
Measuring the insulation resistance

Instruction

E-Truck



Translation of the original document

Legal notice

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	NOTICE
	Read this document
	Read this document carefully and follow the information contained in it.
	Failure to comply with this instruction may result in death, injury, damage to the product and the environment.
	Always use the latest document version.

Validity

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

Model	Code 1	Code 2
E-Truck	Mid Cab / Mid Cab X / High Cab	V2.1
E-Truck	Mid Cab / Mid Cab X / High Cab	V2.2
E-Truck	Low Cab	V2.2

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1 Foreword

The Designwerk E-Truck, an immensely powerful and versatile product. Since it 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 product.

1.1 General information

This document includes instructions for the safe measurement of the insulation resistance by trained professionals. Additional information on the vehicle can be found in the operating manual.

The E-Truck version can be found in the display under “settings”.

1.2 List of abbreviations

Abbreviation	Meaning
AC	Alternating Current
DC	Direct Current
HV	High Voltage (> 80 V)
HVDU	High Voltage Distribution Unit
HVH	High Voltage Heater
LV	Low Voltage
OBC	On Board Charger
PTO	Power Take-Off
SPB	Serial Parallel Switchbox

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 meaning

Various symbols are used throughout this document. An overview and their meaning can be found in the following tables:

2.1.1 Warning signs

Symbol	Designation	Symbol	Designation
	General warning of a danger zone		Warning of electrical voltage

2.1.2 Commandment signs

Symbol	Designation	Symbol	Designation
	Important information to avoid potential property damage		Read the manual
	Wear protective shoes		Use antistatic footwear
	Important 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 General safety information

	DANGER Danger caused by electrical discharge The incorrect handling of the high voltage system can cause electrical shocks and electric arcs, which may result in severe burns or death. • The process may only be conducted by authorized professionals. • Carefully read the safety instructions • Wear Personal Protective Equipment according to the instructions.
	NOTICE Required qualification for measuring the insulation resistance The work described in this document may only be carried out in instructed workshops and by trained personnel.
 	NOTICE Wear protective shoes Wear safety shoes that meet the following requirements during the work described: • Protective cap • Antistatic insole and oil- and petrol-resistant outsole with non-slip tread pattern • Safety class S3, as per European Standard EN ISO 20345
	INFORMATION Marking of high-voltage components • All high-voltage cables are orange in colour. • All high-voltage components are marked with an appropriate warning label.
	INFORMATION The figures may slightly deviate from the vehicle being serviced. However, the key components listed in this informational document are illustrated as accurately as possible.

3 General information on the insulation resistance

The insulation resistance of the entire vehicle is measured continuously during operation and during the charging process of the batteries.

Normally, the value of the insulation resistance of the entire system is approx. $400 \text{ k}\Omega \pm 0.5$.

If the measured value deviates greatly from the normal value, there is a problem with the insulation resistance. This represents a safety risk on the vehicle.

If the value of the insulation resistance falls below $100 \text{ k}\Omega$ in a parked vehicle, the vehicle switches off and can no longer be restarted.

4 Preparation

4.1 Decommissioning

Before measuring the insulation resistance, the vehicle must be decommissioned.

For this purpose follow the instructions in the document «DW_VOC_V2.X-Decommissioning_EN» or «DW_LOC_V2.X-Decommissioning_EN»

4.2 Tools and auxiliary materials



NOTICE

Calibration and certification

Have your measuring devices calibrated and certified regularly.

4.2.1 Resistance meter

Designwerk recommends the measuring device by the brand Fluke **175 true RMS**.
Minimum requirements (measuring device AND measuring cables)

- IEC 61010-1 for overvoltage categories CAT IV
- 600V/CAT III 1000V tested
- True-RMS measurements for voltage
- Basic accuracy of approx. 0.09 %
- Max. Voltage resolution 0.1 mV
- Max. resistance resolution 0.1 Ω
- Max. measured resistance 50 M Ω



4.2.2 Resistance values of individual components

	INFORMATION
	The values of the individual components are only valid if they are measured individually or decoupled from the system. Otherwise, the value of the entire system applies.

Component	R ISO	Measuring voltage
Total system	> 250 kOhm	500 V
HV heater DBK	> 10 MOhm	500 V
HVH Webasto	> 50 MOhm	500 V
PTO	> 4 MOhm	500 V
OBC Brusa and Refu	> 5 MOhm	500 V
Charging port	> 10 MOhm	1 kV
SPB	> 10 MOhm	1 kV
Drive motor	> 4 MOhm	500 V
Air conditioning compressor (CCP)	> 5 MOhm	500 V

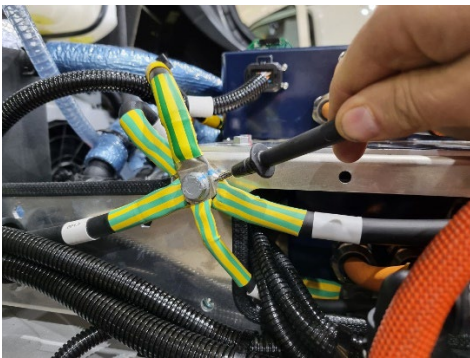
5 Measuring the insulation resistance

- 1 Remove the covers of the HVDU (HVDU_A and HVDU_B. For a for battery drive also HVDU_C und HVDU_D.



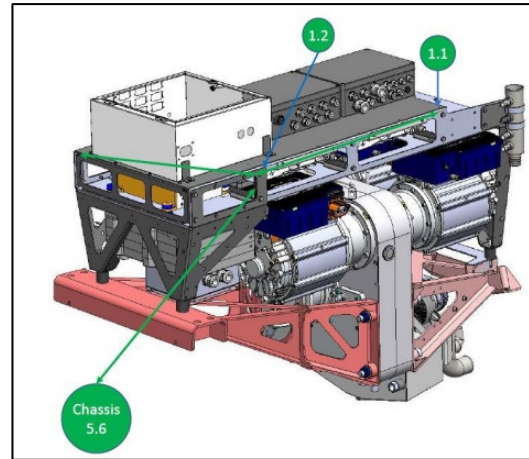
- 2 The vehicle has a nominal voltage of 400 V.
Therefore set the test voltage at the resistance meter to 500 VDC.

	INFORMATION
	When measuring the ground point, do not measure on the screw but on the cable lug. The measurement on the screw does not provide a reliable measurement result.



- 3 Perform the insulation check on all HVDUs:
 - between HV + and the mass point 1.2
 - between HV- and mass point 1.2

The measured value must be greater than 550 kΩ and the device must display a test voltage of at least 500 VDC.



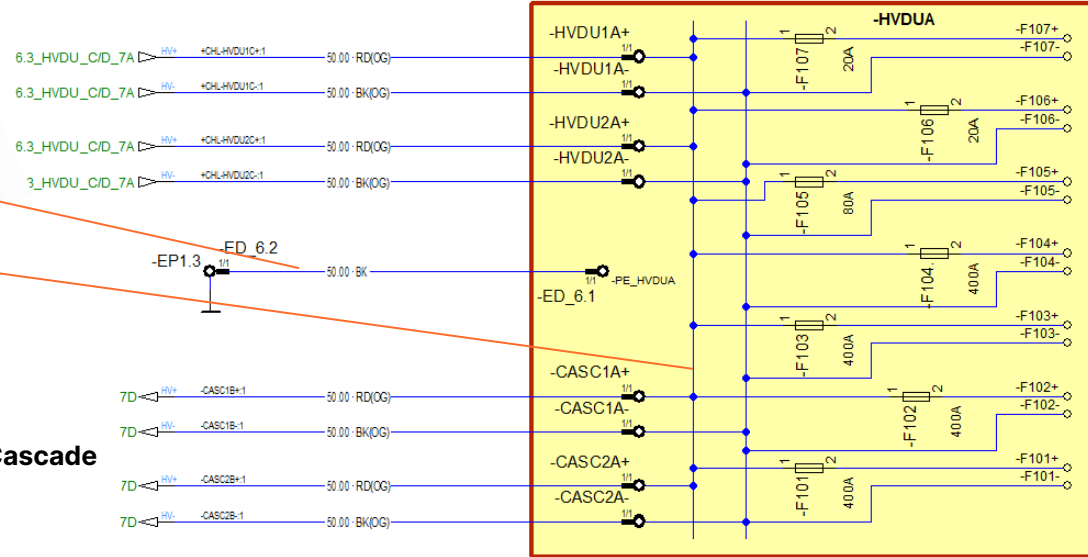
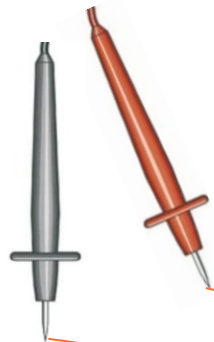
4 If the value is too low:

- remove the connections of the fuse of a high voltage circuit one by one (see left figure below).
- Measure the insulation resistance at the cable connection. (see right figure below).

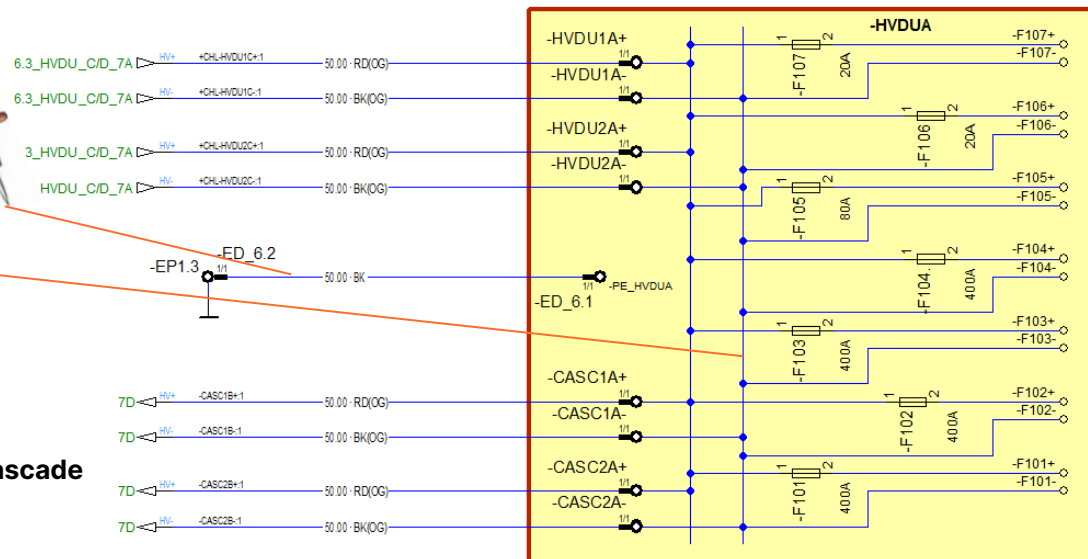
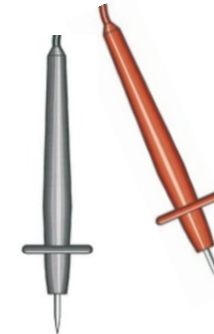
Continue like this until the faulty circuit is found.



On the following page, the measurement of the insulation resistance is shown again schematically using an example electrical diagram:



Cascade



Cascade

