DGUV Test
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Translation

Principles of testing and certification for hand-held, power-driven cutting / pressing tools for electrical installation material

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These Principles of testing serve as verification that, in connection with 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 testing and certification body of the committee for electrical engineering.

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 hand-held, power-driven cutting / pressing tools.

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

Changes with respect to Issue 2006-08:

Fundamental revision

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1 General

1.1 Scope

1.1.1 These Principles apply to hand-held, power-driven cutting / pressing tools used at building and assembly sites for the processing of electrical installation material.

1.1.2 These Principles of testing do not contain any requirements for hand-held cutting / pressing tools operated by human energy or for stationary cutting / pressing machinery.

1.1.3 These Principles are applicable for cutting / pressing tools operated solely from a mains or battery power source. In addition, the requirements in DIN EN 60745-1, Annex L must be taken into consideration when a battery-operated cutting / pressing tool can also be operated in parallel on the grid via a power supply.

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 3.2 is to be submitted together with the contract.

A complete, functional cutting / pressing tool is to be made available at the time design testing is to be carried out. All special tools necessary for the assembly and disassembly of components must be made available.

Moreover, if the cutting / pressing tool is comprised of different modules or assemblies, these components must also be made available.

If necessary, the testing facility may request diverse materials for processing from the equipment manufacturer.

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 ISO 1402	Rubber and plastics hoses and hose assemblies - Hydrostatic testing
DIN EN ISO 6507-1	Metallic materials - Vickers hardness test - Part 1: Test method
DIN EN ISO 6803	Rubber or plastics hoses and hose assemblies - Hydraulic-pressure impulse test without flexing
DIN EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
DIN EN ISO 13857	Safety of machinery - Safety distances to prevent hazard zones from being reached by upper and lower limbs
DIN EN 349	Safety of machinery - Minimum gaps to avoid crushing of parts of the human body
DIN EN 853	Rubber hoses and hose assemblies - Wire braid reinforced hydraulic type - Specification
DIN EN 854	Rubber hoses and hose assemblies - Textile reinforced hydraulic type - Specification
DIN EN 855	Plastic hoses and hose assemblies - Thermoplastics textile reinforced hydraulic type - Specification
DIN EN 856	Rubber hoses and hose assemblies - Rubber-covered spiral wire reinforced hydraulic type - Specification

DIN EN 857	Rubber hoses and hose assemblies - Wire braid reinforced compact type for hydraulic applications - Specification
DIN EN 982	Safety of machinery - Safety requirements for fluid power systems and their components - Hydraulics
DIN EN 1037	Safety of machinery - Prevention of unexpected start-up
DIN EN 60335-2-29	Household and similar electrical appliances - Safety - Particular requirements for battery chargers
DIN EN 60745-1	Hand-held motor-operated electric tools - Safety - Part 1: General requirements
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
DIN EN 61029-1	Safety of transportable motor-operated electric tools - Part 1: General requirements

2 Terms

2.1 Hand-held, power-driven pressing tool

An electro-hydraulically driven, hand-held device for attaching cable terminal lugs or connecting cable ends.

It can be comprised of multiple components (component design), whereby the drive unit is transportable or consists of one unit (compact design).

2.2 Hand-held, power-driven cutting tool

An electro-hydraulically driven, hand-held device for cutting electrical installation materials, such as cables, stranded conductors, mounting rails and stud bolts, as well as for punching holes.
It can be comprised of multiple components (component design), whereby the drive unit is transportable or consists of one unit (compact design).

2.3 Compact design

Designation for a cutting / pressing tool, in which the drive unit, hydraulic components and working head form one unit, and which is held in the hand during the work process (Fig. 1).

Fig. 1: Compact design example

2.4 Component design

Designation for a cutting / pressing tool that is essentially comprised of a working head, hydraulic hose line and pump assemblies, and whose working head, alone, is held in the hand during the work process (Fig. 2).

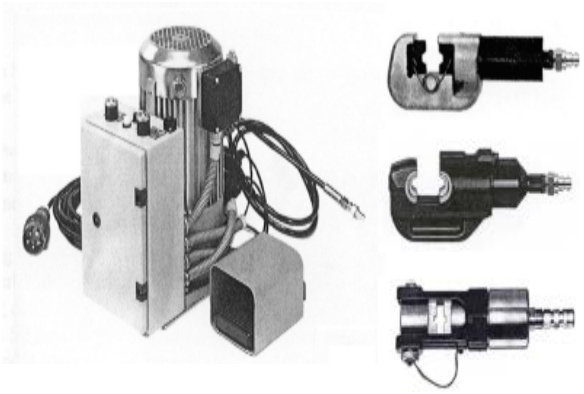

Fig. 2: Example of component design

2.5 Electrical installation material

Semi-finished products and elements used to build or maintain electrical equipment, assemblies and systems.

2.6 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.

2.7 Hydraulic hose line

Pressure-tight, direct connection between the working head and pump, comprised of a hose and hose fittings.

2.8 Pump

The device component that generates hydraulic fluid pressure in the hose line for driving the working head.

2.9 Reversing valve

Opens the hydraulic fluid return flow path from the pressure chamber to the reservoir chamber.

2.10 Maximum operating pressure

Operating pressure specified by the manufacturer that must not be exceeded while operating the cutting / pressing tool.

Note: This pressure is normally determined by the safety valve.

2.11 Bend/kink protection

Prevents the line-end bending radius from falling below specified minimums.

2.12 Hydraulic connecting element

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

2.13 Test object

The cutting / pressing tool in component or compact design, including the power supply equipment provided by the manufacturer.

2.14 Type test

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

3 Test conditions

3.1 General

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

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

Testing of the requirements according to:

Sec. 4.1.11.6 (Safety valve: compact / component design)

Sec. 4.7.1, Sec. 4.7.2 (Additional requirements for pressing tools: temperature influences/resistance)

Sec. 4.8.1, Sec. 4.8.3 (Additional requirements for cutting tools: temperature influences/resistance)

is to be carried out at the end of the type testing process, as this testing can cause changes in the function and device characteristics that may influence other test results. Additional test objects may be used for this testing if necessary.

The sequence used for the remaining tests is arbitrary.

Testing is to be carried out on one test object.

Testing of the electrical equipment should be carried out on an additional test object.

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 hydraulic fluid
- Engineering drawings
- Calculation verification for pressure-volume-product on the basis of the Pressure Equipment Directive
- Data sheet for the hydraulic connecting elements (fittings)
- Data sheet for the hydraulic hose
- Manufacturer's declaration related to PAH contamination, or data sheets for the materials that may come into contact with the skin, if applicable.
- Data sheet for the drive unit

4 Requirements and testing

4.1 General requirements

4.1.1 External materials and properties

4.1.1.1 Parts that may come in contact with the operator's skin during usage 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).

4.1.1.2 Device components accessible by hand must not have any sharp corners, edges or abrasive surfaces that could cause injury.

Test:

Visual inspection and handling check

4.1.2 Operator interface

4.1.2.1 Switching off the drive unit

It must be possible to switch off the drive unit at any time (Stop category 0) by means of an operator interface (e.g. push-button or switch).

4.1.2.2 Unintentional actuation

Actuating elements used to initiate potentially hazardous movements must be protected against unintentional activation.

Either:

it must not be possible to actuate the device by positioning a 100 ± 1mm diameter ball perpendicular to the device surface onto the switch and the gripping surface directly behind or in front of the switch must be at least 70 mm long,

or

actuation of the switch must require two distinct and separate actions.

Test:

Visual inspection, measurement and handling check

4.1.2.3 Marking of operator interfaces

Operator interfaces (e.g. push-button or switch) must be clearly, unmistakably and permanently marked based upon DIN EN 60204-1: 2007, Sec. 10.2 provisions. Operator interfaces must be arranged for easy access for operation and maintenance. The method of assembly must minimize the possibility of damage, such as could be incurred during transport.

Test:

Visual inspection and wipe test in accordance with DIN EN 60745-1, Sec. 8.13 or DIN EN 61029-1, Sec. 7.9 (depending on design type).

4.1.3 Charging devices

If charging units are to be included in the testing process, these must comply with the requirements of DIN EN 60335-2-29.

Test:

According to DIN EN 60335-2-29

4.1.4 Electromagnetic compatibility

If the drive unit falls within the scope of application of the EMC Directive, it must be designed in such a manner that the protection requirements in the Directive are complied with.

Note:
Application of the EMC Directive is normally not necessary if passive components (lamps, batteries, capacitors, coils, diodes) are used exclusively.

Test:

If the EMC Directive is relevant, then according to DIN EN 61000-6-2 and DIN EN 61000-6-3

Remark 1:
In the event of a pure battery operation, testing of conducted transients is not necessary.

Remark 2:
If it cannot be estimated whether the device maintains the interference emission limit values, measurement of the radiated transient emissions should be made on an individual basis.

Remark 3:
ESD-testing and testing for radiated transient emissions become relevant when active electronics are involved.

4.1.5 Closing speed

The greatest resulting closing speed for the tool's individual inner edges must not exceed 10 mm/s.

Test:

Measurement

4.1.6 Overrun traverse

The greatest resulting overrun traverse for the tool's individual inner edges must not exceed 2 mm.

Test:

Measurement of the overrun traverse without back-pressure on the tool inserts.

4.1.7 Motion reversal

If a motion reversal of the tool inserts (reversing) is initiated due to an interruption of the closing motion, then the inserts must automatically retract far enough so the part can be removed.

Test:

Functional test

4.1.8 Handling of the working head

The working head must be designed in such a manner that a secure insertion of the material being processed is warranted.

Test: Handling check

4.1.9 Mechanical hazards

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

Test:

Visual inspection, measurement and handling check (values according to DIN EN 349 or DIN EN ISO 13857)

4.1.10 Hydraulic fluid

4.1.10.1 Hazardous substances

The hydraulic fluid must not contain any polychlorinated biphenyls (PCB) and/or polychlorinated tophenyls (PCT).

Test:

Check the safety data sheet

4.1.11 Hydraulic unit

4.1.11.1 Application of the Pressure Equipment Directive (97/23/EC)

With consideration given to Article 1, Sec. 3.6 in conjunction with Articles 3 and 9, the Pressure Equipment Directive should be reviewed beforehand to determine whether parts of the cutting / pressing tool fall within the scope of this Directive's application.

Test, if applicable:

Check the manufacturer's supporting documentation accordingly with consideration given to the relevant category according to the Pressure Equipment Directive.

4.1.11.2 Integral components

The pump must comprise the components listed below as a minimum:

- Pump unit
- Reservoir tank
- Safety valve
- Reversing valve

Standard hydraulic parts must be configured for the designated operational purpose.

Test:

Review and check parts lists and circuit diagrams and, if necessary, check for conformity of the manufacturer's specifications with the hydraulic component specifications prescribed in the standards.

4.1.11.3 Reversing valve

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

Test:

Visual inspection and handling check

4.1.11.4 Safety valve

In the event of excess operating pressure in the pressure chamber, the safety valve must divert the hydraulic fluid to the reservoir chamber and then automatically close once the operating pressure falls below its limit value.

Test:

The test is to be carried out on a ready-for-use hydraulic unit.

A calibrated pressure gauge should be connected to the pump connecting element.

The pump should be actuated until the safety valve responds. The safety valve's switching pressure can then be read off the calibrated pressure gauge. The test cycle should be repeated four times.

A visual inspection will reveal whether hydraulic fluid has leaked out.

The test has been passed when:

- the safety valve's switching pressure does not exceed the operating pressure and
- there is no hydraulic fluid leakage.

4.1.11.5 Automatic shutdown of the pump

Following the response of the safety valve, the pump must shutdown automatically or the safety valve must remain open until the pump can be manually switched off.

Test:

Check the circuit documentation, functional test

4.1.11.6 Manual shutdown of the pump

It must be possible to switch off the pump at any time via a command device.

Test:

Check the circuit documentation, functional test

4.1.11.7 Pressure setting

Mechanisms for setting operating pressure must be protected with a cover/plate or enclosed with a fixture that can only be removed by a tool.

Test:

Visual inspection and/or handling check

4.2 Instruction manual

Each cutting / pressing tool must be accompanied by an Instruction manual in German and comprehensible to a level that can realistically be expected of the user. It must contain all the information necessary for handling, servicing and assembly of the device.

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

The following list of details must be included (refer additionally to Sec. 4.4 and/or 4.5 or Sec. 4.6 for information required for mains-powered or battery-operated devices:

General specifications:

- Manufacturer's/authorised representative's name and complete address
- Machine designation/description
- CE-marking
- Year of manufacture
- Design series or type designation
- Rendering of the content found in the EC Declaration of Conformity
- Information as to the service and maintenance work that may be carried out by the operator
- All technical documentation related to the service and maintenance work that may be carried out by the operator

a) Explanation of the inscriptions

- Statement regarding operating pressure
- References to the meaning of the markings on the working head, hydraulic hose line and hydraulic unit (for component design)
- Explanation of the markings on the hydraulic hose and the hydraulic hose lines (for component design)

b) Description of the cutting / pressing tool

- Description of the components; working head, hydraulic hose line and hydraulic unit (for component design)
- Listing of the technical specifications (including weight specifications and emitted sound pressure level, as well as the vibration total value for the upper limbs)
- Description of the actuating and monitoring equipment (charge status)
- Description of the connecting elements (if applicable)
- Information regarding suitable hydraulic fluid

c) Instructions regarding proper handling

- Information regarding the scope of application
- Instructions regarding proper usage
- Information regarding admissible temperature and environmental influences when using the device
- Description of the work process as well as the safe and proper handling of the cutting / pressing tool
- Notice regarding proper handling during assembly and loosening of the individual parts with the aid of connecting elements
- Correlation of the tool inserts to the working heads and to the material being processed
- Instructions regarding the safe exchange of the tool inserts and the working head, if applicable
- Information regarding the largest material cutting diameter or the greatest material thickness for punching tools, as well as the types of materials to be processed (with strength values if applicable)
- Instructions regarding the intervals for replacing the hydraulic fluid, how this is to be carried out and what hydraulic fluid should be used

- Description of the insulating fluid filling process
- Notice regarding the approved replacement of parts by the user
- Instructions regarding safety-relevant actions in the event of a malfunction, such as when the cutting / pressing process cannot be properly completed according to the Instruction manual, when the cutting head is damaged during the cutting / pressing process or when hydraulic fluid is leaking.
- Warning notice regarding the potential for improper usage of the cutting / pressing tool as determined from practical experience
- Information regarding residual risks
- Information regarding storage and transport

Test:

Check the Instruction manual for completeness of the requirements mentioned above

4.3 Sales literature

If sales literature is available, it 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.

4.4 Additional requirements for hand held, mains-powered drive units

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 specifications	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

Reference standard	Section	Requirement	Section	Test
DIN EN 60745-1	8.15	Fuse markings	8.15	Visual inspection
DIN EN 60745-1	**9**	**Protection against access to live 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
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 prolonged 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
Reference standard	**Section**	**Requirement**	**Section**	**Test**
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
DIN EN 60745-1	21.17	Switches and reset buttons on non-self-resetting control units	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 dual insulation and reinforced insulation
DIN EN 60745-1	21.28	Isolation through protective impedance	21.28	Test as established for dual insulation and reinforced insulation
DIN EN 60745-1	21.30	Spindles must be inactive if they can be accessed when removing parts	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 wiring**		
DIN EN 60745-1	22.1	Cable path properties	22.1	Visual inspection
DIN EN 60745-1	22.2	Internal wiring and electrical connection protection	22.2	Visual inspection
DIN EN 60745-1	22.3	Air gaps and creepage distances with internal wiring	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 wiring usage	22.5	Visual inspection
DIN EN 60745-1	22.6	Stabilization 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
Reference standard	**Section**	**Requirement**	**Section**	**Test**
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 applicable standard Test according to inscription
DIN EN 60745-1	23.1.8	Individual part without an applicable standard or whose usage does not correspond to the inscription	23.1.8	Test based on conditions corresponding to electric tooling
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	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
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 cables**		
DIN EN 60745-1	24.1	Type of equipment	24.1	Visual inspection, tensile test for interlocking devices 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	Stabilization of conductor	24.7	Visual inspection
DIN EN 60745-1	24.8	Wiring adaptation	24.8	Visual inspection
DIN EN 60745-1	24.9	Requirements related to 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 fixture	24.14	Visual inspection, test according to 24.14
DIN EN 60745-1	24.15	Strain relief fixture configuration	24.15	Visual inspection
DIN EN 60745-1	24.16	Strain relief fixture 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 fixture 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	Equipment plug configuration	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

Reference standard	Section	Requirement	Section	Test
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 at two-thirds 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	Plug socket connecting terminal configuration	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	Secure 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
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 related 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 related to insulation between metal parts	28.1	Visual inspection and measurement
DIN EN 60745-1	**29**	**Heat and fire resistance, tracking resistance**		
DIN EN 60745-1	29.1	Condition deterioration of external and holding parts	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	Tracking resistance of insulating materials	29.3	Test tracking 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

4.5 Additional requirements for transportable, mains-powered drive units

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 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	7.7	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
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 connection type with more than two power supplies	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 parts strength	8.2	Visual inspection, manual check, test according to Sec. 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	Performance with proper usage	11.1	Measure 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	Performance 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
Reference standard	**Section**	**Requirement**	**Section**	**Test**
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	Performance with prolonged 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
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	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 check
DIN EN 61029-1	**21**	**Internal wiring**		
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 wiring 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 applicable standard
Reference standard	**Section**	**Requirement**	**Section**	**Test**
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	Radio and television proximity 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 cables**		
DIN EN 61029-1	23.1	Requirements related to mains connection	23.1	Visual inspection, test finger, gauge 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 applicable standard	23.3	Check data sheet
DIN EN 61029-1	23.4	Rated cross-section for permanently attached flexible cables	24.4	Visual inspection
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 check
DIN EN 61029-1	24.6	Connecting terminals on electric tools up to 16A rated current	24.6	Visual inspection of 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 applicable standard	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
Reference standard	**Section**	**Requirement**	**Section**	**Test**
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	Screw contact length 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 related 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 related 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
DIN EN 61029-1	**28**	**Heat and fire resistance, tracking 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 live parts in position.	28.2	Test according to 28.2
DIN EN 61029-1	28.3	Tracking 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

4.6 Additional requirements for battery-operated drive units

4.6.1 General requirements for battery-operated drive units

4.6.1.1 Operating voltage

The maximum operating voltage must not exceed 24 V.

Test:

Check the technical specifications and inscriptions

4.6.1.2 False polarity

Storage batteries must be designed in such a manner that false polarity upon insertion into the pump is not possible.

Test:

Visual inspection and handling check

4.6.1.3 Connection contacts

Storage battery connection contacts must be configured in such a manner that short-circuiting upon insertion into the pump is not possible.

Test:

Visual inspection and handling check

4.6.1.4 Electrolyte

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

Test:

The drive unit should be placed in all possible positions in which 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.

4.6.1.5 Battery inserts

Battery inserts must comply with the requirements of DIN EN 62133: 2003 or DIN IEC 62133: 2008.

Test:

Verification of external certificates

4.6.2 Additional requirements for hand-held, battery-operated drive units

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-operated 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 specifications	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
Reference standard	**Section**	**Requirement**	**Section**	**Test**
DIN EN 60745-1	K8.12.1.1	General safety instructions for battery-operated 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 live 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-operated 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
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-self-resetting control units	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 wiring**		
DIN EN 60745-1	22.1	Cable path properties	22.1	Visual inspection

Reference standard	Section	Requirement	Section	Test
DIN EN 60745-1	22.2	Internal wiring and electrical connection protection	22.2	Visual inspection
DIN EN 60745-1	22.5	Aluminium wiring usage	22.5	Visual inspection
DIN EN 60745-1	22.6	Stabilization 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 applicable standard Test according to inscription
DIN EN 60745-1	23.1.8	Individual part without an applicable standard or whose usage does not correspond to the inscription	23.1.8	Test based on conditions corresponding to electric tooling
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 cables**		
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 related to insulation**		
DIN EN 60745-1	K28.1	Minimum values	28.1	Measurement, Table K2
DIN EN 60745-1	**29**	**Heat and fire resistance, tracking 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

4.6.3 Additional requirements for hand-held, battery-operated drive units

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 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	Performance 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	Performance with prolonged 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
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
Reference standard	**Section**	**Requirement**	**Section**	**Test**
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 check
DIN EN 61029-1	**21**	**Internal wiring**		
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 wiring 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 applicable standard
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
DIN EN 61029-1	**27**	**Air gaps and creepage distances, clearance distances related 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, tracking 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 live parts in position.	28.2	Test according to 28.2
DIN EN 61029-1	**29**	**Rust protection**	29	Test according to 29

4.7 Additional requirements for pressing tools

4.7.1 Temperature influences

When cable pressing tools are properly used as intended, it must be possible to work safely within the temperature range specified by the manufacturer.

Test:

The test is to be carried out on a ready-for-use cable pressing tool.

The cable pressing tool should be stored in a climatic exposure test cabinet for 48 hours at the maximum temperature ± 2 K specified by the manufacturer.

Upon removing the cable pressing tool from the climatic exposure test cabinet, tool inserts for the largest cable cross-section should be inserted and the pressing process carried out according to the Instruction manual, within 2 minutes after removal from the cabinet and at an ambient temperature of +20° C ± 2 K.

The test should be repeated after a storage time of 48 hours at the minimum temperature specified by the manufacturer.

The test has been passed when all pressing processes have been properly completed according to the Instruction manual, there is no leakage of hydraulic fluid and no obvious damage has been detected, which could impair the safety or handling of the device.

4.7.2 Working head / pump strength

The working head and the pressurized section of the pump must withstand the forces they are subjected to during operation without endangering the operator, even when the safety valve does not open.

Test:

Load testing as follows:

Load testing is to be carried out one time with the maximum output from the hydraulic unit. The processing step is carried out at this pressure using material prescribed by the manufacturer (if applicable, the material's most unfavourable mechanical position should be selected in the working head). The processing step should be carried out using the presumably most heavily stressed pressing insert.

The device should remain exposed to this loading for 1 min.

With the load applied, there must be no part spalling or blistering and no leakage of hydraulic fluid.

4.7.3 Additional inscriptions

Tool inserts

- Manufacturer's identification mark
- Type designation
- Size specifications / Pressing cross-sections
- With punching tools: Maximum steel sheet cutting thickness (mm) with material tensile strength specifications, if other than 390 Mpa (390N/ mm^2).

Test:

Test in accordance with Sec. 7.9, DIN EN 61029-1 or Sec. 8.13, DIN EN 60745-1 (depending on design type)

4.8 Additional requirements for cutting tools

4.8.1 Temperature influences

When cutting tools are properly used as intended, it must be possible to work safely within the temperature range specified by the manufacturer.

Test:

The test is to be carried out on a ready-for-use cutting tool.

The cutting tool should be stored in a climatic exposure test cabinet at +40° C or at the maximum temperature ± 2 K specified by the manufacturer.

One layer of steel band ST 37, 1 mm thick and 60 mm wide, should be wound cylindrically around a rod made of HDPE with a thickness of 0.94g/cm^3, an ultimate elongation of 450% ± 50% and a diameter of 50% of the maximum cutting diameter. The steel band should be secured against slippage.

Further tool inserts are to be tested at the maximum material dimensions and maximum strength using materials defined according to manufacturer specifications.

Upon removing the cutting tool from the climatic exposure test cabinet and at an ambient temperature of +20° C ± 2 K, the prepared rod or the appropriate material should be inserted into the cutting head in such a manner that both sides extend at least 100 mm over the blade(s) and the steel band is positioned centred at the cutting level.

The cutting process should be carried out according to the Information manual within 2 minutes of the removal from the climatic exposure test cabinet.

The test should be repeated after a storage time of 48 hours at the minimum temperature ± 2 K specified by the manufacturer.

The test has been passed when all cutting processes have been properly completed according to the Instruction manual, there is no leakage of hydraulic fluid and no obvious damage has been detected, which could impair the safety or handling of the device.

4.8.2 Cutting range

When properly used, the cutting head must be able to accept all cables up to largest admissible diameter specified by the manufacturer.

Test:

Measurement

4.8.3 Working head / pump strength

The working head and the pressurized section of the pump must withstand the forces they are subjected to during operation without endangering the operator, even when the safety valve does not open.

Test:

Load testing as follows:

Load testing is to be carried out one time with the maximum output from the hydraulic unit. A processing step, whereby the cutting blade is driven to and remains in the end position, is simulated at this pressure.

The device should remain exposed to this loading for 1 min.

With the load applied, there must be no part spalling or blistering and no leakage of hydraulic fluid.

4.9 Additional requirements for cutting and pressing tools in compact design

4.9.1 Grip design

Gripping elements on the compact cutting / pressing tool must be designed in such a manner that safe handling during the work process is warranted.

Test:

Handling check

4.9.2 Configuration of the ON/OFF switching device

The actuating device for switching the cutting / pressing tool in compact design ON and OFF must be located in the grip element. In this context, it must be warranted that the tool can still be held securely while it is being turned OFF.

Test:

Handling check

4.9.3 Configuration of the reset device

The actuating device for resetting the tool inserts on the cutting / pressing tool in compact design must be configured in such a manner that it can be actuated with the same hand as that holding the tool.

Test:

Handling check

4.9.4 Holding device

Cutting / pressing tools in compact design weighing more than 5 kg must be outfitted with an attachment such as an eye bolt or an additional grip.

Test:

Visual inspection

4.9.5 Unit weight

The weight of the overall device must not exceed 15 kg.

Test:

Measurement

4.9.6 Additional inscriptions

The following inscriptions as a minimum must be affixed to the cutting / pressing tool in compact design:

- General specifications and, for electrical power supplies, (refer to Sec. 4.4 or 4.6.2)
- CE marking identification of the related cutting / pressing tool type(s) with which the pump(s) can be used.

Test:

Test in accordance with Sec. 8.13, DIN EN 60745-1

4.10 Additional requirements for cutting and pressing tools in component design

4.10.1 Carrying handles

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

Test:

Visual inspection and handling check

4.10.2 Unit weight

Transportable drive units must not exceed a maximum weight of 20 Kg.

Test:

Weigh the drive unit

4.10.3 Working head

4.10.3.1 Grip element

It must be warranted that the working head on the component design unit is designed in such a manner that it can be carried or held securely during the processing step.

Test:

Visual inspection and handling check

4.10.3.2 Working head weight

The weight of the working head must not exceed 15 kg.

Test:

Measurement

4.10.4 Hydraulic hose line

4.10.4.1 General

Hydraulic hose lines must be manufactured according to the requirements of the respective relevant standard.

Test:

Check the markings and the data sheet

If manufacturer specifications are not provided or if the hose line configuration is unclear, then at least the requirements should be met according to Sec. 4.10.4.2.

4.10.4.2 Compressive strength of the hose line

The hydraulic hose line must withstand a test pressure with a factor of 2 and a burst pressure with a factor of 4, as well as 100,000 impulses at an impulse pressure of 133% of the admissible operating pressure.

Test:

The hydraulic hose line should be tested according to DIN EN ISO 1402 and DIN EN ISO 6803. The test has been passed when the values above are maintained.

4.10.4.3 Minimum length of the hose line

The hydraulic hose line must be at least 3,000 mm long.

Test:

Measurement

4.10.5 Hydraulic connecting elements

The connecting elements, once connected, must not inadvertently loosen and must remain pressure-tight and leak-tight in both the connected as well as disconnected states.

Test:

Handling check

4.10.6 Accessibility of command devices

The operator in working position must be able to reach all command devices to initiate, interrupt and reset the work process without removing a hand from the working head. The use of a foot switch is also an option for component design configurations.

Test:

Functional test

4.10.7 Foot switch

When a foot switch is used as a command device, it must be configured with at least three switch positions and feature the following functions:

Step	Position	Function
I:	not actuated	STOP (no closing motion)
II: (middle position)	actuated	initiates the closing motion
III:	depressed	STOP (no closing or reversing motion)

Test:

Functional test

4.10.8 Stability under load

When properly used, the hydraulic unit must demonstrate sufficient stability under load.

Test:

The test is to be carried out on a ready-for-use cutting and pressing tool.

The hydraulic unit should be positioned on a 15° inclined, form-stable and flat base covered with an isolating mat in accordance with IEC 61111, Class 0. The hydraulic hose line and working head should be arranged in such a manner that the test will not be adversely influenced.

The work process should be carried out according to the Instruction manual.

Following a self-resetting of the tool inserts, the ready-for-use hydraulic unit should be turned on the base 90° in the same direction, with the work process cycle being repeated until once again reaching the start position.

The test has been passed when the safety valve has triggered in all four actuating positions without the pump overturning or dislodging from its operative position to the degree that the work process is impaired.

4.10.9 Additional inscriptions

The following inscriptions must be affixed as a minimum to the cutting / pressing tool in component design:

On the working head:

- Indication of origin (manufacturer's name or trademark)
- Year of manufacture
- Type designation
- Serial number
- Maximum operating pressure

On the hydraulic hose at spacing intervals of not greater than 50 cm:

Markings appropriate to the relevant standard for hydraulic hose used. Marked as a minimum with:

- Name or identifying mark of the manufacturer
- Standard specifications if applicable
- Type
- Nominal diameter
- Quarter and last two digits of the year of manufacture

At one location on the hydraulic hose line (preferably on the fitting):

Markings appropriate to the relevant standard for the hydraulic hose line used. Marked as a minimum with:

- Name and identifying mark of the manufacturer
- Max. hose line operating pressure in bar
- Each with the last two digits of the year and month of manufacture.

On the pump:

- General specifications and, for electrical power supplies, (refer to Sec. 4.5 or 4.6.3).
- Maximum operating pressure
- CE marking
- Identification of the related cutting / pressing tool type(s), with which the pump(s) can be used.

Test:

Test in accordance with Sec. 7.9, DIN EN 61029-1

5 Routine 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 cutting / pressing tool.

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 in the following section.

Test:

Review of the test protocol or test instructions for component testing

5.1 Functional test

The function of all control elements is to be tested for conformity with the specifications in the Instruction manual.

5.2 Operating pressure/max. work force testing

It must be ensured through suitable measures that the operating pressure/max. work force is not exceeded.

5.3 Electrical testing of cutting / pressing tools

5.3.1 Protective conductor connectors (only for Protection class I devices)

A test of continuity is to be carried out between the protective conductor connecting point on the one side, and all accessible conducting parts (connection terminals, mains plugs and equipment connectors), which could be exposed to voltage in the event of a fault and therefore must be connected with the protective conductor, on the other. The test procedures selected must ensure that the maximum admissible protective conductor resistance of 0.3 Ohm is warranted.

This is valid for connecting lines up to a length of 5 m plus 0.12 Ohm for each additional 5 m (reference: Annex N4, DIN EN 60745-1).

5.3.2 Dielectric strength

A test voltage (sinusoidal voltage / 50 Hz) should be applied for 3 s according to the table below between the live parts on the one side, and accessible metallic parts that could be exposed to voltage in the event of an insulation fault or related to assembly under voltage (non-accessible metallic parts in Protection class II devices) on the other.

There must be no dielectric breakdown or flashover occurring during the test.

Application of test voltage	Test voltage		
	Electric tools in Protection class III	Electric tools in Protection class II	Electric tools in Protection class I
Atop basic insulation	400V AC	1000V AC	1000V AC
Atop dual insulation or reinforced insulation	-	2500V AC	-

Annex 1: Information regarding contract preparation

DGUV Test Prüf- und Zertifizierungsstelle Fachausschuss Elektrotechnik	Information related to contract preparation **- Hand-held, power-driven cutting / pressing tools -**	Company:

Product identification information	
Product nomenclature	
Type	
Structural shape	Compact ☐ Components ☐
Product variants available? Battery / Mains powered	yes ☐ / no ☐
Variant matrix attached? Pumps / Working heads	yes ☐ / no ☐

Test specification(s) and parameters to be used according to test specification(s)	
EMC certification according to EMC Directives	Required ☐ / Not required ☐
Hydraulic hose line compressive strength Burst pressure / Impulse pressure DIN EN ISO 1402 and DIN EN ISO 6803	Required ☐ / Not required ☐

Test reports provided by external accredited test bodies for…	*attached*	*will be submitted*	*Testing not external*
Electromagnetic compatibility	☐	by	☐
Hydraulic hose line compressive strength Burst pressure / Impulse pressure	☐	by	☐
Vibration measurement for the upper limbs	☐	by	☐
Noise measurement	☐	by	☐
PAH	☐	by	☐

DGUV Test Prüf- und Zertifizierungsstelle Fachausschuss Elektrotechnik	Information related to contract preparation **- Hand-held, power-driven cutting / pressing tools -**	Company:
Documentation to be submitted	*attached*	*will be submitted*
Instruction manual	☐	by
Sales literature	☐	by
Circuit diagram(s) (hydraulic/electric)	☐	by
Printed circuit board-layout(s), as required	☐	by
Declaration of Conformity	☐	by
Parts list(s)	☐	by
Data sheets for hydraulic connecting elements	☐	by
Engineering drawings	☐	by
Data sheet for hydraulic fluid	☐	by
Calculation verification for pressure-volume-product (Pressure Equipment Directive)	☐	by
Data sheet for the drive unit	☐	by

Test reports provided by external accredited test bodies for…	*attached*	*will be submitted*	*Testing not external*
Electromagnetic compatibility	☐	by	☐
Hydraulic hose line compressive strength Burst pressure / Impulse pressure	☐	by	☐
Vibration measurement for the upper limbs	☐	by	☐
Noise measurement	☐	by	☐
PAH	☐	by	☐

Test reports provided for tests performed under special agreement for…	*attached*	*will be submitted*
	☐	by
	☐	by

Note: In the interest of prompt order processing, it is essential that the information above be provided in its entirety!

_____ _____ _____

Date Name Signature