DGUV Test
Prüf- und Zertifizierungsstelle
Elektrotechnik
Fachbereich Energie Textil
Elektro Medienerzeugnisse

Translation

Principles of testing and certification for insulating hose assemblies on cable cutting devices

Status as of 2014-01

Principles of testing
Insulating hose assemblies on cable cutting devices
GS-ET-40

GS-ET-40

Energy, textile & electrical media products department
Testing and certification facility in DGUV Test
Gustav-Heinemann-Ufer 130
50968 Cologne, Germany

These Principles of testing serve as verification that the requirements of the German Product Safety Act (ProdSG) with respect to the use of cable cutting devices have been complied with in accordance with DIN EN 50340 and GS-ET 23.

These principles will be revised and supplemented periodically in consideration of knowledge gained in the area of occupational health and safety, as well as technical progress. The most recent edition shall always be binding for tests conducted by the Electrical engineering testing and certification body.

These Principles of testing serve to render more precisely the requirements and tests found in DIN EN 50340 and in GS-ET 23 for motor-operated cable cutting devices.

This is the English translation of the German test principle. The German original version is obligatory.

Changes from the edition 2013-10:

3.3 Number of test devices adapted
4.4.4 Reference to test standard specified

Table of Contents Page

1. General

Considerations behind the Principles of testing:

Only insulating hoses are tested within the framework of the electrical testing. Other components associated with the insulating hose assembly (e.g. fittings, bend/kink protection, etc.) are not taken into consideration.
It has also been determined that it is not possible to reproducibly make a cut of ($0.1^{+0.1}$) width on the insulating hose.
Testing according to Section 5.4.2 „Long-term exposure“ is not practical for application on cable cutting devices because these insulating hose assemblies are not subjected to the underlying loads.
„Change of length testing“ according to Section 5.4.5 is not practical because the determination of compliance with a minimum length is tested using an insulating hose assembly at least 10 m long.

1.1 Scope of application

1.1.1 These Principles of testing apply to insulating hydraulic hose assemblies used on cable cutting devices.
Cable cutting devices are used in order to determine whether cables with nominal voltages up to 30 kV (maximum permissible operating voltage up to 36 kV) and nominal frequencies up to 60 Hz are exposed to live voltage at the workplace in conjunction with organisational measures. Testing is carried out in accordance with DIN VDE 0105 Part 1 (2005-06), Section 6.2.3.

1.1.2 These Principles of testing may be applied accordingly to insulating hydraulic hose assemblies with exposure greater than 30 kV up to 60 kV (maximum permissible operating voltage over 36 kV up to 72.5 kV).

1.2 Testing and/or certification process

The testing and/or certification process will be initiated upon signing of the contract by the contractual partners. The technical documentation set forth in Section 3 is to be submitted together with the contract. All test objects and test pieces required for testing are set forth in Section 3.3 and are to be made available at no charge.

Additional components and materials are to be made available at the request of the testing laboratory.

1.3 Test specifications

The standards listed below were taken into consideration while preparing these Principles of testing:

DIN EN 62237	Live working – Insulating hoses with fittings for use with hydraulic tools and equipment

2 Definitions

2.1 Insulating hose

Insulating, pressure resistant hose used as part of an insulating hose assembly.

2.2 Insulating hose assembly

Insulating, pressure resistant component consisting of an insulating hose with fittings at each end for the connection of parts of hydraulic equipment at different electrical potentials

2.3 Connecting elements

A pair of fittings to permit a connection between hydraulic components

2.4 Maximum operating pressure

Operating pressure specified by the manufacturer that must not be exceeded during operation of the cable cutter.

2.5 Bend/kink protection

Prevents the bending radius at each end of the insulating hose from falling below specified minimums.

2.6 Type test

Testing carried out on a test object/test piece under subjection to certain assumptions in order to verify that defined requirements have been complied with.

2.7 Test object

Insulating hose assembly

2.8 Test piece

Part of the test object (hose section, connecting element, bend/kink protection, etc.)

3 Test conditions

3.1 General

All tests on ready-for-use insulating hydraulic hose assemblies are to be carried out on the same test object each time.

Insofar as it has not been set forth in the individual test sections, the tests are to be carried out at an ambient temperature of 20° C ± 5 K and a relative humidity of 30 to 70 %.

All values required for testing must be maintained with such precision that ensuing test results will not be influenced by more than ± 5 %.

3.2 Test documentation to be submitted

The following technical documentation is required for testing:

- Parts list(s)
- Engineering drawings for the insulating hose
- Data sheet for the hydraulic connecting elements (fittings)
- Data sheet for the insulating hose
- Manufacturer's declaration related to PAH contamination, or data sheets for the materials that may come into contact with the skin, if applicable.

3.3 Required test objects and test pieces

To be provided at no charge for testing:

Test object: 1 piece, at original length
3 pieces, with free hose lengths as calculated according to Section 4.4.2
3 pieces, with free hose lengths of 2000 mm
9 pieces, with free hose lengths of 600 mm

Test pieces: 1 piece, insulating hose (length = 400 mm)
1 piece, connecting element
1 piece, bend/kink protection (if used)
1 piece, protective tubing (if used)
1 piece, press fittings for protective tubing (if used)

4 Requirements and tests

4.1 General requirements

4.1.1 Insulating hose assembly

The overall length of the insulating hose assembly must be flexible and be made of insulating material.

Test:

Visual inspection and handling check of the insulating hose assembly as well as a review of the product data sheets.

4.1.2 Insulating hose assembly measurement

The insulating hose assembly must consist of one piece and the insulating hose must not be shorter than 10 m when maximum operating pressure is applied.

Test:

The insulating hose assembly must be completely filled with fluid and subsequently sealed on one end with suitable connecting element fittings.
The other end of the insulating hose assembly is to be connected to the pressure source via a pressure gauge.
The pump should be operated until reaching the maximum permissible operating pressure. The length of the insulating hose assembly should be measured after one minute.

The test has been passed when the hose length does not fall below 10 m.

4.1.3 External materials and properties

4.1.3.1 Parts, which may come in contact with the operator's skin when used, must not be comprised of any dangerous substances.

Test:

Review of the safety data sheets for the materials used. Use the procedure according to ZEK 01.2-08 to check the amount of polycyclic aromatic hydrocarbon (PAH) with consideration given to PAH-substance list 04-11.

4.1.3.2 Touchable parts that may be contacted with proper usage must be free from sharp edges, burrs or similar features.

Test:

Handling and visual inspection

4.2 Inscriptions

4.2.1 Insulating hose

The following inscriptions must be permanently applied and clearly visible:

- Indication of origin (manufacturer's name or trademark);
- Year of manufacture;
- Type designation;
- Nominal diameter

The prescribed inscriptions must be affixed at spacing intervals of not greater than 500 mm over the length of the insulating hose assembly.

Test:

The spacing intervals between the inscriptions are to be measured.

The inscriptions are to be visually checked for conspicuousness and completeness. Inscription durability is to be tested by rubbing them for 15 s with a water-soaked, lint-free cloth, and then rubbing them for 15 s with an ethyl alcohol-soaked, lint-free cloth.

The test has been passed when the spacing intervals between the inscriptions are not greater than 500 mm apart and the inscriptions are still clearly legible and haven't become wavy or begun to detach following the wipe test.

4.2.2 Insulating hose assembly

The following inscriptions must be permanently applied and clearly visible at one location on the insulating hose assembly:

- Indication of origin (manufacturer's name or trademark);
- Month and year of manufacture;
- Type designation;
- Maximum operating pressure;
- Graphic symbol (double triangle) (see Fig. 2 in DIN EN 50340 (VDE 0682-661):
- 2011-04)

The prescribed inscriptions may be affixed to, or in the vicinity of the connecting elements. If the markings are affixed to the insulating hose, they must be clearly distinguishable from the markings referenced in 4.2.1.

Test:

The inscriptions are to be visually checked for conspicuousness, completeness and distinctiveness.
Inscription durability is to be tested by rubbing them for 15 s with a water-soaked, lint-free cloth, and then rubbing them for 15 s with an ethyl alcohol-soaked, lint-free cloth.

Engraved or embossed markings must not be subjected to durability testing.

The test has been passed when the inscriptions are still clearly legible and haven't become wavy or begun to detach.

4.3 Electrical testing

4.3.1 Leakage current

Insulating hose assemblies must provide sufficient isolation between the connecting elements based on the highest rated voltage at the supply frequency, even with external contamination and wear.

The test object's leakage current must not exceed a value of 50 µA.

Test:

Testing is to be carried out on the test object with free hose lengths of (2000 ± 50) mm and without fluid. The ends of the test object are to be sealed with suitable connecting element fittings.

The outer jacket layer of each test object is to be removed down to the webbing layer to a distance of (990 ± 5) mm from the connecting elements; centred over a length of (20 ± 2) mm and a width of (5 ± 1) mm (Fig. 1).

To accomplish this, cut into the outer jacket with a disc-type milling cutter (Ø 63 mm, width 0.5 mm), longitudinally over a length of (20 ± 2) mm, until the webbing is visible. A second cut should be made parallel to the first cut at a distance of (5 ± 1) mm. Incisions should then be made with a knife into the outer jacket and, starting at the cut ends and progressing from cut-to-cut along the partial circumference, it should be peeled from the webbed layer.

Each test object should be stored for at least 96 h; completely submerged in water with a specific electric resistance of (100 ± 15) Ωm and a temperature of (20 ± 5) °C.

At the end of the storage period, any residual moisture on the test objects should be wiped off using a clean lint-free cloth.

Within 5 min. following water storage, each test object should be placed in a test configuration corresponding to Fig. 1. The two electrodes should then be attached to insulating stanchions at a minimum height of 800 mm above the floor.

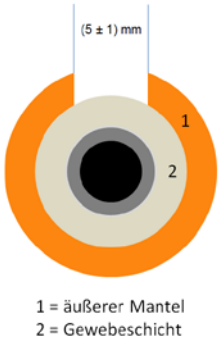
Electrode 1 should be connected to the high voltage potential source.

Electrode 2 should be attached to the measuring device's connection cable.

The high voltage potential connecting line should be installed on approximately the same axis as the test object is fastened to the connecting elements. The current across the test setup must not exceed 10 µA with the test voltage applied and without the test object in place.

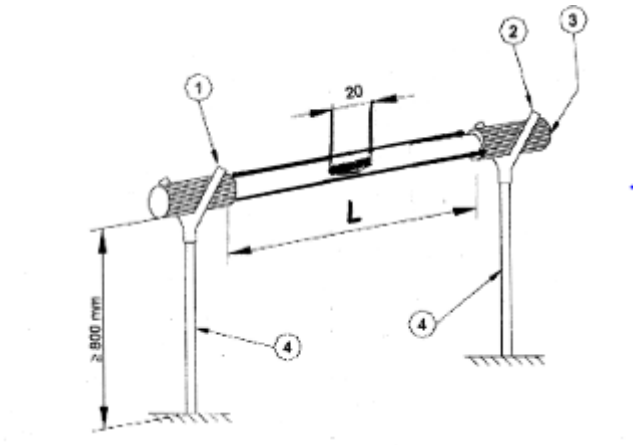
An AC test voltage (50 Hz to 60 Hz) corresponding to customer specifications should be applied for at least 5 min. without interruption in accordance with IEC 60060-1 and IEC 60060-2. The current should be measured during the last 4 min. of the test.

The test has been passed when a sparkover or flashover does not occur on any of the three test objects and the measured current I_1 does not exceed 50 µA during the last 4 min. of the test.



1. Outer jacket layer
2. Webbed layer

Fig. 1: Depiction of outer jacket removal



1 Electrode 1
2 Electrode 2
3. Connecting element
4. Insulating stanchions
L Test object with a free hose length of (2000 ± 50) mm

Fig. 2 - Test configuration for measurement of the leakage current

4.4 Mechanical testing

4.4.1 Hydrostatic testing

The insulating hose assembly must withstand the loads under the conditions at maximum operation pressure.

Test:

Testing is to be carried out on 3 test objects with free hose lengths of (600 ± 10) mm in accordance with DIN EN 62237 (VDE 0682-744):2005-12, Section 5.4.1.

4.4.2 Testing with mechanical pressure impact

The insulating hose assembly must withstand the loads under the conditions with the smallest bending radius and at maximum operation pressure.

Test:

Testing is to be carried out on 3 test objects with free hose lengths according to the following formula in accordance with DIN EN 62237 (VDE 0682-744):2005-12, Section 5.4.3:

$$L_{90} = \pi \frac{R}{2} + 2D_o$$

$$L_{180} = \pi R + 2D_o$$

L_{90} Determined length with a bend of approx. 90°;
L_{180} Determined length with a bend of approx. 180°;
R Smallest bending radius;
D_0 Outside hose diameter

4.4.3 Burst testing

The insulating hose assembly must withstand the loads under conditions at four times the maximum operation pressure.

Test:

Testing is to be carried out on 3 test objects with free hose lengths of (600 ± 10) mm in accordance with DIN EN 62237 (VDE 0682-744):2005-12, Section 5.4.6.

4.4.4 Cold bend testing

The insulating hose assembly must withstand the loads and must not leak.

Test:

Testing is to be carried out on 3 test objects with free hose lengths of (600 ± 10) mm in accordance with DIN EN 62237 (VDE 0682-744):2005-12, Section 5.4.7.
Testing in accordance with DIN EN 62237 (VDE 0682-744):2005-12, Section 5.4.4 is to be carried out subsequent to this.

5 Testing at manufacturer facilities

The tests described in this section should serve to uncover any discernible safety-related changes in the materials or the production process.

The manufacturer can select test procedures better suited for its production process if the tests selected guarantee at least the same level of safety represented by the tests listed below:

5.1 Piece testing

5.1.1 Visual inspection of the inscriptions for legibility and completeness

5.2 Random testing

5.2.1 Measurement of the leakage current according to Section 4.3.1