

● APPENDIX - REGULATIONS

In the modern industrial sector, safety is an issue of fundamental importance and relevance for companies all over the world.

Technological progress and the growing level of production automation make it necessary to devote more space and greater importance to the legal aspects of safety and its technical and legal implications.

To give substance to the focus on safety, TER designs and makes its products to comply with all the directives, requirements, recommendations and laws applicable in the industry and systematically subjects them to accurate, in-depth lab tests to check their conformity.

Directives and Regulations

2014/35/UE: Low voltage directive

The aim of the directive is to harmonize the provisions of Member States relating to safety and to potential health hazards of electric and electronic equipment operating within the rated voltage limits of 50 to 1000 V for alternating current and 75 to 1500 V for direct current, with the aim of ensuring that devices are not placed on the market if they can jeopardize the safety of people, pets or property.

2006/42/CE: Machinery directive

The Directive aims to ensure free circulation of machines and their accessories, while at the same time setting out essential requirements for the health and safety of workers and consumers

EN 60204-1 Safety of Machinery - Electrical equipment of machines

The Standard provides requirements and recommendations relating to the electrical equipment of machines so as to promote safety of persons and property, consistency of control response, ease of maintenance. It applies to the application of electrical, electronic and electronic programmable equipment and systems to machines working together in a co-ordinated manner. The equipment covered by this standard commences at the point of connection of the supply to the electrical equipment of the machine.

Part 1 of Standard 60204 is applicable to the electrical equipment or parts of the electrical equipment that operate with nominal supply voltages not exceeding 1000 V for alternating current and not exceeding 1500 V for direct current, and with nominal frequencies not exceeding 200 Hz. It does not cover all the requirements (e.g. guarding, interlocking, or control) that are needed or required by other standards or regulations in order to safeguard persons from hazards other than electrical hazards.

EN 60204-32 Safety of Machinery - Electrical equipment of machines - Requirements for hoisting machines

Part 32 of Standard 60204 applies to the application of electrical and electronic equipment and systems to hoisting machines not exceeding 1000 V for alternating current or 1500 V for direct current between lines and with nominal frequencies not exceeding 200 Hz.

For the purposes of this standard, hoisting machines include cranes of all types, winches of all types, and storage and retrieval machines. The Standard does not cover machines for lifting and transporting people.

The second edition is adapted to the changes introduced in Part 1 published in 2006 and amends the paragraph on wireless controls.

EN 60947-1 Low-voltage switchgear and controlgear

The purpose of Part 1 of Standard 60947 to harmonize all rules and requirements of a general nature applicable to low-voltage switchgear and controlgear in order to obtain uniformity of requirements and tests throughout the corresponding range of equipment and to avoid the need for testing to different standards.

The Standard sets out general rules and requirements which are common to low-voltage equipment including, for example, definitions, characteristics, information, normal service, mounting and transport conditions, constructional and performance requirements, verification of characteristics and performance.

This standard applies, when required by the relevant product standard, to switchgear and controlgear intended to be connected to circuits, the rated voltage of which does not exceed 1000 V for alternating current or 1500 V for direct current.

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EN 60947-3 Low-voltage switchgear and controlgear - Switches, disconnectors, switch-disconnectors and fuse-combination units

Part 3 of Standard 60947 applies to switches, disconnectors, switch-disconnectors and fuse-combination units to be used in distribution circuits and motor circuits of which the rated voltage does not exceed 1000 V for alternating current or 1500 V for direct current.

The Standard does not apply to equipment coming within the scope of EN/IEC 60947-2, EN/IEC 60947-4-1 and EN/IEC 60947-5-1; however, when switches and fuse-combination units coming into the scope of this Standard are normally used to start, accelerate and/or stop an individual motor they shall also comply with the additional requirements given in Annex A. The requirements for single-pole-operated three-pole switches are included in Annex C. Auxiliary switches fitted to equipment within the scope of this Standard shall comply with the requirements of EN/IEC 60947-5-1.

EN 60947-5-1 Low-voltage switchgear and controlgear - Control circuit devices and switching elements - Electromechanical control circuit devices

Part 5-1 of Standard 60947 applies to control circuit devices and switching elements intended for controlling, signalling, interlocking, etc., of switchgear and controlgear. It applies to control circuit devices having a rated voltage not exceeding 1000 V for alternate current or 600 V for direct current.

EN 60947-5-5 Low-voltage equipment - Control circuit devices and switching elements - Electrical emergency stop device with mechanical latching function

Part 5-5 of Standard 60947 provides detailed specifications relating to the electrical and mechanical construction of emergency stop devices with mechanical latching function and to their testing. This standard is applicable to electrical control circuit devices and switching elements which are used to initiate an emergency stop signal. This standard does not apply to emergency stop devices for non-electrical control circuit, nor to those without mechanical latching function.

EN 60529 Degrees of protection provided by enclosures

This Standard describes a system for classifying the degrees of protection provided by the enclosures of electrical equipment with a rated voltage not exceeding 72.5 kV.

The object of this Standard is to give definitions for degrees of protection provided by enclosures of electrical equipment, designations for these degrees of protection, requirements for each designation and tests to be performed.

EN 418

Standard EN 418 concern Safety of Machinery and functional aspects. The Standard sets out principles for the design of emergency stop devices on machines.

ISO 13850 Safety of Machinery - Emergency stop - Principles for design

The Standard specifies functional requirements and design principles for the emergency stop function on machinery, independent of the type of energy used.

Regulation for prevention of injury BGV C 1 (only for Germany)

The Regulation describes how the protection objectives set out by the accident prevention standards can be achieved. This regulation does not exclude other equally safe solutions, required by other member states of the European Union.

CAN/CSA-C22.2 No 14-13 - Industrial control equipment

CSA C22.2 No. 14 is one of a series of standards under Part II of the Canadian Electrical Code. This standard applies to control and protective devices, and accessory devices, rated at not more than 1500 V, for starting, stopping, regulating, controlling, or protecting electric motors, generators, heating apparatus, or other equipment used to control an industrial process that is intended to be installed and used in non-hazardous locations in accordance with the rules of the CE Code, Part I.

UL 508 - Industrial control equipment

These requirements cover industrial control devices, and devices accessory there to, for starting, stopping, regulating, controlling, or protecting electric motors. These requirements also cover industrial control devices or systems that store or process information and are provided with an output motor control function(s). This equipment is for use in ordinary locations in accordance with the National Electrical Code, NFPA 70.

Test

Mechanical duration test

The test checks the efficiency of a component during operation and under given conditions of use.

Test on mechanical properties of terminals

- Sturdiness test
- Damage test
- Pull test
- Checking access to conductors

All the parts of the terminals that ensure contact and that convey current shall be metal with adequate mechanical strength. Terminal connections must be such that the conductors can be connected by means of screws, springs or other equivalent means to guarantee that the necessary contact strength is maintained. The terminals must be constructed so that they may be fixed between metal surfaces in a way that will prevent significant damage to the conductor or to the terminal. The terminals must not allow the conductors to move or change their mutual position in a way that would affect the operation of the equipment and they must ensure that the insulation voltage does not drop below the rated values.

The above tests are carried out to verify the requirements indicated.

IP code protection degree

Standard 60529 classifies and evaluates the degree of protection provided by enclosures for electrical equipment with a rated voltage not exceeding 72.5 kV, ingress of solid foreign objects (such as body parts and dust) and liquids. The Standard describes the various tests which the electrical equipment must pass depending on the IP degree.

| First digit | Description |
|-------------|--|
| 0 | Non protected |
| 1 | Protected against access to hazardous parts with the back of a hand and against solid foreign objects of 50 mm \varnothing and greater |
| 2 | Protected against access to hazardous parts with a finger and against solid foreign objects of 12.5 mm \varnothing and greater |
| 3 | Protected against access to hazardous parts with a tool and against solid foreign objects of 2,5 mm \varnothing and greater |
| 4 | Protected against access to hazardous parts with a wire and against solid foreign objects of 1 mm \varnothing and greater |
| 5 | Protected against access to hazardous parts with a wire and dust-protected |
| 6 | Protected against access to hazardous parts with a wire and dust-tight |

| Second digit | Description |
|--------------|--|
| 0 | Non protected |
| 1 | Protected against vertically falling water drops |
| 2 | Protected against vertically falling water drops when enclosure tilted up to 15° |
| 3 | Protected against spraying water |
| 4 | Protected against splashing water |
| 5 | Protected against water jets |
| 6 | Protected against powerful water jets |
| 7 | Protected against the effects of temporary immersion in water |
| 8 | Protected against the effects of continuous immersion in water |
| 9 - K | Protected against high-pressure, high-temperature water jets |

| IP degree | Description |
|-----------|---|
| IP44 | The access probe of 1.0 mm \varnothing shall not penetrate and the object probe of 1.00 mm \varnothing shall not penetrate at all. Water splashed against the enclosure from any direction shall have no harmful effects. |
| IP54 | The access probe of 1.0 mm \varnothing shall not penetrate and ingress of dust is not totally prevented, but dust shall not penetrate in a quantity to interfere with satisfactory operation of the apparatus or to impair safety. Water splashed against the enclosure from any direction shall have no harmful effects. |
| IP55 | The access probe of 1.0 mm \varnothing shall not penetrate and ingress of dust is not totally prevented, but dust shall not penetrate in a quantity to interfere with satisfactory operation of the apparatus or to impair safety. Water projected in jets against the enclosure from any direction shall have no harmful effects. |
| IP65 | The access probe of 1.0 mm \varnothing shall not penetrate and no ingress of dust. Water projected in jets against the enclosure from any direction shall have no harmful effects. |
| IP66 | The access probe of 1.0 mm \varnothing shall not penetrate and no ingress of dust. Water projected in powerful jets against the enclosure from any direction shall have no harmful effects |
| IP67 | The access probe of 1.0 mm \varnothing shall not penetrate and no ingress of dust. Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is temporarily immersed in water under standardized conditions of pressure and time. |
| IP68 | The access probe of 1.0 mm \varnothing shall not penetrate and no ingress of dust. Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is continuously immersed in water under conditions which shall be agreed between manufacturer and user but which are more severe than for numeral 7. |
| IP69 - K | The access probe of 1.0 mm \varnothing shall not penetrate and no ingress of dust. Protection against high-pressure, high-temperature water jets. |



IK Code protection degree

Standard 62262 describes a system (IK code) for classifying the degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (rated voltage of the protected equipment not exceeding 72.5 kV).

| Code IK | E (J) |
|---------|---------------|
| 00 | Non protected |
| 01 | 0.14 |
| 02 | 0.2 |
| 03 | 0.35 |
| 04 | 0.5 |
| 05 | 0.7 |
| 06 | 1 |
| 07 | 2 |
| 08 | 5 |
| 09 | 10 |
| 10 | 20 |

Electrical duration test

The tests checks the electrical efficiency of a component during operation and under given conditions of use.

Making and breaking capacity test under normal and abnormal conditions

Breaking capacity: the test determines the value of presumed current that a switch or fuse is able to break at a set voltage and in given operation conditions.

Making capacity: the test determines the value of presumed current that a switch or fuse is able to make at a specified voltage and in given operation conditions.

Short-circuit test

The test is designed to check the resistance of a device to given short-circuit conditions.

Storage and/or operational temperature test:

- Testing efficiency in cold environment
- Testing efficiency in dry hot environment
- Testing efficiency in humid hot environment
- Testing uniformity of behaviour with temperature changes
- Testing efficiency in cyclic humid hot environment

The tests are designed to check fitness for operation and storage of a device in given environmental condition.

H.A.L.T. "HIGHLY ACCELERATED LIFE TEST"

HALT is a ruggedness margin discovery process, which reveals the main causes of product failures.

During the test, the product is subjected to gradually higher stress levels brought on by vibration and by rapid temperature and humidity transitions with the aim of uncovering the main causes of failure and the real operating limits of the product.

The HALT process subjects the product to stresses well beyond the expected operating conditions, until broken or jammed.