



Tests on High-Voltage Wiring Harnesses for Motor Vehicles

Consisting of shielded high-voltage sheathed cables, passive electrical and mechanical components and connection systems

Technical guideline – TLF 0217-2

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1 Scope of application

The scope of application is limited to testing of the wiring harness, consisting of shielded high-voltage sheathed cables (single-core or multi-core sheathed cables for motor vehicles), passive electrical and mechanical components and connection systems.

The design of the cables is based on ISO 6722-1 and ISO 19642 and their parts.

Equivalent or better tests should not be ruled out, as they serve the purpose of rapid further development, taking into account the increasing requirements in the development of vehicles.

2 General information

This version of the technical guideline (ZVEI-TLF) was drawn up by representatives of the wiring harness manufacturers in the ZVEI.

The information in this ZVEI-TLF is intended for the creation of an individual specification by the manufacturer and/or the OEM.

This ZVEI-TLF in the various update statuses will be made available to the members of the working group "Bordnetze Technik" in the appropriate "Teams folder" and will be updated and expanded as required. After completion of the work, this ZVEI-TLF will be published promptly as a publication of the association.

The ZVEI-TLF corresponds to the current status at the time the guide was created. It is intended as a non-binding guide for manufacturers and does not claim to be comprehensive.

Tests can be customised according to the state of the art in measurement and production technology.

3 Test recommendation

Series and sample inspection are carried out at the end of the process. Type approval / validation is required for new wiring harnesses or existing wiring harnesses with new components. The procedure for minor changes to the wiring harness must be agreed with the OEM's specialised department.

Test		Series inspection	Sample inspection	Type approval / validation	Requirements	Test conditions	Underlying specification
Method	Scope						
Product assembly	Presence, position and orientation test of accessories and fixation elements	X		X	According to assembly instructions / drawing		Customer specific requirements
Product assembly	Presence of sealing elements	X			Correct assembly of all components	Quantitative leak test of sealing function / process-controlled component assignment and their tolerance ranges	Customer specific requirements

Test		Series inspection	Sample inspection	Type approval / validation	Requirements	Test conditions	Underlying specification
Method	Scope						
Electric	Continuity test of the shield	X		X	Continuity / no continuity	Test voltage ≤ 60 V DC	ISO 6469-3
Electric	Shield resistance measurement			X	Resistance according to specification	Test voltage ≤ 60 V DC	Customer specific requirements
Electric	Continuity test of the conductor	X		X	Continuity / no continuity	Test voltage ≤ 60 V DC	ISO 6469-3
Electric	Conductor resistance measurement			X	Resistance according to specification	Test voltage ≤ 60 V DC	Customer specific requirements
Electric	Insulation resistance	X			Resistance according to specification	Test voltage $U = 1$ kV DC Duration: 1 s	ISO 6469-3*
				X	Resistance according to specification	Test voltage $U = 1$ kV DC Duration: 60 s	ISO 6469-3*
Electric	Dielectric strength test of harness set for electrical safety	X			No spark	Test voltage: AC = $2 \times U_0 + 1$ kV DC = $(2 \times U_0 + 1 \text{ kV}) \times \sqrt{2}$ Duration: 1 s (according to ISO 6469-3 (Edition 2011))	ISO 6469-3**
				X	No spark	Test voltage: AC = $2 \times U_0 + 1$ kV DC = $(2 \times U_0 + 1 \text{ kV}) \times \sqrt{2}$ Duration: 60 s (according to ISO 6469-3 (Edition 2011))	ISO 6469-3**
Electric	System specific inductance including ferrites	(x)			Nominal value according to specification		Customer specific requirements
Product assembly	Lever / Locker position	(x)			Defined position for transport and assembly		Customer specific requirements

(X) Test required, if components are included.

* For higher operating voltages, appropriate standards must be taken into account. For 1000V DC and higher the test voltage must be adjusted to the maximum operating voltage.

** Test execution based on standard ISO 6469-3. Test voltage and test duration should be selected according to the values in this table. If newer standards require higher values, these must be used accordingly.

Test		Series inspection	Sample inspection	Type approval / validation	Requirements	Test conditions	Underlying specification
Method	Scope						
Mechanical	Mechanical stability			X	Mechanical stability of the harness components. No functional restrictions after mechanical stress test	System Validation Test Vibration table/system, preferably on a vehicle shaker when installed (test with connected components). Special examination in selected areas e.g. transitions from fixed to moving components	Customer specific requirements
Product assembly	Watertightness in mounting position			X	No penetration of moisture into the harness	System Analysis Harness construction based on validated individual components. Verification through testing on the entire vehicle system by OEM	Customer specific requirements. Requirements must be taken in consideration during component development
Electric	Short circuit strength			X	No functional restrictions of harness in defined event of a short circuit. Afterwards inspection and assessment based on the EOL Test requirements	System Analysis Tripping characteristics of the fuse, I ² t value and short-circuit current should be specified by the OEM. Design verification by simulation. Verification through testing on the entire vehicle system by OEM preferred.	Customer specific requirements
Electric	Harness derating			X	Current carrying capacity test	System Analysis Dimensioning of the cable harness based on simulation. Verification based on measurements in vehicle system by OEM	Customer specific requirements

(X) Test required, if components are included.

* For higher operating voltages, appropriate standards must be taken into account. For 1000V DC and higher the test voltage must be adjusted to the maximum operating voltage.

** Test execution based on standard ISO 6469-3. Test voltage and test duration should be selected according to the values in this table. If newer standards require higher values, these must be used accordingly.

Test		Series inspection	Sample inspection	Type approval / validation	Requirements	Test conditions	Underlying specification
Method	Scope						
Electric	EMC			X	Requirements according to specification	System Analysis Harness construction based on validated individual components. Verification through measurements only on the entire vehicle system by OEM possible.	Customer specific requirements

(X) Test required, if components are included.

* For higher operating voltages, appropriate standards must be taken into account. For 1000V DC and higher the test voltage must be adjusted to the maximum operating voltage.

** Test execution based on standard ISO 6469-3. Test voltage and test duration should be selected according to the values in this table. If newer standards require higher values, these must be used accordingly.

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