

Live working — Portable equipment for earthing or earthing and short-circuiting

The European Standard EN 61230:1995, with the incorporation of amendment A11:1999, has the status of a British Standard

ICS 13.340.20

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Power Electrical Engineering Standards Policy Committee (PEL/-) to Technical Committee PEL/88, upon which the following bodies were represented:

- Association of Manufacturers Allied to the Electrical and Electronic Industry (BEAMA Ltd.)
- BECCAMA (BEAMA Electrical Cable Connector and Accessories Manufacturers' Association)
- British Railways Board
- Department of Trade and Industry
- Department of Trade and Industry (Consumer Safety Unit, CA Division)
- Electricity Association
- Federation of British Hand Tool Manufacturers
- GAMBICA (BEAMA Ltd.)
- Health and Safety Executive
- Industrial Safety (Protective Equipment) Manufacturers' Association
- International Powered Access Federation
- Ministry of Defence
- National Association of Glove Manufacturers
- Coopted member

This British Standard, having been prepared under the direction of the Power Electrical Engineering Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 March 1994

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National foreword

This British Standard has been prepared by Technical Committee PEL/78 (formerly PEL/88) and is the English language version of EN 61230:1995, *Live working — Portable equipment for earthing or earthing and short-circuiting*, including amendment A11:1999, published by the European Committee for Electrotechnical Standardization (CENELEC). It was derived by CENELEC from IEC 61230:1993, including Corrigenda July 1999, May 2000 and December 2000, published by the Electrotechnical Commission (IEC).

Annex A, Annex B, Annex C, Annex D are normative and are an integral part of this standard. The graphic signs, symbols and letters used in this standard may be found in the following British Standards:

BS 3939 *Guide for graphics symbols for electrical power; telecommunications and electronic diagrams —*
Part 1:1986 *General information, general index*
(Related to IEC 60617-1:1985)
Part 2:1985 *Symbol elements, qualifying symbols and other symbols having general application*
(Identical with IEC 60617-2:1983)

IEC corrigendum July 1999 revises the solvent used in **6.6.3** about employer responsibility. IEC corrigendum May 2000 replaces references to IEC 410:1973 with ISO 2859-1:1999 in Clause **2**, **6.1.2**, Annex B and Table B.1. IEC corrigendum December 2000 corrects the value of *R* in Figure C.1.

The Technical Committee has reviewed the provisions of IEC 60068-2, IEC 60068-2-42:1982, IEC 60071-3:1982 and IEC 61138:1992, to which normative reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

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Summary of pages

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English version

Live working — Portable equipment for earthing or earthing and short-circuiting

(includes amendment A11:1999)

(IEC 61230:1993, modified)

Travaux sous tension —
Dispositifs portables de mise à la terre ou de
mise à la terre et en court-circuit
(inclut l'amendement A11:1999)
(CEI 61230:1993, modifiée)

Arbeiten unter Spannung —
Örtsveränderliche Geräte zum Erden oder
Erden und Kurzschließen
(enthält Änderung A11:1999)
(IEC 61230:1993, modifiziert)

This European Standard was approved by CENELEC on 1995-07-04 and amendment A11 was approved by CENELEC on 1999-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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European Committee for Electrotechnical Standardization
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Foreword

The text of the International Standard IEC 1230:1993, prepared by IEC TC 78, Tools for live working, together with common modifications prepared by the Technical Committee CENELEC TC 78, was submitted to the formal vote and was approved by CENELEC as EN 61230 on 1995-07-04.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-07-01
- latest date by which national standards conflicting with the EN have to be withdrawn (dow) 1996-07-01

For products which have complied with the relevant national standard before 1996-07-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2001-07-01.

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given only for information. In this standard, Annex A, Annex B, Annex C and Annex D and Annex ZB are normative and Annex ZA is informative. Annex ZA and Annex ZB have been added by CENELEC.

Foreword to amendment A11

This amendment was prepared by the Technical Committee CENELEC TC 78, Equipment and tools for live working.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A11 to EN 61230:1995 on 1999-10-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2000-10-01
- latest date by which national standards conflicting with the amendment have to be withdrawn (dow) 2002-10-01

Experience in short-circuit current tests carried out in accordance with IEC 61230 subclause 6.6 shows that the evaluation of the tests according to subclause 6.6.7 are impossible to fulfill if we refer to the LV touch-voltage curve.

In 1995, when IEC 61230 was adopted by CENELEC, a note was added, explaining that this point was under study.

This amendment provides a solution based on Figure 9.1 of HD 637 S1:1999 giving a curve of the admissible touch-voltage in case of earth-fault in HV systems. This curve is derived from IEC 60479-1.

1 Scope

This standard is applicable to portable equipment, with or without matching fixed connection points, for temporary earthing or earthing and short-circuiting of electricity isolated a.c. installations, transmission and distribution networks whatever their rated voltages and including railway systems, for the protection of workers.

The earthing equipment covered by this standard should be based primarily on current and time, and on voltage where needed for insulation purposes. IEC 60855 provides the electrical requirements for insulating components of the equipment.

Component types or configurations are not specified but should comply with the electrical and mechanical requirements of this standard.

This standard is applicable only to equipment using copper cables, copper bars or aluminium bars as the earthing and short-circuiting medium.

Devices meant only for the draining of induced currents, where the risk of energization is completely eliminated, are not included in this standard. However, certain requirements and tests for that type of device can be taken from this standard.

NOTE The standardization of equipment for d.c. systems is under consideration.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050 (151):1978, *International Electrotechnical Vocabulary (IEV) — Chapter 151: Electrical and magnetic devices*.

IEC 60060-1:1989, *High voltage test techniques — Part 1: General definitions and test requirements*.

IEC 60068-2, *Environmental testing — Part 2: Tests*.

IEC 60068-2-42:1982, *Environmental testing — Part 2: Tests — Test Kc: Sulphur dioxide test for contacts and connections*.

IEC 60071-3:1982, *Insulation co-ordination — Part 3: Phase-to-phase insulation co-ordination. Principles, rules and application guide*.

IEC 60479-1:1984, *Effects of current passing through the human body — Part 1: General aspects — Chapter 1: Electrical impedance of the human body — Chapter 2: Effects of alternating current in the range of 15 Hz to 100 Hz — Chapter 3: Effects of direct current*.

IEC 60855:1985, *Insulating foam-filled tubes and solid rods for live working*.

IEC 61235:1993, *Insulating hollow tubes for electrical purposes (under consideration)*.

IEC 61138:1992, *Cables for portable earthing and short-circuiting equipment*.

ISO 2859-1:1999, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*.

3 Definitions

For the purposes of this International Standard, the following definitions apply.¹⁾

3.1 Tests

3.1.1

type test

a test of one or more devices made to a certain design to show that the design meets certain specifications [IEV 151-04-15]

3.1.2

routine test

a test to which each individual device is subjected during or after manufacture to ascertain whether it complies with certain criteria [IEV 151-04-16]

3.1.3

sampling test

a test on a number of devices taken at random from a batch [IEV 151-04-17]

3.1.4

acceptance test

a contractual test to prove to the customer that the device meets certain conditions of its specification [IEV 151-04-20] (see Annex A)

3.2 Special terms

3.2.1

portable equipment for earthing or earthing and short-circuiting

equipment which is brought and connected to parts of electric installations for earthing or earthing and short-circuiting purposes by hand, with insulating component(s). Comprises earthing components, short-circuiting components and one or more insulating components, for instance earthing poles (see Figure 1, Figure 2 and Figure 3)

3.2.2

earthing cable

cable connecting a short-circuiting device with the earthing system (see Figure 1a, Figure 2a, Figure 2b and Figure 3)

3.2.3

short-circuiting device

device for interconnecting conductors for short-circuiting purposes (see Figure 1, Figure 2 and Figure 3, items 2, 3, 5, 15 and 17). The interconnection may be made partly through the earthing system (see Figure 2d)

3.2.4

short-circuiting cable

cable forming part of a short-circuiting device (see Figure 1 and Figure 2)

3.2.5

short-circuiting bar

rigid conductor, such as a bar or tube, forming part of a short-circuiting device (see Figure 3)

3.2.6

connecting cluster

component for connecting short-circuiting cables either directly or through connecting links, such as cable lugs, with each other and with earthing cable or earth clamp (see Figure 1a and Figure 2a)

¹⁾ See IEC 60050 (441) and IEC 60050 (601) for the general terms used in this standard.

3.2.7**earth clamp**

clamp which is attached to an earthing cable, short-circuiting cable or connecting cluster, either directly or through connecting links, and is used for connecting to the earthing system, either directly or through a fixed connection point (see Figure 1a, Figure 2 and Figure 3)

3.2.8**line clamp**

clamp which is attached to a short-circuiting cable, short-circuiting bar or conductive extension component, either directly or through connecting links, and used for connecting to line (line conductors, busbars or other current-carrying conductors, or through a fixed connection point (see Figure 1, Figure 2 and Figure 3)

3.2.9**fixed connection point**

part of installation specially arranged for clamp connection (for example, ball pin, cylinder bolt, bow, hook, stirrup, stud) (see Figure 1a and Figure 5a)

3.2.10**insulating element**

hand-held insulating component for bringing and connecting line clamps to parts of electric installations, for earthing or earthing and short-circuiting purposes

3.2.11**earthing pole (earthing stick)**

insulating element comprising an insulating pole (see Figure 1, $L_H + L_I$) equipped with a permanent or detachable coupling (see Figure 1, item 14) for line clamp, short-circuiting bar or conductive extension component

3.2.12**conductive extension component**

rigid conductor between an insulating pole and a line clamp, forming an extension of an earthing or a short-circuiting cable (see Figure 1b)

3.2.13**rated current I_r and rated time t_r**

values assigned to a device, or part of it, to define the highest r.m.s value of current and the highest Joule-integral ($I_r^2 - t_r$) that it can resist without unacceptable effects. The values apply only to those parts designed to withstand short-circuit current

3.2.14**peak current I_m**

peak value of the highest current during the transient period following initial energizing of the circuit

4 Data for electrical characteristics

Each component of an earthing or earthing and short-circuiting device that shall withstand short-circuit current is characterized by its rated current, I_r , and rated time, t_r .

Six values of rated time, t_r , are standardized:

3 s, 2 s, 1 s, 0,5 s, 0,25 s and 0,1 s

I_r shall be specified for one of these standard times as:

I_{r3} ; I_{r2} ; I_{r1} ; $I_{r0,5}$; $I_{r0,25}$ or $I_{r0,1}$ kA r.m.s.

No part of an earthing and short-circuiting device shall be exposed to:

- a current greater than its rated current, I_r ;
- a Joule-integral greater than $I_r^2 - t_r$.

5 Requirements

5.1 General requirements

Equipment shall permit safe earthing and short-circuiting of electrical installations (see Annex A).

Devices, when installed according to instructions for use, shall be able to withstand all stresses from fault currents for which they are designed without causing electrical, mechanical, chemical or thermal danger to persons.

For indoor use, the material of the device shall be selected and dimensioned so as to prevent the arising of toxic vapours in such amounts, which can risk the health of persons, seriously damage installations or buildings, or impair the evacuation of personnel.

With respect to climatic conditions, normal use shall refer to a temperature range -25°C to $+55^{\circ}\text{C}$. Two special categories for warm (W) and cold (C) temperature use are included (see Table 1).

Table 1 — Special temperature categories

Category	Temperature range
Warm (W)	-5°C to $+70^{\circ}\text{C}$
Cold (C)	-40°C to $+55^{\circ}\text{C}$

The following subclauses specify the requirements and tests necessary to verify that equipment meet the requirements. Any agreement may be made between manufacturer and customer on additional requirements and tests prescribed in the customer's specification.

NOTE The requirements on special temperatures are not covered by a referenced test. A test may be added (under consideration).

5.2 Cables for earthing and short-circuiting

Cables for earthing and short-circuiting purposes shall meet special requirements regarding low weight, flexibility over a wide range of temperature and properties at high temperature. The insulating covering is essential for protection against mechanical and chemical damage. It shall withstand 50 V r.m.s. during the time of the short-circuit and when exposed to the clashing and temperature rise produced by the short-circuit current. These requirements are met, in part, by selecting short-circuiting cables according to IEC 61138.

NOTE There are two common practices regarding the colour of the covering:

- 1) a bright colour, such as orange or red, to increase the visibility of the device. Preferences differ among users;
- 2) Transparency to permit inspection of the conductor for signs of corrosion or surface strand damage, although such transparency is usually lost after repeated use.

Earthing and short-circuiting cables shall be selected to withstand the maximum currents, times and Joule-integrals to which they can be exposed in practice.

5.2.1 Earthing cables used on solidly earthed systems

Earthing cables used on solidly earthed systems shall have the same cross-section as the associated short-circuiting cables or bars.

5.2.2 Earthing cables used on non-solidly earthed systems

Earthing cables used on non-solidly earthed systems may have a cross-section less than the corresponding short-circuiting cables or bars, but never less than that given in Table 2.

Table 2 — Minimum cross-section of earthing cable related to the cross-section of the short-circuiting cable and/or bar

Copper equivalent cross-section of short-circuiting cable and/or bar mm ²	Minimum copper equivalent cross-section of earthing cable mm ²
16	16
25	16
35	16
50	25
70	35
95	35
≥ 120	50

5.3 Short-circuiting bars

Short-circuiting bars shall be selected to withstand the maximum currents, time and Joule-integrals to which they can be exposed in practice.

Dimensions of bars for short-circuiting purposes are not standardized.

Material for short-circuiting bars shall be selected in accordance with IEC standards.

5.4 Connections within devices

Excellent fatigue resistance is required for the connections of cables to rigid parts (ferrules, etc.) (see Annex A). The connections shall be made with great care to ensure that the specified minimum characteristics of the cable are maintained. Soldered connections are not allowed. If the primary attachment is made to intermediate parts such as cable lugs, the next connection shall be protected against unintentional loosening. Single screws or nuts, if used, shall always be combined with a device, for instance lock washers, that positively prevents slippage or rotation.

Compliance shall be verified by tests according to **6.2**, **6.4**, **6.5** and **6.6** and by visual inspection. If a humidity penetration test on a device with copper cable is agreed to between the customer and manufacturer, it shall be carried out according to **5.3**.

5.5 Clamps

After exposure to prescribed atmospheric conditions (see **6.6.3**) and when connected in accordance with instructions (see **6.6.5** and Table 4) to conductors or fixed connection points for which they are intended, clamps shall provide reliable contact performance and withstand the thermal and mechanical stresses produced by the rated fault currents.

Tightening forces shall not cause damage to clamps or connecting points (fixed connection points or conductors).

Line clamps shall permit easy installation by means of an insulating element, to connecting points having the specific properties (such as size, shape, freedom of movement) to be agreed between customer and manufacturer. If fixed connection points are not provided, the clamp shall be suitable for the surface and shape of the conductor at the connecting point.

Compliance shall be verified by tests according to **6.5** and **6.6** and by checking manually.

5.6 Complete earthing and short-circuiting device

After connection according to instructions, the short-circuiting device shall offer protection against dangerous voltages and electric arcs caused by accidental energization.

All conductors and connections of the device shall withstand the combined thermal and mechanical stresses caused by a short time peak current of a short-circuit.

For a device, all cables exposed to short-circuit current shall have the same cross-section.

The device shall have adequate insulation to ensure that temporary contact between parts of the device, or between these parts and surrounding structures, does not cause arcing. For cables this is dealt with in **5.2**. For connecting clusters and conductive extension components, the need for insulation shall be considered with regard to risk from temporary contacts.

Compliance shall be verified by tests according to **6.6** and by visual inspection.