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Electrical apparatus for potentially explosive atmospheres

Part 1. General requirements

Matériel électrique pour atmosphères explosibles
Partie 1. Règles générales

Elektrische Betriebsmittel für explosionsgefährdete Bereiche
Teil 1. Allgemeine Bestimmungen

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English version

Electrical apparatus for potentially explosive atmospheres General requirements

(Includes Amendments 1: July 1979; 2: June 1982; 3: December 1982; 4: December 1982 and 5: February 1986)

Matériel électrique pour atmosphères explosibles – Règles générales
(Inclut les amendements 1 : 1979 + 2 : 1982 + 3 : 1982 + 4 : 1982 + 5 : 1986)

Elektrische Betriebsmittel für explosionsgefährdete Bereiche – Allgemeine Bestimmungen
(Einschließlich Änderungen 1 : 1979 + 2 : 1982 + 3 : 1982 + 4 : 1982 + 5 : 1986)

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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IEC Publications referred to in European Standard EN 50 014

IEC 34-5 (1968) (1st edition)	Rotating electrical machines Part 5 Degrees of protection by enclosures for rotating machinery
IEC 79-1A (1975)	First supplement [to IEC 79-1 (1971) Electrical apparatus for explosive atmospheres, Part 1 Construction and test of flameproof enclosures of electrical apparatus] : Appendix D : Method of test for ascertainment of maximum experimental safe gap
IEC 79-4 (1975) (2nd edition)	Electrical apparatus for explosive gas atmospheres Part 4 Method of test for ignition temperature
IEC 112 (1979)	Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions
IEC 144 (1963) (1st edition)	Degrees of protection of enclosures for low-voltage switchgear and controlgear
IEC 216	Guide for the determination of thermal endurance properties of electrical insulating materials
IEC 216-1 (1974)	Part 1 : General procedures for the determination of thermal endurance properties, temperature indices and thermal endurance profiles
IEC 216-2 (1974)	Part 2 : Lists of materials and available tests
IEC 292-1 (1969) (1st edition)	Low-voltage motor starters Part 1 Direct-on-line (full voltage) a.c. starters [with following supplements: 292-1A (1971) & 292-1B (1973)]

ISO Standards referred to in European Standard EN 50 014

ISO 178 (1975)	Plastics – Determination of flexural properties of rigid plastics
ISO/R 179 (1961)	Plastics – Determination of the Charpy impact resistance of rigid plastics. (Charpy impact flexural test)
ISO 262 (1973) (1st edition)	ISO general purpose metric screw threads – Selected sizes for screws, bolts and nuts
ISO/R 272 (1968) (2nd edition)	Hexagon bolts and nuts – Widths across flats, heights of heads, thicknesses of nuts – Metric series
ISO/R 286 (1962) (1st edition)	ISO system for limits and fits – Part 1 : General, tolerances and deviations
ISO/R 527 (1966)	Plastics – Determination of tensile properties
ISO/R 861 (1968) (1st edition)	Hexagon socket-head cap screws – Metric series
ISO 965/I (1973) (1st edition)	ISO general purpose metric screw threads – Tolerances – Principles and basic data
ISO 965/II (1973) (1st edition)	ISO general purpose metric screw threads – Tolerances – Limits of sizes for commercial bolt and nut threads – Medium quality
ISO 1817 (1975)	Vulcanized rubbers – Resistance to liquids – Methods of test
ISO 4892 (1981)	Methods of exposure to laboratory light sources

European Standards referred to in European Standard EN 50 014

EN 50 015 (1977) (1st edition)	Electrical apparatus for potentially explosive atmospheres – Oil immersion 'o'
EN 50 016 (1977) (1st edition)	Electrical apparatus for potentially explosive atmospheres – Pressurized apparatus 'p'
EN 50 017 (1977) (1st edition)	Electrical apparatus for potentially explosive atmospheres – Powder filling 'q'
EN 50 018 (1977) (1st edition)	Electrical apparatus for potentially explosive atmospheres – Flameproof enclosure 'd'
EN 50 019 (1977) (1st edition)	Electrical apparatus for potentially explosive atmospheres – Increased safety 'e'
EN 50 020 (1977) (1st edition)	Electrical apparatus for potentially explosive atmospheres – Intrinsic safety 'i'

Fifth report on specifications and testing conditions relating to fire-resistant fluids used for power transmission – Commission of the European Community – Mines Safety and Health Commission, Luxembourg, 15.11.74.

This European Standard has been prepared by the CENELEC Technical Subcommittee 31.1.

Section I. General

1. Scope

1.1 This European Standard contains the 'General requirements' for the construction and testing of electrical apparatus for use in potentially explosive atmospheres in order to ensure that such apparatus will not cause an explosion of the surrounding atmosphere. It is supplemented or modified by the following European Standards, concerning the specific standard types of protection:

EN 50 015: Oil immersion 'o'
EN 50 016: Pressurized apparatus 'p'
EN 50 017: Powder filling 'q'
EN 50 018: Flameproof enclosure 'd'
EN 50 019: Increased safety 'e'
EN 50 020: Intrinsic safety 'i'

It also covers the other safety aspects which shall be taken into consideration for such electrical apparatus.

1.2 The above European Standards and this European Standard are not applicable to the construction of electro-medical apparatus, exploders, test devices for exploders and for shotfiring circuits.

1.3 Devices in which, according to the manufacturer's specifications, none of the values 1.2 V, 0.1 A, 20 µJ or 25 mW is exceeded need not be certified or marked.

2. Definitions

The following definitions are applicable in this European Standard and in the European Standards listed in **1.1.**

2.1 electrical apparatus. All items applied as a whole or in part for the utilization of electrical energy. These include, among others, items for the generation, transmission, distribution, storage, measurement, regulation, conversion, and consumption of electrical energy and items for telecommunications.

2.2 potentially explosive atmosphere. An atmosphere which could become explosive (the danger is a potential one).

2.3 explosive atmosphere. A mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour or mist, in such proportions that it can be exploded by excessive temperature, arcs or sparks (the danger is a real one).

2.4 explosive mixture. A specific mixture used for testing electrical apparatus for potentially explosive atmospheres.

2.5 ignition temperature of an explosive mixture. The temperature at which the mixture ignites when tested according to the method given in IEC 79-4.

2.6 maximum surface temperature. The highest temperature which is attained in service under the most unfavourable conditions (but within the tolerances) by any part or surface of an electrical apparatus, which is able to produce an ignition of the surrounding atmosphere.

NOTE. The most unfavourable conditions include recognized overloads and fault conditions specified in the standard for the type of protection concerned.

2.7 rating. The designed performance of an electrical apparatus.

2.8 type of protection. The measures applied in the construction of electrical apparatus to prevent ignition of the surrounding explosive atmosphere by such apparatus.

2.9 degree of protection of enclosures. The measures applied to the enclosures of electrical apparatus to ensure

(1) the protection of persons against contact with live or moving parts inside the enclosure and protection of the apparatus against ingress of solid foreign bodies;

(2) the protection of the apparatus against ingress of liquids.

2.10 terminal compartment. A separate compartment or part of a main enclosure, communicating or not with the main enclosure, and containing connection facilities.

2.11 connection facilities. Terminals, screws and other parts, used for the electrical connection of conductors of external circuits.

2.12 cable entry. A device permitting the introduction of an electric cable into an electrical apparatus.

2.13 conduit entry. A means of introducing a conduit into an electrical apparatus.

2.14 sealing ring. A ring used in a cable or conduit entry to ensure the sealing between the entry and the cable or conduit.

2.15 stopping box with setting compound. A device preventing any explosion within electrical apparatus from being transmitted into a conduit.

2.16 enclosure. All the walls which surround the live parts of electrical apparatus including doors, covers, cable entries, rods, spindles and shafts, and which ensure the protection of the electrical apparatus.

2.17 Ex component. Part of electrical apparatus for potentially explosive atmospheres which is not to be used alone in such atmospheres and which requires additional certification of any electrical apparatus with which it is used.

3. Grouping and classification of electrical apparatus

3.1 Electrical apparatus for potentially explosive atmospheres is divided into

Group I: electrical apparatus for mines susceptible to firedamp;

Group II: electrical apparatus for places with a potentially explosive atmosphere, other than mines susceptible to firedamp.

For mines where gases other than firedamp may normally and naturally occur, the electrical apparatus shall be constructed in accordance with Group I requirements, but shall also be submitted to the tests prescribed for the appropriate Group II explosive mixture and marked accordingly.

3.2 The electrical apparatus of Group II is subdivided according to the nature of the potentially explosive atmosphere for which it is intended.

3.2.1 For certain types of protection, the subdivision A, B, C is prescribed; this is based on the maximum experimental safe gap (MESG) for flameproof enclosures or on the minimum ignition current (MIC) for intrinsically safe electrical apparatus (see annex A).

3.2.2 For all types of protection, the temperature classes T1 to T6 correspond to the classification of electrical apparatus according to its maximum surface temperature.

3.3 The electrical apparatus may be tested for a particular explosive atmosphere. In this case it shall be certified and marked accordingly.

4. Temperatures

4.1 Maximum surface temperature. The maximum surface temperature of electrical apparatus is:

4.1.1 For Group I electrical apparatus:

150 °C where coal dust can form a layer;

or 450 °C if the above risk is avoided, for example, by sealing against dust or by ventilation.

4.1.2 For Group II electrical apparatus:

preferably one of the values given in table 1;

or another value.

NOTE. When choosing electrical apparatus of Group II, the user shall take into account the influence and the smouldering temperature of dusts if they are likely to be deposited in a layer.

This European Standard indicates in 26.2(6) the corresponding marking.

Table 1. Classification of maximum surface temperature for Group II electrical apparatus

Temperature class	Maximum surface temperature °C
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

4.2 Ambient temperatures. Electrical apparatus shall normally be designed for use in the ambient temperature range between –20 °C and +40 °C; in this case, no additional marking is necessary.

When the electrical apparatus is designed for use in a different range of ambient temperatures, it is considered to be special; the ambient temperature range shall then be stated by the manufacturer and specified in the certificate; the marking shall then include either the special range of ambient temperatures or, if this is impracticable, the sign X according to 26.2(9) of this European Standard.

Table 2 summarizes these requirements.

Table 2. Ambient temperatures in service and additional marking

Electrical apparatus	Ambient temperature in service	Additional marking
Normal	Maximum: +40 °C Minimum: –20 °C	none
Special	Stated by the manufacturer and specified in the certificate	Ambient temperature range or sign X

4.3 Surface temperature and ignition temperature. The lowest ignition temperature of the explosive atmospheres concerned shall be above the maximum surface temperature. However, for components having a total surface area of not more than 10 cm^2 (e.g. transistors or resistors used in intrinsically safe electrical circuits), their surface temperature may exceed that for the temperature class marked on the electrical apparatus, if there is no direct or indirect risk of ignition from these components, with a safety margin of:

50 K for T1, T2 and T3,
25 K for T4, T5 and T6.

This margin shall be ensured by experience of similar components or by tests of the electrical apparatus itself in representative explosive mixtures.

NOTE. During the tests, the safety margin may be provided by increasing the ambient temperature.

Section II. Requirements for all electrical apparatus

5. General

5.1 Electrical apparatus for use in potentially explosive atmospheres shall:

5.1.1 comply with the requirements of this European Standard except where these requirements are modified by the specific European Standards for the types of protection concerned listed in 1.1.

NOTE. If the electrical apparatus has to withstand particularly adverse service conditions (e.g. rough handling, humidity effects, effects of chemical agents, ambient temperature variations) these have to be specified by the user, and the appropriate measures have to be agreed between user and manufacturer.

5.1.2 be constructed so as not to affect adversely the safety of persons, domestic animals and property when properly installed, maintained and used in the applications for which it was designed and manufactured. The manufacturer shall, under his sole responsibility, indicate that this is so by making a declaration in the form given in Annex E.

5.2 Enclosures for electrical apparatus which can be opened more quickly than the time necessary:

for the discharge of incorporated capacitors to a residual energy of

0.2 mJ for electrical apparatus of Groups I and IIA, or

0.06 mJ for electrical apparatus of Group IIB, or

0.02 mJ for electrical apparatus of Group IIC;

or for the cooling of enclosed components to a temperature below the temperature class of the electrical apparatus

shall be provided with a label stating the delay required before attempting to open the enclosure.

6. Non-metallic enclosures and non-metallic parts of enclosures

The following requirements, also those of 22.4.7, apply to non-metallic enclosures and non-metallic parts of enclosures, except for non-metallic accessories such as sealing rings of cable entries, insulation of plugs and sockets, insulation of bushes, sealing gaskets on which the type of protection does not depend, light transmitting parts with a surface of less than 100 cm^2.

6.1 Definition of the material

6.1.1 The documents presented by the manufacturer and verified by the testing station in accordance with 22.2 of this European Standard shall define precisely both the material and the manufacturing process of the enclosure or part of enclosure.

6.1.2 For plastics materials, the definition shall include:

the name and address of the manufacturer of the material:

the exact and complete reference of the material, its colour, as well as the kind and percentage of fillers and other additives, when they are included;

the possible surface treatments, such as varnishes, etc.;

the thermal endurance graph in accordance with IEC Publications 216-1 and 216-2;

the standard designation, where it exists in the documents published by ISO/TC 61.

NOTE. The characteristics to be given are the resistance to bending in accordance with ISO 178 and, if the material does not break in this test before exposure to heat, the tensile strength in accordance with ISO/R 527 with test bars of type 1.

6.1.3 The testing station is not required to verify compliance of the material with its definition.

6.2 **Thermal endurance of plastics materials.** The plastics materials used for the enclosures or parts of enclosures shall have a temperature index TI (corresponding to the 20 000 h point of the thermal endurance graph referring to the resistance to bending with a loss of 50 % of the initial value; see also note to 6.1.2) of 20 K greater than the temperature of the hottest point of the enclosure or the part of the enclosure, having regard to the maximum ambient temperature in service (see 4.2).

The endurance to heat and to cold of the enclosures, or parts of enclosures, of plastics materials shall be satisfactory (see 22.4.7.3 and 22.4.7.4).

6.3 Electrostatic charges of enclosures of plastics material

6.3.1 *Electrical apparatus of Group I.* Enclosures of plastics material with a surface area projected in any direction of more than 100 cm^2, or containing exposed metallic parts with a capacitance to earth of more than 3 pF, under the most unfavourable conditions in practice, shall be so designed that under normal conditions of use, maintenance and cleaning, danger of ignition due to electrostatic charges is avoided.

This requirement shall be satisfied:

either by suitable selection of the material: its insulation resistance, measured according to the method given in **22.4.7.8** of this European Standard shall not exceed:

1 GΩ at (23 ± 2) °C and (50 ± 5) % relative humidity, or

100 GΩ under the extreme service conditions of temperature and humidity specified for the electrical apparatus;

or by the size, shape, layout or by other protective methods. The non-appearance of dangerous electrostatic charges shall then be verified by actual tests for ignition of an air-methane mixture of (8,5 ± 0,5) % methane.

If, however, the danger of ignition cannot be avoided in the design, a warning label shall indicate the safety measures to be applied in service.

6.3.2 *Electrical apparatus of Group II.* Enclosures should be so designed that under normal conditions of use, maintenance and cleaning, all danger of ignition due to electrostatic charges is avoided, for example,

by suitable disposition of the surfaces of the enclosure;

or by suitable selection of the material so that the insulation resistance of the enclosure, measured according to the method given in **22.4.7.8** of this European Standard, does not exceed:

1 GΩ at (23 ± 2) °C and (50 ± 5) % relative humidity, or

100 GΩ under the extreme service conditions of temperature and humidity specified for the electrical apparatus; the sign X shall then be placed after the certificate reference, as given in **26.2(9)**;

or by virtue of the size, shape and layout, or other protective methods, dangerous electrostatic charges are not likely to occur.

If the danger of ignition cannot be avoided in the design, a warning label shall indicate the safety measures to be applied in service.

6.4 Threaded holes in enclosures of plastics material. Threaded holes for fasteners which secure covers intended to be opened in service for adjustment, inspection and other operational reasons may only be tapped into the plastics material when the thread form is compatible with the plastics material of the enclosure.

7. Light alloy enclosures

7.1 The alloys used in the construction of enclosures of electrical apparatus of Group I shall not contain, by weight,

(a) more than 15 % in total of aluminium, titanium and magnesium, and

(b) more than 6 % in total of magnesium and titanium.

The alloys used in the construction of enclosures of electrical apparatus of Group II shall not contain, by weight, more than 6 % of magnesium.

7.2 Threaded holes in enclosures for fasteners which secure covers intended to be opened in service for adjustment, inspection and other operational reasons may only be tapped in the light alloy when the thread form is compatible with the light alloy used for the enclosure.

8. Fasteners

8.1 General. Parts necessary to achieve a standard type of protection or used to prevent access to uninsulated live parts shall be capable of being released or removed only with the aid of a tool.

Fastening screws for light alloy enclosures may be made of light alloy or of plastics materials if the material of the fasteners is compatible with that of the enclosure.

8.2 Special fasteners. When any of the European Standards for a specific standard type of protection requires a special fastener, this shall comprise

(a) unslotted hexagonal-headed screws conforming to ISO 262 and ISO/R 272, standard head,

or hexagonal nuts conforming to ISO 262 and ISO/R 272, standard head, fitting threaded studs conforming to ISO 262,

or screws with cylindrical heads and hexagonal sockets conforming to ISO 262 and ISO/R 861;

and

(b) a protective shroud or a counterbored hole enclosing each screw head or nut over its full height and at least two-thirds round its periphery, forming either:

an uninterrupted arc of a circle, subtending an angle of at least 240° (see figure 1);

or an uninterrupted half circle extended by straight portions of a length such that the angle subtended by the opening does not exceed 120° (see figure 2).

If shrouds are used, they shall be either:

integral with the enclosure;

or attached to the enclosure and firmly secured to it;

or so fixed to one another that they can neither turn nor be removed.

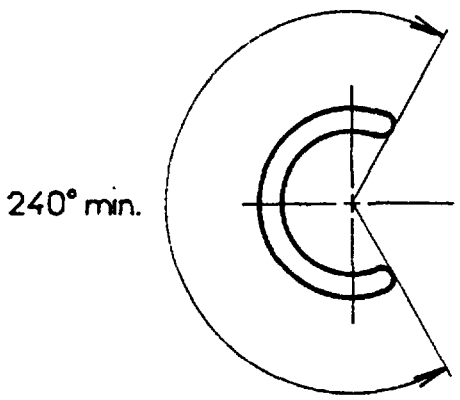


Figure 1. Example of partial cylindrical protective shroud

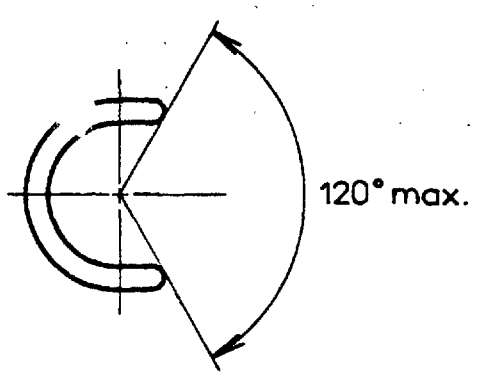


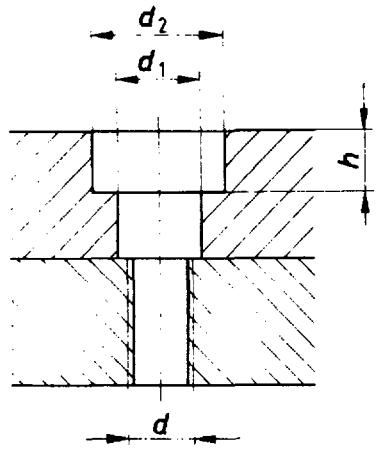
Figure 2. Example of semi-cylindrical partial protective shroud

The dimensions of the screws and of the protective shrouds or counterbored holes are given in table 3. Either the normal or the reduced diameter of shroud or counterbore may be used except where particular restrictions are imposed by the European Standard for the specific type of protection of the electrical apparatus.

Table 3. Special fasteners

Nominal diameter		Protective shroud or counterbored holes				
of thread d	of hole d_1 mm	h mm	normal d_2 mm		reduced d_2 mm	
6H ISO 965	H 13 ISO/R 286	min.	min.	max.	min.	max.
M 4	4.5	4	–	–	8	9
M 5	5.5	5	17	19	10	11
M 6	6.6	6	18	20	11	12
M 8	9	8	22	25	15	16
M 10	11	10	27	30	18	20
M 12	14	12	31	35	20	22
M 14	16	14	36	40	24	26
M 16	18	16	40	44	26	28
M 20	22	20	46	50	33	35
M 24	26	24	57	61	40	42

NOTE. Hexagonal-headed screws and nuts with nominal thread diameter M 5 should be avoided.



Hexagonal-headed screws and nuts of M 4, M 18 and M 22 are not permitted.

Screws with cylindrical heads and hexagonal sockets of M 18 and M 22 are not permitted.

Screws and nuts above M 16 (Group II) or M 24 (Group I) need not be protected by shrouds or counterbored holes.

9. Interlocking devices

Interlocking devices used to maintain a type of protection shall be so constructed that their effectiveness can be defeated only by the use of means specifically provided for that purpose.

10. Bushings

Bushings used as connection facilities and which may be subjected to a torque while the connection is being made shall be mounted in such a way that all parts are secured against turning.

The relevant type tests are specified in **22.4.5.**

11. Materials used for cementing

The materials used for cementing shall be chemically stable, inert and resistant to external influences (for example to water, oil and solvents), or else be effectively protected against these influences. They shall have a permanent thermal stability adequate for the maximum temperature to which they will be subjected, within the rating of the electrical apparatus. The permanent thermal stability is considered adequate if the limiting value for the material exceeds this maximum temperature by at least 20 K, the minimum value being 120 °C.

12. Connections

The contact pressure of electrical connections shall not be affected by dimensional changes in service (due to temperature, humidity, etc.) of insulating materials.

13. Connection facilities for earthing or bonding conductors

13.1 Inside the terminal compartment and near other connection facilities, electrical apparatus shall have a connection facility for an earthing or bonding conductor.

13.2 Electrical apparatus with metallic enclosure shall have an additional external connection facility for an earthing or bonding conductor. The external connection facility is not required for electrical apparatus which is intended to be moved while energized and is supplied by a cable incorporating an earthing or bonding conductor.

13.3 Neither an internal nor external earthing or bonding connection facility is required for electrical apparatus for which earthing is not allowed or is not necessary.

Example: Double insulated electrical apparatus.

13.4 Earthing or bonding connection facilities inside terminal compartments shall be suitable for the effective connection of at least one conductor with a section equivalent to that of the live conductors up to 35 mm^2, and above that, equivalent to half the section with a minimum of 35 mm^2.

13.5 Earthing or bonding connection facilities on the outside of electrical apparatus shall allow the effective connection of at least a 4 mm^2 conductor.

To ensure good electrical contact these connection facilities shall be effectively protected against corrosion. They shall also be designed so that the conductors are secured against loosening and twisting and so that contact pressure is permanently ensured.

13.6 Special precautions shall be taken if one of the parts in contact consists of light alloy.

14. Connection facilities and terminal compartments

14.1 Electrical apparatus which is intended for connection to external circuits shall include connection facilities, except for

Group II electrical apparatus, or
portable Group I electrical apparatus,

which is manufactured with a cable permanently connected to it.

14.2 Terminal compartments and their access openings shall be dimensioned so that the conductors can be readily connected.

14.3 Terminal compartments shall comply with one of the specific European Standards for the standardized types of protection.

14.4 Terminal compartments shall be so designed that after proper connection of the conductors, the creepage distances and the clearances comply with the requirements, if any, of the specific European Standard for the type of protection concerned.

15. Cable and conduit entries

15.1 Cable and conduit entries shall be constructed and fixed so that they do not alter the specific characteristics of the type of protection of the electrical apparatus on which they are mounted. This shall apply to the whole range of cable diameters specified by the manufacturer of the cable entries as suitable for use with those entries.

Sealing of cable entries shall be assured by use of one of the following means (see figure 3):

an elastomeric sealing ring, or

hard setting resin or compound, or

a metallic sealing ring (in the case of metal sheathed cable).

The cable entries shall ensure

(a) the passage of the cable through the enclosure wall without damage to the cable;

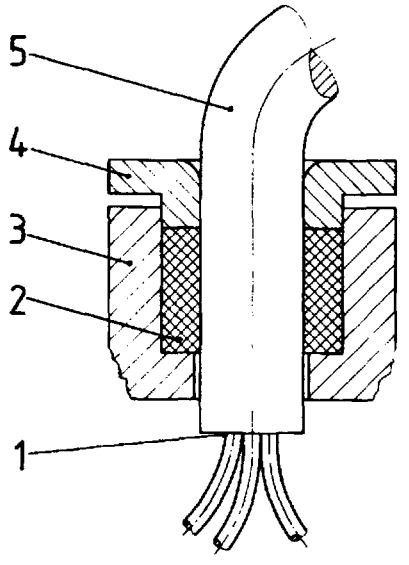
(b) and if necessary, clamping of the cable and the bonding of the metal armouring, sheath or screen.

15.2 The cable entries shall produce an effective clamping of the cable in order to prevent pulling or twisting applied to the cable being transmitted to the connections. They shall comply with the tests prescribed in **22.4.9** or **22.4.10**.

These requirements do not apply to cable entries of Group II fixed electrical apparatus for which the clamping of the cable can be effected elsewhere.

NOTE. A cable entry with a sealing ring can ensure effective clamping of unarmoured cables.

15.3 The entries for flexible cables shall have no sharp edges capable of damaging the cable when it is moved through an angle of 90° in any direction with respect to the axis of the entry. The entry point shall be rounded so that the radius of curvature of the cable cannot be less than a quarter of the diameter of the maximum size cable allowed for the entry.



1 Branching point of the conductors
2 Sealing ring
3 Cable entry body
4 Clamping ring with curved rim
5 Cable

Figure 3. Illustration of the terms used for cable entries using a sealing ring

15.4 Entry by conduit may be by screwing into threaded holes or locking in plain holes:

in the wall of the enclosure, or

in an adaptor plate designed to be fitted in or on the walls of the enclosure, or

into a suitable stopping box, integral with or attached to the wall of the enclosure.

15.5 Openings in the walls of electrical apparatus which are intended for cable or conduit entries shall be designed so that, if an entry is not used, the corresponding opening can be closed by a blanking element in such a way that the requirements of the specific European Standard for the type of protection of the electrical apparatus and the degree of protection are satisfied.

The means provided for this shall be such that the blanking element can be removed only with the aid of a tool.

15.6 When the temperature under rated conditions is higher than 70 °C at the cable or conduit entry point, or 80 °C at the branching point of the conductors, a label shall be provided on the outside of the electrical apparatus as a guide for the selection by the user of the cable or of the wiring in the conduit.

Section III. Supplementary requirements for certain electrical apparatus

16. Rotating electrical machines

16.1 Ventilation openings for external fans. The degree of protection of ventilation openings for external fans of rotating electrical machines shall be at least

IP 20 on the air inlet side,

IP 10 on the air outlet side,

according to IEC 34-5.

For vertical rotating electrical machines, foreign bodies shall be prevented from falling vertically into the ventilation openings.

For Group I rotating electrical machines, the degree of protection IP 10 is adequate only when the openings are designed or arranged so that foreign bodies with dimensions above 12 mm cannot be carried onto the moving parts of the machine, either by falling vertically or by vibration.

16.2 Construction and mounting of the ventilating system. Fans, fanhoods, ventilation screens, etc. shall be strongly constructed and fixed so as to prevent distortion and displacement which could cause impact or friction of rotating parts against the fixed parts.

16.3 Clearances for the ventilating system. In normal operation the clearances between an external fan and its hood, ventilation screen and their fasteners shall be at least $^{1}/_{100}$ of the maximum diameter of the fan and shall be not less than 1 mm.

These clearances need not exceed 5 mm. They may be reduced to 1 mm if the opposing parts are machined.

16.4 Materials for fans. The external fans of rotating electrical machines, manufactured in plastics material, shall have an electrical resistance, as measured according to the method specified in **22.4.7**, not exceeding 1 GΩ except for Group II electrical machines, the fans of which have a peripheral speed below 50 m/s.

The external fans of rotating electrical machines, manufactured in light alloy, shall not contain, by weight,

for Group I electrical machines, more than 15 % in total of aluminium, titanium and magnesium, and more than 6 % in total of magnesium and titanium,

for Group II electrical machines, more than 6 % of magnesium.

17. Switchgear

17.1 Switchgear with contacts immersed in oil is not permitted for direct current.

Alternating current switchgear with contacts immersed in oil is not permitted for Group I electrical apparatus, where the voltage does not exceed 1100 V; it is permitted above 1100 V only when each pole is segregated, with an oil content of not more than 5 litres per pole.

17.2 Isolators of Group I which have a breaking capacity less than that of category AC 3, as specified in IEC 292-1, shall be electrically or mechanically interlocked with a suitable load breaking device.

Isolators of Group II may alternatively have a label 'DO NOT OPERATE UNDER LOAD' placed near the isolator.

17.3 Where switchgear includes an isolator, the latter shall disconnect all poles and shall be designed so that the position of the isolator contacts is plainly visible, or their open position is reliably indicated. Any interlock between such isolator and the cover or door of the switchgear shall allow this cover or door to be opened only when the separation of the isolator contacts is sufficient.

17.4 The operating mechanism of isolators for Group I switchgear shall be capable of being padlocked in the open position.

17.5 For Group I switchgear short-circuit and earth fault protection relays, if used, shall latch out. The resetting device shall either have a special fastener conforming to **8.2** or shall be inside the enclosure containing the relays.

17.6 Covers giving access to the interior of enclosures containing remotely operated apparatus[1] with switching contacts shall

either be interlocked with an isolator,

or bear a label saying 'DO NOT OPEN WHILE ENERGIZED'.

Parts which remain energized after opening these covers shall be protected by a standard type of protection.

18. Fuses

Enclosures containing fuses shall be interlocked so that insertion or removal of replacement elements can be carried out only with the voltage off and so that the fuses cannot be energized until the enclosure is correctly closed.

An interlock is not required if a label 'DO NOT OPEN WHILE ENERGIZED' is fixed on the enclosure.

19. Plugs and sockets

19.1 Plugs and sockets shall be interlocked mechanically or electrically so that they cannot be separated while the contacts are energized and the contacts cannot be energized while the plug and socket are separated.

Alternatively, plugs and sockets which are not interlocked as indicated above shall be fixed together by means of the special fasteners conforming to **8.2** and shall bear a label reading 'DO NOT SEPARATE WHILE ENERGIZED'.

19.2 Plugs and sockets for rated currents not exceeding 10 A or rated voltage not exceeding either 250 V a.c. or 60 V d.c. need not comply with **19.1** above if the normally energized part is a socket outlet and if the parts which remain energized after separation are protected according to one of the standard types of protection mentioned in **1.1** of this European Standard.

Plugs with components remaining energized when not engaged with a socket are not permitted.

20. Luminaires

20.1 The source of light of luminaires shall be protected by a light-transmitting cover and may also be protected by a guard. These shall be capable of passing the tests prescribed in **22.4.3.1.**

20.2 All luminaires shall have a label reading 'DO NOT OPEN WHILE ENERGIZED' unless they are fitted with a device which automatically isolates all poles of the luminaire lampholders as soon as the opening procedure is begun, in which case parts remaining energized shall comply with the requirements of the European Standard EN 50 019 'Increased safety' and access to those parts shall be prevented by a cover (which can be the reflector) assuring a degree of protection of at least IP 30 according to IEC 144 and bearing a label reading 'DO NOT OPEN WHILE ENERGIZED'.

21. Hand lamps and cap lamps

21.1 The materials used for hand lamps and cap lamps shall be chemically resistive to the electrolyte of the source of supply. Leakage of the electrolyte shall be prevented in all positions of the apparatus.

21.2 Where the source of light and source of supply are housed in separate enclosures, the cable entries and the connecting cable shall withstand a tensile load of 150 N, with no reduction in their security against explosions. The connecting cable shall be covered with a sheath of material which is oil-resistant and difficult to ignite.

[1] In which circuits can be made or broken by a separate influence (which may be mechanical, electrical, electro-optical, pneumatic, acoustic, magnetic or thermal) when this influence is not applied manually to the apparatus itself.

Section IV. Verifications and tests [1]

Section IV is not applicable to 5.1.2.

22. Type verifications and tests

22.1 General. The type verifications and tests are intended to ensure that the requirements of this European Standard and of the specific European Standard for the type of protection concerned have been met on a prototype or sample of the electrical apparatus.

22.2 Verification of documents. The testing station shall verify that documents submitted by the manufacturer give a full and correct specification of the safety aspects of the electrical apparatus.

It shall also verify that in the design of the electrical apparatus the requirements of this European Standard and of the specific European Standard for the type of protection concerned have been observed.

22.3 Compliance of prototype or sample with documents. The testing station shall verify that the prototype or sample of the electrical apparatus submitted for the type test complies with the manufacturer's definitive documents referred to above.

22.4 Type tests

22.4.1 *General.* The prototype or sample shall be tested by the testing station in accordance with the requirements for type tests of this European Standard and of the specific European Standards for the types of protection concerned. However, the testing station may omit certain tests judged to be unnecessary; the justification for such omission is to be given in the test report.

The tests are made either in the laboratory of the testing station or elsewhere under the supervision of that organization, for example at the manufacturer's works.

The testing station will where necessary call for modifications that it considers to be needed to bring the electrical apparatus into conformity with this European Standard and with the specific European Standard for the type of protection concerned.

22.4.2 Each test shall be made with the accessories (e.g. cable entries, instruments, plugs and sockets, blanking plates) provided for by the manufacturer in the descriptive documents of the electrical apparatus and the mounting of which is considered by the testing station to be the most unfavourable.

The test report will cover the electrical apparatus and the accessories listed in the report. The manufacturers of these accessories need not be specified if their construction is completely defined.

22.4.3 *Mechanical tests*

22.4.3.1 *Test for resistance to impact.* In this test the electrical apparatus is submitted to the effect of a test mass of 1 kg falling vertically from a height h. The height h is dependent on the impact energy which is specified in table 4 according to the application of the electrical apparatus ($h = E/10$; h in metres and E in joules). The weight shall be fitted with an impact head in the form of a hemisphere of 25 mm diameter

in nylon 6.6 (polyamide), Rockwell hardness R 100 (at a temperature of 23 ± 2 °C and a relative humidity between 45 % and 55 %), for testing light-transmitting parts of enclosures;

in hardened steel for testing other parts of enclosures.

NOTE. Before each test, it is necessary to check that the surface of the impact head is in good condition: the head shall be changed as often as necessary and, in the case of the polyamide head, at least after every 100 impacts.

Normally the test shall be made on the apparatus completely assembled and ready for use; however, if this is not possible for light-transmitting parts, the tests shall be made with the parts removed but fixed in their mounting frame or an equivalent frame.

[1] Verification and tests are included in the single German word 'Prüfungen'.

Table 4. Tests of resistance to impact

	Impact energy *E* (joules)			
Group	**I**		**II**	
Risk of mechanical danger	**High**	**Low**	**High**	**Low**
1 Guards, protective covers, fanhoods, cable entries 2 Plastics enclosures 3 Light metal or cast metal enclosures 4 Enclosures of other materials than in 3 with wall thickness less than 3 mm, for Group I less than 1 mm, for Group II	20	7		4
5 Light-transmitting parts without guard	10	4		2
6 Light-transmitting parts with guard (tested without guard)	4	2		1
When an electrical apparatus is submitted to tests corresponding to the low risk of mechanical danger, it shall be marked X in accordance with **26.2(9)**.				

For light-transmitting parts made of glass, the test shall be made on three samples but only once on each. In all other cases the test shall be made on two samples, twice on each sample.

The point of impact shall be the place considered by the testing station to be the weakest. The electrical apparatus shall be mounted on a steel base so that the direction of the impact is normal to the surface being tested if it is flat, or to the tangent to the surface at the point of impact if it is not flat. The base shall have a mass of at least 20 kg or be rigidly fixed or inserted in the floor (secured in concrete, for example). Annex B gives an example of a suitable test rig.

Normally the test shall be carried out at an ambient temperature of (20 ± 5) °C.

When the electrical apparatus has an enclosure or a part of an enclosure in plastics material, the test shall be carried out at the ambient temperatures specified in **22.4.7.1** of this European Standard. However, this requirement does not apply to the exceptions mentioned in **6** of this European Standard.

Tests to be carried out at a temperature different from the ambient temperature shall be made by placing the sample in a climatic cupboard at a temperature above the prescribed temperature. After the temperature of the sample has stabilized, it is removed from the cupboard, placed on the base and subjected to the test at the moment when the temperature (checked by thermocouple) reaches the prescribed temperature.

22.4.3.2 *Drop test.* Portable electrical apparatus, ready for use, shall be dropped four times from a height of 1 m on to a horizontal concrete surface. The positions of the sample for the drop test shall be selected by the testing station.

22.4.3.3 *Required results.* The impact and drop tests shall not produce damage invalidating the type of protection of the electrical apparatus.

Superficial damage, chipping to paint work, breakage of cooling fins or other similar parts of the electrical apparatus, and small dents shall be ignored.

External fanhoods and ventilation screens shall resist the tests without displacement or deformation causing rubbing by the moving parts.

22.4.4 *Tests for the degree of protection of enclosures.* These tests are to be made, as appropriate, in accordance with IEC 144 or IEC 34-5.

22.4.5 *Torque test for bushings.* Bushings used for connection facilities and which are subjected to torque during connection or disconnection of conductors shall be tested for resistance to torque and shall not turn when submitted to a torque of the value given in table 5.

Table 5. Torque to be applied to bushings used for connection facilities

Diameter of the stem of the bushing	Torque (Nm)
M 4	2.0
M 5	3.2
M 6	5
M 8	10
M 10	16
M 12	25
M 16	50
M 20	85
M 24	130

22.4.6 *Thermal tests*

22.4.6.1 *Temperature measurement.* The thermal tests shall be made at the rating of the electrical apparatus and with the most unfavourable voltage within the range ± 10 % of the nominal voltage of the electrical apparatus unless other European Standards or CENELEC harmonization documents prescribe other tolerances for equivalent industrial electrical apparatus.

The measured maximum surface temperature shall not exceed,

for electrical apparatus where each item is submitted to the thermal test, the temperature as marked on the electrical apparatus;

for other electrical apparatus, the marked temperature, less 5 K for temperature classes T6, T5, T4 and T3, or less 10 K for temperature classes T2 and T1.

The result shall be corrected for the maximum ambient temperature specified in the rating.

The measurement of the surface temperatures, temperatures of cable entries and temperatures of other parts as prescribed in this European Standard and the specific European Standards for the types of protection concerned shall be made in still, ambient air, with the electrical apparatus mounted in its normal service position.

For electrical apparatus which can be normally used in different positions, the temperature in each position is to be determined and the highest temperature is to be considered. When the temperature is determined for certain positions only, this shall be specified in the test report and the electrical apparatus shall be marked accordingly.

The measuring devices (thermometers, thermocouples, etc.) and the connecting cables shall be selected and so arranged that they do not significantly affect the thermal behaviour of the electrical apparatus. The final temperature is considered to have been reached when its rate of rise does not exceed 2 K/h.

The testing station shall also determine the temperature of the hottest point of any enclosure, or part of enclosure, of plastics material (see **6.2**).

22.4.6.2 *Thermal shock test.* Glass parts of luminaires and windows of electrical apparatus shall withstand, without breaking, a thermal shock caused by a jet of water of about 1 mm diameter at a temperature 10 ± 5 °C sprayed on them when they are at maximum service temperature.

22.4.7 *Tests of non-metallic enclosures and of non-metallic parts of enclosures.* The following requirements do not apply to the exceptions mentioned in 6 of this European Standard.

22.4.7.1 *Ambient temperatures during tests.* When, according to this European Standard or to the specific European Standards mentioned in 1.1, tests have to be made at ambient temperatures different from the ambient temperature existing where the tests are made, these ambient temperatures shall be:

for the upper ambient temperature, the maximum ambient temperature in service (see 4.2) increased by at least 10 K but at most 15 K;

for the lower ambient temperature, the minimum ambient temperature in service (see 4.2) reduced by at least 5 K but at most 10 K.

22.4.7.2 *Tests of enclosures and parts of enclosures in plastics materials*

Electrical apparatus of Group I:

The tests shall be made on 6 samples:

2 samples shall be submitted to the tests of thermal endurance to heat (22.4.7.3), then to the tests of thermal endurance to cold (22.4.7.4), then to the mechanical tests (22.4.7.7) and finally to the tests specific to the type of protection concerned.

2 samples shall be submitted to the tests of resistance to oils and greases (22.4.7.6), then to the mechanical tests (22.4.7.7) and finally to the tests specific to the type of protection concerned.

2 samples shall be submitted to the tests of resistance to hydraulic liquids for mining applications (22.4.7.6), then to the mechanical tests (22.4.7.7) and finally to the tests specific to the type of protection concerned.

Electrical apparatus of Group II:

The tests shall be made on 2 samples which shall be submitted to the tests of thermal endurance to heat (22.4.7.3), then to tests of thermal endurance to cold (22.4.7.4), then to the mechanical tests (22.4.7.7) and finally to the tests specific to the type of protection concerned.

22.4.7.3 *Thermal endurance to heat.* The thermal endurance to heat is determined by submitting the enclosures and parts of enclosures in plastics materials on which the type of protection depends to continuous storage for four weeks in an ambience of 90 % relative humidity and at a temperature of 20 K above the maximum service temperature and at least 80 °C.

In the case of a maximum service temperature above 80 °C the period of four weeks provided above will be replaced by a period of two weeks at (95 ± 2) °C and 90 % relative humidity followed by a period of two weeks at a temperature of 20 K higher than the maximum service temperature and at normal ambient humidity.

22.4.7.4 *Thermal endurance to cold.* The thermal endurance to cold is determined by submitting the enclosures and parts of enclosures in plastics materials on which the type of protection depends to storage for 24 hours in an ambience corresponding to the minimum service temperature reduced as specified in 22.4.7.1.

22.4.7.5 *Resistance to light.* A test of resistance of the material to light shall be made only if the enclosure or parts of enclosure made of plastics materials are not protected from light by another enclosure; for electrical apparatus of Group I, the test applies only to luminaires.

The test shall be made on 6 test bars of standard size (50 × 6 × 4) mm according to ISO/R 179. The test bars are to be made under the same conditions as those used for the manufacture of the enclosure concerned; these conditions are to be stated in the test report of the electrical apparatus.

The test shall be made in accordance with ISO 4892 in an exposure chamber using a xenon lamp and a sunlight simulating filter system, at a black panel temperature of (55 ± 3) °C. The exposure time shall be 1000 h.

The evaluation criterion is the impact bending strength in accordance with ISO/R 179. The impact bending strength following exposure in the case of an impact on the exposed side shall be at least 50 % of the corresponding value measured on the unexposed test pieces. For materials whose impact bending strength cannot be determined prior to exposure because no rupture has occurred, not more than 3 of the exposed test bars may break.

22.4.7.6 *Resistance to chemical agents for Group I electrical apparatus.* The plastics enclosures and plastics parts of enclosures shall be submitted to tests of resistance to the following chemical agents:

oils and greases,
hydraulic liquids for mining applications.

The relevant tests shall be made on four samples of enclosure sealed against the intrusion of test liquids into the interior of the enclosure:

two samples shall remain for (24 ± 2) hours in oil no. 2 according to the Annex 'Reference immersion liquids' of ISO Standard 1817, at a temperature of 50 °C;

the two other samples shall remain for (24 ± 2) hours in an hydraulic liquid of Group C (aqueous solution of polymer in 35 % water) according to 'Fifth report on specifications and testing conditions relating to fire-resistant fluids used for power transmission' of 15th November 1974 of the European Coal and Steel Community, at a temperature of 50 °C.

At the end of the test, the enclosure samples concerned shall be removed from the liquid bath, carefully wiped and then stored for 24 hours in the laboratory atmosphere. Subsequently, each of the enclosure samples shall pass the mechanical tests specified in **22.4.7.7** of this European Standard.

If one or more of the enclosure samples do not withstand these mechanical tests, this shall be stated in the certificate and the marking of the electrical apparatus shall include the sign X according to **26.2**(9) of this European Standard.

22.4.7.7 *Mechanical tests.* The mechanical tests specified in **22.4.3** of this European Standard shall be carried out on the enclosures and, additionally, in the case of plastics enclosures, in accordance with **22.4.7.2.**

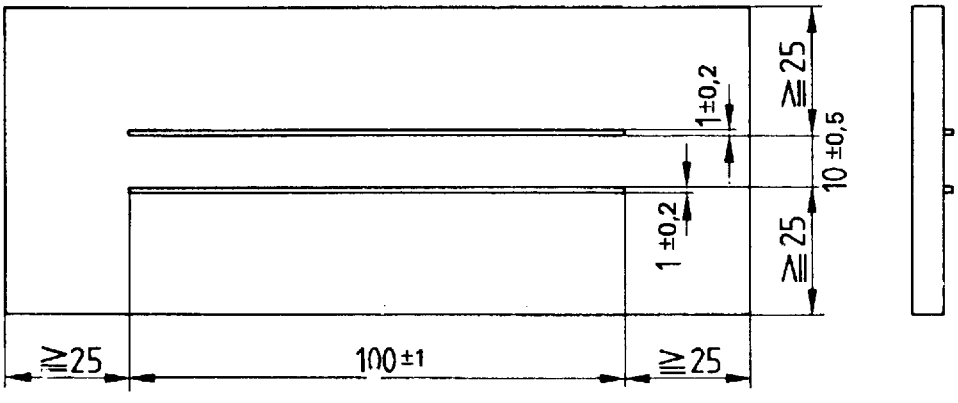
The following detailed conditions shall be observed:

(a) *Impact test.* The place of impact shall be on the external parts exposed to impact. If the enclosure of non-metallic material is protected by another enclosure, only the external parts of the assembly shall be subjected to the impact tests.

The test shall first be made at the highest temperature, then at the lowest temperature, according to **22.4.7.1.**

(b) *Drop test.* The drop test for portable electrical apparatus shall be made at the lowest temperature, according to **22.4.7.1.**

22.4.7.8 *Insulation resistance test of parts of enclosures of plastics materials.* The resistance is tested on the parts of enclosures if size permits, or on a test piece comprising a rectangular plate with dimensions in accordance with figure 4, on which two parallel electrodes are painted on the surface, using a conducting paint with a solvent which has no effect on the insulation resistance.



Dimensions in millimetres.

Figure 4. Test piece with painted electrodes

The test piece shall have an intact surface and shall be cleaned with distilled water, then with isopropyl alcohol (or any other solvent that can be mixed with water and will not affect the material of the test piece), then once more with distilled water before being dried. Untouched by bare hands, it shall then be conditioned for 24 hours at the temperature and humidity required in 6.3. The test shall be carried out under the same ambient conditions.

The direct voltage applied for 1 minute between the electrodes shall be equal to 500 V ± 10 V.

During the test, the voltage shall be sufficiently steady so that the charging current due to voltage fluctuation will be negligible compared with the current flowing through the test piece. In certain cases this requires the use of batteries or accumulators.

The insulation resistance is the ratio of the direct voltage applied at the electrodes to the total current flowing between them when the voltage has been applied for 1 minute.

Possible methods are indicated in annex C.

In cases where cleaning would adversely affect the significance of the test results, an additional test may be made without first cleaning the test piece.

22.4.8 *Tests in explosive mixtures.* The European Standard for the specific type of protection states if tests in explosive mixtures are required, and the explosive mixtures to be used.

NOTE. The purity of commercially available gases and vapour is in general satisfactory for these tests, but if their purity is below 95 % they should not be used. The effects of normal variations in the laboratory temperature and of atmospheric pressure, and of variations in the humidity of the explosive mixture are acceptable because they have been found to have negligible effect.

22.4.9 *Tests of clamping of non-armoured cables in cable entries*

22.4.9.1 *Entries with clamping by the sealing ring.* The tests of clamping shall be performed using for each type of cable entry a sealing ring of each of the sizes permitted for use.

In the case of elastomeric sealing rings, each ring is mounted on a clean, dry, polished, cylindrical mild steel mandrel of a diameter equal to the smallest cable diameter allowable in the ring and specified by the manufacturer of the cable entry.

In the case of metallic sealing rings, each ring is mounted on the metallic sheath of a sample of clean dry cable of a diameter equal to the smallest diameter allowable in the ring and specified by the manufacturer of the cable entry.

The elastomeric sealing ring with the mandrel, or the metallic sealing ring with the cable, is then fitted into the cable entry which is then loosely assembled and mounted on a tensile test machine. The sealing ring is then compressed and the minimum torque which it is necessary to apply to the screws (in the case of a clamping ring with clamp and screws) or the nut (in the case of a screwed clamping ring) to prevent slipping of the mandrel or of the cable is observed when the force applied to it reaches a value in newtons equal to 20 times the value in millimetres of the diameter of the mandrel or cable sample.

22.4.9.2 *Entries with clamping by means other than a sealing ring.* The tests of clamping shall be performed using for each type of cable entry a clamping device of each of the sizes permitted for use.

Each device is mounted on a sample of clean, dry cable of a diameter equal to the smallest diameter allowable in the device and specified by the manufacturer of the cable entry.

The device with the cable is then fitted into the cable entry and the latter is mounted on a tensile test machine. The device is then tightened and the minimum torque which it is necessary to apply to the screws (in the case of clamping device fitted with screws) or the nut (in the case of a screwed clamping device) to prevent slipping of the cable is observed when the force applied to it reaches a value in newtons equal to 20 times the value in millimetres of the diameter of the cable sample.

22.4.9.3 *Tensile test.* The screws or the nut of the cable entry are then submitted to a new torque of a value equal to 110 % of that observed during the initial test mentioned in **22.4.9.1** or **22.4.9.2** of this European Standard. A constant tensile force equal to that defined during the initial test above mentioned is then applied for six hours.

22.4.9.4 *Mechanical strength.* The cable entry is then removed from the tensile test machine and is submitted to a test of mechanical strength by applying to the screws or the nut, whichever is the case, a torque of which the value is twice that which prevents slipping. The cable entry is finally dismantled and the components examined.

22.4.9.5 *Acceptance criteria.* The clamping assured by the sealing ring or by the clamping device is considered to conform to the requirements of this European Standard if the slipping of the mandrel or cable sample is not more than 6 mm.

The mechanical strength of the cable entry is considered to conform to the requirements of this European Standard if no noticeable damage is found. Any deformation of the sealing ring shall be ignored.

22.4.10 *Tests of clamping of armoured cables in cable entries.* The tests of clamping of armoured cables in cable entries shall be performed using for each size of entry a sample of armoured cable of the smallest diameter allowable as indicated by the manufacturer of the cable entry. Each test is in two parts.

22.4.10.1 *Clamping.* The sample of armoured cable is fitted into the clamping device of the cable entry and this is then mounted in a tensile test machine. The clamping device is then tightened and the value is observed of the minimum torque applied to the screws (in the case of a clamping device tightened by screws) or to the nut (in the case of the clamping device being a nut) necessary to prevent slipping of the cable when the applied force reaches a value in newtons equal to 80 times the value in millimetres of the diameter of the cable sample over the armour.

The tightness of the clamping device is considered sufficient if the slipping of the armour is effectively zero during 2 min of tension, the tensile force being maintained at a constant value.

22.4.10.2 *Mechanical strength.* The cable entry is then removed from the tensile test machine and is submitted to a mechanical strength test by applying to the screws or the nut, whichever is the case, a torque of which the value is twice that determined in the clamping test.

The cable entry is finally dismantled and the components examined.

The test is satisfactory if no deformation is found.

23. Routine verifications and tests

The manufacturer shall make the routine verifications and tests necessary to ensure that the electrical apparatus produced complies with the specification submitted to the testing station together with the prototype or sample. He shall also make any routine verifications and tests required by the European Standards concerned as given in 1.1.

24. Manufacturer's responsibility

By marking the electrical apparatus in accordance with clause 26 of this European Standard, the manufacturer attests on his own responsibility that the routine verifications and tests in clause 23 have been successfully completed and that the product complies with the specification submitted to the testing station.

25. Verifications and tests on modified or repaired electrical apparatus

25.1 Modifications made on the electrical apparatus affecting the type of protection or the temperature of the apparatus shall be permitted only if the modified apparatus is resubmitted to a testing station.

25.2 In the case of repairs to electrical apparatus affecting the type of protection, the parts which have been repaired shall be subjected to new routine verifications and tests which need not be made by the manufacturer.

Section V. Marking

26. Marking

NOTE. In the interest of safety, it is essential that the system of marking indicated below shall not be applied to electrical apparatus which does not comply with this European Standard and with the specific European Standard for the type of protection concerned, listed in 1.1.

26.1 The electrical apparatus shall be marked on the main part in a visible place. This marking shall be legible and durable taking into account possible chemical corrosion.

NOTE. For Group I annex D gives an example of marking which is considered as legible and durable.

26.2 The marking shall include:

(1) The name of the manufacturer or his registered trade mark.

(2) The manufacturer's type identification.

(3) The symbol EEx, which indicates that the electrical apparatus corresponds to one or more CENELEC standard types of protection mentioned in 1.1.

(4) The sign for each type of protection used:

o : oil immersion

p : pressurized apparatus

q : powder filling

d : flameproof enclosure

e : increased safety

ia : intrinsic safety, category a

ib : intrinsic safety, category b

(5) The symbol of the group of the electrical apparatus:

I for electrical apparatus for mines susceptible to firedamp;

II or IIA or IIB or IIC for electrical apparatus for places with a potentially explosive atmosphere other than mines susceptible to firedamp.

The letters A, B, C shall be used if the specific European Standard for the type of protection concerned specifies this.

When the electrical apparatus is certified for use only in a particular gas, the symbol II shall be followed by the chemical formula or name of the gas.

(6) For Group II electrical apparatus, the symbol indicating the temperature class or the maximum surface temperature in °C, or both. When the marking includes both, the temperature class shall be given last in parentheses.

Example: T1 or 350 °C or 350 °C (T1)

Electrical apparatus for Group II, having a maximum surface temperature greater than 450 °C, shall bear only the inscription of the temperature.

Example: 600 °C

Electrical apparatus for Group II, certified and marked for use in a particular gas, need not have a temperature reference.

(7) Generally a serial number, except for

connection accessories (cable and conduit entries, blanking plates, adaptor plates, plugs and sockets and bushings);

very small electrical apparatus on which there is limited space.

(8) The indication of the testing station and the certificate reference in the following form: the year of certification followed by the serial number of the certificate in that year.

(9) If the testing station considers that it is necessary to indicate special conditions for safe use, the sign X shall be placed after the certificate reference.

(10) Any additional marking prescribed in the specific European Standards for the types of protection concerned.

(11) Any marking normally required by the standards of construction of the electrical apparatus.

26.3 Where different types of protection are used on different parts of an electrical apparatus, each respective part shall bear the sign for the type of protection concerned.

Where more than one type of protection is used in an electrical apparatus, the sign for the main type of protection shall appear first and be followed by the signs for the other types of protection used.

26.4 The markings (3) to (6) of **26.2** shall be placed in the order in which they are given.

26.5 Ex components according to **2.17** of this European Standard shall be marked in a visible place. This marking shall be legible and durable and shall include only:

(1) The name or the registered trademark of the manufacturer.

(2) The manufacturer's type identification.

(3) The symbol EEx.

(4) The sign for each type of protection used.

(5) The symbol of the Group of the Ex component.

(6) The name or mark of the testing station.

(7) The certificate reference followed by the sign U.

(8) The additional marking prescribed in the specific European Standard for the types of protection concerned.

(9) The marking normally required by the standards for construction of the Ex component.

26.6 On very small electrical apparatus and on Ex components, where there is limited space, the testing station may allow a reduction in the marking but will require at least:

(1) The symbol EEx.

(2) The name or mark of the testing station.

(3) The certificate reference.

(4) For electrical apparatus, the sign X if appropriate; for Ex components, the sign U.

(5) The name or registered trademark of the manufacturer.

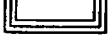
26.7 Examples of marking:

NOTE. These examples do not include the marking normally required by the standards of construction of the electrical apparatus; see **26.2(11)**.

26.7.1 Flameproof electrical apparatus for use in gassy mines.

BEDELLE S.A.
TYPE A B 5
EEx d I
No 325
HSE (M) 80.2209
.....
.....

26.7.2 Ex component, partly powder filling and partly intrinsically safe, for places in potentially explosive atmospheres other than gassy mines, gas of subdivision C, manufactured by H. RIDSTONE and Co., Ltd:



TYPE KW 369

EEx qia IIC
DEMKO 80.536 U
.....
.....

26.7.3 Electrical apparatus partly increased safety and partly with pressurized enclosure, maximum surface temperature of 125 °C, for places in potentially explosive atmospheres other than gassy mines, with gas of ignition temperature greater than 125 °C and with special conditions of safe use indicated in the certificate.

H. ATHERINGTON LTD
TYPE 250 JG 1
EEx ep II 125 °C (T4)
No 56732
L.C.I.E. 80.076 X
.....
.....

26.7.4 Electrical apparatus, partly flameproof and partly increased safety for use in gassy mines and places in potentially explosive atmospheres other than gassy mines with gas of subdivision B and ignition temperature greater than 200 °C.

A. R. ACHUTZ A.G.
TYP 5 CD
EEx de I/IIB T3
No 5634
BVS Nr 80.521
.....
.....

26.7.5 Flameproof electrical apparatus for places in potentially explosive atmospheres other than gassy mines on the basis of ammonia gas only.

WOKAITERT SARL
TYPE NT 3
EEx d II (NH_3)
No 6549
INIEX-NIEB 80.3102
.....
.....

Annex A

(Supplementary information)

Subdivision of gases and vapours according to their maximum experimental safe gaps and minimum ignition currents

For flameproof enclosures of electrical apparatus, gases and vapours are subdivided according to their maximum experimental safe gaps (MESG) determined by means of an experimental vessel having a width of joint of 25 mm. The standard method of determining the MESG shall be with the vessel described in IEC 79-1A, but if the determinations have been made only with an 8 litre sphere with ignition close to the joint these can be accepted provisionally.

The limits are

subdivision A: MESG above 0.9 mm

subdivision B: MESG between 0.5 mm and 0.9 mm

subdivision C: MESG below 0.5 mm

For intrinsically safe electrical apparatus, gases and vapours are subdivided according to the ratio of their minimum igniting currents (MIC) to that of laboratory methane. The standard method of determining this ratio shall be with the apparatus described in annex B of European Standard EN 50 020 'Intrinsic safety' but if these determinations have been made only with other apparatus these can be accepted provisionally.

The limits are

subdivision A: MIC ratio above 0.8

subdivision B: MIC ratio between 0.45 and 0.8

subdivision C: MIC ratio below 0.45

For most gases and vapours it is sufficient to make only one of these determinations (either MESG or MIC ratio) to place the gas or vapour in the appropriate subdivision. A single determination is sufficient in the following cases:

subdivision A: when the MESG exceeds 0.9 mm or otherwise the MIC ratio exceeds 0.9;

subdivision B: when the MESG is between 0.55 mm and 0.9 mm or otherwise the MIC ratio is between 0.5 and 0.8;

subdivision C: when the MESG is less than 0.5 mm or otherwise the MIC ratio is less than 0.45.

It is necessary to do the determination of both the MESG and MIC ratio in the following cases.

(1) Only the MIC ratio has been determined and its value is between 0.8 and 0.9: the determination of the MESG is necessary to determine the subdivision.

(2) Only the MIC ratio has been determined and its value is between 0.45 and 0.5: the determination of the MESG is necessary to determine the subdivision.

(3) Only the MESG has been determined and its value is between 0.5 mm and 0.55 mm: the determination of the MIC ratio is necessary to determine the subdivision.

When a gas or vapour belongs to a homologous series of compounds, the appropriate subdivision of the gas or vapour can provisionally be inferred from the results of the determinations of other compounds of the series with lower molecular weights.

These general principles have been used to draw up the following lists of gases and vapours.

The letters against each gas or vapour denote

(a) subdivision according to the MESG value;

(b) subdivision according to the value of MIC ratio;

(c) where both MESG and MIC ratio have been determined;

(d) subdivision according to similarity of chemical structure (provisional subdivision).

NOTE 1. Industrial methane includes methane mixtures containing up to 15 % by volume of hydrogen.

NOTE 2. Carbon monoxide may include a moisture content sufficient to saturate a carbon monoxide-air mixture at normal ambient temperature.

Subdivision A

1. Hydrocarbons		
Alkanes		
methane	CH_4	c
ethane	C_2H_6	c
propane	C_3H_8	c
butane	C_4H_{10}	c
pentane	C_5H_{12}	c
hexane	C_6H_{14}	c
heptane	C_7H_{16}	c
octane	C_8H_{18}	a
nonane	C_9H_{20}	d
decane	$C_{10}H_{22}$	a
cyclobutane	$CH_2(CH_2)_2CH_2$	d
cyclopentane	$CH_2(CH_2)_3CH_2$	a
cyclohexane	$CH_2(CH_2)_4CH_2$	c
cycloheptane	$CH_2(CH_2)_5CH_2$	d
methylcyclobutane	$CH_3CH(CH_2)_2CH_2$	d
methylcyclopentane	$CH_3CH(CH_2)_3CH_2$	d
methylcyclohexane	$CH_3CH(CH_2)_4CH_2$	d
ethylcyclobutane	$C_2H_5CH(CH_2)_2CH_2$	d
ethylcyclopentane	$C_2H_5CH(CH_2)_3CH_2$	d
ethylcyclohexane	$C_2H_5CH(CH_2)_4CH_2$	d
decahydronaphthalene (dekalin)	$CH_2(CH_2)_3CH\,CH(CH_2)_3CH_2$	d
Alkenes		
propene (propylene)	$CH_3CH = CH_2$	a
Aromatic hydrocarbons		
styrene	$C_6H_5CH = CH_2$	b
isopropenylbenzene (methyl styrene)	$C_6H_5C(CH_3) = CH_2$	a
Benzenoids		
benzene	C_6H_6	c
toluene	$C_6H_5CH_3$	d
xylene	$C_6H_4(CH_3)_2$	a
ethylbenzene	$C_6H_5C_2H_5$	d
trimethyl benzene	$C_6H_3(CH_3)_3$	d
naphthalene	$C_{10}H_8$	d
cumene	$C_6H_5CH(CH_3)_2$	d
cymene	$(CH_3)_2CH\,C_6H_4CH_3$	d
Mixed hydrocarbons		
methane (industrial)	(See Note 1)	a (calc.)
turpentine		d
petroleum naphtha		d
coal tar naphtha		d
petroleum (including motor spirit)		d
solvent or cleaning petroleum		d
heating oil		d
kerosene		d
diesel oil		d
motor benzole		a

2. Compounds containing oxygen		
Oxides (including ethers)		
carbon monoxide	CO (See Note 2)	c
dipropyl ether	$(C_3H_7)_2O$	a
Alcohols and phenols		
methanol	CH_3OH	c
ethanol	C_2H_5OH	c
propanol	C_3H_7OH	c
butanol	C_4H_9OH	a
pentanol	$C_5H_{11}OH$	a
hexanol	$C_6H_{13}OH$	a
heptanol	$C_7H_{15}OH$	d
octanol	$C_8H_{17}OH$	d
nonanol	$C_9H_{19}OH$	d
cyclohexanol	$CH_2(CH_2)_4CH\,OH$	d
methylcyclohexanol	$CH_3CH(CH_2)_4CH\,OH$	d
phenol	C_6H_5OH	d
cresol	$CH_3C_6H_4OH$	d
4-hydroxy-4-methylpentan-2-one (diacetone alcohol)	$(CH_3)_2C(OH)CH_2COCH_3$	d
Aldehydes		
acetaldehyde	CH_3CHO	a
metaldehyde	$(CH_3CHO)_n$	d
Ketones		
acetone	$(CH_3)_2CO$	c
butanone (ethyl methyl ketone)	$C_2H_5CO\,CH_3$	c
pentan-2-one (propyl methyl ketone)	$C_3H_7CO\,CH_3$	a
hexan-2-one (butyl methyl ketone)	$C_4H_9CO\,CH_3$	a
amyl methyl ketone	$C_5H_{11}CO\,CH_3$	d
pentane-2, 4-dione (acetylacetone)	$CH_3CO\,CH_2CO\,CH_3$	a
cyclohexanone	$CH_2(CH_2)_4CO$	a
Esters		
methyl formate	$H\,COO\,CH_3$	a
ethyl formate	$H\,COO\,C_2H_5$	a
methyl acetate	$CH_3COO\,CH_3$	c
ethyl acetate	$CH_3COO\,C_2H_5$	a
propyl acetate	$CH_3COO\,C_3H_7$	a
butyl acetate	$CH_3COO\,C_4H_9$	c
amyl acetate	$CH_3COOC_5H_{11}$	d
methyl methacrylate	$CH_2 = CCH_3COOCH_3$	a
ethyl methacrylate	$CH_2 = CCH_3COOC_2H_5$	d
vinyl acetate	$CH_3COOCH = CH_2$	a
ethyl acetoacetate	$CH_3COCH_2COOC_2H_5$	a
Acids		
acetic acid	CH_3COOH	b

Subdivision A *(continuation)*

3. Compounds containing halogens			propane-1-thiol (propylmercaptan)	C_3H_7SH	a (calc.)
Compounds without oxygen			thiophene	$\underline{CH{=}CH.CH{=}CH\,S}$	a
chloromethane	CH_3Cl	a	tetrahydrothiophene	$\underline{CH_2(CH_2)_2CH_2S}$	a
chloroethane	C_2H_5Cl	b	**5. Compounds containing nitrogen**		
bromoethane	C_2H_5Br	d			
chloropropane	C_3H_7Cl	a	ammonia	NH_3	a
chlorobutane	C_4H_9Cl	a	acetonitrile	CH_3CN	a
bromobutane	C_4H_9Br	d	ethyl nitrite	CH_3CH_2ONO	a
dichloroethane	$C_2H_4Cl_2$	a	nitromethane	CH_3NO_2	d
dichloropropane	$C_3H_6Cl_2$	d	nitroethane	$C_2H_5NO_2$	d
chlorobenzene	C_6H_5Cl	d	*Amines*		
benzyl chloride	$C_6H_5CH_2Cl$	d	methylamine	CH_3NH_2	a
dichlorobenzene	$C_6H_4Cl_2$	d	dimethylamine	$(CH_3)_2NH$	a
allyl chloride	$CH_2{=}CHCH_2Cl$	b	trimethylamine	$(CH_3)_3N$	a
dichloroethylene	$CHCl{=}CH\,Cl$	a	diethylamine	$(C_2H_5)_2NH$	d
chloroethylene (vinyl chloride)	$CH_2{=}CH\,Cl$	c	triethylamine	$(C_2H_5)_3N$	d
d,d,d-trifluorotoluene (benzotrifluoride)	$C_6H_5CF_3$	a	propylamine	$C_3H_7NH_2$	d
dichloromethane (methylene chloride)	CH_2Cl_2	d	butylamine	$C_4H_9NH_2$	c
Compounds with oxygen			cyclohexylamine	$\underline{CH_2(CH_2)_4CH\,NH_2}$	d
acetyl chloride	CH_3COCl	d	2-aminoethanol (ethanolamine)	$NH_2CH_2CH_2OH$	d
chloroethanol	CH_2ClCH_2OH	d	2-diethylaminoethanol	$(C_2H_5)_2NCH_2CH_2OH$	d
4. Compounds containing sulphur			diaminoethane	$NH_2CH_2CH_2NH_2$	a
			aniline	$C_6H_5NH_2$	d
ethanethiol (ethylmercaptan)	C_2H_5SH	c	NN-dimethylaniline	$C_6H_5N(CH_3)_2$	d
			amphetamine	$C_6H_5CH_2CH(NH_2)CH_3$	d
			toluidine	$CH_3C_6H_4NH_2$	d
			pyridine	C_5H_5N	d

Subdivision B

1. Hydrocarbons		
propine (allylene, methylacetylene)	$CH_3C{=}CH$	b
ethylene	C_2H_4	c
cyclopropane	$\underline{CH_2CH_2CH_2}$	b
1,3-butadiene	$CH_2 = CH\,CH = CH$	c
2. Compounds containing nitrogen		
acrylonitrile	$CH_2 = CHCN$	c
isopropyl nitrate	$(CH_3)_2CHONO_2$	b
hydrogen cyanide	HCN	a
3. Compounds containing oxygen		
dimethyl ether	$(CH_3)_2O$	c
ethyl methylether	$CH_3OC_2H_5$	d
diethyl ether	$(C_2H_5)_2O$	c
dibutyl ether	$(C_4H_9)_2O$	c
ethylene oxide (oxione)	$\underline{CH_2CH_2O}$	c
1,2-epoxypropane (propylene oxide)	$CH_3\underline{CHCH_2O}$	c

Subdivision B *(continuation)*		
1,3-dioxolane	$CH_2CH_2OCH_2O$	d
1,4-dioxan	$CH_2CH_2OCH_2CH_2O$	a
1,3,5-trioxan	$CH_2OCH_2OCH_2O$	b
butyl glycolate (hydroxyacetic acid, butyl ester)	$HOCH_2COOC_4H_9$	a
tetrahydrofurfuryl alcohol	$CH_2CH_2CH_2O\,CH\,CH_2OH$	d
methyl acrylate	$CH_2 = CHCOOCH_3$	a
ethyl acrylate	$CH_2 = CHCOOC_2H_5$	a
furan	$CH = CHCH = CHO$	a
crotonaldehyde	$CH_3CH = CHCHO$	a
acrylaldehyde (acrolein)	$CH_2 = CHCHO$	a (calc.)
tetrahydrofuran	$CH_2(CH_2)_2CH_2O$	a
4. Mixtures		
coke oven gas		d
5. Compounds containing halogens		
tetrafluoroethylene	C_2F_4	a
1-chloro-2,3-epoxypropane (epichlorohydrin)	OCH_2CHCH_2Cl	a

Subdivision C		
hydrogen	H_2	c
acetylene	C_2H_2	c
carbon disulphide	CS_2	c
ethyl nitrate	$C_2H_5ONO_2$	

Annex B

(Supplementary information)

Example of test rig for impact test

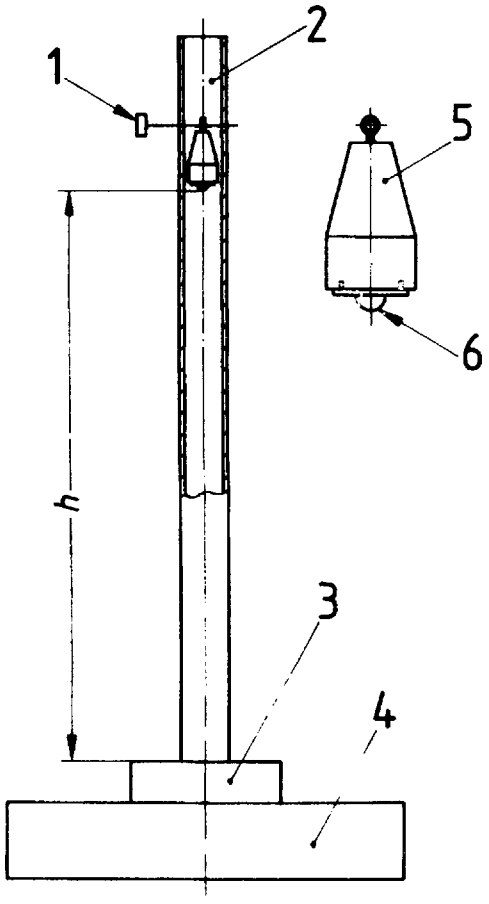


Figure B1

1 Adjustment pin
2 Plastics guide tube
3 Test piece
4 Steel base (mass ≥ 20 kg)
5 Steel mass of 1 kg
6 Impact head 25 mm diameter:
in polyamide for testing light-transmitting parts
in hardened steel for testing other parts
h Height of fall

Annex C

(Supplementary information)

Methods of measurement of the insulation resistance of parts of enclosures of plastics materials

C.1 Voltmeter-ammeter method. The current is measured directly by means of a micro-ammeter, or a galvanometer (figure C1), or indirectly by a d.c. amplifier which indicates the current by measuring the voltage drop which it determines in a known resistance (figure C2). The voltage is measured by a voltmeter. In certain cases the voltage-current ratio is measured by an instrument indicating the resistance directly (figure C2b).

C.2 Comparative method. The unknown resistance is compared to a known resistance by determining the ratio of the currents when the same voltage is applied in succession to two resistances (figure C3a), or by balancing the two resistances in a Wheatstone bridge (figure C3b).

For all these methods, the unknown resistance shall be large in relation to any calibrated resistance connected in series with it so as to be submitted to practically all the voltage.

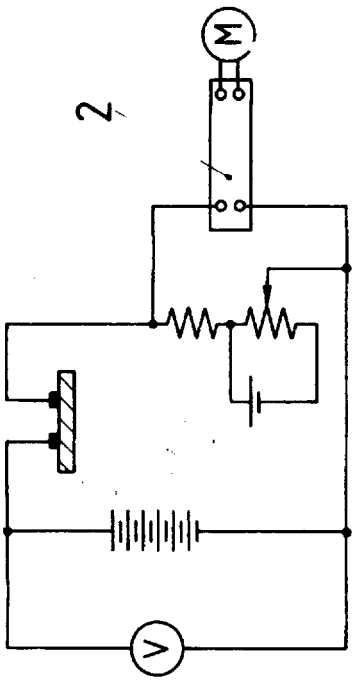


Figure C2b.

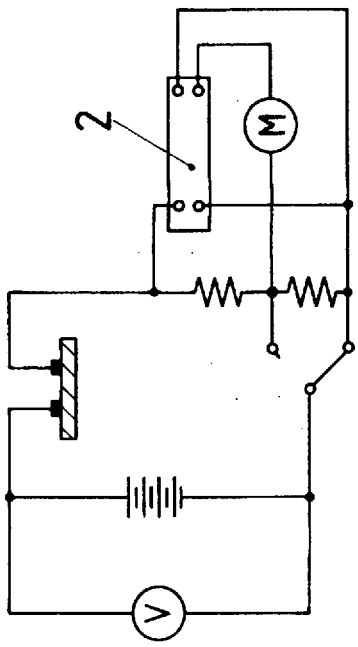


Figure C2a. Current measurement by means of a d.c. amplifier

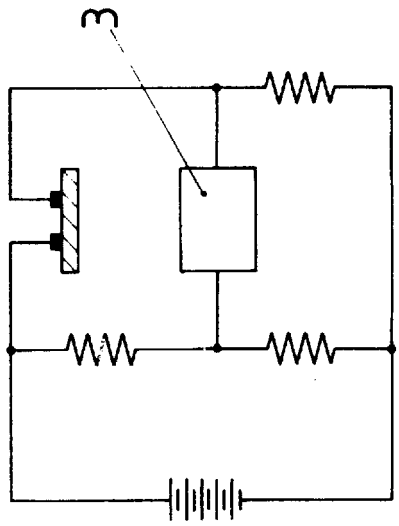


Figure C3b. Wheatstone bridge method

Voltmeter-ammeter method

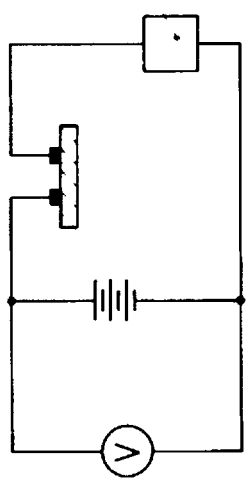


Figure C1. Current measurement by micro-ammeter or galvanometer

Comparative method

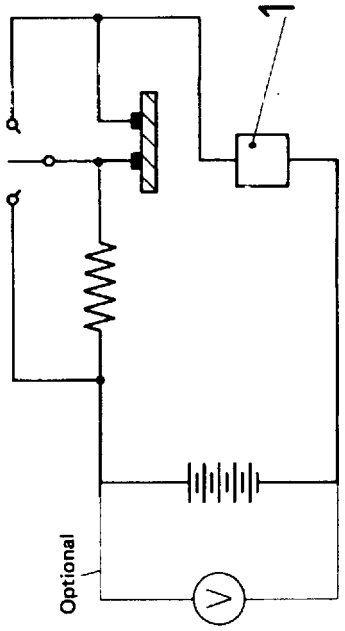


Figure C3a. Determination of the ratio of currents when the same voltage is applied successively to the two resistances

1 Galvanometer with shunt
2 D.C. amplifier
3 Detector

Annex D

(Supplementary information)

Practical examples of legible and durable marking

Until completion of the procedures for verifying legibility and durability, the marking on Group I electrical apparatus

of the name of the manufacturer or his registered trade mark,

of the manufacturer's type identification,

of the testing station of the electrical apparatus and of the certificate reference,

of the serial number, if required,

is considered satisfactory if it complies with the following requirements.

D.1 The characters shall be recessed or raised directly as part of the casting or moulding or be engraved directly onto the enclosure of the electrical apparatus or on a plate securely fixed to the enclosure. Engraving by pressure or by chemical action is also permitted. The minimum height of the characters shall be 5 mm, the depth of recess or relief being at least $^1/_{10}$ of the height. On small electrical apparatus where the space available for marking is limited, the characters may be reduced to 3 mm and 0.3 mm. On stainless steel labels the depth of engraving need not exceed 0.6 mm irrespective of the height of the characters.

D.2 The labels shall have a thickness equal to $^1/_{25}$ of their largest dimension with a minimum of 2 mm. They shall consist of bronze or brass or stainless steel.

The minimum thickness is reduced to 1 mm if the plate is fixed by a frame or if it is soldered or brazed round the whole of the periphery or if it is recessed.

D.3 The labels shall be fixed to the principal part of the enclosure

by soldering or brazing, either directly or by means of a frame;

by sunken headed screws, locked in place by punching or soldering;

by riveting on both sides of a wall of the enclosure, if permitted by the type of protection concerned;

in the case of plastics enclosures, by gluing into a recess.

D.4 If the serial number is required, it shall be stamped or engraved directly on the enclosure or on the above label.

Annex E

(Integral part of the standard)

Declaration by the manufacturer

To indicate compliance with **5.1.2** the manufacturer declares on his sole responsibility that the electrical apparatus concerned:

(a) complies with the appropriate CENELEC European Standards or with the appropriate CENELEC Harmonization Documents or with the corresponding harmonized national standards; or

(b) complies with the appropriate national standards of any CENELEC member selected by the manufacturer but only when harmonization has not yet been achieved; or

(c) complies with other principles which the manufacturer assesses on his sole responsibility as providing a degree of safety equivalent to (a) or (b) above but only when the standards referred to in (a) or (b) are not available, or if technical developments require divergences from these standards.

NOTE In the event of a challenge the manufacturer may be required to provide details of the basis on which his declaration was made.

Form of declaration by the manufacturer:

DECLARATION BY .....
(name, address, etc.)

This is to declare, in accordance with annex E of EN 50 014, that .....

.....
(product, type, description)

has been designed and manufactured in accordance with **5.1.2** of EN 50 014.

This declaration is based on:

– compliance with .....*
(CENELEC EN Standards or Harmonization Documents or harmonized national standards)

– compliance with .....*
(national standards of CENELEC members selected)

– the following principles: .....*
(give details)

Date: ..... Signature: .....

*Make the appropriate statement.

National appendix A

The United Kingdom participation in the preparation of this European Standard came under the direction of the General Electrotechnical Engineering Standards Committee of BSI. This committee consists of representatives from the following Government departments and scientific and industrial organizations:

Associated Offices Technical Committee
British Approvals Service for Electric Cables Ltd
*British Electrical and Allied Manufacturers' Association (BEAMA)
British Radio Equipment Manufacturers' Association
British Steel Corporation
Department of Energy – Electricity
Electric Cable Makers' Confederation
*Electrical Contractors' Association
Electrical Contractors' Association of Scotland
*Electrical Research Association
*Electricity Supply Industry in England and Wales
*Electronic Components Industry Federation
Electronic Engineering Association
*Engineering Equipment Users' Association
*Health and Safety Executive
Home Office
Institution of Electrical Engineers
*Ministry of Defence
*National Coal Board
*Oil Companies' Materials Association
*Post Office
*Telecommunication Engineering and Manufacturing Association (TEMA)

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee involved with the work on this standard:

British Industrial Measuring and Control Apparatus Manufacturers' Association
British Industrial Truck Association
CBMPE
Council for Electrical Equipment for Flammable Atmospheres (BEAMA)
Council of Underground Machinery Manufacturers
Department of the Environment – Building Research Establishment (Fire Research Station)
Department of Trade (Marine Division)
Fire Offices Committee
Lighting Industry Federation Ltd
Rotating Electrical Machines Association (BEAMA)
Sira Institute
Transmission and Distribution Association (BEAMA)

National appendix B

The British Standards corresponding to the IEC Publications, ISO Standards, and European Standards listed on page 4 of EN 50 014 are as follows.

IEC Publications	British Standards
IEC 34-5 (1968)	BS 4999 General requirements for rotating electrical machines Part 20 : 1972 Classification of types of enclosure (Technically equivalent)
IEC 112 (1979)	BS 5901 : 1980 Method of test for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions (Identical)
IEC 144 (1963)	BS 5420 : 1977 Specification for degrees of protection of enclosures of switchgear and controlgear for voltages up to and including 1000 V a.c. and 1200 V d.c. (Identical)
IEC 216	BS 5691 Guide for the determination of thermal endurance properties of electrical insulating materials
IEC 216-1 (1974)	BS 5691 : Part 1 : 1979 General procedures for the determination of thermal endurance properties, temperature indices and thermal endurance profiles (Identical)
IEC 216-2 (1974)	BS 5691 : Part 2 : 1979 Lists of materials and available tests (Identical)
IEC 292-1 (1969) IEC 292-1A (1971) IEC 292-1B (1973)	BS 4941 Motor starters for voltages up to and including 1000 V a.c. and 1200 V d.c. Part 1 : 1979 Direct-on-line (full voltage) a.c. starters (Identical)

NOTE. There are no British Standard equivalents for IEC 79-1A (1975) and IEC 79-4 (1975). The technical committee has reviewed their provisions, and has decided that they are acceptable for use in conjunction with this standard.

ISO Standards	British Standards
ISO 178 (1975)	BS 2782 : Part 3 : Method 335A : 1978 Determination of flexural properties of rigid plastics (Identical)
ISO 262-1973	BS 3643 ISO metric screw threads (Technically equivalent) Part 1 : 1963 Thread data and standard thread series Part 2 : 1966 Limits and tolerances for coarse pitch series threads Part 3 : 1967 Limits and tolerances for fine pitch threads (constant pitch series)
ISO/R 272-1968	BS 3692 : 1967 ISO metric precision hexagon bolts, screws and nuts (Technically equivalent) BS 4190 : 1967 ISO metric black hexagon bolts, screws and nuts (Technically equivalent)
ISO/R 286/I-1962	BS 4500 ISO limits and fits Part 1 : 1969 General, tolerances and deviations (Technically equivalent)
ISO/R 861-1968	BS 4168 : 1967 Hexagon socket screws and wrench keys (Technically equivalent)
ISO 965/I-1973 ISO 965/II-1973	BS 3643 ISO metric screw threads Part 2 : 1966 Limits and tolerances for coarse pitch series threads (Technically equivalent)
ISO 1817 (1975)	BS 903 : Part A16 : 1971 The resistance of vulcanized rubber to liquids (Technically equivalent)
ISO 4892 (1981)	BS 2782 : Part 5 : Method 540B 1982 Methods of exposure to laboratory light sources (xenon arc lamp, enclosed carbon arc lamp, open flame carbon arc lamp, fluorescent tube lamps) (Identical)

NOTE. There are no British Standard equivalents for ISO/R 179 (1961) and ISO/R 527 (1966). The technical committee has reviewed their provisions and has decided that they are acceptable for use in conjunction with this standard. BS 2782 is however a related standard both to ISO/R 179 and ISO/R 527.

European Standards	British Standards (titles and content identical)
EN 50 015 (1977)	BS 5501 : Part 2 : 1977
EN 50 016 (1977)	BS 5501 : Part 3 : 1977
EN 50 017 (1977)	BS 5501 : Part 4 : 1977
EN 50 018 (1977)	BS 5501 : Part 5 : 1977
EN 50 019 (1977)	BS 5501 : Part 6 : 1977
EN 50 020 (1977)	BS 5501 : Part 7 : 1977

National appendix C

Interim guides

The interim guides in this appendix provide clarification on the use of the European Standard and have been submitted by the British Committee to CENELEC as proposals for formal amendments to the EN. Until such time as CENELEC takes a decision on these matters the BS will be applied in the UK as indicated in the interim guides.

The guidance given is interim and the decisions taken by CENELEC may not necessarily follow the interim guides exactly and the guidance should be used with this in mind. When a decision on a specific interim guide has been implemented by CENELEC it will be withdrawn. It is the responsibility of the user of the interim guide to take account of the current status of the guide.

This introductory cover sheet, which will be updated each time a new issue of an interim guide is produced, shows the status and history of the interim guides to this standard, whether current, or withdrawn either because they have been implemented by amendment or because they have been found unacceptable by the CENELEC Committee concerned.

NOTE. The up-to-date status of the interim guides can only be ascertained from the latest issue of the cover sheet. It is essential to ensure, therefore, that when referring to any of the interim guides, whatever the date of issue, its status is ascertained from the information given on the cover sheet supplied with the latest amendment.

BS 5501: Part 1: 1977
National appendix C
Cover sheet (Issue 1: June 1984)
(Page 2 of 2 pages)

NOTE. The symbols used to indicate the status in the table below are as follows.

C = Current
R = Question and answer ratified by CENELEC Committee
I = Withdrawn, implemented as amendment to European Standard
W = Withdrawn, rejected by CENELEC

Interim guide number and subject	Issue date	Status	Withdrawal or implementation date
C.1 Subclause 8.2	29 June 1984	R	

Subclause 8.2 Special fasteners

Question

Are screw and nut combinations allowed under 8.2 (a) of EN 50 014?

Answer

Yes, provided that both the head of the screw and the nut are protected by a shroud or counter bored hole as specified in 8.2 (a).

Justification

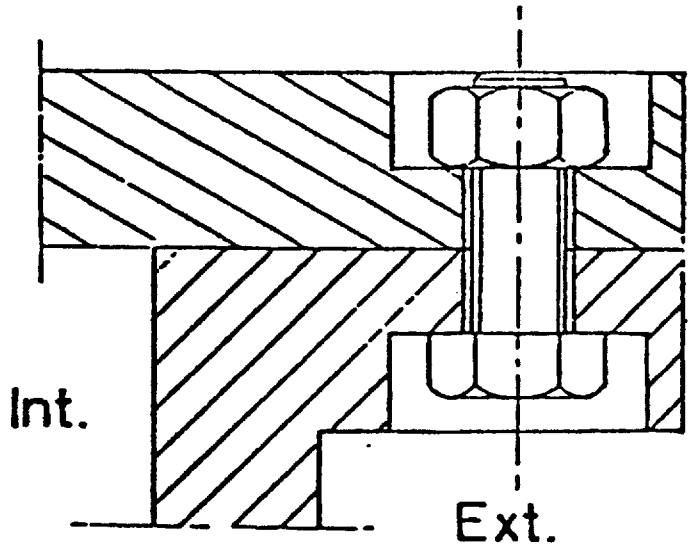
It has been a long established practice to use screw and nut or bolt and nut combinations as fasteners, a practice that has proved perfectly safe.

Proposed amendment

The position would be clarified by the addition of a third alternative under 8.2 (a) on the following lines.

'or fasteners consisting of appropriate combination of the above screws and nuts'.

NOTE. The figure illustrating the proposed UK interpretation was not included in the document circulated to CENELEC



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Austria	Netherlands
Belgium	Norway
Denmark	Portugal
Finland	Spain
France	Sweden
Germany	Switzerland
Ireland	United Kingdom
Italy	

Amendments issued since publication

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3233	January 1980	Indicated by a line in the margin
4058	April 1983	Indicated by a line in the margin
4290	December 1982	Indicated by a line in the margin
4291	August 1983	Indicated by a line in the margin
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