

Translation

Principles of testing and certification for motor-operated cable cutting devices

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Principles of testing
Motor-operated cable cutting devices
GS-ET-23

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These Principles of testing serve as verification that, in connection with DIN EN 50340, DIN EN 60745-1 and DIN EN 61029-1, the requirements of the German Equipment and Product Safety Act (GPSG) and, as such, the 1st, 9th and 14th provisions of the GPSG in particular, have been complied with.

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 compile relevant, product-specific requirements and tests from DIN EN 50340, DIN EN 60745-1 and DIN EN 61029-1 applicable to motor-operated cable cutting devices.

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

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1. General

1.1 Scope of application

- 1.1.1** These Principles of testing apply to motor-operated cable cutting devices, with which it can be determined in accordance with DIN VDE 0105 Part 1 (2005-06) Section 6.2.3 at the workplace in conjunction with organisational measures 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.
- 1.1.2** These Principles of testing may be applied accordingly to motor-operated cable cutting devices used on cables with nominal voltages greater than 30 kV up to 60 kV (maximum permissible operating voltage over 36 kV up to 72.5 kV) and on single conductor cables with nominal voltages up to 110 kV (maximum permissible operating voltage up to 123 kV).
- 1.1.3** These Principles of testing do not contain any requirements or tests for cable cutting devices used on cables with special reinforcement, such as high-strength support cables, support casing or armoured casing.
- 1.1.4** DIN EN 50340 is to be applied exclusively for hand and/or foot operated hydraulic cable cutting devices.

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.

A complete, functional cable cutting device, together with all components required for testing, is to be made available at the time design testing is to be carried out.

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

1.3 Test specifications

The following regulations and standards have been used as a basis for the development of these Principles of testing:

1.3.1 EC Directives

2006/42/EC	“Machinery Directive“
2004/108/EC	“EMC Directive“
97/23/EC	“Pressure Equipment Directive“

1.3.2 Standards

DIN EN 50340	Hydraulic cable cutting devices - Devices to be used on electrical installations with nominal voltages up to AC 30 kV
DIN EN 60745-1	Hand-held motor-operated electric tools - Safety - Part 1: General requirements
DIN EN 61029-1	Safety of transportable motor-operated electric tools Part 1: General requirements
DIN EN ISO 12100	Safety of machinery; General principles for design - Risk assessment and risk reduction
DIN EN ISO 13849-1	Safety of machinery - Safety-related parts of control systems Part 1: General principles for design
DIN EN ISO 13849-2	Safety of machinery - Safety-related parts of control systems Part 2: Validation
DIN EN 60335-2-29	Safety of electronic equipment for the household and similar use; - Particular requirements for battery chargers –
DIN EN 61000-6-2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
DIN EN 61000-6-3	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments
GS-ET-07	Principles of testing and certification of wireless control equipment for machine safety requirements.

2 Terms

2.1 Motor-operated cable cutting devices

Portable device fitted with a drive system other than directly applied human or animal effort for the safe cutting of cables. This device will be deployed at the workplace to test whether a cable has been activated. The device is comprised of the following components:

- 1 – Cutting head
- 2 – Force transmission unit
- 3 – Drive assembly and
- 4 – Controller (with hand held operating unit where applicable)
- 5 – Grounding system



Fig. 1: Example of a motor-operated cable cutter

2.2 Cutting head

That part of the device that holds the blade(s) and is applied to the cable for cutting. The blade(s) is(are) driven by means of a drive assembly.

2.3 Insulating hose

Insulating, pressure resistant sleeve as part of an insulating hose line.

2.4 Insulating hose assembly

Insulating, pressure resistant component, which is comprised of an insulating sleeve with terminal fittings for connecting hydraulic unit components where a different electrical potential exists at each end.

2.5 Insulating hydraulic fluid

Fluid with sufficient electrical insulating properties, which is used for transferring pressure between the pump and the cutting head.

2.6 Pump

The part of the device that generates pressure in the insulating hydraulic fluid hose line for driving the cutting head.

2.7 Reversing valve

Manually controlled valve, which is fitted and installed for the return flow of the fluid from the pressure chamber to the reservoir chamber following completion of the cable cutting process.

2.8 Safety valve

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.

2.9 Hydraulic connecting element

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

2.10 Maximum operating pressure

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

2.11 Bend/kink protection

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

2.12 Blades

Metallic part(s) with a sharp knife-edge or sharp knife-edges for penetrating the cable in such a manner that it is positively cut into two distinct sections.

2.13 Grounding system

A system comprised of all necessary connecting lines, conductors and connectors, with which it can be guaranteed that the equipment electrical potential is at ground potential, insofar as this is practical (e.g. equal to or nearly 0 V).

2.14 Force transmission unit

Part of the cable cutting device that establishes the connection between the drive assembly and the cutting head (e.g. insulating hose line with insulating fluid, gear assembly).

2.15 Type test

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

2.16 Test object

The cutting head, force transmission unit, drive assembly, controller and grounding system.

2.14 Test piece

Part of a test object.

3 Test conditions

3.1 General

All tests on ready-for-use cable cutting devices 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 $20^{\circ}\text{C} \pm 5\text{K}$ 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 $\pm 5\%$.

3.2 Test documentation to be submitted

The following technical documentation is required for testing:

- Instruction manual incl. technical specifications
- Sales literature
- Circuit diagrams (electrical, hydraulic)
- Parts lists with material or standards specifications
- Circuit board layout, if applicable
- Product/safety data sheet for the insulating hydraulic fluid
- Engineering drawings
- Calculation verification for 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
- Data sheet for the threaded hydraulic fittings
- Manufacturer's declaration regarding PAH contamination, or data sheets for the materials that may come into contact with the skin, if applicable.
- Data sheet for the drive assembly

4 Requirements and tests

4.1 General requirements

4.1.1 Requirements from reference standard DIN EN 50340:2011-04

Reference standard	Section	Requirement	Section	Test
DIN EN 50340	4.1.1	Temperature range	5.13	Functional tests
			5.6	Test under loading
DIN EN 50340	4.1.2	Operating pressure	5.12	Compressive strength of the device
DIN EN 50340	4.1.3	Transportation container	5.2.1	Visual inspection
DIN EN 50340	4.2	Cutting head		
DIN EN 50340	4.2.1	Handling	5.2.1	Visual inspection and handling check
DIN EN 50340	4.2.2	Weight	5.2.1	Measurement and handling check
DIN EN 50340	4.2.3	Correct placement	5.8	Accuracy of cutting process
DIN EN 50340	4.2.4	Cable diameter	5.2.1	Measurement
DIN EN 50340	4.2.5	Material cutting head	5.5	Blade hardness
DIN EN 50340	4.2.6	Structural shape	5.2.1	Functional test
DIN EN 50340	4.2.7	Pressure loss	5.7	Test of automatic opening
DIN EN 50340	4.2.8	Hose line connection	5.2.1	Visual inspection and handling check
DIN EN 50340	4.2.9	Compatibility	5.2.1	Visual inspection and handling check
DIN EN 50340	4.3	Insulating hose line		
DIN EN 50340	4.3.1	Method A	5.3.1	Method A
DIN EN 50340	4.3.1.1	Sufficient insulation	5.3.1	Method A
DIN EN 50340	4.3.1.2	Insulating, flexible line	5.2.1	Visual inspection and handling check
DIN EN 50340	4.3.1.3	Minimum length	5.2.1	Visual inspection and measurement

DIN EN 50340	4.3.2	Method B	5.3.2	Method B
DIN EN 50340	4.4	Dielectric strength of the insulating hydraulic fluid	5.4	Electrical breakdown strength of the hydraulic fluid
DIN EN 50340	4.5	Pump		
DIN EN 50340	4.5.1	Configuration	5.2.1	Visual inspection
DIN EN 50340	4.5.2	Stability under load	5.2.1	Visual inspection and handling check
DIN EN 50340	4.5.4	Operating pressure adjustment device cover	5.2.1	Visual inspection
DIN EN 50340	4.6	Safety valve		
DIN EN 50340	4.6.1	Functionality at max. pressure	5.11	Safety valve function
DIN EN 50340	4.6.2	Functional process for lowering pressure	5.11	Safety valve function
DIN EN 50340	4.7	Reversing valve operability	5.2.1	Visual inspection and handling check
DIN EN 50340	4.8	Pressure gauge		
DIN EN 50340	4.8.1	Conspicuousness of the gauge	5.2.1	Visual inspection
DIN EN 50340	4.8.2	Protection against damage	5.2.1	Visual inspection and handling check
DIN EN 50340	4.8.3	Pressure range	5.2.1	Visual inspection
Reference standard	Section	Requirement	Section	Test
DIN EN 50340	4.9	Hydraulic connecting element		
DIN EN 50340	4.9.1	Connecting element handling	5.2.1	Visual inspection and handling check
DIN EN 50340	4.9.2	Connecting element stability	5.2.1	Visual inspection and handling check
DIN EN 50340	4.9.3	Protection against contamination	5.2.1	Visual inspection and handling check
DIN EN 50340	4.10	Potential equalisation connection and grounding system		
DIN EN 50340	4.10.1	Pump grounding line connection	5.2.1	Visual inspection and measurement
DIN EN 50340	4.10.2	Cutting head grounding line connection	5.14	Test of the grounding system
DIN EN 50340	4.11	Inscriptions	5.2.3	Inscriptions
DIN EN 50340	4.11.1	Conspicuousness and durability	5.2.1	Visual inspection
DIN EN 50340	4.11.2	Inscriptions on cable cutting device		
DIN EN 50340	4.11.2.1	Inscriptions on cutting head	5.2.1	Visual inspection
DIN EN 50340	4.11.2.2	Inscriptions on insulating hose	5.2.1	Visual inspection
DIN EN 50340	4.11.2.3	Inscriptions on insulating hose line	5.2.1	Visual inspection
DIN EN 50340	4.11.2.4	Inscriptions on pump	5.2.1	Visual inspection

4.1.2 External materials and properties

4.1.2.1 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).

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

Test:

Handling and visual inspection

- 4.1.2.3** The operator interface (e.g. push-button or switch) for the START/ON function for initiating the cutting process must be designed and installed in such a manner that unintentional actuation is prevented.

Test:

Visual inspection, handling check and ball test

- 4.1.2.4** The hydraulic fluid must not contain any polychlorinated biphenyls (PCB) or polychlorinated tophenyls (PCT).

Test:

Check the safety data sheet

- 4.1.3** Electromagnetic compatibility

Cable cutting devices addressed within the scope of application of the EMC Directive must be designed in such a manner that the protection requirements in the EMC Directive are complied with.

Test:

In accordance with DIN EN 61000-6-2 and DIN EN 61000-6-3

- 4.1.4** **Instruction manual**

Each cable cutting device must be accompanied by an Instruction manual. This Instruction manual must contain all necessary information for assembly, operation and maintenance of the device to ensure its use in a safe manner.

General specifications:

- Manufacturer's/authorised representative's name and complete address
- Machine designation
- CE-marking
- Design series or type designation (machine description)
- Year of manufacture
- Rendering of the content found in the EC Declaration of Conformity
- Information regarding the maintenance and repair that may be carried out by the operator.
- All technical documents related to the maintenance and repair that may be carried out by the operator.
- Maintenance through the manufacturer or designated representative: Address list

Description of the cable cutting device

- Description of the components (cutting head, force transmission unit, drive assembly, controller and grounding system)
- Description of the actuating and monitoring equipment
- Description of the connecting elements
- Description of the cutting process
- Listing of the technical specifications (including weight specifications and the emitted sound pressure level)
- Voltage limitations
- Information regarding suitable insulating fluids
- Description of the insulating fluid filling process

Instruction regarding proper usage

- Specifications related to the ambient conditions at the workplace (e.g. temperature range, climatic conditions)
- Reference to the alternative determination of the voltage-free state as a result of the cable cutting, according to DIN VDE 0105-1: 2005-06, Section 6.2.3, with information regarding personnel qualifications.
- Reference to the largest diameter of the cables to be cut
- Notice that cables with special reinforcement (e.g. mining cables, self supporting aerial cables, submarine cables, etc.) must not be cut.

- Explanation of the scope of application with particular reference to usage with 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 according to DIN VDE 0105-1: 2005-06, Section. 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, thorough examination by qualified persons at regular intervals.
- Notice regarding attachment of the cutting head with an additional notice that single-wire cables should be combined where possible to be cut as a three-wire bundle.
- Notice that the insulating hose line should be considered as a self-contained, complete component.
- Notice regarding proper handling during assembly and loosening of the individual parts with the aid of connecting elements.
- Notice that, in those cases where the safety zone cannot be maintained by the operator, additional personal protective measures should be taken, such as through earthworks or protective walls, as well as additional local insulation.
- Notice regarding the use of the grounding system.
- Notice that a safety zone clearance distance of 10 m around the cutting location must be secured against access prior to beginning the cutting process. (Method A)
- Notice that a safety zone around the cutting location must be secured against access, corresponding to local regulations, prior to beginning the cutting process. (Method B)
- Notice that the operator may initiate the cutting process only after he has departed the safety zone.
- Description of the cutting process with instruction regarding observation of, and the uninterrupted completion of the cutting process.
- Instructions as to how completion of the cutting process can be recognised and how the cutting process should be concluded.
- Reference to accompanying organisational measures, such as communication with the mains power location prior to and following the cutting process, including particular incidents or 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.
- Notice regarding the approved replacement of parts by the user.
- Warning notice with respect to the potential for improper usage of the cable cutting devices as determined from practical experience.
- Information regarding residual risks

Actions in the event of malfunction of the cable cutting devices

- Notice regarding safety-relevant actions in the event of a malfunction, such as when the cutting process cannot be properly completed according to the Instruction manual, when the cutting head is damaged during the cutting process or when insulating fluid is leaking.

Actions to take following a short-circuit

- Notice that the blade(s) will no longer open automatically following completion of the cutting process, as the case may be.
- Notice regarding maintenance of the cable cutting devices

The equivalent continuous sound pressure level as rated in dB (A) must be specified for the cable cutting device. d) Actions in the event of malfunction of the cable cutting devices.

In addition, for hydraulic-operated cable cutting devices:

Explanation of the inscriptions

- Explanation of the maximum operating pressure
- Reference to the largest diameter of the cables to be cut
- References to the meaning of the inscriptions on the cutting head, insulating hose line with fittings and drive assembly
- Explanation of the inscriptions on the insulating hose and insulating hose line
- Explanation of the „double triangle“ graphic symbol

Special instructions related to proper usage.

- Notice that the insulating hose line should be completely unrolled.
- Notice that the distance between the cutting head and the pump provided by the insulating hose length should be as large as possible. In this context, pressure-dependent length changes should also be taken into account.
- Instructions regarding the time intervals and procedures for replacing insulating hydraulic fluid, the recording of specific data and the date of replacement.

Test:

Check the Instruction manual for completeness of the requirements mentioned above.

4.1.5 Sales literature

The sales literature must not contradict the Instruction manual with respect to safety and health aspects.

Test:

Check the sales literature for potential contradictions to the Instruction manual.

4.2 Additional requirements for hand held, mains operated drive assemblies

4.2.1 Additional requirements from reference standard DIN EN 60745-1:2010-01

Reference standard	Section	Requirement	Section	Test
DIN EN 60745-1	6	Work environment requirements		
DIN EN 60745-1	6.1	Noise	6.1.2.2	Sound power level
DIN EN 60745-1	6.2	Vibration	6.2.1	Oscillation characteristic value
DIN EN 60745-1	7	Classification		
DIN EN 60745-1	7.1	Classification in Protection class	7.1	Visual inspection and applicable test
DIN EN 60745-1	7.2	Determination of degree of protection	7.2	Visual inspection and applicable test
DIN EN 60745-1	8	Inscriptions and Instruction manual		
DIN EN 60745-1	8.1	Inscriptions	8.1	Visual inspection
DIN EN 60745-1	8.2	Additional inscriptions for short-term / periodic operation	8.2	Visual inspection
DIN EN 60745-1	8.3	Inscription for rated range	8.3	Visual inspection
DIN EN 60745-1	8.4	Recognisability of rated voltage setting	8.4	Visual inspection
DIN EN 60745-1	8.5	Specification of the rated power with adjustability of the rated voltage	8.5	Visual inspection
DIN EN 60745-1	8.6	Symbols to be used for units or for technical data	8.6	Visual inspection and measurement
DIN EN 60745-1	8.7	Recognisability of connection type with more than two mains leads	8.7	Visual inspection
DIN EN 60745-1	8.8	Connecting terminal markings with affixing method Z	8.8	Visual inspection
DIN EN 60745-1	8.9	Switch marking	8.9	Visual inspection

DIN EN 60745-1	8.10	„Off“ position marking on the mains switch	8.10	Visual inspection
DIN EN 60745-1	8.11	Direction marking for adjustment of control devices	8.11	Visual inspection
DIN EN 60745-1	8.12	Requirements concerning the Instruction manual and safety instructions	8.12	Visual inspection
DIN EN 60745-1	8.13	Recognisability and durability of inscriptions	8.13	Visual inspection, rubbing test
DIN EN 60745-1	8.14	Location and arrangement of inscriptions	8.14	Visual inspection
DIN EN 60745-1	8.15	Fuse markings	8.15	Visual inspection
DIN EN 60745-1	9	Protection against access to active parts	9.2-9.4	Visual inspection and test finger
DIN EN 60745-1	10	Start-up		
DIN EN 60745-1	10.1	Stress status for motor start-up	10.1	Functional test
DIN EN 60745-1	10.2	Automatic starting switch	10.2	Functional test
DIN EN 60745-1	10.3	Overload protection device characteristics	10.3	Functional test
DIN EN 60745-1	11	Power and current consumption	11	Measurement
DIN EN 60745-1	12	Temperature rise	12.1	Determination of temperature rise Test according to 12.2-12.5 with subsequent test according to 13
DIN EN 60745-1	12.1	No excess temperature under normal loading	12.1	Determination of temperature rise Test according to 12.2-12.5 with subsequent test according to 13
DIN EN 60745-1	12.6	Windings that are not classified according to IEC 60085	12.6	Test according to 12.6
DIN EN 60745-1	13	Leakage current must not be inadmissibly high	13.1-13.2	Measurement

Reference standard	Section	Requirement	Section	Test
DIN EN 60745-1	14	Resistance to humidity/moisture		
DIN EN 60745-1	14.1	Degree of protection against humidity/moisture	14.1.1-14.1.2	Degree of protection test based on classification
DIN EN 60745-1	14.3	Protection against humidity/moisture conditions with proper usage	14.3	Humidity/moisture test according to 14.3
DIN EN 60745-1	15	Sufficient dielectric strength	15.2	Dielectric strength test
DIN EN 60745-1	16	Overload protection of transformers and associated power circuits	16	Short-circuit test
DIN EN 60745-1	17	Durability	17.1	Test according to 17.2 and 17.3
DIN EN 60745-1	17.1	No electrical or mechanical malfunctions with lengthy proper usage	17.1	Test according to 17.2 and 17.3
DIN EN 60745-1	18	Improper operation		
DIN EN 60745-1	18.1	Fire hazard and electrical shock	18.1	Test according to 18.2-18.9
DIN EN 60745-1	18.10	Single fault safety of electronic circuitry	18.10	Test according to 18.10.1 and 18.10.2
DIN EN 60745-1	18.10.3	Fuses	18.10.3	Test according to 18.10.2 or 18.2
DIN EN 60745-1	18.10.4	Electronic components	18.10.4	Test according to 18.10.1-18.10.4
DIN EN 60745-1	18.11	Rotation direction switch	18.11	Test according to Section 18.11
DIN EN 60745-1	18.12	Protection against electrical shock due to overloading	18.12	Test according to 18.12
DIN EN 60745-1	19	Mechanical hazards		
DIN EN 60745-1	19.1	Protection against injuries due to moving parts	19.1	Test according to 19.1
DIN EN 60745-1	19.4	Safe handling during usage	19.4	Visual inspection
DIN EN 60745-1	19.6	Working shaft idling speed	19.6	Turning speed measurement
DIN EN 60745-1	20	Mechanical strength		
DIN EN 60745-1	20.1	Resistance to rough handling during proper usage	20.1	Test according to 20.2-20.4
DIN EN 60745-1	20.5	Mechanical strength and insulation of gripping surfaces	20.5	Drop test with subsequent dielectric strength test
DIN EN 60745-1	21	Assembly	21.1-21.37	
DIN EN 60745-1	21.1	Unintentional changes to voltage and turning speed settings	21.1	Visual inspection and manual check
DIN EN 60745-1	21.2	Unintentional changes to controller and regulator settings	21.2	Visual inspection and manual check
DIN EN 60745-1	21.3	Removal of parts	21.3	Manual check
DIN EN 60745-1	21.4	Switch attachment at incorrect locations	21.4	Visual inspection and manual check
DIN EN 60745-1	21.5	Replacement of flexible connecting cables	21.5	Visual inspection and manual check
DIN EN 60745-1	21.6	Insulating material usage	21.6	Visual inspection
DIN EN 60745-1	21.7	Asbestos	21.7	Visual inspection
DIN EN 60745-1	21.8	Drive belt usage	21.8	Visual inspection
DIN EN 60745-1	21.9	Insulating material partitions with Protection class II	21.9	Visual inspection and manual check
DIN EN 60745-1	21.10	Cable insulation, internal	21.10	Visual inspection
DIN EN 60745-1	21.11	Insulation jointing	21.11	Visual inspection and measurement
DIN EN 60745-1	21.12	Attachment material with Protection class I	21.12	Visual inspection, measurement and manual check
DIN EN 60745-1	21.13	Additional or reinforced insulation	21.13	Visual inspection, measurement and, for rubber, test according to 21.13
DIN EN 60745-1	21.14	Protection against internal lubricants	21.14	Visual inspection, test according to standards
DIN EN 60745-1	21.15	Access to carbon brushes only with tools	21.15	Visual inspection, manual check, test according to 21.15
DIN EN 60745-1	21.16	Protection against electrical shock with fluid systems	21.16	Visual inspection

Reference standard	Section	Requirement	Section	Test
DIN EN 60745-1	21.17	Switches and reset buttons on non-automatic resettable control devices	21.17	Visual inspection, test according to 21.17
DIN EN 60745-1	21.18	Mains switch	21.18	Visual inspection, manual check, test according to 21.18
DIN EN 60745-1	21.19	Electrical shock at screw connections	21.19	Test according to 21.19 and 28.1
DIN EN 60745-1	21.20	First IP-System position marking	21.20	Test according to IEC60529
DIN EN 60745-1	21.21	Electrical shock from capacitors	21.21	Voltage test according to 21.21
DIN EN 60745-1	21.22	Reliable attachment of non-removable parts	21.22	Tensile/pressure test according to 21.22
DIN EN 60745-1	21.23	Reliable attachment of handles, buttons, grips, levers, etc.	21.23	Visual inspection, manual check, tensile/pressure test according to 21.22
DIN EN 60745-1	21.24	Material storage hooks for flexible cables	21.24	Visual inspection
DIN EN 60745-1	21.25	Corrosion resistance	21.25	Test according to Section 30
DIN EN 60745-1	21.27	Insulation with safety low voltage	21.27	Test as established for double insulation and reinforced insulation
DIN EN 60745-1	21.28	Isolation through protective impedance	21.28	Test as established for double insulation and reinforced insulation
DIN EN 60745-1	21.30	Spindles must be inactive if they can be contacted by parts being removed	21.30	Visual inspection, test finger and test according to 9.2
DIN EN 60745-1	21.31	Insulation of handles, levers or buttons	21.31	Visual inspection and tests as established for insulation, as necessary
DIN EN 60745-1	21.32	Insulation of gripping surfaces when a risk of short-circuit exists	21.32	Visual inspection, test according to 20.5
DIN EN 60745-1	21.33	Capacitors in Protection class II equipment	21.33	Visual inspection, test for additional insulation
DIN EN 60745-1	21.34	Installation of capacitors	21.34	Visual inspection
DIN EN 60745-1	21.35	Lamp fittings	21.35	Visual inspection
DIN EN 60745-1	21.36	Realisation of protective impedance	21.36	Visual inspection and measurement, test according to 21.36
DIN EN 60745-1	21.37	Large ventilation openings	21.37	Test according to 21.37
DIN EN 60745-1	22	Internal cabling		
DIN EN 60745-1	22.1	Cable path properties	22.1	Visual inspection
DIN EN 60745-1	22.2	Internal cable and electrical connection protection	22.2	Visual inspection
DIN EN 60745-1	22.3	Air gaps and creepage distances with internal cabling	22.3	Visual inspection, manual check and measurement
DIN EN 60745-1	22.4	Green/yellow cables	22.4	Visual inspection
DIN EN 60745-1	22.5	Aluminium cable usage	22.5	Visual inspection
DIN EN 60745-1	22.6	Consolidation of stranded conductors with lead-tin solder	22.6	Visual inspection
DIN EN 60745-1	23	Individual parts		
DIN EN 60745-1	23.1	Safety requirements according to IEC standards	23.1	Agreement between inscription and assembly
DIN EN 60745-1	23.1.1	Capacitors	23.1.1	Visual inspection
DIN EN 60745-1	23.1.2	Field capacitor	23.1.2	Visual inspection
DIN EN 60745-1	23.1.3	Lamp fittings	23.1.3	Visual inspection
DIN EN 60745-1	23.1.4	Isolating transformers / Safety transformers	23.1.4	Requirements from IEC 61558-1
DIN EN 60745-1	23.1.5	Device plug connections	23.1.5	Test according to IEC 60309 up to IPX0 degree of protection, test according to IEC 60320
DIN EN 60745-1	23.1.6	Automatic control and regulating devices	23.1.6	Test according to IEC 60730-1
DIN EN 60745-1	23.1.7	Components from other standards	23.1.7	Test according to its standard Test according to inscription
DIN EN 60745-1	23.1.8	Individual part without standard or whose usage does not correspond to the inscription	23.1.8	Test based on conditions found in the electric tooling
DIN EN 60745-1	23.1.9	Capacitors arranged in series with	23.1.9	Test according to 23.1.9

		motor winding		
DIN EN 60745-1	23.1.10	Mains switch	23.1.10	Visual inspection according to 23.1.10
DIN EN 60745-1	23.1.11	Switches not tested separately	23.1.11	See 23.1.11
Reference standard	Section	Requirement	Section	Test
DIN EN 60745-1	23.2	Prohibited equipment	23.2	Visual inspection
DIN EN 60745-1	23.3	Overload protection devices	23.3	Visual inspection
DIN EN 60745-1	23.4	Exchangeability of plugs and equipment connectors	23.4	Visual inspection
DIN EN 60745-1	23.5	Motors connected to the mains supply	23.5	Test according to Annex B
DIN EN 60745-1	24	Mains connection and external cabling		
DIN EN 60745-1	24.1	Type of equipment	24.1	Visual inspection, for interlocking devices a tensile test according to 24.14
DIN EN 60745-1	24.2	Method of affixing	24.2	Visual inspection and manual check
DIN EN 60745-1	24.3	Number of connecting cables	24.3	Visual inspection
DIN EN 60745-1	24.4	Weight	24.4	Visual inspection and measurement
DIN EN 60745-1	24.5	Admissible cable cross-section	24.5	Measurement, Table 6
DIN EN 60745-1	24.6	Protective conductors with Protection class I	24.6	Visual inspection
DIN EN 60745-1	24.7	Consolidation of the conductor	24.7	Visual inspection
DIN EN 60745-1	24.8	Moulding of the conductor	24.8	Visual inspection
DIN EN 60745-1	24.9	Requirements related to the insertion opening	24.9	Visual inspection
DIN EN 60745-1	24.10	Insertion sleeve characteristics	24.10	Visual inspection and manual check
DIN EN 60745-1	24.12	Mechanical strength of bend protection sleeves	24.12	Test according to 24.12
DIN EN 60745-1	24.13	Bend protection sleeves for connecting cables	24.13	Visual inspection, test according to 24.13
DIN EN 60745-1	24.14	Strain relief device	24.14	Visual inspection, test according to 24.14
DIN EN 60745-1	24.15	Strain relief device configuration	24.15	Visual inspection
DIN EN 60745-1	24.16	Strain relief device with affixing method X	24.16	Visual inspection, test according to 24.14 with conditions from 24.16
DIN EN 60745-1	24.17	Strain relief devices with affixing methods Y and Z	24.17	Test according to 24.14 with connecting cables in delivery state
DIN EN 60745-1	24.18	No cable knotting or binding with affixing method X	24.18	Visual inspection
DIN EN 60745-1	24.19	Requirements related to insulated conductors in the fixed connecting cable.	24.19	Visual inspection
DIN EN 60745-1	24.20	Wiring compartment affixing method X	24.20	Visual inspection
DIN EN 60745-1	24.21	Arrangement of the equipment plugs	24.21	Test according to 24.21
DIN EN 60745-1	25	Connecting terminals for external conductors		
DIN EN 60745-1	25.1	Connecting terminals with affixing method X	25.1	Visual inspection
DIN EN 60745-1	25.2	Cable cross-section for connecting terminals with affixing method X	25.2	Test according to 25.2
DIN EN 60745-1	25.3	Attachment of connecting terminals with affixing method X	25.3	Visual inspection, test according to IEC60999-1, 9.6 with torque two-thirds of the value prescribed in Table 4
DIN EN 60745-1	25.4	Attachment of conductors with affixing method X	25.4	Visual inspection of connecting terminals and conductors according to Test 25.3
DIN EN 60745-1	25.5	Attachment on connecting terminals with affixing method X	25.5	Visual inspection of connecting terminals and conductors according to Test 25.3
DIN EN 60745-1	25.6	Arrangement of the plug socket connecting terminals	25.6	Visual inspection and measurement
DIN EN 60745-1	25.7	Visibility of connecting terminals	25.7	Visual inspection
DIN EN 60745-1	25.8	Accessibility of connecting terminals	25.8	Visual inspection and manual check
DIN EN 60745-1	25.9	Safe connection of a multi-strand conductor with affixing method X	25.9	Test according to 25.9

DIN EN 60745-1	26	Protective conductor connection		
DIN EN 60745-1	26.1	Protective conductor connecting terminals and protective conductors	26.1	Visual inspection
DIN EN 60745-1	26.2	Requirements related to the detachability of protective conductor connecting terminals	26.2	Visual inspection, manual check and, with screwless connecting terminals, test according to IEC 60998-2-2
Reference standard	Section	Requirement	Section	Test
DIN EN 60745-1	26.3	Protective conductor connectors on removable parts	26.3	Visual inspection and manual check
DIN EN 60745-1	26.4	Corrosion resistance	26.4	Visual inspection, measurement, manual check and test according to 30.1
DIN EN 60745-1	26.5	Low resistance with protective conductor connectors	26.5	Test according to 26.5
DIN EN 60745-1	27	Screws and connections		
DIN EN 60745-1	27.1	Mechanical loading	27.1	Visual inspection and test according to 27.1
DIN EN 60745-1	27.2	Contact pressure on electrical connections	27.2	Visual inspection
DIN EN 60745-1	27.3	Screw connections	27.3	Visual inspection
DIN EN 60745-1	27.4	Secure against loosening	27.4	Visual inspection Manual check
DIN EN 60745-1	28	Air gaps and creepage distances, clearance distances due to insulation		
DIN EN 60745-1	28.1	Minimum value according to Table 10	28.1	Measurement, Table 10
DIN EN 60745-1	28.2	Minimum clearance distance due to insulation between metal parts	28.1	Visual inspection and measurement
DIN EN 60745-1	29	Heat and fire resistance, track resistance		
DIN EN 60745-1	29.1	Deterioration of external and holding part condition	29.1	Test according to 29.1
DIN EN 60745-1	29.2	Fire resistance of non-metallic materials	29.2	Test according to 29.2
DIN EN 60745-1	29.3	Track resistance of insulating materials	29.3	Test track resistance according to Annex G
DIN EN 60745-1	30	Rust protection		
DIN EN 60745-1	30.1	Sufficient protection against rust	30.1	Test according to 30.1

4.2.2 Operator unit weight

The weight of the operator unit must not exceed 5 Kg

Test:

Measurement

4.3 Additional requirements for transportable, mains-operated drive assemblies from reference standard DIN EN 61029-1:2010-01

4.3.1 Additional requirements from reference standard DIN EN 61029-1:2010-01

Reference standard	Section	Requirement	Section	Test
DIN EN 61029-1	7	Inscriptions and user information		
DIN EN 61029-1	7.1	Inscriptions	7.1	Visual inspection
DIN EN 61029-1	7.2	Additional inscriptions for short-term / periodic operation	7.2	Visual inspection and measurement
DIN EN 61029-1	7.4	Recognisability of the rated voltage or rated power setting	7.4	Visual inspection
DIN EN 61029-1	7.5	Specifications for rated power with adjustable rated voltage	7.5	Visual inspection
DIN EN 61029-1	7.6	Symbols to be used for units or for technical data	7.6	Visual inspection
DIN EN 61029-1	7.7	Marking of the neutral conductor	7.7	Visual inspection
DIN EN 61029-1	7.8	Position marking of control and regulating devices	7.8	Visual inspection
DIN EN 61029-1	7.9	Legibility and durability of inscriptions	7.9	Visual inspection and wipe test
Reference standard	Section	Requirement	Section	Test
DIN EN 61029-1	7.10	Direction marking for regulator setting changes	7.10	Visual inspection
DIN EN 61029-1	7.11	Explicit switch allocation	7.11	Visual inspection
DIN EN 61029-1	7.12	Recognisability of the type of connection with more than two mains adapters	7.12	Visual inspection
DIN EN 61029-1	7.13	Handbook or information sheet contents	7.13	Visual inspection
DIN EN 61029-1	8	Protection against electric shock		
DIN EN 61029-1	8.1	Sufficient protection against accidental contact	8.1	Visual inspection, test with test finger
DIN EN 61029-1	8.2	Mechanical strength of the parts	8.2	Visual inspection, manual check, test according to Sections 16 and 19
DIN EN 61029-1	8.3	Actuating device spindles	8.3	Visual inspection
DIN EN 61029-1	8.4	Metal switch insulation	8.4	Visual inspection
DIN EN 61029-1	8.5	Protection class II capacitors	8.5	Visual inspection, test for additional insulation
DIN EN 61029-1	8.6	Electrical shock from capacitors	8.6	Test according to 8.6
DIN EN 61029-1	9	Start-up		
DIN EN 61029-1	9.1	Operation under all normal stress conditions	9.1	Test according to 9.1
DIN EN 61029-1	9.2	Characteristics of overload protection devices	9.2	Test according to 9.2
DIN EN 61029-1	10	Power and current consumption		
DIN EN 61029-1	10.1	Power consumption tolerance	10.1	Test according to 10.1
DIN EN 61029-1	10.2	Rated current	10.2	Test according to 10.2
DIN EN 61029-1	11	Temperature rise		
DIN EN 61029-1	11.1	Characteristics with proper usage	11.1	Measure the temperature rise under the conditions specified in 11.2, 11.3, 11.4, 11.5, 11.6
DIN EN 61029-1	12	Leakage current		
DIN EN 61029-1	12.1	Characteristics with proper usage	12.1	Test according to 12.2
DIN EN 61029-1	13	Ambient conditions		
DIN EN 61029-1	13.2	Noise	13.2.2	Test according to 13.2.2-13.2.7
DIN EN 61029-1	13.3	Vibration measurement	13.3.2	Test according to 13.3.2-13.3.8
DIN EN 61029-1	14	Protection against infiltration of foreign objects and resistance to humidity/moisture		
DIN EN 61029-1	14.1	Compliance with Protection class	14.1	Test of requirements according to EN 60529

DIN EN 61029-1	14.2	Degree of protection greater than IPX0	14.2	Test according to 14.2
DIN EN 61029-1	14.3	Exposure to humidity/moisture with proper usage	14.3	Test according to 14.3
DIN EN 61029-1	14.4	Overflowing fluids	14.4	Test according to 14.4
DIN EN 61029-1	15	Insulation resistance and dielectric strength		
DIN EN 61029-1	15.1	Sufficient insulation resistance and dielectric strength	15.1	Test according to 15.2-15.3
DIN EN 61029-1	16	Durability		
DIN EN 61029-1	16.1	Characteristics with lengthy proper usage	16.1	Test according to 16.2 with centrifugal or other automatic start-up switches 16.3
DIN EN 61029-1	17	Improper operation		
DIN EN 61029-1	17.1	Prevention of hazards due to improper or careless handling	17.1	Test according to 17.1
DIN EN 61029-1	17.2	Malfunction of electronic control and regulating devices	17.2	Test according to 17.2
DIN EN 61029-1	17.3	Switch loading for direction of rotation	17.3	Test according to 17.3
DIN EN 61029-1	20	Assembly		
DIN EN 61029-1	20.1	Classification of Protection class	20.1	Visual inspection
DIN EN 61029-1	20.2	Inadvertent changes to voltage or turning speed settings	20.2	Manual check
Reference standard	Section	Requirement	Section	Test
DIN EN 61029-1	20.3	Inadvertent changes to control or regulating device settings	20.3	Manual check
DIN EN 61029-1	20.4	Removal of protection against humidity/moisture	20.4	Manual check
DIN EN 61029-1	20.5	Location of switch attachments	20.5	Visual inspection and manual check
DIN EN 61029-1	20.6	Replacement of individual parts	20.6	Visual inspection and manual check
DIN EN 61029-1	20.7	Replacement of flexible connecting cables	20.7	Visual inspection and manual check
DIN EN 61029-1	20.8	Insulating materials	20.8	Visual inspection
DIN EN 61029-1	20.9	Prerequisite for use of reinforced insulation	20.9	Visual inspection
DIN EN 61029-1	20.10	Reinforced insulation with Protection class II	20.10	Visual inspection and manual check
DIN EN 61029-1	20.11	Collapsing of insulation jointing	20.11	Visual inspection and measurement
DIN EN 61029-1	20.12	Loosening of parts with Protection class I	20.12	Visual inspection, manual check and measurement
DIN EN 61029-1	20.13	Contamination of additional or reinforced insulation	20.13	Visual inspection, measurement and, for rubber, test according to 20.13
DIN EN 61029-1	20.14	Protection against internal lubricants	20.14	Visual inspection
DIN EN 61029-1	20.15	Access to carbon brushes	20.15	Visual inspection, manual check, test according to 20.15
DIN EN 61029-1	20.16	Means of radio interference suppression	20.16	Visual inspection, test according to 19.1
DIN EN 61029-1	20.17	ON-OFF switch	20.17	Visual inspection
DIN EN 61029-1	20.18	Switch configuration	20.18	Visual inspection
DIN EN 61029-1	20.19	Machine shutdown	20.19	Visual inspection
DIN EN 61029-1	20.20	Restarting the machine following interruption	20.20	Handling
DIN EN 61029-1	21	Internal cabling		
DIN EN 61029-1	21.1	Air gaps and creepage distances	21.1	Visual inspection, manual check and measurement, test according to 21.1
DIN EN 61029-1	21.2	Protection of internal cables and connections	21.2	Visual inspection
DIN EN 61029-1	21.3	Cable paths must be smooth and free of sharp edges	21.3	Visual inspection
DIN EN 61029-1	21.4	Protection class II	21.4	Visual inspection
DIN EN 61029-1	21.5	Green/yellow cables	21.5	Visual inspection, test according to 21.2-21.5
DIN EN 61029-1	21.6	Mechanical loading	21.6	Visual inspection, test according to 21.6

DIN EN 61029-1	21.7	Minimum clearance distances with flexible cabling	21.7	Visual inspection
DIN EN 61029-1	21.8	No aluminium wiring	21.8	Visual inspection
DIN EN 61029-1	22	Individual parts		
DIN EN 61029-1	22.1	Conformance to standards	22.1	Test dependent on standard used
DIN EN 61029-1	22.2	Contact opening, ON-OFF switch	22.2	Visual inspection, test according to 22.2
DIN EN 61029-1	22.3	ON-OFF switch position	22.3	Visual inspection
DIN EN 61029-1	22.4	Restarting overload protection devices	22.4	Visual inspection
DIN EN 61029-1	22.5	Exchangeability of plugs	22.5	Visual inspection and manual check
DIN EN 61029-1	22.6	Capacitor locations	22.6	Visual inspection
DIN EN 61029-1	22.7	Location of radio and television interference	22.7	Visual inspection
DIN EN 61029-1	22.8	Radio interference in protective conductor circuitry	22.8	Test according to 22.8
DIN EN 61029-1	22.9	Device plug connections must correspond to EN 60320-1	22.9	Check data sheet
DIN EN 61029-1	23	Mains connection and external cabling		
DIN EN 61029-1	23.1	Requirements related to mains connection	23.1	Visual inspection, test finger, teach according to EN 60320-1
DIN EN 61029-1	23.2	Permanently attached flexible cables	23.2	Visual inspection and measurement
DIN EN 61029-1	23.3	Plugs according to standards	23.3	Check data sheet
DIN EN 61029-1	23.4	Rated cross-section for permanently attached flexible cables	24.4	Visual inspection
Reference standard	Section	Requirement	Section	Test
DIN EN 61029-1	23.5	Strain relief for mains connecting cables	23.5	Visual inspection, test according to 23.5
DIN EN 61029-1	23.6	Bend/kink protection	23.6	Visual inspection Measurement, test according to 23.6
DIN EN 61029-1	23.7	Requirements related to insertion opening / sleeves	23.7	Visual inspection and manual check
DIN EN 61029-1	23.8	Space for mains connecting cables inside device	23.8	Visual inspection and installation test, test according to 23.8
DIN EN 61029-1	24	Connecting terminals for external cables		
DIN EN 61029-1	24.1	Requirements related to connecting terminal attachment	24.1	Visual inspection
DIN EN 61029-1	24.2	Cable cross-sections for connecting terminals with affixing method X	24.2	Test according to 24.1-24.2, measurement and connection test using conductors with the smallest and largest cross-sections specified in the table.
DIN EN 61029-1	24.3	Connecting terminal and connection device with affixing method M	24.3	Visual inspection, tensile loading of the connection with 5N
DIN EN 61029-1	24.4	Connecting terminal attachment	24.4	Test according to 24.4
DIN EN 61029-1	24.5	Contact pressure on connecting terminals	24.5	Handling
DIN EN 61029-1	24.6	Connecting terminals on electric tools up to 16A rated current	24.6	Visual inspection of the terminals and conductors subsequent to testing according to 24.4
DIN EN 61029-1	24.7	Plug socket terminal dimensions	24.9	Visual inspection, measurement and test according to 24.10 if necessary
DIN EN 61029-1	24.8	Screw terminal dimensions	24.9	Visual inspection, measurement and test according to 24.10 if necessary
DIN EN 61029-1	24.9	Connecting bolts	24.9	Visual inspection, measurement and test according to 24.10 if necessary
DIN EN 61029-1	24.10	Thread length not according to standards	24.10	Test according to 24.10
DIN EN 61029-1	24.11	Location of terminals with affixing methods X and M	24.11	Visual inspection
DIN EN 61029-1	24.12	Connecting devices must not be accessible without tooling	24.12	Visual inspection and manual check
DIN EN 61029-1	24.13	Affixing the conductor with connection points	24.13	Visual inspection, manual check, test according to 24.13

DIN EN 61029-1	24.14	Protection against stress with affixing methods X and M		Visual inspection, manual check, test according to 24.14
DIN EN 61029-1	25	Protective conductor connection		
DIN EN 61029-1	25.1	Protective conductor connection	25.1	Visual inspection
DIN EN 61029-1	25.2	Protective conductor connection not outfitted with screwless terminals	25.2	Visual inspection, manual check, test according to 24
DIN EN 61029-1	25.3	Corrosion resistance	25.3	Visual inspection
DIN EN 61029-1	25.4	Strain relief for mains connecting cables	25.4	Visual inspection
DIN EN 61029-1	25.5	Low resistance of the protective conductor connection	25.5	Test according to 25.5
DIN EN 61029-1	25.6	Terminal screw usage	25.6	Visual inspection
DIN EN 61029-1	26	Screws and connections		
DIN EN 61029-1	26.1	Mechanical loading	26.1	Visual inspection, test according to 26.1
DIN EN 61029-1	26.2	Penetration length of screws into insulating material threads	26.2	Visual inspection, manual check and measurement
DIN EN 61029-1	26.3	Contact pressure on electrical connections	26.4	Visual inspection
DIN EN 61029-1	26.4	Tapping and thread cutting screw usage	26.4	Visual inspection
DIN EN 61029-1	26.5	Mechanical connections secured against loosening	26.5	Visual inspection and manual check
DIN EN 61029-1	27	Air gaps and creepage distances, clearance distances due to insulation		
DIN EN 61029-1	27.1	Minimum clearance distance	27.1	Measurement, values 27.1
DIN EN 61029-1	27.2	Minimum clearance distances due to insulation between metal parts	27.3	Visual inspection and measurement
DIN EN 61029-1	27.3	Minimum clearance distance with rated current over 25A	27.3	Visual inspection and measurement

Reference standard	Section	Requirement	Section	Test
DIN EN 61029-1	28	Heat and fire resistance, track resistance		
DIN EN 61029-1	28.1	External insulating parts	28.1	Test according to 28.1
DIN EN 61029-1	28.2	Heat and fire resistance of insulating parts that hold parts exposed to voltage in position.	28.2	Test according to 28.2
DIN EN 61029-1	28.3	Track resistance of insulating parts according to 28.2 and additional insulation	28.3	Test according to 28.3 for ceramic materials
DIN EN 61029-1	29	Rust protection	29	Test according to 29

4.3.2 Drive assembly weight

The weight of the drive assembly must not exceed 20 Kg

Test:

Measurement

4.3.3 The drive assembly must be outfitted with carrying handles to insure safe handling.

Test:

Visual inspection and handling check

4.4 Additional requirements for battery operated drive assemblies

4.4.1 The maximum operating voltage must not exceed 24 V.

Test:

Check the technical data and inscriptions

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

Test:

Check the circuit documentation, functional test

4.4.3 It must be possible to switch off the drive assembly at any time (Stop category 0) by means of an operator interface (e.g. push-button or switch). Electromechanically actuated push-button switching elements used to initiate the Stop function must be outfitted with positive break NC contacts according to DIN EN 60947-5-1: 2005, Annex K. Switches must possess an isolating function.

If the drive assembly switch Off function takes place via an electromechanical, electronic or programmable electronic controller, then interconnection of the safety-related parts of the control unit must fulfil the requirements of Performance Level c (PL c) according to DIN EN ISO 13849-1.

Test:

Check of circuit documentation, visual inspection, functional test, validation according to DIN EN ISO 13849-2

4.4.4 The drive assembly must perform the cutting process (initiate the cutting process up to cable separation) within 60 s.

Test:

The test is to be carried out on a ready-for-use cable cutting device. Initiate the cutting process with the Start button.

The time between actuation of the Start button and switch Off of the cable cutting device must be measured. The test has been passed when the time measured is equal to or less than 60 s.

- 4.4.5** The operator interface (e.g. push-button or switch) for the START/ON and STOP/OFF functions must be arranged for easy access and clearly, unmistakably and permanently marked on the basis of the DIN EN 60204-1: 2007, Sec. 10.2 .

Test:

Visual inspection, handling and wipe test according to DIN EN 50340:2011-04, Section 5.2.3

- 4.4.6** Storage batteries must be designed in such a manner that polarity reversal when being inserted into the pump is not possible.

Test:

Visual inspection and handling check

- 4.4.7** The storage battery connection contacts must be arranged in such a manner that short-circuiting when being inserted into the pump is not possible.

Test:

Visual inspection and handling check

- 4.4.8** Battery inserts must be designed in such a manner that electrolyte leakage is not possible, no matter in which attitude the drive assembly is positioned.

Test:

The drive assembly should be placed in all possible positions where electrolyte leakage could occur and maintained in each position for at least one minute. The test has been passed when no electrolyte leakage is detected following the positioning times.

- 4.4.9** The drive assembly casing must have sufficient structural strength to withstand external influences.

Test:

The test is carried out using an impact test device according to Sec. 5, DIN EN 60068-2-75: 1998, with an impact energy of 1.0 Nm.

The drive assembly should be placed on a rigid base with each location considered to be a weak point on the case being exposed to three blows. The test has been passed when no holes or cracks are found in the casing following exposure to the impact loads.

- 4.4.10** All components installed in the device must be appropriate for the rated data. Unmarked components or those whose operating conditions deviate from the rated values, must comply with the requirements of the respective VDE specifications with consideration given to the operational demands the device will be subjected to.

Test:

Component-specific according to VDE specifications

- 4.4.11** Battery charging devices built into battery-operated drive assemblies must comply with the requirements of DIN EN 60335-2-29.

Test:

Carry out the applicable tests according to DIN EN 60335-2-29.

- 4.4.12** Battery inserts must comply with the requirements of DIN EN 62133: 2003 or DIN IEC 62133: 2008 accordingly

Test:

Verification of external certificates

- 4.4.13** Inscriptions on battery inserts:

- Type designation
- Rated voltage
- Capacity

Test:

Visual inspection

4.5 Additional requirements for hand held, battery-operated drive assemblies

4.5.1 Additional requirements from reference standard DIN EN 60745-1:2010-01

Reference standard	Section	Requirement	Section	Test
DIN EN 60745-1	6	Work environment requirements		
DIN EN 60745-1	6.1	Noise	6.1.2.2	Sound power level
DIN EN 60745-1	6.2	Vibration	6.2.1	Oscillation characteristic value
DIN EN 60745-1	8	Inscriptions and instruction manual		
DIN EN 60745-1	K8.1	Mandatory inscriptions for battery-powered tools	K8.1	Visual inspection
DIN EN 60745-1	8.3	Inscription for rated range	8.3	Visual inspection
DIN EN 60745-1	8.4	Recognisability of rated voltage setting	8.4	Visual inspection
DIN EN 60745-1	8.6	Symbols to be used for units or for technical data	8.6	Visual inspection and measurement
DIN EN 60745-1	8.9	Switch marking	8.9	Visual inspection
DIN EN 60745-1	8.10	„Off“ position marking on mains switch	8.10	Visual inspection
DIN EN 60745-1	8.11	Direction marking for adjustment of control devices	8.11	Visual inspection
DIN EN 60745-1	8.12	Requirements concerning the instruction manual and safety instructions	8.12	Visual inspection
DIN EN 60745-1	K8.12.1.1	General safety instructions for battery-powered tools	8K8.12.1.1	Visual inspection
DIN EN 60745-1	8.13	Recognisability and durability of inscriptions	8.13	Rubbing test
DIN EN 60745-1	8.14	Location and arrangement of inscriptions	8.14	Visual inspection
DIN EN 60745-1	8.15	Fuse markings	8.15	Visual inspection
DIN EN 60745-1	9	Protection against access to active parts	9.2-9.4	Visual inspection and test finger
DIN EN 60745-1	12	Temperature rise	12.1	Determination of temperature rise, test according to 12.2-12.5, subsequently test according to 13
DIN EN 60745-1	K12.1	Temperature rise of battery-powered tools and storage batteries	K12.1	Test according to K12.1
DIN EN 60745-1	18	Improper operation	18.1	Test according to 18.2-18.9
DIN EN 60745-1	K18.1	Fire hazard and electrical shock	K18.1	Test according to K18.1
DIN EN 60745-1	18.10	Single fault safety of electronic circuitry	18.10	Test according to 18.10.1 and 18.10.2
DIN EN 60745-1	18.10.3	Fuses	18.10.3	Test according to 18.10.2 or 18.2
DIN EN 60745-1	18.10.4	Electronic components	18.10.4	Test according to 18.10.1-18.10.4
DIN EN 60745-1	18.11	Rotation direction switch	18.11	Test according to Section 18.11
DIN EN 60745-1	19	Mechanical hazards		
DIN EN 60745-1	19.1	Protection against injuries due to moving parts	19.1	Test according to Section 20
Reference standard	Section	Requirement	Section	Test
DIN EN 60745-1	19.4	Safe handling during usage	19.4	Visual inspection
DIN EN 60745-1	19.6	Working shaft idling speed	19.6	Turning speed measurement
DIN EN 60745-1	K.19.201	Reverse polarity	K.19.201	Visual inspection
DIN EN 60745-1	20	Mechanical strength	20.1	Test according to 20.2-20.4
DIN EN 60745-1	20.5	Mechanical strength and insulation of gripping surfaces	20.5	Drop test with subsequent dielectric strength test
DIN EN 60745-1	K20.1	Mechanical strength	K20	Test according to K20.1 and K20.3
DIN EN 60745-1	21	Assembly	21.1-21.37	Visual inspection, manual check and measurement

DIN EN 60745-1	21.1	Unintentional changes to voltage and turning speed settings	21.1	Visual inspection and manual check
DIN EN 60745-1	21.2	Unintentional changes to controller and regulator settings	21.2	Manual check
DIN EN 60745-1	21.3	Removal of parts	21.3	Manual check
DIN EN 60745-1	21.4	Location of switch attachments	21.4	Visual inspection and manual check
DIN EN 60745-1	21.7	Asbestos	21.7	Visual inspection
DIN EN 60745-1	21.17	Switches and reset buttons on non-automatic resettable control devices	21.17	Test according to 21.17
DIN EN 60745-1	21.18	Mains switch	21.18	Visual inspection, manual check, test according to 21.18
DIN EN 60745-1	21.19	Electrical shock at screw connections	21.19	Test according to 21.19 and 28.1
DIN EN 60745-1	21.20	First IP-System position marking	21.20	Test according to IEC 60529
DIN EN 60745-1	21.22	Reliable attachment of non-removable parts	21.22	Tensile/pressure test according to 21.22
DIN EN 60745-1	21.23	Reliable attachment of handles, buttons, grips, levers, etc.	21.23	Visual inspection, manual check, tensile/pressure test according to 21.23
DIN EN 60745-1	21.24	Material storage hooks for flexible cables	21.24	Visual inspection
DIN EN 60745-1	21.35	Lamp fittings	21.35	Visual inspection
DIN EN 60745-1	21.36	Realisation of protective impedance	21.36	Visual inspection and measurement, test according to 21.36
DIN EN 60745-1	21.37	Large ventilation openings	21.37	Test according to 21.37
DIN EN 60745-1	K.21.201	Multipurpose batteries	K.21.201	Visual inspection and handling check
DIN EN 60745-1	22	Internal cabling		
DIN EN 60745-1	22.1	Cable path properties	22.1	Visual inspection
DIN EN 60745-1	22.2	Internal cable and electrical connection protection	22.2	Visual inspection
DIN EN 60745-1	22.5	Aluminium cable usage	22.5	Visual inspection
DIN EN 60745-1	22.6	Consolidation of stranded conductors with lead-tin solder	22.6	Visual inspection
DIN EN 60745-1	23	Individual parts		
DIN EN 60745-1	23.1	Safety requirements according to IEC standards	23.1	Agreement between inscription and assembly
DIN EN 60745-1	23.1.1	Capacitors	23.1.1	Visual inspection
DIN EN 60745-1	23.1.2	Field capacitor	23.1.2	Visual inspection
DIN EN 60745-1	23.1.3	Lamp fittings	23.1.3	Visual inspection
DIN EN 60745-1	23.1.4	Isolating transformers / Safety transformers	23.1.4	Requirements from IEC 61558-1
DIN EN 60745-1	23.1.5	Device plug connections	23.1.5	Test according to IEC 60309 up to IPX0 degree of protection, test according to IEC 60320
DIN EN 60745-1	23.1.6	Automatic control and regulating devices	23.1.6	Test according to IEC 60730-1
DIN EN 60745-1	23.1.7	Components from other standards	23.1.7	Test according to its standard Test according to inscription
DIN EN 60745-1	23.1.8	Individual part without standard or whose usage does not correspond to the inscription	23.1.8	Test based on conditions found in the electric tooling

Reference standard	Section	Requirement	Section	Test
DIN EN 60745-1	23.1.9	Capacitors arranged in series with motor winding	23.1.9	Test according to 23.1.9
DIN EN 60745-1	K23.1.10	Circuit breaker breaking-capacity	K23.1.10	Test according to K23.1.10
DIN EN 60745-1	K23.1.11	Circuit breaker robustness with proper usage	K23.1.11	Test according to K23.1.11
DIN EN 60745-1	23.2	Prohibited equipment	23.2	Visual inspection
DIN EN 60745-1	23.3	Overload protection devices	23.3	Visual inspection
DIN EN 60745-1	23.4	Exchangeability of plugs and equipment connectors	23.4	Visual inspection
DIN EN 60745-1	24	Mains connection and external cabling		
DIN EN 60745-1	K.24.201	Strain relief for isolated storage batteries	K.24.201	Visual inspection
DIN EN 60745-1	27	Screws and connections		
DIN EN 60745-1	K.27.1	Mechanical loading	27.1	Visual inspection and test according to 27.1
DIN EN 60745-1	27.2	Contact pressure on electrical connections	27.2	Visual inspection
DIN EN 60745-1	27.3	Screw connections	27.3	Visual inspection
DIN EN 60745-1	27.4	Secure against loosening	27.4	Visual inspection Manual check
DIN EN 60745-1	28	Air gaps and creepage distances, clearance distances due to insulation		
DIN EN 60745-1	K28.1	Minimum values	28.1	Measurement, Table K2
DIN EN 60745-1	29	Heat and fire resistance, track resistance		
DIN EN 60745-1	K29.1	Heat resistance of non-metallic materials	29.1	Test according to K29.1
DIN EN 60745-1	K29.2	Fire resistance of non-metallic sections of the external casing on current-conducting components	29.2	Test according to 29.2
DIN EN 60745-1	30	Rust protection		
DIN EN 60745-1	30.1	Sufficient protection against rust	30.1	Test according to 30.1

4.5.2 Operator unit weight

The weight of the operator unit must not exceed 5 Kg

Test:

Measurement

4.5.3 If the cable cutter drive storage battery is an integral component of the operator unit, then a second, fully charged storage battery must be available on-site.

Test:

Check delivered components

4.5.4 Instruction manual

Reference must be made in the Instruction manual that a second, fully charged storage battery must be available at the workplace.

Test:

Check the Instruction manual

4.6 Additional requirements for transportable, battery operated drive assemblies

4.6.1 Additional requirements from DIN EN 61029-1:2010-01

Reference standard	Section	Requirement	Section	Test
DIN EN 61029-1	7	Inscriptions and user information		
DIN EN 61029-1	7.1	Inscriptions	7.1	Visual inspection
DIN EN 61029-1	7.2	Additional inscriptions for short-term or periodic operation	7.2	Visual inspection and measurement
DIN EN 61029-1	7.4	Recognisability of the rated voltage or rated power setting	7.4	Visual inspection
DIN EN 61029-1	7.5	Specifications for rated power with adjustable rated voltage	7.5	Visual inspection
DIN EN 61029-1	7.6	Symbols to be used for units or for technical specifications	7.6	Visual inspection
DIN EN 61029-1	7.8	Position marking of control and regulating devices	7.8	Visual inspection
DIN EN 61029-1	7.9	Legibility and durability of inscriptions	7.9	Visual inspection and wipe test
DIN EN 61029-1	7.10	Direction marking for regulator setting changes	7.10	Visual inspection
DIN EN 61029-1	7.11	Explicit switch allocation	7.11	Visual inspection
DIN EN 61029-1	7.13	Handbook or information sheet contents	7.13	Visual inspection
DIN EN 61029-1	11	Temperature rise		
DIN EN 61029-1	11.1	Characteristics with proper usage	11.1	Measure the temperature rise under the conditions according to 11.2-11.6 Test according to K12.1 (DIN EN 60745-1)
DIN EN 61029-1	13	Ambient conditions		
DIN EN 61029-1	13.2	Noise	13.2.2	Test according to 13.2.2-13.2.7
DIN EN 61029-1	13.3	Vibration measurement	13.3.2	Test according to 13.3.2-13.3.8
DIN EN 61029-1	14	Protection against infiltration of foreign objects and resistance to humidity/moisture	15.1	Test according to 15.2 and 15.3
DIN EN 61029	14.1	Compliance with Protection class	14.1	Test of requirements according to EN 60529
DIN EN 61029	14.2	Degree of protection greater than IPX0	14.2	Test according to 14.2
DIN EN 61029	14.3	Exposure to humidity/moisture with proper usage	14.3	Test according to 14.3
DIN EN 61029-1	14.4	Overflowing fluids	14.4	Test according to 14.4
DIN EN 61029-1	15	Insulation resistance and dielectric strength	15.1	Test according to 15.2 and 15.3
DIN EN 61029-1	16	Durability		
DIN EN 61029-1	16.1	Characteristics with lengthy proper usage	16.1	Test according to 16.2 with centrifugal or other automatic start-up switches 16.3
DIN EN 61029-1	17	Improper operation		
DIN EN 61029-1	17.1	Prevention of hazards due to improper or careless handling	17.1	Test according to 17.1

Reference standard	Section	Requirement	Section	Test
DIN EN 61029-1	17.2	Malfunction of electronic control and regulating devices	17.2	Test according to 17.2
DIN EN 61029-1	17.3	Switch loading for direction of rotation	17.3	Test according to 17.3
DIN EN 61029-1	20	Assembly		
DIN EN 61029-1	20.1	Classification of Protection class	20.1	Visual inspection
DIN EN 61029-1	20.2	Inadvertent changes to voltage or turning speed settings	20.2	Manual check
DIN EN 61029-1	20.3	Inadvertent changes to control or regulating device settings	20.3	Manual check
DIN EN 61029-1	20.4	Removal of protection against humidity/moisture	20.4	Manual check
DIN EN 61029-1	20.5	Location of switch attachments	20.5	Visual inspection and manual check
DIN EN 61029-1	20.6	Replacement of individual parts	20.6	Visual inspection and manual check
DIN EN 61029-1	20.8	Insulating materials	20.8	Visual inspection
DIN EN 61029-1	20.9	Prerequisite for the use of reinforced insulation	20.9	Visual inspection
DIN EN 61029-1	20.13	Contamination of additional or reinforced insulation	20.13	Visual inspection, measurement and, for rubber, test according to 20.13
DIN EN 61029-1	20.14	Protection against internal lubricants	20.14	Visual inspection
DIN EN 61029-1	20.16	Means of radio interference suppression	20.16	Visual inspection, test according to 19.1
DIN EN 61029-1	20.17	ON-OFF switch	20.17	Visual inspection
DIN EN 61029-1	20.18	Switch configuration	20.18	Visual inspection
DIN EN 61029-1	20.19	Machine shutdown	20.19	Visual inspection
DIN EN 61029-1	20.20	Restarting the machine following interruption	20.20	Handling
DIN EN 61029-1	21	Internal cabling		
DIN EN 61029-1	21.1	Air gaps and creepage distances	21.1	Visual inspection, manual check and measurement, test according to 21.1
DIN EN 61029-1	21.2	Protection of internal cables and connections	21.2	Visual inspection
DIN EN 61029-1	21.3	Cable paths must be smooth and free of sharp edges	21.3	Visual inspection
DIN EN 61029-1	21.6	Mechanical loading	21.6	Visual inspection, test according to 21.6
DIN EN 61029-1	21.7	Minimum clearance distances with flexible cabling	21.7	Visual inspection
DIN EN 61029-1	21.8	No aluminium wiring	21.8	Visual inspection
DIN EN 61029-1	22	Individual parts		
DIN EN 61029-1	22.1	Conformance to standards	22.1	Test dependent on standard used
DIN EN 61029-1	22.2	Contact opening, ON-OFF switch	22.2	Visual inspection, test according to 22.2
DIN EN 61029-1	22.3	ON-OFF switch position	22.3	Visual inspection
DIN EN 61029-1	22.4	Restarting overload protection devices	22.4	Visual inspection
DIN EN 61029-1	22.5	Exchangeability of plugs	22.5	Visual inspection and manual check
DIN EN 61029-1	22.6	Capacitor locations	22.6	Visual inspection
DIN EN 61029-1	22.7	State of basic fault elimination	22.7	Visual inspection
DIN EN 61029-1	22.9	Device plug connections must correspond to EN 60320-1	22.9	Visual inspection, test according to EN 60320-1
DIN EN 61029-1	26	Screws and connections		
DIN EN 61029-1	26.1	Mechanical loading	26.1	Test according to 26.1
DIN EN 61029-1	26.2	Penetration length of screws into insulating material threads	26.2	Visual inspection, manual check and measurement
DIN EN 61029-1	26.3	Contact pressure on electrical connections	26.3	Visual inspection
DIN EN 61029-1	26.4	Tapping and thread cutting screw usage	26.4	Visual inspection
DIN EN 61029-1	26.5	Mechanical connections secured against loosening	26.5	Visual inspection and manual check

Reference standard	Section	Requirement	Section	Test
DIN EN 61029-1	27	Air gaps and creepage distances, clearance distances due to insulation		
DIN EN 61029-1	27.1	Air gaps and creepage distances		Measurement Test according to K28.1 (DIN EN 60745-1)
DIN EN 61029-1	28	Heat and fire resistance, track resistance		
DIN EN 61029-1	28.1	External insulating parts	28.1	Test according to 28.1
DIN EN 61029-1	28.2	Heat and fire resistance of insulating parts that hold parts exposed to voltage in position.	28.2	Test according to 28.2
DIN EN 61029-1	29	Rust protection	29	Test according to 29

4.6.2 The drive assembly must not exceed a maximum weight of 20 Kg.

Test:

Measurement

4.6.3 If the drive storage battery for the cable cutter is not an integral component of the operator unit, then the cutting process must be initiated only after it can be ensured that sufficient energy is available to completely carry out the cutting process. If sufficient energy is not available, then this condition must be indicated on the operator unit.

Test:

Check the circuit documentation, Instruction manual and technical specifications.

The cable cutting device will be operated without a test specimen until the maximum allowable operating pressure has been reached and the cutting process can no longer be initiated.

The test has been passed when:

- the cutting process can no longer be initiated after the maximum allowable operating pressure has been reached
- the status of the operator unit is displayed
- the cable cutting device automatically blocks renewed initiation of the cutting process
- the operator receives a signal with absolute certainty, as described in the Instruction manual, that insufficient battery capacity is available

4.6.4 The drive assembly must be outfitted with carrying handles to insure safe handling.

Test:

Visual inspection and handling check

4.7 Additional requirements for cable cutting devices with radio remote control

4.7.1 General

4.7.1.1 If radio remote control is used for control of the drive assembly, then it must comply with the requirements of the testing principles, GS-ET-07 „Principles of testing and certification of wireless control equipment for machinery safety requirements“.

Test:

According to GS-ET-07

4.7.1.2 Transmission disruptions between the transmitter and receiver must immediately interrupt and shutdown the cutting process and initiate an automatic blade reversal back to the start position.

Test:

Functional test

4.7.1.3 A radio receiver must be paired to only one corresponding radio transmitter.

Test:

Verification of coding

4.7.2 Additional requirements for the radio receiver

4.7.2.1 The radio receiver should be switched On by means of a hand-actuated switch, which is protected against unintentional actuation.

Test:

Functional test

4.7.2.2 The operating state of the radio receiver should be displayed by means of a signal lamp.

Test:

Visual inspection

4.7.2.3 When the radio receiver has been switched On, the radio link between the radio transmitter and receiver should be established only after 30 seconds have expired.

Test:

Functional test and measurement

4.7.3 Additional requirements for the radio transmitter

4.7.3.1 The operating voltage of the radio transmitter must not exceed 24 VDC.

Test:

Documentation review

4.7.3.2 When the radio link between the radio transmitter and receiver has been established, it must be indicated on the radio transmitter with the control elements on the transmitter being released manually.

Control elements that are actuated prior to the radio link having been established must not cause the cutting process to start automatically.

If a signal lamp is used, it must be designed with a green-coloured indication display.

Test:

Functional test

4.7.3.3 Initiation of the cutting process must take place exclusively via the radio transmitter.

Test:

Functional test

4.7.3.4 The radio transmitter must feature the following control elements:

- A control element for starting the cutting process
- A control element for stopping the cutting process
- A control element for reversing the direction of cutting blade movement

Test:

Functional test

4.7.3.5 The following functions must be displayed on the radio transmitter:

- Cutting process in progress
- Cutting process ended
- Cutting process not properly carried out
- Cutting blade has reached its start position

Test:

Functional test

5 Component 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. These tests are to be performed on each cable cutting device.

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 Visual inspection

Test according to DIN EN 50340:2011-04; Section 5.2.

5.2 Testing of the safety valve

Test according to DIN EN 50340:2011-04; Section 5.11.