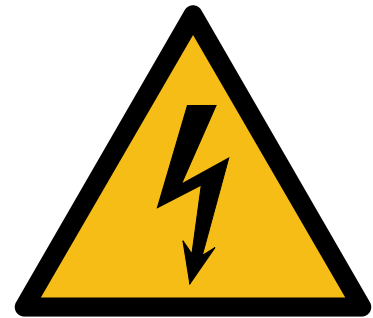




**SI 2170**  
For technical personnel only!  
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# SERVICE **INFORMATION**

## HIGH VOLTAGE – BASIC INFORMATION



### WHAT IS HIGH VOLTAGE IN A VEHICLE?

In general vehicle technology, voltage ranges are specified in “volt”.

#### Voltages

- greater than 30 volts alternating current (AC) or
- greater than 60 volts direct current (DC) are considered “high voltage” in vehicles.

Battery-electric vehicles (BEV), hybrid vehicles and vehicles with fuel cells operate with DC voltages of up to 800 volts and current strengths of up to 125 amperes, depending on the manufacturer.

### WHY HIGH VOLTAGE?

A high level of electric power is required to power a vehicle electrically.

Advantages of higher electric voltage:

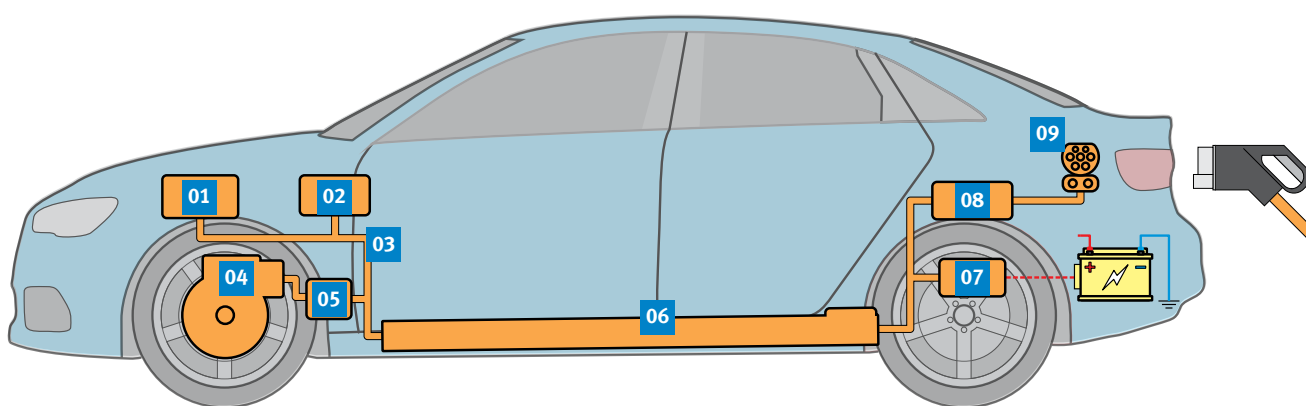
- A lower current strength is required for the same level of electric power.  
Example: if the voltage is doubled, half the current strength is sufficient.
- With higher voltages, it is easier to realise driving and charging performance than with high current strengths.
- Cables with a lower cross-sectional area can be used in the vehicle, which helps to save on material, weight, cooling and costs.
- Loss of power is reduced.



## HIGH-VOLTAGE COMPONENTS

The drive system of a hybrid or electric vehicle generally has the following HV components:

- |  |  |
|--|--|
| <b>01</b> HV air-conditioning compressor   | <b>06</b> HV battery (accumulator)                                 |
| <b>02</b> PTC auxiliary heater (cabin heating)   | <b>07</b> DC-DC converter (HV → 12 V)                              |
| <b>03</b> HV wiring harness  | <b>08</b> Battery charger (on-board charger, OBC, AC-DC converter) |
| <b>04</b> Electric motor / drive motor   | <b>09</b> Charging socket  |
| <b>05</b> Inverter (DC-AC converter, converts the direct current of the HV battery into 3-phase alternating current for the motor) |  |



High-voltage components in a BEV

## COMMONLY USED ABBREVIATIONS

BEV	Battery electric vehicle
BMS	Battery management system
DGUV	German Social Accident Insurance (see DGUV 209-093)*
EuP	Elektrotechnisch unterwiesene Person (electrically instructed person)
EV	Electric vehicle
FHV	Fachkundige Person Hochvolt (a person who possesses the expertise and specialist knowledge to perform a special task on high-voltage systems), Qualification Level 2S
FuP	Fachkundig unterwiesene Person (a person who has received instructions by an FHV), Qualification Level 1S
HV	High voltage
IT	“Isolé terre” (French) = isolated earth (the IT network is a non-earthed electrical supply)
PHEV	Plug-in hybrid electric vehicle (vehicle with a combustion engine and an electric drive)
S to 3S	Qualification and training levels for series production vehicles
SoC	State of charge
SoF	State of function (describes the performance of the battery)
SoH	State of health (describes the age condition of the battery)
ZEV	Zero emission vehicle



## SAFETY MEASURES

### ORGANISATIONAL / PERSONNEL

- Only persons with one of the required qualifications (levels 1S, 2S, 3S)\* are permitted to work on vehicles with high-voltage systems and their components.
- Wearing personal protective equipment (PPE) according to DIN EN 60903\* is compulsory, depending on the work step.
- Familiarisation among all repair shop personnel is essential.
- Vehicle-specific work information must be available (manufacturer documentation, rescue cards).

### TECHNICAL

- All high-voltage components are indicated by orange cables and warning signs.
- In the event of thermal overload, disconnection of the pilot line or a short circuit, the HV network is disconnected from the battery through contactors.
- An IT system ("isolé terre") is used in HV vehicles. The IT system is galvanically isolated from the vehicle earth and not earthed via the body.
- All live parts have covers to protect them against direct contact. These covers can only be removed with tools or by being destroyed.
- The HV system can be deactivated by means of an isolating facility (maintenance plug, service disconnect, emergency stop).
- Plug contacts are used to connect all HV components to a safety loop (pilot line, interlock) electrically in series in the 12V on-board power supply system. If the pilot line is interrupted in one place, the HV contactors open, the HV battery disconnects from the HV network and the capacitors are forcibly discharged.
- The isolation monitoring ensures that there is sufficient isolation (galvanic separation) between the body and the HV components.
- All HV components are connected to one another and to the vehicle body through "potential equalisation". This compensates for differences in potential.



#### Disclaimer

All information in this publication has been carefully researched and compiled. However, we are unable to provide any guarantee nor to accept any legal liability for the completeness or currency of the information provided. All liability on our part for damages, whether direct or indirect, material or immaterial, arising as the result of the use or misuse of information or incomplete / incorrect information is excluded, insofar as it is not the result of wilful intent or gross negligence on our part.

\*) This information sheet predominantly considers German and European standards. Please note: The relevant applicable statutory provisions and safety provisions may differ between countries.

All content, including pictures and diagrams, is subject to change.



You can find further information on high voltage on our website.