



**DGUV Test**

Prüf- und Zertifizierungsstelle

Elektrotechnik

Fachbereich Energie Textil

Elektro Medienerzeugnisse

*Translation*

# Principles of Testing and Certification of Battery-Operated Cable Cutting Devices

**Edition: 2025-07**

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**GS-ET-23E**

## Introduction

These Principles of Testing serve as verification that the requirements of the German Product Safety Act (ProdSG), including the 1st and 9th provisions of ProdSG and the EMC Directive, have been complied with pursuant DIN EN 50340 (as well as DIN EN 62841-1).

These Principles of Testing compile and supplement relevant, product-specific requirements and tests from DIN EN 50340 and DIN EN 62841-1 applicable to handheld and transportable, battery-operated Cable Cutting Devices.

These Principles of Testing will be revised and amended periodically in consideration of knowledge gained in occupational safety and the state of technological progress.

The most recent edition shall always be binding for tests conducted by the Electrical engineering testing and certification body of the energy, textile & electrical media products department.

### **1.1 Changes with respect to the 2019-05 edition:**

- Editorial amendments
- Definition of three design variants of battery-operated Cable Cutting Devices
- Incorporation of the requirements for battery-operated Cable Cutting Devices without insulating hose assembly (Design variant 3)
- Incorporation of the requirements for handling lithium-ion batteries
- Incorporation of the requirements for battery management
- Adaptation to current standards

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# 1 General

## 1.1 Preliminary remarks

If work is planned on an underground cable system in a voltage-free state pursuant Article 6, Sec. 2 of the German Accident Prevention Regulations, "Electrical systems and operating equipment" (DGUV Regulation 3) in conjunction with DIN VDE 0105-100, Sec. 6.2.4, the voltage-free state must be established prior to beginning work and must be maintained throughout the entire work process. It is not always possible to establish the voltage-free state of cable lines, and particularly of underground cables, at the workplace.

If cable isolation at the workplace cannot be established conclusively, then other proven safety measures should be taken instead. These can include, for example, the use of suitable Cable Cutting Devices. Further measures for working safely following completion of the cutting process are described in the procedural instructions found in Sec. 6 Para. 2.

## 1.2 Scope of application

These Principles of Testing are applicable to battery-operated, electro-hydraulic Cable Cutting Devices used for testing the voltage-free state of cables in accordance with the prescribed rules pursuant DIN EN 50110-1 (VDE 0105-1), Sec. 6.2.4, including replaceable accumulators (battery packs) and battery chargers.

In this context, transportable models are distinguished as follows:

- without remote-control but with insulating hose assembly (Design variant 1)
- with remote-control and insulating hose assembly (Design variant 2)
- with remote-control but without insulating hose assembly (Design variant 3)

These Principles of Testing are applicable to battery-operated, electro-hydraulic Cable Cutting Devices used for working on

- multi-core cables with nominal voltages not greater than 60 kV (maximum permissible operating voltage 72.5 kV)
- single-core cables with nominal voltages not greater than 110 kV (maximum permissible operating voltage up to 123 kV)

and a nominal frequency of not greater than 60 Hz.

These Principles of Testing can be used as a directive for units deployed in alternating current systems, on multi-core cables with nominal voltages greater than 60 kV, or on single-core cables with nominal voltages greater than 110 kV. In order to ensure a comparable level of safety, additional requirements and tests shall be agreed upon by the manufacturer and the customer.

The highest operating voltage for battery-operated Cable Cutting Devices and the highest nominal voltage for battery packs is 75 VDC.

These Principles of Testing do not include requirements or tests for Cable Cutting Devices used for cutting cables with special alerting systems, with steel wire or with steel strapping with more than 1 mm diameter or thickness.

DIN EN 50340 is to be applied exclusively for the testing and certification of hand- or foot-operated, hydraulic Cable Cutting Devices.

These Principles of Testing are applicable solely to transportable, battery-operated Cable Cutting Devices.

### 1.3 EU Directives and Technical rules

The EU Directives and Standards listed below were taken into consideration while preparing these Principles of Testing:

#### 1.3.1 EU Directives/Regulations

DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL from 17 May 2006 on machinery, and amending Directive 95/16/EC (revised version)

DIRECTIVE 2014/30/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL from 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (revised version)

DIRECTIVE 2014/68/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL from 15 May 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment

#### 1.3.2 Technical rules

DIN EN ISO 13854:  
2020-01 Safety of machinery – Minimum gaps to avoid crushing of parts of the human body

DIN EN 1005-2:  
2009-05 Safety of machinery – Human physical performance – Part 2: Manual handling of machinery and component parts of machinery

DIN EN 50110-1  
(VDE 0105-1):  
2024-11 Operation of electrical installations – Part 1: General requirements

DIN VDE 0105-100  
(VDE 0105-100):  
2015-10 Operation of electrical installations – Part 100: General provisions

DIN EN 50340  
(VDE 0682-661):  
2011-04 Hydraulic cable cutting devices – Devices to be used on electrical installations with nominal voltages up to AC 30 kV

|  |  |
|--|--|
| DIN EN IEC 55014-1<br>(VDE 0875-14-1):<br>2022-12  | Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission   |
| DIN EN IEC 61000-6-2<br>(VDE 0839-6-2):<br>2019-11 | Electromagnetic compatibility (EMC) – Part 6- 2: Generic standards – Immunity standard for industrial environments   |
| DIN EN 62133-1<br>(VDE 0510-81):<br>2017-11        | Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications – Part 1: Nickel systems  |
| DIN EN 62133-2<br>(VDE 0510-82):<br>2022-12        | Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications – Part 2: Lithium systems |
| UN 38.3:2015 (Ed. 6)                               | Recommendations on the Transport of Dangerous Goods – Manual of Tests and Criteria   |
| DIN EN 62841-1<br>(VDE 0740-1):<br>2023-03         | Electric motor-operated handheld tools, transportable tools and lawn and garden machinery – Safety – Part 1: General requirements  |
| DIN EN ISO 4413:<br>2011-04                        | Hydraulic fluid power – General rules and safety requirements for systems and their components   |
| DIN EN ISO 12100:<br>2011-03                       | Safety of machinery – General principles for design – Risk assessment and risk reduction   |
| DIN EN ISO 13849-1:<br>2023-12                     | Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design  |
| DIN EN ISO 13849-2:<br>2013-02                     | Safety of machinery – Safety-related parts of control systems – Part 2: Validation   |
| DIN EN ISO 13857:<br>2020-04                       | Safety of machinery – Safety distances to prevent hazard zones from being reached by upper and lower limbs   |
| DIN EN 60204-1<br>(VDE 0113-1):<br>2019-06         | Safety of machinery – Electrical equipment of machines – Part 1: General requirements  |

|  |  |
|--|--|
| DIN EN 60947-5-1<br>(VDE 0660-200):<br>2018-03 | Low voltage switchgear and control gear – Part 5-1:<br>Control circuit devices and switching elements –<br>Electromechanical control circuit devices |
| DIN EN 60812:<br>2006-11                       | Analysis techniques for system reliability – Procedure<br>for failure mode and effects analysis (FMEA)   |
| DIN EN 61025:<br>2007-08                       | Fault tree analysis (FTA)  |
| GS-ET-07:<br>2020-03                           | Wireless control equipment subject to safety<br>requirements of machinery  |
| GS-ET-40:<br>2014-01                           | Principles of testing and certification for insulating hose<br>lines on cable Cutting Devices  |
| AfPS GS 2019:01 PAK                            | Testing and evaluation of polycyclic aromatic hydro-<br>carbon (PAH) for the issuance of the GS mark   |

For greater legibility, the standards referenced throughout these Principles of Testing will be undated.

## 2 Terms

### 2.1 Battery-operated Cable Cutting Devices

An electro-hydraulically driven device using battery power to cut cables in a safe manner.

This device is used at the workplace to verify the establishment of a voltage-free state on the cable.

#### 2.1.1 Handheld, battery-operated hydraulic unit

A hydraulic unit for Design variant 1 devices, that are held in the hand / hands during the work process.

#### 2.1.2 Transportable, battery-operated hydraulic unit

A portable, battery-operated cable cutting device

**2.1.3 Battery-operated Cable Cutting Devices, Design variant 1**

An electro-hydraulically driven device using battery power to cut cables without remote-control but with an insulating hose assembly.

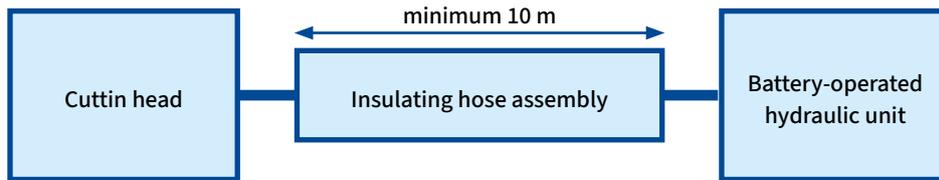


Fig. 1: Battery-operated Cable Cutting Devices, Design variant 1

**2.1.4 Battery-operated Cable Cutting Devices, Design variant 2**

An electro-hydraulically driven device using battery power to cut cables using remote-control and with an insulating hose assembly.

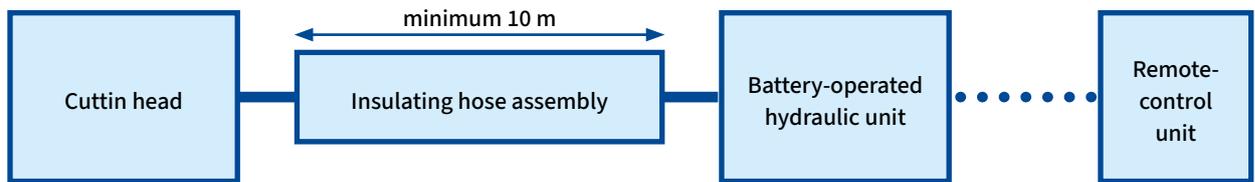


Fig. 2: Design type 2 battery-operated Cable Cutting Devices

**2.1.5 Battery-operated Cable Cutting Devices, Design variant 3**

An electro-hydraulically driven device using battery power to cut cables using remote-control but without an insulating hose assembly.

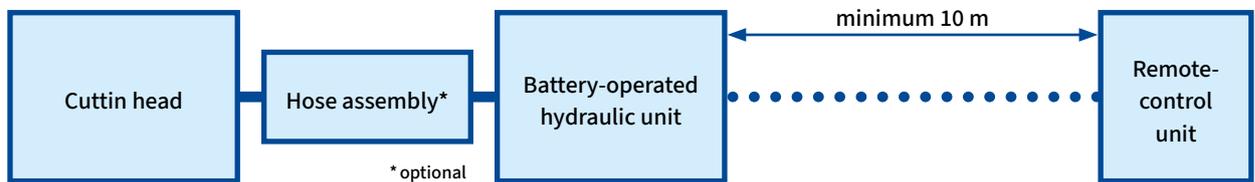


Fig. 3: Battery-operated Cable Cutting Devices, Design variant 3

**2.2 Cutting head**

That part (component) of the device that holds the cutting blade(s) and that is applied to the cable.

### **2.3 Insulating hose**

Insulating, pressure-resistant tubing and part of an insulating hose assembly

### **2.4 Insulating hose assembly**

Insulating, pressure-resistant assembly, comprised of an insulating hose with terminal fittings for connecting parts of a hydraulic unit with differing electric potential on each side

### **2.5 Hydraulic fluid (fluid)**

A fluid used to transfer pressure between the hydraulic unit and the cutting head.

### **2.6 Insulating hydraulic fluid (insulating fluid)**

Hydraulic fluid with sufficient electrically insulating properties

### **2.7 Hydraulic unit**

That part of the device, including the battery packs, that generates pressure in the fluid or insulating fluid by means of an integrated pump to drive the cutting head.

#### **NOTE**

The DIN EN 50340 standard uses merely the term Pump, while, in the context of these Principles of Testing, the terms Pump and Hydraulic unit are used synonymously.

### **2.8 Reversing valve**

A valve requiring active triggering (manual or remote control), that releases the fluid or insulating fluid return flow path from the pressure chamber to the reservoir chamber.

### **2.9 Safety valve**

A valve that releases fluid pressure in the pressure chamber when the maximum operating pressure in the hydraulic system is reached, thereby protecting the system from excessive pressure build-up.

### **2.10 Hydraulic connecting elements**

A pair of terminal fittings for establishing a connection between hydraulic components.

### **2.11 Maximum operating pressure**

Operating pressure specified by the manufacturer that must not be exceeded during operation of the battery-operated Cable Cutting Devices.

**2.12 Maximum overpressure**

The value prescribed by the manufacturer, which must not be exceeded at any time.

**2.13 Bend/kink protection**

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

**2.14 Cutter**

Metal part(s) with a sharp blade or sharp blades for penetrating the cable in such a manner that it is positively cut into two distinct sections.

**2.15 Earthing system**

A system comprised of all necessary connecting cables, conductors and connectors to ensure that the electrical equipment is at earth potential, insofar as practical (e.g. equal to or nearly 0 V).

**2.16 Force transmission unit**

That part of the battery-operated Cable Cutting Devices that establishes the connection between the hydraulic unit and the cutting head (e.g. insulating hose assembly with insulating fluid).

**2.17 Type test**

Conformity test carried out on one or more items representative of the production [IEV 151-16-16]

**2.18 Routine test**

Conformity test carried out on each individual item during or after manufacture [IEV 151-16-17]

**2.19 Test object**

Item submitted for testing, including any accessories, unless otherwise specified [IEV 151-16-28]

**2.20 Test piece**

ist Teil eines Prüflings

**2.21 Danger area**

A radius of at least 10 m encompassing the area around the cut point.

### **2.22 Remote-control unit**

A device that is used to control the hydraulic unit from a distance, without having to physically touch the unit. The data transfer between the remote-control unit and the hydraulic unit can take place via wireless transmission or via cable.

### **2.23 Remote station**

Integral part of a wireless control system, that serves as an interface between the operator and the wireless control system.

### **2.24 Base station**

Integral part of a wireless control system, providing an interface between the wireless control and other components of the machine control system.

### **2.25 Minimum range of the remote control**

The greatest distance between the remote-control device and the receiver, at which all functions are still available in their entirety.

## **3 Test conditions**

### **3.1 General**

Insofar as it has not been otherwise prescribed in the individual test sections, testing is to be carried out at an ambient temperature of  $20\text{ °C} \pm 5\text{ K}$  and at a relative humidity of 30 % to 70 %.

The limiting deviation for the test results is  $\pm 5\%$ .

In principle, all tests will be performed on a single test object, which must pass all relevant tests in the condition intended for delivery. If not otherwise specified, the sequence of testing is arbitrary.

### **3.2 Documents to be submitted**

The following technical documentation is required for testing:

- Operating instructions including technical specifications
- Sales literature (if available)
- Circuit diagrams (electrical, hydraulic)
- Parts lists with material specifications or standards specifications, as well as a list of individual circuit board components
- Circuit board layout

- EU Declaration of Conformity
- Product/Safety data sheet for the insulating fluid or fluid
- Engineering drawings
- Calculation verification for the pressure-volume product on the basis of the Pressure Equipment Directive
- Data sheets
  - Data sheet for the hydraulic connecting elements (fittings)
  - Data sheet for the insulating hose or the hydraulic hose
  - Data sheet for the threaded hydraulic fittings
  - Data sheet for the hydraulic unit
  - Other Data sheets, as necessary
- PAH-Self-disclosure and, accordingly, Data sheets for materials that could come into direct contact with the skin
- Documentation pertaining to the validation of the safety functions implemented pursuant DIN EN ISO 13849-1, Sec. 12
- Hardware fault analysis FMEA/FTA pursuant DIN EN 60812/DIN EN 61025
- Technical documentation for the battery (e.g. verification pursuant DIN EN 62133-1 or -2 and UN 38.3), including a functional verification of the battery management system
- Variants with a wireless control unit, additional documentation pursuant GS-ET-07

### 3.3 Test objects/Test pieces to be submitted

In principle, the following test objects/test pieces are to be submitted for testing:

| Type         | Quantity      | Remarks  |
|--------------|---------------|--|
| Test object  | 1             | In a configuration coordinated with the testing laboratory   |
| Test piece 1 | 1             | Hydraulic unit with a parameterisation coordinated with the testing laboratory for safety valve testing pursuant DIN EN 50340, Sec. 5.11 |
| Test piece 2 | 1 per variant | Blade for hardness testing pursuant DIN EN 50340, Sec. 5.5   |
| Test piece 3 | 3 per variant | Insulating hose assembly (600 ± 50) mm for testing pursuant DIN EN 50340, Sec. 5.3   |
| Test piece 4 | 1 per variant | Material sample(s) for assessing the PAH levels  |
| Accessories  | 1             | An adapter for connecting a pressure sensor  |

## 4 Requirements and tests

### 4.1 General requirements

#### 4.1.1 Configuration of the battery-operated Cable Cutting Devices

Battery-operated Cable Cutting Devices are comprised of the following components:

- Cutting head
- Insulating hose assembly (depending on the design variant)
- Hydraulic unit
- Insulating fluid (if necessary)
- Control unit (or with remote-control accordingly)
- Earthing system (in accordance with national regulations, as necessary)

Test:

Visual inspection

#### 4.1.2 External materials and properties

##### 4.1.2.1 Polycyclic aromatic hydrocarbons

Parts that could come into direct contact with the operator's skin during use must not contain of any substances that could be hazardous to health.

Test:

Test of critical components pursuant the German AfPS GS 2019:01 PAK

##### 4.1.2.2 Surfaces

Parts that could come into direct contact with the operator's skin with proper usage must be free from sharp edges, burrs and similar features.

Test:

Handling and visual inspection

#### 4.1.3 Electromagnetic compatibility

Battery-operated Cable Cutting Devices must be designed in such a manner that the protection requirements pursuant the EMC Directive are complied with.

Test:

Pursuant DIN EN 61000-6-2 (Immunity to interference) or DIN EN 55014-1 (Emission)

**Hinweis:** For electronic circuitry with safety-related functions, refer additionally to Section 4.4 (Additional requirements pursuant DIN EN 62841-1) of these Principles of Testing.

**Hinweis:** For wireless remote-control devices, refer additionally to Section 5 (Additional requirements for transportable, battery-operated Cable Cutting Devices with wireless ) of these Principles of Testing.

#### 4.1.4 Functional safety

Safety-relevant functions, such as:

- stopping the closure motion
- response of pressure monitoring
- detection of cutting process completion

must fulfil the requirements of PL c, as a minimum, pursuant DIN EN ISO 13849-1. A higher Performance Level may be necessary depending on the Risk assessment.

Test:

Validation of all safety functions pursuant DIN EN ISO 13849-1 and DIN EN ISO 13849-2, Annexes A-E

#### 4.1.5 Foreseeable usage (foreseeable misuse)

The product must not impair the safety or endanger the health of persons or present a risk of damage to products with reasonably foreseeable usage.

Test:

Visual inspection, review inscriptions/markings and Operating instructions.

#### 4.1.6 Intended proper usage

According to these Principles of Testing, a cable cutting device is to be used for alternatively establishing a voltage-free state by cutting cables pursuant DIN EN 50110-1 (VDE 0105-1), Sec. 6.2.4

Test:

Visual inspection, functional test, review of the Operating instructions

#### 4.1.7 Mechanical hazards

Crushing and shearing points outside the operating area must not be present or must be made safe.

Test:

Visual inspection, handling check, measurement (if applicable, consider DIN EN 13854 or DIN EN ISO 13857).

#### 4.1.8 Energy source isolation

A cable cutting device must be outfitted with equipment, with which it can be isolated from every energy source that might present a hazard.

Test:

Visual inspection and handling check

#### **ANMERKUNG**

Removing the battery pack may also be a means of isolating the energy source without the use of tools.

#### 4.1.9 Application of the Pressure Equipment Directive 2014/68/EC

Considering Article 1, Sec. 2.f) and in conjunction with Articles 3 and 9 of the Pressure Equipment Directive, a review should be made beforehand as to whether parts of the Cable Cutting Devices fall within the scope of this Directive.

If applicable, Test:

Review the manufacturer's supporting documentation, with consideration given to the relevant categories pursuant the Pressure Equipment Directive.

#### 4.1.10 Maximum overpressure

Maximum overpressure must not exceed 1.2 times the specified maximum operating pressure.

Test:

Review of technical documentation and specifications

#### 4.1.11 Reservoir oil volume

The volume (filling capacity) of the hydraulic unit's oil reservoir and, if present, the storage unit/adapter must be dimensioned so that proper operation of the Cable Cutting Devices is warranted throughout the entire operating cycle, up to the next scheduled servicing (oil change). The filling capacity of the oil reservoir and, if present, the storage unit/adapter must:

- correspond to at least 1.1 times the oil volume of the cutting head on Design variant 3 Cable Cutting Devices without the hose assembly but with a permanently installed cutting head.
- correspond to at least 1.5 times the oil volume of the cutting head on all other variants.

Test:

Review of technical documentation and specifications

#### 4.1.12 Reversing valve

The reversing valve must be easily actuated or triggered manually from the operator's working position.

In addition to the electric actuator, the hydraulic unit must also feature a control actuator, that can be accessed for mechanically actuating the reversing valve.

Test:  
Visual inspection, handling check and functional test

#### 4.1.13 Operator interface

##### 4.1.13.1 Starting and stopping the hydraulic unit

It must be possible to start the hydraulic unit at any time by actuating an operator interface (push-button with self-resetting function), and to stop it by releasing it.

Test:  
Visual inspection and handling check

##### 4.1.13.2 Unintentional actuation

Power switches on the Cable Cutting Devices and/or the remote-control device must be configured in such a manner that inadvertent actuation is unlikely.

Test:  
It must not be possible to initiate the cable cutting process by actuating the power switch with a solid ( $100 \pm 1$ ) mm diameter ball, applied from any arbitrary direction.  
The test has been passed when hazardous motions are not initiated during testing.

##### 4.1.13.3 Configuration of the actuating devices on handheld, battery-operated hydraulic units (only Design variant 1)

###### **Starting and interrupting the cutting process**

The actuating device(s) for starting and for interrupting the cutting process must be located in the grip element. In this context, it must be warranted that the tool can still be held securely while the cutting process is being interrupted.

Test:  
Handling check

###### **Stopping the cutting process and actuating the reversing valve**

Stopping the cutting process can take place automatically via the Cable Cutter control unit following a successful cut, or by manually actuating the reversing valve. The reversing valve actuating device must be readily accessible to the operator and easy to actuate.

Test:  
Handling check

#### 4.1.13.4 Accessibility of command devices on transportable, battery-operated hydraulic units

The command devices for properly starting and for interrupting the cutting process, as well as for actuating the reversing valve, must be readily accessible and safe to operate.

When initiating the cutting process on Design variant 2 Cable Cutting Devices, and when multiple command devices (remote control, cable-bound, hydraulic unit trigger or switch) are present, it must be ensured that the cutting process can be started only through one of the command devices.

On Design variant 3 Cable Cutting Devices, it must not be possible to start the cutting process on the hydraulic unit.

Test:

Visual inspection and handling check

#### 4.1.13.5 Marking and durability

The operator interface (e.g. push-button or switch) for the START/ON and STOP/OFF functions must be configured for easy access, and clearly, unmistakably and durably marked pursuant DIN EN 60204 60204-1, Sec. 10.2.

Test:

Visual inspection, handling check and wipe test pursuant DIN EN 50340, Sec. 5.2.3

#### 4.1.13.6 STOP function

It must be possible to switch OFF the hydraulic unit at any time (Stop Category 0) via an operator interface (push-button switch).

Electromechanically actuated, push-button switching elements used to initiate the STOP function must be outfitted with positive break NC contacts pursuant DIN EN 60947-5-1, Annex K. Switches must possess an isolating function.

If the hydraulic unit switch OFF function is initiated via an electromechanical, electronic or programmable electronic controller, then interconnection of the control unit's safety-related parts must fulfil the requirements of Performance Level c (PL c) pursuant DIN EN ISO 13849-1.

Test:

Check of circuit documentation, visual inspection, functional test and validation pursuant DIN EN ISO 13849-1, DIN EN ISO 13849-2, Annexes A-E

#### 4.1.14 Operating voltage

The maximum operating voltage must not exceed 75 VDC.

Test:

Check the technical data and inscriptions

#### 4.1.15 Automatic switch OFF

The hydraulic unit drive assembly must shut off automatically following completion of the cutting process (blade returned to start position).

Test:

Check the circuit documentation, functional test

#### 4.1.16 Components installed

All components are to be operated within the limits of their respective specifications.

Test:

Visual inspection and review of technical documentation

#### 4.1.17 Weight

Regarding battery-operated Cable Cutting Devices (including inserted battery packs), the following device weights must not be exceeded:

- 5 kg for handheld, battery-operated hydraulic units, without cutting head
- 15 kg for transportable, battery-operated hydraulic units, without cutting head
- 15 kg for the cutting head with hose assembly
- 20 kg transportable, battery-operated hydraulic units, including permanently installed cutting head (Design variant 3)

Test:

Weight measurement

#### 4.1.18 Handling the hydraulic unit

Hydraulic units must be outfitted with carrying handles to ensure safe handling.

The handle diameter should be between 2 cm and 4 cm.

The width of the handle, or breadth of the handle opening accordingly, should be at least 12.5 cm in order to facilitate the wearing of gloves, with a clearance space of 7 cm above the fingers.

Test:

Measurement, visual inspection and handling check

#### 4.1.19 Preventing the cutting process with insufficient energy

The cutting process shall be initiated only when it is warranted that sufficient energy is available to fully carry out the cutting process (up to the return to depressurised state of the hydraulic system). If sufficient energy is not available, then this condition must be indicated on the control unit.

On Design variant 3 Cable Cutting Devices, the remaining battery charge must be sufficient to complete the cutting sequence already in progress, even after it has been interrupted.

Test:

Review of the circuit documentation, Operating instructions and technical specifications, as well as the testing described as follows:

The Cable Cutting Devices will be operated without a test object until the cutting process is complete, and a new cutting process can no longer be initiated. On Design variant 3 Cable Cutting Devices, the cutting process will also be interrupted and subsequently restarted until completion of the cutting process.

The test has been passed when:

- upon reaching maximum operating pressure for the last time, a renewed cutting process can no longer be initiated, and
- the operator receives an unambiguous signal on the control unit that the battery capacity, as described in the Operating instructions, is insufficient.

#### 4.1.20 Prevention of unanticipated start-up

Cable Cutting Devices must be designed in such a manner that there is no risk of an unanticipated start-up following voltage restoration or an undesirable run-on after the handle has been released.

Test:

Visual inspection and handling check

#### 4.1.21 Minimum distance from the cut point

It must be ensured that the operator can initiate the cutting process at a safe distance from the cut point (located outside the danger area).

The remote-control unit must be designed with a range that makes it possible for the operator to remain outside the danger area at all times.

Test for Design variants 1 and 2:

- Measure the length of the insulating hose assembly
- Review of the Operating instructions with regard to the necessary information on maintaining safe distances.

Test for Design variant 3:

- Functional test of the remote-control minimum range (minimum 15 m) in an open area 1 m above the surface
- Review of the Operating instructions with regard to the necessary measures toward maintaining safe distances.
- If present, review the function of the technical measures
- If necessary, check the isolation of the connections between the handheld, battery-operated hydraulic unit and the cable-bound remote-control device pursuant DIN EN 50340, Sec. 5.3.1

#### 4.1.22 Operating instructions

Each Cable Cutter unit must be accompanied by Operating instructions in the German language, which are comprehensible at a level realistically expected of the users. It must contain all the information necessary for handling, servicing, maintenance and assembly of the device.

The language version(s), for which the manufacturer assumes responsibility, shall be annotated „Original Operating Instructions“. Each additional translation shall be annotated „Translation of the Original Operating Instructions“.

The following information must be incorporated:

##### a) General information

- Manufacturer's/authorised representative's company name and complete address
- Designation of the Cable Cutting Devices
- Design series or Type designation
- EU Declaration of Conformity (original or rendering of the content)
- Information regarding the service, maintenance and repair work that may be carried out by the operator
- All technical documents related to the service, maintenance and repair work that may be carried out by the operator
- Regular servicing and maintenance to be carried out by the manufacturer or by a person assigned by and properly instructed by the manufacturer.
- Maximum operating pressure and, accordingly, maximum overpressure
- General specifications regarding the electrical power supply (battery type, operating voltage)
- Explanation of the inscriptions on the Cable Cutting Devices (e.g. Year of manufacture/Serial number)
- Notice regarding the use of Cable Cutting Devices with replaceable batteries, that a second, fully charged battery must be available at the workplace.
- Notice regarding the use of Cable Cutting Devices with integrated batteries and integrated charging units, that these should be charged to the minimum capacity required for the cutting process.

##### b) Description of the Cable Cutting Devices

- Description of the Cable Cutter Design variant
- Description of the components (cutting heads, force transmission unit, hydraulic unit and earthing system)
- Description of the actuating devices and displays
- Description of the connecting elements
- Information regarding suitable (insulating) fluids
- Accordingly, description of the (insulating) fluid filling process
- Description of the cutting process
- Listing of the technical specifications, including weight specifications
- A-weighted emission sound pressure level  $L_{pA}$  (measured pursuant DIN EN 62841-1, Annex I.2),
- A-weighted sound power level  $L_{wA}$  (measured pursuant DIN EN 62841-1, Annex I.2), in the event the emission sound pressure level exceeds a value of 80 dB.
- The vibration total value for the upper limbs (for handheld Cable Cutting Devices); if the value exceeds  $2.5 \text{ m/s}^2$ , the actual value must be depicted; if the value is less than  $2.5 \text{ m/s}^2$ , „ $< 2.5 \text{ m/s}^2$ “ should be depicted

**c) Instruction regarding proper usage**

- Information regarding the scope of application
- Description of proper usage
- Warning Notice regarding the reasonably foreseeable misuse of Cable Cutting Devices that experience has shown could occur.
- Instruction regarding admissible temperature and environmental influences during usage and when storing the device
- Instructions regarding isolating energy sources
- Instructions regarding proper handling when attaching the insulating hose assembly
- Instructions regarding intervals for replacing the hydraulic fluid, how this is to be carried out and what hydraulic fluid should be used
- Instructions regarding the approved replacement of parts by the user
- Reference to alternatively establishing a voltage-free state by cutting cables pursuant DIN EN 50110-1 (VDE 0105-1), Sec. 6.2.4, with a description of personnel qualifications.
- Reference to the largest cable diameter to be cut
- Notice that cables with special reinforcement (e.g. mining cables, self-supporting aerial cables, undersea cables, etc.) must not be cut.
- Explanation as to the scope of application, with special instructions for applications on cables with nominal voltages greater than 30 kV up to 60 kV, and single conductor cables with nominal voltages up to 110 kV.
- Reference to maintaining the proper condition pursuant DIN EN 50110-1 (VDE 0105-1), Sec. 5.3, including, among other items, a check of the fault-free condition prior to each usage, cleaning after each usage, maintaining and re-establishing a clean and dry condition, as well as thorough inspections at regular intervals by qualified persons authorised by the manufacturer.
- Notice regarding placement of the cutting head, with an additional notice that single-wire cables should be combined wherever possible to be cut as a three-wire bundle.
- Notice that the insulating hose assembly should be considered as a self-contained, complete component.
- Notice regarding proper handling during assembly and disassembly of the individual parts using connecting elements.
- Notice regarding the use of the earthing system

**NOTE**

- In some countries and with some applications, earthing of the cutting head is not permitted.
- Notice regarding the danger area, that a clearance distance of 10 m around the cut point must be secured against access prior to beginning the cutting process.
- Notice regarding the danger area, that if it cannot be established or maintained by the operator, additional personal protective measures shall be taken, such as earth walls or protective walls and additional facility isolation.
- Notice that the operator shall initiate the cutting process only after he is outside the danger area.
- Notice that the Cable Cutter operator must be able to oversee the danger area during the cutting process.
- Description of the cutting process with reference to monitoring the cutting assembly or the pressure curve, accordingly.
- Instructions on how to detect completion of the cutting process and, accordingly, how to terminate the cutting process (e.g. manual actuation of the reversing valve).
- Reference to organisational measures, such as the need for coordinating with the electrical supply office before and after the cutting process, in view of possible unusual occurrences.
- Notice regarding safe removal of the cutting head.

- Statement regarding proper packing and storage of the Cable Cutting Devices and individual components in the transport case.
  - Instructions regarding the approved replacement of parts by the user.
  - Information regarding residual risks, as required
- d)** Actions to be taken in the event of a malfunction of the Cable Cutting Devices
- Notice regarding safety-relevant actions to be taken in the event of a malfunction, such as when the cutting process is not properly completed as per the Operating instructions and when the cutting head is damaged during the cutting process, or when insulating fluid is leaking.
- e)** Actions to be taken in the event of a short-circuit
- Notice that the blade(s) could possibly fail to open automatically following completion of the cutting process.
  - Notice regarding service and maintenance of the Cable Cutting Devices
- f)** In addition, for hydraulic-operated Cable Cutting Devices
- Explanation of the maximum operating pressure
  - Reference to the largest cable diameter to be cut
  - Explanation of inscriptions on the cutting head, insulating hose, insulating hose assembly with fittings and hydraulic unit
  - Explanation of the „double triangle“ graphic symbol
  - Special instructions related to proper usage
  - Notice that the insulating hose assembly should be completely unrolled
  - Notice that the distance between the cutting head and the Hydraulic unit, dependent on the length of the insulating hose, should be as large as possible. Accordingly, the pressure-dependent length variation is also to be considered.
  - Instructions regarding the time intervals and procedures for replacing insulating hydraulic fluid, the recording of specific data and the date of replacement.
- g)** Additional information pursuant DIN EN 62841-1  
Information is required from the following sections of this Standard:
- 8.6
  - 8.14
  - K.8.14.1.1
  - K.8.14.2
- h)** Additional information regarding the handling lithium-ion batteries (transport, storage, charging, disposal)

Test:

Check the Operating instructions for completeness of the requirements referenced above.

#### 4.1.23 Sales literature

The sales literature must not contradict the Operating instructions in any aspect of safety and health.

Test:

Check the sales literature for potential contradictions to the Operating instructions.

## **4.2 Requirements related to battery packs:**

### **4.2.1 Battery packs**

Battery packs must conform to the requirements pursuant DIN EN 62133-1 or DIN EN 62133-2 and UN 38.3.

Test:  
Verification via the Test Report

### **4.2.2 Reverse polarity**

Battery packs must be designed in such a manner that, when being inserted into the Cable Cutting Devices, reverse polarity is not possible.

Test:  
Visual inspection and handling check

### **4.2.3 Connection contacts**

Battery pack connection contacts must be configured in such a manner that short-circuiting is not possible when the packs are inserted into the Cable Cutting Devices.

Test:  
Visual inspection and handling check

### **4.2.4 Inscriptions on battery packs**

In addition to the requirements pursuant DIN EN 62841-1, Sec. K.8.3, the following inscriptions must be affixed to, and clearly legible on the battery packs:

- Rated voltage
- Capacity

Test:  
Visual inspection

### **4.2.5 Electrolyte**

Battery inserts must be designed in such a manner that electrolyte leakage is not possible, regardless of the position of the hydraulic unit.

Test:  
The hydraulic unit should be placed in all possible positions that could be conducive to electrolyte leakage and maintained in each position for at least one minute respectively. The test has been passed when electrolyte leakage is not detected following the testing period.

#### 4.2.6 Spare batteries

A spare battery should be included in the scope of delivery of Cable Cutting Devices with replaceable batteries.

Test:

Check delivered components

#### 4.2.7 Battery management system for battery inserts/battery packs

Every battery must be outfitted with a Battery Management System (BMS). The BMS must monitor the current, voltage, temperature and other parameters required for safety and for preserving the cells within their scope of operation and switch the cells OFF if the prescribed parameters are not maintained.

Test:

Review of technical documentation for the battery packs regarding the BMS and verification of BMS function, as required

### 4.3 Requirements pursuant DIN EN 50340-2011-04

#### 4.3.1 Temperature range and Environmental influences

Cable Cutting Devices must be able to function fault-free and safely indoors, outdoors and in the rain, at temperatures between 20 °C to +40 °C pursuant DIN EN 50340, Sec. 4.1.1.

For use in the rain, Cable Cutting Devices must conform to the minimum Protection class IP44. If organisational policy limits usage in the rain (e.g. a notice in the Operating instructions), then the minimum Protection class IP32 is sufficient for transportable Cable Cutting Devices.

Tests:

- Pursuant DIN EN 50340, Sec. 5.13<sup>1</sup> with the following amendment: In each of the two functional tests, the duration of the cutting process is to be measured (from initiation of the cutting process through complete separation of the sample workpiece). The test has been passed when the time measured is  $\leq 60$  s.
- Pursuant DIN EN 50340, Sec. 5.6 (with the modification that the hydraulic unit should be actuated until a response from the pressure monitor occurs)
- Verify the IP Protection class pursuant DIN EN 60529

#### 4.3.2 Operating pressure

Pursuant DIN EN 50340, Sec. 4.1.2, the complete Cable Cutter assembly must be able to safely withstand the maximum operating pressure.

Test:

Pursuant DIN EN 50340, Sec. 5.12 (with the modification that the hydraulic unit should be actuated until a response from the pressure monitor occurs)

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<sup>1</sup> In DIN EN 50340, the term „tensile strength“ is mistakenly used instead of „ultimate elongation“ in Sec. 5.13.

The test has been passed when the recorded pressure is not more than 10 % below the pressure monitor response pressure and insulating fluid leakage is not detected.

#### 4.3.3 Additional requirements according to DIN EN 50340

| Section    | Requirement  | Section      | Requirement   |
|------------|--|--------------|---|
| 4.1.3      | Transport case   | 5.2.1        | Visual inspection   |
| <b>4.2</b> | <b>Cutting head</b>  |              |   |
| 4.2.1      | Handling   | 5.2.1        | Visual inspection and handling check                        |
| 4.2.3      | Correct placement  | 5.8          | Precision of the cutting process                            |
| 4.2.4      | Cable diameter   | 5.2.1        | Measurement   |
| 4.2.5      | Cutting head material  | 5.5          | Blade hardness  |
| 4.2.6      | Structural design  | 5.2.1        | Functional test   |
| 4.2.7      | Pressure loss  | 5.7          | Test of automatic opening                                   |
| 4.2.8      | Hose assembly connection                                     | 5.2.1        | Visual inspection and handling check                        |
| 4.2.9      | Compatibility  | 5.2.1        | Visual inspection and handling check                        |
| <b>4.4</b> | <b>Dielectric strength of the insulating hydraulic fluid</b> | <b>5.4</b>   | <b>Electrical breakdown strength of the hydraulic fluid</b> |
| 4.5        | Pump   |              |   |
| 4.5.1      | Configuration  | 5.2.1        | Visual inspection   |
| 4.5.2      | Stability under load   | 5.10         | Stability under load  |
| 4.5.4      | Cover for the operating pressure setting device              | 5.2.1        | Visual inspection   |
| 4.7        | <b>Reversing valve operability</b>                           | <b>5.2.1</b> | <b>Visual inspection and handling check</b>                 |
| <b>4.8</b> | <b>Pressure display</b>                                      |              |   |
| 4.8.1      | Conspicuousness of the display                               | 5.2.1        | Visual inspection   |
| 4.8.2      | Protection against damage                                    | 5.2.1        | Visual inspection and handling check                        |

| Section     | Requirement  | Section | Requirement  |
|-------------|--|---------|--|
| 4.8.3       | Pressure range   | 5.2.1   | Visual inspection (with the following amendment: With a purely digital display, in addition to the actual operating pressure, the maximum operating pressure and the maximum realised pressure must also be displayed continually during operation.) |
| <b>4.9</b>  | <b>Hydraulic connecting elements</b>                         |         |  |
| 4.9.1       | Handling connecting elements                                 | 5.2.1   | Visual inspection and handling check   |
| 4.9.2       | Strength of the connecting elements                          | 5.2.1   | Visual inspection and handling check   |
| 4.9.3       | Protection against contamination                             | 5.2.1   | Visual inspection and handling check   |
| <b>4.10</b> | <b>Potential equalisation connection and earthing system</b> |         |  |
| 4.10.1      | Pump – earthing cable connector                              | 5.2.1   | Visual inspection and measurement  |
| 4.10.2      | Cutting head – earthing cable connector                      | 5.14    | Earthing system test   |

#### 4.3.4 Inscriptions

##### 4.3.4.1 Legibility and durability of inscriptions

Inscriptions must be clearly legible and durable.

Test:

Pursuant DIN EN 50340, Sections 5.2.1 and 5.2.3

##### 4.3.4.2 Completeness of inscriptions

The following inscriptions must be affixed to the Cable Cutting Devices as a minimum:

- On the cutting head:
- Company name and full address of the manufacturer and representatives, if applicable
- Year of manufacture
- Type designation
- Manufacturer/Serial number
- Maximum operating pressure
- Maximum cable diameter
- Double triangle graphic symbol (refer to DIN EN 50340:2011- 04, Fig. 2)

On the insulating hose:

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

- Name or identifying mark of the manufacturer
- Year of manufacture
- Type designation
- Nominal diameter

On the insulating hose assembly:

The prescribed inscriptions may be affixed to the connecting element, or close to a part of the connecting element. If the markings are affixed to the hydraulic hose, they must be clearly distinguishable from the insulating hose markings.

- Name or identifying mark of the manufacturer
- Year and month of manufacture
- Type designation
- Maximum operating pressure
- Double triangle graphic symbol (refer to DIN EN 50340:2011-04, Fig. 2)

On the hydraulic unit:

- Company name and full address of the manufacturer and representatives, if applicable
- Year of manufacture
- Designation of the electric power tool
- Type designation
- Manufacturer/Serial number
- Maximum operating pressure
- Designation of the cutting head model(s) to be used with the hydraulic unit
- Rated operating voltage
- IP-Protection class
- Double triangle graphic symbol (refer to DIN EN 50340:2011-04, Fig. 2)
- CE marking

Test:

Check for plausibility and completeness of information

#### 4.3.5 Safety valve

Pursuant DIN EN 50340, Sections 4.6.1 and 4.6.2, the safety valve must

- prevent the maximum overpressure from being exceeded by diverting the insulating fluid back to the reservoir chamber
- close automatically when the system overpressure falls below the maximum operating pressure.

Test:  
 Pursuant DIN EN 50340, Sec. 5.11

The test has been passed when:

- the safety valve response pressure does not exceed the maximum overpressure prescribed by the manufacturer
- insulating fluid leakage is not detected
- the safety valve functions fault-free throughout testing.

#### 4.4 Additional requirements pursuant DIN EN 62841-1

| Section     | Requirement                                      | Section | Test                                    | Battery-operated Hydraulic unit |                |
|-------------|--|---------|---|---------------------------------|----------------|
|             |  |         |   | Hand-held                       | Trans-portable |
| <b>6</b>    | <b>Radiation, toxicity and similar hazards</b>   |         |   |                                 |                |
| 6.2         | Laser radiation                                  | 6.2     | Visual inspection                       | x                               | x              |
| 6.3         | Non-coherent radiation                           | 6.3     | Visual inspection                       | x                               | x              |
| <b>I.2</b>  | <b>Noise measurement</b>                         |         | <b>I.2</b>                              | <b>Measurement</b>              | <b>x</b>       |
| <b>I.3</b>  | <b>Vibration</b>                                 |         | <b>I.3</b>                              | <b>Measurement</b>              | <b>x</b>       |
| <b>K.8</b>  | <b>Inscriptions and user information</b>         |         |   |                                 |                |
| 8.2         | Inscriptions / Safety remarks                    | 8.2     | Visual inspection                       | x                               | x              |
| K.8.3       | Additional inscriptions on battery-powered tools | K.8.3   | Visual inspection                       | x                               | x              |
| K.8.4       | Inscriptions on removable parts                  | K.8.4   | Visual inspection                       | x                               | x              |
| 8.9         | Switch configuration                             | 8.9     | Visual inspection                       | x                               | x              |
| 8.10        | Circuit breakers                                 | 8.10    | Visual inspection                       | x                               | x              |
| 8.11        | Control and regulating devices                   | 8.11    | Visual inspection                       | x                               | x              |
| 8.12        | Conspicuousness and durability                   | 8.12    | Visual inspection and wipe test         | x                               | x              |
| 8.13        | Fuses  | 8.13    | Visual inspection                       | x                               | x              |
| <b>K.9</b>  | <b>Protection against electric shock</b>         |         |   |                                 |                |
| K.9.3       | Exposed conductive parts                         | K.9.3   | Visual inspection, test with test probe | x                               | x              |
| K.9.5       | Insulating properties                            | K.9.5   | Voltage test                            | x                               | x              |
| <b>K.12</b> | <b>Heating</b>                                   |         |   |                                 |                |
| K.12.1      | Heating  | K.12.1  | Heating test                            | x                               | x              |

| Section     | Requirement   | Section           | Test                                    | Battery-operated Hydraulic unit |                |
|-------------|---|-------------------|---|---------------------------------|----------------|
|             |   |                   |   | Hand-held                       | Trans-portable |
| K.12.201    | Normal charging of Li-Ion systems                   | K.12.201          | Heating test                            | x                               | x              |
| <b>K.13</b> | <b>Heat and fire resistance</b>                     |                   |   |                                 |                |
| K.13.1      | Heat resistance                                     | K.13.1            | Ball pressure test                      | x                               | x              |
| 13.2        | Fire resistance of non-metallic materials           | 13.2              | Glow wire test                          | x                               | x              |
| K.13.2      | Fire resistance of external battery casing          | K.13.2            | Glow wire test                          | x                               | x              |
| K.13.2.201  | Battery pack casing material                        | K.13.2.201        | Needle flame test                       | x                               | x              |
| <b>K.18</b> | <b>Improper operation</b>                           |                   |   |                                 |                |
| K.18.1      | Fire hazard due to improper operation               | K.18.1            | Fault simulation                        | x                               | x              |
| 18.6        | Electronic circuitry design                         | 18.6.1,<br>18.6.2 | Fault simulation                        | x                               | x              |
| 18.8        | Electronic circuitry with safety-related function   |                   |   |                                 |                |
| 18.8.1      | General, Performance Level Immunity to interference | 18.8.1            | Validation of Performance Level         | x                               | x              |
| 18.8.2      | Immunity to interference                            | 18.8.2            | EMC testing                             | x                               | x              |
| 18.8.3      | Immunity to interference                            | 18.8.3            | EMC testing                             | x                               | x              |
| 18.8.5      | Immunity to interference                            | 18.8.5            | EMC testing                             | x                               | x              |
| 18.8.6      | Immunity to interference                            | 18.8.6            | EMC testing                             | x                               | x              |
| 18.8.7      | Immunity to interference                            | 18.8.7            | EMC testing                             | x                               | x              |
| K.18.201    | Lithium-ion charging system – fault conditions      | K.18.201          | Fault simulation                        | x                               | x              |
| K.18.202    | Short-circuiting of lithium-ion batteries           | K.18.202          | Fault simulation                        | x                               | x              |
| K.18.203    | Other than lithium-ion batteries – overcharging     | K.18.203          | Fault simulation                        | x                               | x              |
| <b>K.19</b> | <b>Mechanical hazards</b>                           |                   |   |                                 |                |
| 19.1        | Protection against injury                           | 19.1              | Visual inspection, test with test probe | x                               | x              |

| Section     | Requirement   | Section  | Test   | Battery-operated Hydraulic unit |                |
|-------------|---|----------|--|---------------------------------|----------------|
|             |   |          |  | Hand-held                       | Trans-portable |
| 19.2        | Teeth and sharp edges                                   | 19.2     | Visual inspection  | x                               | x              |
| 19.3        | Removable parts   | 19.3     | Test with test probe   | x                               | x              |
| 19.4        | Handle  | 19.4     | Visual inspection  | x                               | x              |
| 19.5        | Conspicuousness of the action point                     | 19.5     | Visual inspection  | x                               | x              |
| K.19.201    | Reverse polarity protection                             | K.19.201 | Visual inspection and handling check   | x                               | x              |
| K.19.202    | Enclosure pressure testing of lithium-ion battery packs | K.19.202 | Enclosure test   | x                               | x              |
| <b>K.20</b> | <b>Mechanical strength</b>                              |          |  |                                 |                |
| 20.2        | Impact testing  | 20.2     | Spring hammer testing<br>Subsequent to testing, the battery must be securely stored for 48 h   | x                               | x              |
| K.20.3.1    | Fall testing  | K.20.3.1 | Fall testing Subsequent to testing, the battery must be securely stored for 48 h               | x                               | –              |
| K.20.3.2    | Impact testing  | K.20.3.2 | Pendulum hammer testing<br>Subsequent to testing, the battery must be securely stored for 48 h | –                               | x              |
| <b>K.21</b> | <b>Assembly</b>   |          |  |                                 |                |
| 21.2        | Inadvertent setting changes                             | 21.2     | Hand sampling  | x                               | x              |
| 21.3        | Removal of moisture protection without tools            | 21.3     | Manual check   | x                               | x              |
| 21.4        | Switch positions  | 21.4     | Visual inspection and hand sampling  | x                               | x              |
| 21.17       | Circuit breakers  | 21.17    | Visual inspection  | x                               | x              |
| 21.17.1     | Switch ON inhibit                                       | 21.17.1  | Visual inspection, heat treatment with functional test   | x                               | x              |
| 21.18.1     | Self-resetting circuit breakers                         | 21.18.1  | Visual inspection and hand sampling  | x                               | –              |
| 21.18.2     | Circuit breaker operation                               | 21.18.2  | Visual inspection and hand sampling  | –                               | x              |

| Section         | Requirement                                     | Section        | Test  | Battery-operated Hydraulic unit |                |
|-----------------|---|----------------|---|---------------------------------|----------------|
|                 |   |                |   | Hand-held                       | Trans-portable |
| 21.19           | Electrical shock, maintenance                   | 21.19          | Visual inspection and measurement                               | x                               | x              |
| 21.22           | Non-removable parts                             | 21.22          | Visual inspection and pressure test                             | x                               | x              |
| 21.23           | Attachment of handles and operating elements    | 21.23          | Visual inspection, hand sampling, pressure test or tensile test | x                               | x              |
| 21.24           | Storage hooks for flexible cables               | 21.24          | Visual inspection   | x                               | x              |
| K.21.201        | The use of general-purpose batteries            | K.21.201       | Visual inspection   | x                               | x              |
| K.21.202        | Vent holes for Lithium-ion cells                | K.21.202       | Visual inspection and Fault simulation                          | x                               | x              |
| K.21.203        | Plug connectors for Lithium-ion battery systems | K.21.203       | Visual inspection   | x                               | x              |
| <b>K.22</b>     | <b>Internal wiring</b>                          |                |   |                                 |                |
| 22.1            | Cable paths                                     | 22.1           | Visual inspection   | x                               | x              |
| 22.4            | Aluminium conductors                            | 22.4           | Visual inspection   | x                               | x              |
| 22.5            | Stranded conductors                             | 22.5           | Visual inspection   | x                               | x              |
| 22.6/<br>K.22.6 | Opposing moving parts                           | 22.6/<br>K22.6 | Visual inspection and bending test                              | x                               | x              |
| <b>K.23</b>     | <b>Individual parts</b>                         |                |   |                                 |                |
| 23.1            | Safety requirements pursuant IEC standards      | 23.1           | Visual inspection   | x                               | x              |
| 23.1.1          | Capacitor marking                               | 23.1.1         | Visual inspection   | x                               | x              |
| 23.1.3          | Small lamp fittings                             | 23.1.3         | Visual inspection   | x                               | x              |
| 23.1.4          | Transformers                                    | 23.1.4         | Visual inspection   | x                               | x              |
| 23.1.5          | Appliance couplers                              | 23.1.5         | Visual inspection   | x                               | x              |
| 23.1.6          | Automatic temperature controllers               | 23.1.6         | Durability  | x                               | x              |
| 23.1.7          | Individual parts from other standards           | 23.1.7         | Visual inspection   | x                               | x              |

| Section         | Requirement   | Section         | Test  | Battery-operated Hydraulic unit |                |
|-----------------|---|-----------------|---|---------------------------------|----------------|
|                 |   |                 |   | Hand-held                       | Trans-portable |
| 23.1.8          | Individual parts, not separately tested                                   | 23.1.8          | Testing under ambient conditions              | x                               | x              |
| K.23.1.10       | Circuit breaker breaking-capacity   | K.23.1.10       | Testing under load                            | x                               | x              |
| 23.1.11         | Electronic circuit breakers   | 23.1.11         | Visual inspection                             | x                               | x              |
| K.23.1.201      | Ambient conditions for circuit breakers                                   | K.23.1.201      | Functional test                               | x                               | x              |
| 23.2            | Inadmissible components   | 23.2            | Visual inspection                             | x                               | x              |
| 23.3            | Protective equipment  | 23.3            | Visual inspection                             | x                               | x              |
| 23.4            | Connectors and connection plugs for Safety extra-low voltage              | 23.4            | Visual inspection                             | x                               | x              |
| K.23.201        | Battery pack cells  | K.23.201        | Testing pursuant IEC 62133-1 or IEC 62133-2   | x                               | x              |
| K.23.202        | Lithium-metal cells   | K.23.202        | Visual inspection                             | x                               | x              |
| <b>K.24</b>     | <b>Mains connection and external cables</b>                               |                 |   |                                 |                |
| K.24.201        | Strain relief for separated battery packs                                 | K.24.201        | Visual inspection                             | x                               | x              |
| <b>K.27</b>     | <b>Screws and connections</b>   |                 |   |                                 |                |
| 27.1/<br>K.27.1 | Mechanical loading associated with attachments and electrical connections | 27.1/<br>K.27.1 | Visual inspection and actuation               | x                               | x              |
| 27.2            | Contact pressure from insulating material                                 | 27.2            | Visual inspection                             | x                               | x              |
| 27.3            | Tapping screws  | 27.3            | Visual inspection                             | x                               | x              |
| 27.4            | Protection against loosening  | 27.4            | Visual inspection and hand sampling           | x                               | x              |
| 27.5            | Screwless connectors  | 27.5            | Tensile test                                  | x                               | x              |
| 27.5.1          | Fixing of conductor cables  | 27.5.1          | Visual inspection and measurement of air gaps | x                               | x              |
| <b>K.28</b>     | <b>Air gaps and creepage distances</b>                                    |                 |   |                                 |                |
| K.28.1          | Minimum specifications for air gaps and creepage distances                | K.28.1          | Measurement                                   | x                               | x              |

#### **4.5 Hose assembly**

##### **4.5.1 Insulating hose assembly for Design variants 1 and 2**

The insulating hose assembly must fulfil the requirements pursuant GS-ET-40.

##### **4.5.2 Hose assembly (optional) for Design variant 3**

The hose assembly must fulfil the requirements pursuant GS-ET-40, Sec. 4.2 (4.2.2 without Double triangle graphic symbol) and Sec. 4.4.

## **5 Additional requirements for transportable, battery-operated Cable Cutting Devices with wireless remote-control (remote-station)**

### **5.1 General**

#### **5.1.1 Remote-control of the hydraulic unit**

If remote-control is used to drive the hydraulic unit, then it must comply with the requirements pursuant GS-ET-07 „Principles of testing and certification of wireless control equipment for machinery safety requirements“.

Test:  
pursuant GS-ET-07

#### **5.1.2 Transmission disruptions**

A transmission disruption or disconnection between the remote station and the base station must immediately interrupt the cutting process and initiate an automatic blade reversal back to the start position.

Test:  
Functional test

#### **5.1.3 Remote and base stations**

Only one remote station may be connected with a base station.  
The initial connection process between the remote station and the base station must take place with a connection procedure involving both units.

Test:  
Functional test, verification of coding

## **5.2 Additional requirements for base stations**

### **5.2.1 Switching the base station ON**

The base station must be switched ON by means of a manually-actuated switch/push-button that is protected against inadvertent actuation (e.g. ON/OFF switch on the hydraulic unit, a manually-actuated function selector switch (Design variant 1) or remote-control (Design variant 2)).

Test:  
Functional test

### **5.2.2 Condition display**

The operating condition of the base station (e.g. operationally ready, connected with the remote control) shall be depicted on an optical display.

Test:  
Visual inspection

## **5.3 Additional requirements for remote stations**

### **5.3.1 Remote station operating voltage**

The operating voltage of the remote station must not exceed 24 VDC.

Test:  
Documentation review

### **5.3.2 Remote station operational readiness**

When the connection between the remote station and the base station has been established, this state must be displayed on the remote station. If a signal lamp is used for the display indication, its colour must be green.

Control elements actuated prior to establishing the connection (e.g. following voltage restoration) must not automatically initiate the cutting process.

Test:  
Functional test

### **5.3.3 Initiating the cutting process**

Initiation of the cutting process shall be introduced only via the remote station.

Test:  
Functional test

### 5.3.4 Remote station control elements

The remote station must be configured with the following control elements:

- START cutting process
- STOP cutting process
- REVERSE direction of cutting blade movement

Test:  
 Functional test

**NOTE**

The START cutting process and STOP cutting process functions can be configured in one control element.

### 5.3.5 Remote station functions

The remote station must display the following functions:

| Function   | Design variant 2 | Design variant 3 |
|--|------------------|------------------|
| Remote station operational readiness (Sec. 5.3.2)              | x                | x                |
| Cutting process in progress                                    | x                | x                |
| Cutting process terminated                                     | x                | x                |
| Cutting process not properly completed                         | x                | x                |
| Cutter start position attained (e.g. via the pressure display) | x                | x                |
| Cutting assembly display (e.g. via the pressure display)       |                  | x                |

Test:  
 Functional test

## 6 Testing at manufacturer facilities

The tests described in this section should serve to uncover any discernible safety-related changes in the materials or in the production process. These tests are to be carried out on each battery-operated cable cutting device or on the insulating fluid, accordingly.

Manufacturers could select test procedures better suited for their respective production process, if the tests selected warrant at least the same level of safety as represented by the tests listed in the following section.

## 6.1 Visual inspection

- Inscriptions shall be checked for completeness and legibility.
- Accordingly, the finished product shall be checked for conformity to the production documents, including working and testing instructions.

Test:  
Visual inspection

## 6.2 Testing of the safety valve

Actuate the battery-operated Cable Cutting Devices until the safety valve responds.

### NOTE 1

With Design variants 1 and 2 battery-operated Cable Cutting Devices, a test solely of the battery-operated hydraulic unit could suffice.

### NOTE 2

With battery-operated Cable Cutting Devices, on which the termination of the cutting process is not initiated upon reaching maximum operating pressure, device adaptations must be made for testing, accordingly.

The test has been passed when:

- the safety valve response pressure does not exceed the maximum overpressure prescribed by the manufacturer,
- insulating fluid leakage is not detected
- the safety valve functions fault-free throughout testing.

## 6.3 Functional test

All control element functions are to be tested according to the Operating instructions.

## 6.4 Testing of insulating fluid dielectric strength (Design variants 1 and 2)

Insulating fluid shall be stored and used according to manufacturer specifications.

### NOTE

If there is any doubt about the insulating properties of the insulating fluid, then testing can be conducted pursuant DIN EN 50340:2011-04, Sec. 5.4.