

Electric fence energizers

Safety requirements for mains-operated electric fence energizers

The European Standard EN 61011 : 1992 has the status of a
British Standard

Electrificateurs de clôtures
Règles de sécurité pour électrificateurs de
clôtures fonctionnant sur le réseau

Elektrozaungeräte
Sicherheitsbestimmungen für
Elektrozaungeräte mit
Netzanschluß

UDC 631.273.3 : 621.311.62 : 620.1 : 614.8

Cooperating organizations

The European Committee for Electrotechnical Standardization (CENELEC), under whose supervision this European Standard was prepared, comprises the national committees of the following countries:

Austria	Italy
Belgium	Luxembourg
Denmark	Netherlands
Finland	Norway
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Germany	Spain
Greece	Sweden
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Amendment No. 1
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Electric fence energizers. Safety requirements for
mains-operated electric fence energizers

NOTE. The English Language version of European Standard EN 61011 was implemented in the United Kingdom by the publication of BS EN 61011 : 1993. This amendment implements amendment A2 to EN 61011.

This amendment, together with the European Standard EN 61011 : 1992, has the status of a British Standard.

Revised text

National foreword

In paragraph 1, line 4, after '*energizers*' insert 'together with amendment A2 : 1994. (Note. There is no amendment A1)'.

In paragraph 1, line 6, after 'first edition' insert 'together with Amendment 1 : 1991, Amendment 2 : 1993 and Corrigendum 1993.'

At the end of paragraph 4 insert the following new paragraph.

'The foreword of EN 61011 : 1992 amendment A2 : 1994 makes reference to the 'date of withdrawal', dow, of the relevant national standard. In this case the relevant national standard is the unamended BS EN 61011 : 1993 for which the date of withdrawal is set at 15 December 1994. Certificates and Marks will not be awarded after this date with regard to the former version of the standard. However such Certificates and Marks already awarded may continue to apply to production until 15 December 1999.'

AMD 8569/July 1995

EN amendment title page and foreword

Insert the attached EN amendment title page (foreword on reverse).

AMD 8569/July 1995

Text of EN 61011 : 1992

Amend the text of European Standard EN 61011 in accordance with the details given on the attached pages.

AMD 8569/July 1995

Descriptors: Electrical installation, electric fence, supply mains, accumulator, safety requirement

Amendment A2 to the English version of EN 61011
(includes amendment AA)

Electric fence energizers Safety requirements for mains-operated electric fence energizers

(IEC 1011 : 1989/corrigendum 1993 + A1 : 1991 + A2 : 1993)

Electrificateurs de clôtures
Règles de sécurité pour électrificateurs
de clôtures fonctionnant sur le réseau
(CEI 1011 : 1989/corrigendum 1993 +
A1 : 1991 + A2 : 1993)

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Sicherheitsbestimmungen für
Elektrozaungeräte mit Netzanschluß
(IEC 1011 : 1989/Corrigendum 1993 +
A1 : 1991 + A2 : 1993)

This amendment A2 modifies the European Standard EN 61011 : 1992. It was approved by CENELEC on 8 March 1994. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This amendment exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

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

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Subclause 2.2.8

Replace the definition for type M attachment by the following:

Type M attachment denotes a method of attachment such that the flexible cable or cord can be easily replaced without the aid of special purpose tools, by a special cable or cord with, for example, a moulded-on cord guard or crimped terminations or by replacing a part of the energizer incorporating the cord.

Replace the definition for type Y attachment by the following:

Type Y attachment denotes a method of attachment such that the flexible cable or cord can only be replaced by the use of a special purpose tool either for gaining access to the connections or for making the connections.

Type Y attachment may be used either with a common flexible cable or cord, or with a special cable or cord.

Subclause 4.4.2

Replace the second dash of Item 8) by the following:

- external independent control of the switching speed of semiconductor devices used as the major pulse switching device by referencing the gate signal of this device to the voltage across it, the switching speed shall be varied in the range 0.1 Hz to two times the supply frequency or 100 Hz whichever is the greater in approximately a 1:2:5 progression sequence over three decades, or

Add the following explanatory note after Item 8):

Details of a simple comparator circuit which has been found suitable for controlling the switching speed of the major pulse switching device are given in Appendix Q.

Subclause 7.1

Replace the eighth indent by:

- designation for degree of protection against harmful ingress of solid foreign objects/water, not less than IP44;

Subclause 7.4

Delete the second sentence of the third paragraph.

Add the following new paragraph after the existing second paragraph:

The symbols for Class II construction, output (Fence) and output (Earth) shall be in accordance with IEC 417.

Add at the end of the subclause, the following explanation:

Additional symbols are allowed provided they do not give rise to misunderstanding.

Subclause 7.5

Add the following new paragraph:

The lettering of the marking shall have a height of at least 3 mm and the symbols a height of at least 6 mm.

Subclause 7.9

Add the following requirement:

The instruction sheet shall also contain the substance of the following information:

- **for energizers with a type M attachment:**
If the supply cord of this energizer is damaged it shall be replaced by the special cord (quote the appropriate part reference);
- **for energizers with a type Y attachment:**
If the supply cord of this energizer is damaged it shall only be replaced by a repair shop appointed by the manufacturer, because special purpose tools are required.

Subclause 7.11

Add the following explanation:

The petroleum spirit to be used for the test is aliphatic solvent hexane having a maximum aromatics content of 0.1 % by volume, a kauri-butanol value of 29, an initial boiling point of approximately 65 °C, a dry point of approximately 69 °C and a specific mass of approximately 0,68 kg/l.

Delete the explanation regarding the revision of the test for durability of marking.

Subclause 8.1

Replace the first sentence of the requirement by the following:

Energizers shall be so constructed that there is adequate protection against accidental contact with live parts, other than the output terminals, with basic insulation or with metal parts separated from live parts by basic insulation only.

Replace the third paragraph of the requirement by the following:

The enclosure of the energizer shall have no openings, other than those necessary for the use and working of the energizer, giving access to live parts, basic insulation and to parts separated from live parts by basic insulation only.

Replace the last sentence of the test specification by the following:

It shall not be possible to touch basic insulation or metal parts separated from live parts by basic insulation only, with the test finger shown in figure 1.

Subclause 10.1

Replace, in the second line of item 6), "Item 3 of this sub-clause" by "Item 1 of this subclause in parallel with a resistor having a non-inductive resistance of 500 Ω ."

Subclause 11.5

In footnote ⁵⁾ of the table delete the reference to subclause 30.2.

Subclause 14.1

Replace this subclause by the following:

Attention is drawn to the fact that compliance with the requirements concerning the limits for interference effects generated by the energizer as specified in the CISPR recommendations and when measured in accordance with the relevant CISPR specifications, will in most cases ensure that the energizer has the required degree of radio and television interference suppression.

Under particularly unfavourable conditions, national authorities may require a greater degree of suppression than recommended by the CISPR, which may necessitate the fitting of additional suppressors; it is therefore recommended that this be taken into account when designing the appliance.

Subclause 15.1

Replace, in the first paragraph, "for which creepage distances and clearances are specified in subclause 29.1" by the following:

"which could result in a reduction of creepage distances and clearances below the values specified in 29.1."

Subclause 15.1

Replace the penultimate paragraph by the following:

Immediately after the treatment for energizers protected against the effects of immersion the energizer shall withstand the electric strength test specified in 16.3 and inspection shall show that water has not entered those spaces of the energizer where live parts are located.

Subclause 15.2

Replace the penultimate paragraph by the following:

The energizers are then subjected to the appropriate tests for appliances protected against splashing water (IPX4) or appliances protected against the effects of immersion (IPX7), as detailed in IEC 529.

Subclause 16.3

Replace the first dash of item 1 in the table and the test voltage value 4 500 by the following:

— for all insulated Class II energizers (reinforced insulation) 3 750

Replace the first sentence of the first footnote in the table by the following:

The value $2 U_o$ is a peak value equal to twice the maximum peak value of the output voltage measured during the test of subclause 10.1.

Subclause 21.1

Replace the last sentence of the third paragraph by the following:

The sample as a whole is rigidly supported against a plane surface and three blows are applied to every point of the enclosure that is likely to be weak.

Add, after the third paragraph, the following new paragraph:

For the calibration of the spring-operated impact-test apparatus, see IEC 817.

22 Construction

Subclause 22.11

Replace this subclause by the following:

Asbestos shall not be used in the construction of energizers, unless the liberation of dust of impregnated asbestos or of asbestos fibres into the surrounding air is adequately prevented.

Compliance is checked by inspection.

The intention of this requirement is to avoid risk associated with the inhalation of fibres or dust of asbestos.

Subclause 22.21

Delete this subclause.

Subclause 22.22

Replace the explanatory matter by the following:

Material complying with the test of Subclause 30.5 is considered to be suitable for the relevant working voltage and for outdoor conditions.

Add, after subclause 23.7, the following new subclause:

23.8 Stranded conductors shall not be consolidated by lead-tin soldering where they are subject to contact pressure, unless the clamping means is so designed that there is no risk of bad contact due to cold flow of solder.

Compliance is checked by inspection.

Consolidation of stranded conductors by lead-tin soldering is allowed if spring terminals are used; securing the clamping screws alone is not considered adequate.

Soldering of the tip of a stranded conductor is allowed.

24 Components

Subclause 24.1

Delete the second explanation.

Add the following new paragraphs at the end of this subclause:

Automatic controls not complying with IEC 730 shall be tested according to this standard and additionally according to 11.3.5 to 11.3.8 and clause 17 of IEC 730.

The tests according to IEC 730 are carried out under the conditions occurring in the energizer during the tests of clause 19.

For the tests of Clause 17 of IEC 730 the number of cycles to be used is:

- for thermostats: 10 000 cycles of operation;**
- for temperature limiters: 10 000 cycles of operation;**
- for self-resetting thermal cut-outs: 200 cycles of operation;**
- for manually reset non-self-resetting thermal cut-outs: 10 cycles of operation.**
- for non-self-resetting thermal cut-outs requiring replacement of a part: three cycles of operation, a new part being fitted for each operation.**

Subclause 24.2

Replace the text of the first dash by the following:

- switches or automatic controls in flexible cables or cords;**

25 Supply connection and external flexible cables and cords

Subclause 25.5

Add the following explanation:

Soldering of the tip of a stranded conductor is allowed.

Subclause 25.8

Replace, the text of the first dash in the paragraph commencing For type M and Y attachments by the following:

- a separate insulating lining fixed to the cord anchorage;

Subclause 25.9

Replace the line reading

- to fixed wiring and for type X attachment, in addition:

by the following:

- to fixed wiring and for type X and type M attachments, in addition:

Subclause 26.3

Replace the last explanation by the following:

Requirements for screwless terminals are given in IEC 685-2-1.

Subclause 26.4

Add the following to the text preceding the table:

unless the energizer is so designed that only one type of cable or cord can be fitted, in which case the terminals shall be suitable for the connection of that cable or cord.

Subclause 28.1

Add the following footnote in the table:

For screws in engagement with a thread of insulating material and which are likely to be tightened by the user the torque is increased by 20 %.

Replace the last line of the first column of the table by:

over 5,3

Subclause 28.2

Replace the test specification by the following:

Compliance is checked by inspection.

Subclause 29.1

Delete the superscript ¹⁾ in the heading of column 1 of the table.

Add a superscript ¹⁾ to the heading in the third column of the table.

Replace footnote ¹⁾ of the table by the following:

1) The clearances specified do not apply across a spark gap or similar device which is necessary for the correct functioning of the energizer.

Delete the text following the table.

Subclause 29.2

Add the following new paragraphs to the requirement:

Moreover this requirement does not apply if the supplementary insulation or the reinforced insulation is inaccessible and meets one of the following conditions:

- the maximum temperature rise determined during the tests of clause 19 does not exceed the permissible value specified in subclause 11.5;**
- the insulation, after having been conditioned for 7 days (168 h) in an oven maintained at a temperature equal to 50 K in excess of the maximum temperature rise determined during the tests of Clause 19, withstands an electric strength test as specified in subclause 16.3, this test being made on the insulation both at the temperature occurring in the oven and approximately at room temperature.**

The insulation between the input winding and the output windings of transformers used for the isolation of the fence circuit, is considered to be reinforced insulation. However, the thickness of this insulation need not be 2 mm if it is applied in thin sheet form and consists of at least three layers. In this case, when two thirds of the total number of layers or, if this does not result in a whole number, the nearest whole number of layers below two thirds of the total number of layers, are placed in contact, they shall withstand the electric strength test prescribed for the relevant insulation in 16.3. During this test, the test voltage is applied between the outer surfaces of the layers.

30 Resistance to heat, fire and tracking

Replace this clause by the following*:

30.1 External parts of non-metallic materials and parts of insulating material retaining live parts in position, the deterioration of which might cause the energizer to fail to comply with this standard, shall be sufficiently resistant to heat.

Compliance is checked by subjecting a specimen of the relevant parts to a ball-pressure test, which is made by means of the apparatus shown in figure 10.

Before starting the test, the specimen is kept for 24 h in an atmosphere having a temperature between 15 °C and 35 °C and a relative humidity between 45 % and 75 %.

The specimen is placed on a support in such a way that its upper surface is horizontal and the spherical tip of the test apparatus having a diameter of 5 mm is pressed against this surface with a force of 20 N. The thickness of the specimen is at least 2,5 mm; this thickness being obtained, if necessary, by placing two or more specimens together.

* The tests specified in this clause are based on the present IEC standards dealing with this subject. Other concepts for determining the resistance to fire, such as preselection testing, are under consideration by the IEC and will be studied when available.

The test is made in a heating cabinet at a temperature the value of which is the higher of 40 K plus the maximum temperature rise determined during the test of Clause 11, with a tolerance of ± 2 K and :

75 °C $\pm$ 2 °C for external parts.

125 °C $\pm$ 2 °C for parts retaining live parts in position.

However, for parts of thermoplastic material providing supplementary insulation or reinforced insulation, the test is made at a temperature which is 25 K in excess of the maximum temperature rise determined during the tests of Clause 19, with a tolerance of ± 2 K, if this will lead to a higher temperature.

Before the test is started, the test apparatus and the support on which the specimen is placed are brought to the temperature specified.

After 1 h, the test apparatus is removed from the specimen, which is then cooled within 10 s, to approximately room temperature by immersion in cold water. The diameter of the impression caused by the spherical tip is then measured and shall not exceed 2 mm.

For coil formers, only those parts which support or retain in position terminals or terminations are subjected to the test.

The test is not made on parts of ceramic material.

30.2 Parts of non-metallic material shall be adequately resistant to ignition and to spread of fire.

This requirement does not apply to decorative trims, knobs and other parts not likely to be ignited or to propagate flames originating from inside the appliance.

Compliance is checked by the tests of 30.3 and 30.4.

30.3 *Separately moulded specimens of the relevant parts are subjected to the burning test referred to in Appendix J.*

If separately moulded specimens are not available, or if there is no evidence that the material withstands the burning test, or if the separately moulded specimens do not withstand that test, the glow-wire test referred to in Appendix K is made on the relevant parts of the appliance, the test being made at a temperature of 650 °C.

30.4 *Connections supported by parts of insulating material and carrying a current during normal operation exceeding 0,5 A are subject to the bad-connection test with heaters referred to in Appendix L. If this test cannot be made due to the design of the connection, the parts of insulating material supporting the connection are subjected to the glow-wire test referred to in Appendix K, the test being made at a temperature of 750 °C. In this case, the test is also carried out on parts in contact with or in close proximity to the connection.*

The test is not carried out on parts supporting welded connections.

"In close proximity" may generally be considered as a distance not exceeding 3 mm.

During the application of the glow-wire, the height and duration of flames are measured.

In addition for parts which withstand the glow-wire test, but which flame during the application of the glow-wire, the surrounding parts are subject to the needle-flame test referred to in Appendix M for the measured duration of the flame if:

- they are positioned within a distance equal to the height of the flame and*
- they are likely to be impinged upon by the flame.*

However, parts shielded by a separate barrier which meets the needle flame test are not tested.

The needle-flame test is not carried out on parts which are made of a material classified as FV-0 or FV-1 according to IEC 707. The sample of material submitted to the test of IEC 707 shall be no thicker than the relevant part.

Parts likely to be impinged upon by the flame are generally considered to be those within the envelope of a vertical cylinder of a radius of 10 mm and a height equal to the height of the flame, positioned above the point of application of the glow-wire.

If parts do not withstand the glow-wire test or the bad-connection test with heaters, the needle-flame test referred to in Appendix M is made on all other parts of non-metallic material which are within a distance of 50 mm. However, parts shielded by a separate barrier which meets the needle-flame test are not tested.

The needle-flame test is not carried out on parts which are made of a material classified as FV-0 or FV-1 according to IEC 707. The sample of material submitted to the test of IEC 707 shall be no thicker than the relevant part.

30.5 Insulating materials across which a tracking path may occur between live parts of different polarity, shall have adequate resistance to tracking, taking into account the severity of its duty conditions.

For parts of insulating material used under severe or extra-severe duty conditions compliance is checked by the proof tracking test referred to in Appendix N.

For parts of insulating material used under normal duty conditions and parts of ceramic material, no tracking test is made.

For parts of insulating materials used under severe duty conditions, the test voltage is 175 V. If these specimens do not withstand this test and there is no hazard other than fire, surrounding parts are subjected to the needle-flame test referred to in Appendix M.

For parts of insulating material used under extra-severe duty conditions, the test voltage is 250 V. If the specimens do not withstand this test, but withstand the test made with a test voltage of 175 V, and there is no hazard other than fire, surrounding parts are subjected to the needle-flame test referred to in Appendix M.

The needle-flame test is made on all parts of non-metallic material positioned within a distance of 50 mm from any place where a tracking path may occur, unless these parts are shielded by a separate barrier or enclosure from that tracking path, in which case the barrier or enclosure is subjected to the needle-flame test.

The needle-flame test is not carried out on parts which are made of a material classified as FV-0 or FV-1 according to IEC 707. The sample of material submitted to the test of IEC 707 shall be no thicker than the relevant part.

For the severity of the duty conditions of insulating materials, see Appendix P.

Switching devices with moving contacts other than manually-operated, are regarded as being subjected to extra-severe duty conditions. In addition, other parts of insulating material are also regarded as being subjected to extra-severe duty conditions, unless these parts are so enclosed or located that pollution by moisture or dirt is unlikely to occur; in such a case, the requirements for severe duty conditions apply.

Figure 7 - Schematic representation of cord anchorages

Replace with the new attached figure 7.

Figure 8 - Pillar terminals

Replace with the new attached figure 8.

Figure 11

Delete this figure.

Figure 12

Delete this figure.

APPENDIX A

Thermal controls and overload releases

Delete this appendix.

Replace the totality of the appendix B by the new appendix.

APPENDIX B

Electronic Circuits

B1 Scope

This appendix applies to circuits comprising at least one electronic component.

B2 Definitions

Additional definitions:

B2.101 Electronic component denotes a part in which conduction is achieved principally by electrons moving through a vacuum, gas or semiconductor.

B2.102 Protective impedance denotes an impedance connected between live parts and accessible conductive parts and of a value such that the current, in normal use and under likely fault conditions in the appliance, is limited to a safe value.

B4 General notes on tests

Addition:

B4.1 All clauses of this standard, as modified in this appendix, apply to electronic circuits.

Addition:

B4.2 *The accumulation of stress resulting from successive tests is to be avoided. It may be necessary to replace components or to use additional samples.*

The number of additional samples should be kept to a minimum by an evaluation of the relevant circuits.

Additional subclauses:

B4.101 *Care is to be taken that the supply is free from such perturbations from external sources that can influence the results of the tests.*

B8 Protection against electric shock

B8.1 The explanation concerning safety extra-low voltage is not applicable.

Addition:

An accessible part is not considered to be live if:

- the part is supplied from a safety isolating transformer, provided that:
 - for a.c., the peak value of the voltage does not exceed 42,4 V;
 - for d.c., the voltage does not exceed 42,4 V;
- or,
- the part is separated from live parts by protective impedance.

In the case of protective impedance, the current between the part and the supply source shall not exceed 2 mA for d.c. and its peak value shall not exceed 0,7 mA for a.c., and moreover:

- for voltages having a peak value over 42,4 V up to and including 450 V the capacitance shall not exceed 0,1 μF ;
- for voltages having a peak value over 450 V up to and including 15 kV, the discharge shall not exceed 45 μC .

Voltages and currents are measured between the relevant parts and either pole of the supply source. Discharges are measured immediately after the interruption of the supply.

The circuit for measuring the current has a total resistance of $(1\,750 \pm 250)\, \Omega$ and is shunted by a capacitor such that the time constant of the circuit is $(225 \pm 15)\, \mu\text{s}$. Details of a suitable circuit are given in Appendix F.

The measuring circuit has an accuracy within 5 % for all frequencies in the range of 20 Hz to 5 000 Hz.

B8.8 *Addition:*

This requirement does not apply to capacitors complying with the requirements for protective impedance.

B11 Heating

B11.5 Addition to the table:

Parts	Temperature rise (K)	
	I	II
Capacitors complying with IEC 384-14 or subclause 14.2 de la IEC 65 ^{a)}	50	-
Printed circuit boards bonded with epoxy resin	120	-
a) There is no limit for the temperature rise of capacitors which are short-circuited as described in clause B19.		

B13 Electrical insulation and leakage current at operating temperature

B13.1 Addition:

Protective impedance is disconnected from live parts before carrying out the tests.

B16 Insulation resistance and electric strength

B16.1 Addition:

Protective impedance is disconnected from live parts before carrying out the tests.

B16.3 Addition:

The electric strength test between parts of different polarity is not made if the requirements of clause B19 are met with the parts short-circuited.

B19 Abnormal operation

Additional subclauses:

B19.101 Electronic circuits shall be so designed and applied that a fault condition will not render the energizer unsafe with regard to electric shock (see 19.2), fire hazard, mechanical hazard or dangerous malfunction.

Compliance is checked by evaluation of the fault conditions specified in B19.103 for all circuits or parts of circuits, unless they comply with the conditions specified in B19.102.

If the safety of the energizer under any of the fault conditions depends on the operation of a miniature fuse-link complying with IEC 127, the test of B19.104 is made.

During and after each test, the temperature of the windings shall not exceed the values specified in column II of the table of Subclause 11.5 and the energizer shall comply with the conditions specified in 19.4. In particular, live parts shall not be accessible to the standard test finger or the test pin, as specified in 8.1. Any current flowing through protective impedance shall not exceed the limits specified in B8.1.

If a conductor of a printed circuit board becomes open-circuited, the appliance is considered to have withstood the particular test, provided all three of the following conditions are met:

- the material of the printed circuit board withstands the burning test of 20.1 of IEC 65;*
- any loosened conductor does not reduce the creepage distances or clearances between live parts and accessible metal parts below the values specified in clause B29;*
- the appliance withstands the tests of B19.103 with the open-circuited conductor bridged.*

In general, examination of the appliance and its circuit diagram will reveal the fault conditions which have to be simulated, so that testing can be limited to those cases which may be expected to give the most unfavourable result.

In general, the tests take into account any failure which may arise from perturbations on the mains supply. However, where more than one component may be affected simultaneously it may be necessary to carry out additional tests which are under consideration.

B19.102 Fault conditions a) to g) specified in B19.103 are not applied to circuits or parts of circuits where both of the following conditions are met:

- the electronic circuit is a low-power circuit as described below;*
- the protection against electric shock, fire hazard, mechanical hazard or dangerous malfunction in other parts of the energizer does not rely on the correct functioning of the electronic circuit.*

A low-power circuit is determined as follows: an example is shown in figure B1.

The energizer is operated at rated voltage or at the upper limit of the rated voltage range and a variable resistor, adjusted to its maximum resistance, is connected between the point to be investigated and the opposite pole of the supply source.

The resistance is then decreased until the power consumed by the resistor reaches a maximum. Any point nearest to the supply at which the maximum power delivered to this resistor does not exceed 15 W at the end of 5 s is called a "low-power point". The part of the circuit farther from the supply source than a low-power point is considered to be a low-power circuit.

The measurements are made from only one pole of the supply source, preferably the one that gives the fewest low-power points.

When determining the low-power points, it is recommended to start with points close to the supply source.

The power consumed by the variable resistor is measured by a wattmeter.

B19.103 *The following fault conditions are considered and, if necessary, applied one at a time. Consequential faults are taken into consideration.*

a) Short-circuit of creepage distances and clearances between live parts of different polarity, if these distances are less than the values specified in clause B29, unless the relevant part is adequately encapsulated.

b) Short-circuit between live parts of different polarity across insulation which does not withstand the tests of clause 16.

c) Open-circuit at the terminals of any component.

d) Short-circuit of capacitors, unless they comply with IEC 384-14 or 14.2 of IEC 65.

e) Short-circuit of any two terminals of an electronic component, other than integrated circuits.

f) Failure of an integrated circuit. In this case the possible hazardous situations of the appliance are assessed to ensure that safety does not rely on the correct functioning of such a component.

g) Failure of a triac in the diode mode.

All possible output signals are considered under fault conditions within the integrated circuit. If it can be shown that a particular output signal is unlikely to occur, then the relevant fault is not considered.

Microprocessors are regarded as integrated circuits.

Silicon controlled rectifiers (SCRs), triacs and the like are not regarded as integrated circuits and are subjected to failure modes c) and e)

In addition, each low-power circuit is short-circuited by connecting the low-power point to the pole of the supply from which the measurements were made.

For simulation of the fault conditions, the energizer is operated under the conditions specified in clause 11, but at rated voltage or at the most unfavourable voltage within the rated voltage range.

When any of the fault conditions is simulated, the duration of the test is until steady conditions are established.

In each case, the test is ended if interruption of the supply occurs within the energizer.

Fault condition e) is not applied between the two circuits of an optocoupler.

If the energizer incorporates an electronic circuit which operates to ensure compliance with clause 19, the relevant test is repeated with a single fault simulated, as indicated in a) to g) above.

Fault condition f) is applied to encapsulated and similar components if the circuit cannot be assessed by other methods.

Positive temperature coefficient resistors (PTCs) complying with IEC 733-1 are not short-circuited.

Negative temperature coefficient resistors (NTCs) and voltage dependent resistors (VDRs) are short-circuited.

B19.104 *If, for any of the fault conditions specified in B19.103, the safety of the energizer depends on the operation of a miniature fuse-link complying with IEC 127, the test is repeated but with the miniature fuse-link replaced by an ammeter.*

If the current measured does not exceed 2,1 times the rated current of the fuse-link, the circuit is not considered to be adequately protected and the test is carried out with the fuse-link short-circuited.

If the current measured is at least 2,75 times the rated current of the fuse-link, the circuit is considered to be adequately protected.

If the current measured exceeds 2,1 times the rated current of the fuse-link, but does not exceed 2,75 times the rated current, the fuse-link is short-circuited and the test is carried out:

- for quick acting fuse-links for the relevant period or for 30 min, whichever is the shorter;*
- for time lag fuse-links, for the relevant period or for 2 min whichever is the shorter.*

In case of doubt, the maximum resistance of the fuse-link has to be taken into account when determining the current.

The verification whether the fuse-link acts as a protecting device is based on the fusing characteristics specified in IEC 127, which also gives the information necessary to calculate the maximum resistance of the fuse-link.

B22 Construction

B22.18 Addition:

Parts separated by protective impedance shall comply with the requirements for double or reinforced insulation.

B22.19 Addition:

Reinforced insulation is allowed for parts separated by a safety isolating transformer or protective impedance and for parts separated by an optocoupler.

Additional subclause:

B22.101 Protective impedance shall consist of at least two separate components the impedance of which is unlikely to change significantly during the life time of the energizer. If one of the components is short-circuited or open-circuited, the values specified in B8.1 shall not be exceeded.

Compliance is checked by inspection and by measurement.

Resistors complying with subclause 14.1 and capacitors complying with 14.2 of IEC 65 are considered to comply with this requirement.

B29 Creepage distances, clearances and distances through insulation

B29.1 Addition:

For conductive patterns on printed circuit boards, except at their edges, the values in the table between parts of different polarity may be reduced as long as the peak value of the voltage stress does not exceed:

- 150 V/mm with a minimum distance of 0,2 mm, if protected against the deposit of dirt;*
- 100 V/mm with a minimum distance of 0,5 mm, if not protected against the deposit of dirt.*

In general the interior of an energizer having a reasonably dustproof enclosure is considered to be protected against deposit of dirt, so hermetic sealing is not required.

For peak voltages exceeding 50 V the reduced creepage distances only apply if the proof tracking Index (PTI) of the printed circuit board is greater than 175.

These distances may be reduced further provided that the energizer complies with the requirements of clause B19 when the distances are short-circuited in turn.

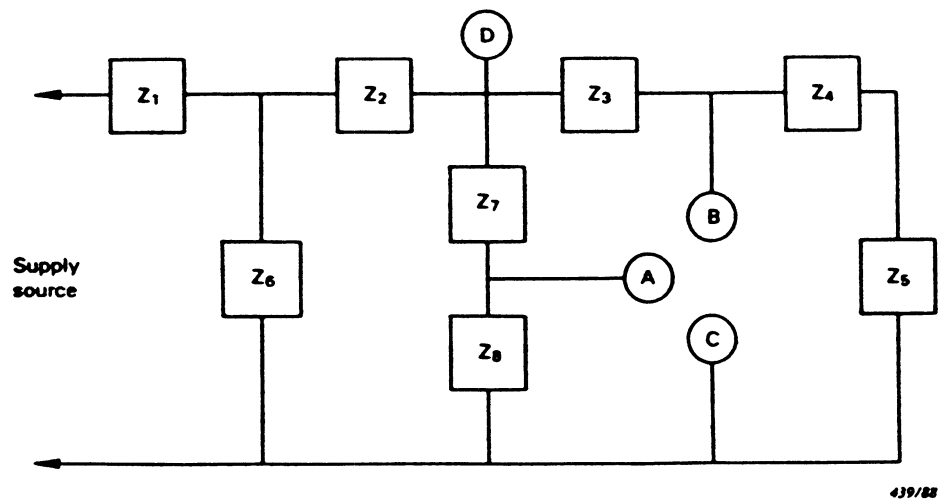
When the limits mentioned above lead to higher values than those of the table, the values of the table apply.

For live parts of different polarity separated by basic insulation only, creepage distances and clearances smaller than those specified in the table are allowed provided the requirements of clause B19 are met if these creepage distances and clearances are short-circuited in turn.

Creepage distances and clearances within optocouplers are not measured if the individual insulations are adequately sealed and if air is excluded between individual layers of the material.

B29.2 Addition:

For optocouplers the conditioning procedure is carried out at a temperature of 50 K in excess of the maximum temperature rise measured on the surface of the optocoupler during the tests of clause 11 or 19 the optocoupler being operated under the most onerous conditions which occur during these tests.



D is the point farthest from the supply source where the maximum power delivered to external load exceeds 15 W

A and B are the points closest to the supply source where the maximum power delivered to external load does not exceed 15 W. These are low-power points. Points A and B are separately short-circuited to C.

The fault conditions a) to g) specified in B19.103 are applied individually to Z_1 , Z_2 , Z_3 , Z_6 and Z_7 where applicable.

Figure B.1 - Example of an electronic circuit with low-power points.

Add the following appendices, G to P:

APPENDIX G

Void.

APPENDIX H

Void.

APPENDIX J

Burning test

The burning test is made in accordance with IEC 707.

For the purpose of this standard, method FH (Flame-Horizontal specimen) is used.

For the evaluation of the test results, category FH3 applies, the maximum burning rate being 40 mm/min.

If more than one specimen does not withstand the test, the material is rejected.

If one specimen does not withstand the test, the test is repeated on another set of five specimens all of which shall then withstand the test.

APPENDIX K

Glow-wire test

The glow-wire test is made in accordance with IEC 695-2-1.

For the purpose of this standard, the following applies:

4 Description of test apparatus

The first paragraph on page 11 is replaced by:

In cases where burning or glowing particles might fall from the specimen onto an external surface underneath the complete appliance, the test is made with a piece of white pine-wood board, approximately 10 mm thick and covered with a single layer of tissue paper, positioned at a distance of (200 ± 5) mm below the place where the tip of the glow-wire is applied to the specimen. If the specimen is a complete appliance, the appliance itself, in its normal position of use, is placed on, or mounted above, the pine-wood board covered with a single layer of tissue paper. Before starting the test, the board is conditioned as described in clause 7 for the specimen.

5 Severities

The duration of application of the tip of the glow-wire to the specimen is (30 ± 1) s.

10 Observations and measurements

Item c) does not apply.

APPENDIX L

Bad-connection test with heaters

The bad connection test with heaters is made in accordance with IEC 695-2-3.

For the purpose of this standard, the following applies:

3 General description of the test

Add the following:

Crimped connections are not subjected to the test if:

- a bad connection cannot give rise to a fire hazard, or
- the continuous current is less than 0,5 A, or
- the conductors are chosen in accordance with the following table and are used together with the correct matching connector:

Continuous current A	Cross-sectional area mm ²	
	a	b
0,5 up to and including 4,0	-	0,5
4,0 up to and including 6,0	0,75	1,0
6,0 up to and including 10,0	1,0	1,5
10,0 up to and including 16,0	1,5	2,5
16,0 up to and including 25,0	2,5	4,0

Column a applies to tinned stranded conductors.

Column b applies to other stranded conductors.

Crimped connections are not considered to give rise to a fire hazard, if the insulating parts which retain the connections withstand the glow-wire test described in appendix K, at the test temperature specified in 30.4.

Sleeves on the ends of stranded conductors intended for insertion into screw terminals are not regarded as crimped connections in the sense of this requirement.

When establishing the value of the continuous current, inrush currents are disregarded.

4 Description of test apparatus

The paragraph concerning the evaluation of the possibility of spread of fire, on page 11, including the three dashed paragraphs, and the first paragraph of the note, are replaced by:

In cases where burning or glowing particles might fall from the specimen onto an external surface underneath the complete appliance, the test is made with a piece of white pine-wood board, approximately 10 mm thick and covered with a single layer of tissue paper, positioned at a distance of (200 ± 5) mm below the place where the test flame is applied to the specimen. If the specimen is a complete appliance, the appliance itself, in its normal position of use, is placed on, or mounted above, the pine-wood board covered with a single layer of tissue paper. Before starting the test, the board is conditioned as described in clause 6 for the specimen.

5 Severities

The duration of application of the test power is (30 ± 1) min.

8 Test procedure

Subclause 8.6 is replaced by the following:

The test is made on one specimen. If the specimen does not withstand the test, the test is repeated on two further specimens, both of which shall then withstand the test.

11 Information to be given in the relevant specification

The first dashed paragraph under item h) does not apply.

