BRITISH STANDARD

BS EN 61180-2:1995
IEC 1180-2: 1994

High-voltage test techniques for low-voltage equipment —

Part 2: Test equipment

The European Standard EN 61180-2:1994 has the status of a British Standard

Committees responsible for this British Standard

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ASTA Certification Services
British Cable Makers Confederation
British Industrial Ceramic Manufacturers' Association
Department of Trade and Industry (Namas Executive)
Electrical and Electronic Insulation Association (BEAMA Ltd.)
Electricity Supply Industry in England and Wales
Institute of Science Technology
Transmission and Distribution Association (BEAMA Ltd.)
University of Manchester

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National foreword

This British Standard has been prepared by Technical Committee PEL/42 and is the English language version of EN 61180-2:1994 *High-voltage test techniques for low-voltage equipment* — Part 2: *Test equipment,* published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 1180-2:1994 published by the International Electrotechnical Commission (IEC).

This Standard should be read in conjunction with BS 7640-1:1993 *High-voltage test techniques for low-voltage equipment* — Part 1: *Definitions, test and procedure requirements.*

Cross-references

Publication referred to	Corresponding British Standard
IEC 68-1:1988	BS 2011 *Environmental testing* Part 1.1:1989 *General and guidance*
IEC 790:1984	BS 6647:1985 *Guide to oscilloscopes and peak voltmeters for impulse tests*
IEC 1083-1:1992	BS EN 61083 *Digital recorders for measurements in high-voltage impulse tests* Part 1:1993 *Requirements for digital recorders*
IEC 1180-1:1992	BS 7640 *High-voltage test techniques for low-voltage equipment* Part 1:1993 *Definitions, test and procedure requirements*

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 6, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

EUROPEAN STANDARD

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EUROPÄISCHE NORM

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High-voltage test techniques for low-voltage equipment Part 2: Test equipment

(IEC 1180-2:1994)

Techniques des essais à haute tension pour matériel à basse tension

Partie 2: Matériel d'essai

(CEI 1180-2:1994)

Hochspannungs-Prüftechnik für Niederspannungsgeräte

Teil 2: Prüfgeräte

(IEC 1180-2:1994)

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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.

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

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Foreword

The text of document 42(CO)53, as prepared by IEC Technical Committee 42: High-voltage testing techniques, was submitted to the IEC-CENELEC parallel vote in December 1993.

The reference document was approved by CENELEC as EN 61180-2 on 5 July 1994.

The following dates were fixed:

— latest date of publication of an identical national standard (dop) 1995-07-01

— latest date of withdrawal of conflicting national standards (dow) 1995-07-01

Annexes designated "normative" are part of the body of the standard. Annexes designated "informative" are given only for information. In this standard, Annex A is informative and Annex ZA is normative.

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1 Scope

This part of IEC 1180 is applicable to the test equipment used for dielectric tests on low-voltage equipment. It covers tests with direct, alternating or impulse voltage, impulse current, and tests with a combination of impulse voltage and impulse current. Verification procedures necessary for ensuring that the dielectric tests comply with the voltage, or current, requirements stated in part 1 of this standard in shape and magnitude are stated.

The test equipment comprises a voltage and/or current generator and a measuring system. This standard covers test equipment in which the measuring system is protected against external interference and coupling by appropriate screening, for example a continuous conducting shield. Therefore, simple comparison tests are sufficient to ensure valid results.

Test equipment having measuring systems composed of non-screened components and/or connected by long leads is not covered in this standard. In this case guidance can be obtained from IEC 60-2 keeping in mind the less stringent requirements of this standard.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 1180. At the time of publication of this standard, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 1180 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 68-1:1988, *Environmental testing — Part 1: General and guidance.*

IEC 790:1984, *Oscilloscopes and peak voltmeters for impulse test.*

IEC 1083-1:1991, *Digital recorders for measurements in high-voltage impulse tests — Part 1: Requirements for digital recorders.*

IEC 1180-1:1992, *High-voltage test techniques for low-voltage equipment — Part 1: Definitions, test and procedure requirements.*

NOTE The requirements of IEC 790 and IEC 1083-1 may be reduced because the uncertainty limits of this part of 1180 are less stringent than those in IEC 60-1, for example, ± 5 % for peak value (± 3 % in IEC 60-1).

3 Definitions

For the purpose of this International Standard, the following definitions apply.

3.1
test equipment

complete set of devices needed to generate and measure the test voltage or current applied to a test object

3.2
reference measuring system

measuring system having sufficient accuracy and stability for it to be appropriate for use in the approval of other systems by making simultaneous comparative measurements of specific types of wave-form and ranges of voltage or current

NOTE Uncertainty limits are given in clause **10**.

3.3
measuring error

difference between the value measured by the test equipment and the value given by the reference measuring system (reference value). It is usually expressed as a percentage of the reference value

3.4
conventional output impedance (impulse voltage generator)

value of $[(V_{OC} - V_R)/V_R]\,R$ where V_{OC} is peak output voltage into an open circuit and V_R is the voltage on a resistive load R where R is such that:

$$0{,}4\ V_{OC} \leq V_R \leq 0{,}6\ V_{OC}$$

NOTE For virtual impulse generator impedance, see **8.1.2.2** of IEC 1180-1.

4 General conditions for verification of test equipment

4.1 Atmospheric conditions

The atmospheric conditions for verifications shall be those stated for testing in IEC 68-1:

Temperature	15 °C to 35 °C
Air pressure	86 kPa to 106 kPa
Relative humidity	25 % to 75 %

The actual atmospheric conditions during the test shall be recorded.

4.2 Connections and arrangement

The connections between the equipment to be calibrated and the reference measuring system shall be direct and as short as possible. For impulse tests, the lead lengths shall be 1 m (tolerance + 0,5 m, – 1 m). The reference measuring system shall be placed at a distance at least equal to its height from any earthed part (object), or shall be screened.

The supply voltage to the test equipment shall be its rated value ± 10 % at the rated frequency.

NOTE A supply voltage lower than the rated voltage may reduce the maximum output voltage of the test equipment.

4.3 Influence of the load

Each comparison test shall be made first with the minimum load (the reference measuring system alone) and repeated with the maximum load (resistive, capacitive, inductive or any combination of these) allowed by the manufacturer of the test equipment.

4.4 Comparison procedure

The test equipment to be verified shall be connected in parallel or series, as appropriate, with a reference measuring system. Simultaneous measurements shall be made at the minimum and maximum of the operating range and at two approximately equally spaced values between these extremes. Readings shall be taken for increasing and decreasing values of voltage or current.

4.5 Frequency of verifications

Verifications shall be made at appropriate intervals but at least annually. Verifications shall be made by the comparison test of **4.4** unless an equivalent test is specified by the relevant technical committee.

5 Verification of characteristics of direct voltage generators

5.1 Ripple factor

The ripple factor shall be within the limits specified in **4.2.1.1** of IEC 1180-1 for a purely resistive load at the maximum current and at the minimum test voltage specified.

5.2 Permitted measuring error

The measuring error shall be within ± 3 % of the voltage measured by the reference measuring system.

5.3 Voltage regulation

The difference in output voltage measured under no-load and full-load, after steady-state conditions have been reached, shall not be greater than 5 %.

6 Verification of characteristics of alternating voltage generators

6.1 Voltage wave-form

The output voltage of the test equipment shall be measured simultaneously with two reference measuring systems connected in parallel, one of which shall be a peak reading system and the other a true r.m.s. reading system. The ratio of peak to r.m.s. values shall be equal to $\sqrt{2}$ % ± 5 % (see **5.2.1.1** of IEC 1180-1).

NOTE 1 This may be achieved by using one converting device with two measuring instruments.

NOTE 2 Some r.m.s. reading instruments do not give a true r.m.s. value.

6.2 Permitted measuring error

The measuring error shall be within ± 3 % of the voltage measured by the reference measuring system.

6.3 Minimum test voltage

The minimum test voltage is obtained as follows:

An ammeter shall be connected across the output terminals of the test equipment. The control setting of the test equipment shall be adjusted until the ammeter reads 0,1 A r.m.s. and this control setting noted. The ammeter shall be removed and the open-circuit voltage of the test equipment measured at this control setting. This open-circuit voltage is the minimum test voltage for tests complying with the requirements of this standard.

NOTE The relevant technical committee may specify higher values than 0,1 A r.m.s. if required.

7 Verification of characteristics of impulse voltage generators

7.1 Voltage wave-form

If the generator and the measuring system are not changed, it is not necessary to verify the wave-form for each load condition. It is sufficient to verify the test equipment wave-form with a calibrated oscilloscope or a calibrated digital recorder which complies with the relevant standard (see clause **2**). This verification shall be carried out according to **4.4** at maximum and minimum load and for both polarities. The measured values of the time parameters shall be within the tolerances given in **6.2.2** of IEC 1180-1.

NOTE More than one impulse may be necessary to establish consistent operation.

7.2 Permitted measuring error

The measuring error shall be within ± 5 % of the voltage measured by the reference measuring system.

If a time parameter is measured, then the measuring error shall be within ± 20 % of the value measured by the reference measuring system.

NOTE This may be done at the same time as the voltage wave-form measurements.

7.3 Conventional output impedance

The conventional output impedance $[(V_{OC} - V_R)/V_R]$ R is determined as follows:

At a specified voltage control setting of the test equipment the output peak voltage shall be measured under open-circuit conditions, V_{OC}. A resistive load, R, shall then be connected to the output terminals of the test equipment, such that the output peak voltage, V_R, at the same control setting is between 40 % and 60 % of the open-circuit peak voltage.

The value of the conventional output impedance shall be within the limits specified by the relevant technical committee.

NOTE 1 The actual output impedance of the test equipment will differ from the conventional output impedance which is used for comparison purposes.

NOTE 2 The impulse wave-form will change when the resistive load R is connected (in particular, the time to half-value will decrease).

NOTE 3 V_{OC} should be greater than 30 % of V_{max}.

8 Verification of characteristics of impulse current generators

8.1 Current wave-form

If the generator and the measuring system are not changed, it is not necessary to verify the wave-form for each load condition (linear or non-linear). It is sufficient to verify the wave-form as follows:

The output terminals of the test equipment shall be connected directly to the reference measuring system with leads as short as possible. The current wave-form shall be measured with a calibrated oscilloscope or digital wave-form recorder following the procedure given in **4.4** and shall comply with the tolerances stated in **7.2.2** of IEC 1180-1.

8.2 Permitted measuring error

The measuring error shall be within ± 5 % of the current measured by the reference measurement system.

If a time parameter is measured then the measuring error shall be within ± 20 % of the value measured by the reference measuring system.

NOTE This may be done at the same time as the current wave-form measurements.

9 Verification of characteristics of hybrid impulse voltage generators

9.1 Wave-form and permitted measuring error

The hybrid generator shall be checked as an impulse voltage generator (see **7.1** and **7.2**) but in the minimum load condition only, and then as a current generator (see **8.1** and **8.2**) at the same control setting. The voltage and current wave-forms shall be within the limits given in **8.2.2.2** and **8.2.2.3** of IEC 1180-1.

9.2 Virtual impedance

The ratio of peak voltage to peak current shall be calculated from the measurements made in **9.1** for the minimum and maximum control settings and at two equally spaced values between these extremes. The mean value of this ratio shall be within the tolerance specified in **8.2.2.4** of IEC 1180-1. This mean value is the virtual impedance of the hybrid generator.

10 Requirements for reference measuring systems

10.1 Direct voltage

A reference measuring system for direct voltage shall have an overall uncertainty within ± 2 % over its range of use. The accuracy shall not be influenced by a ripple factor up to 3 %.

10.2 Alternating voltage

A reference measuring system for alternating voltage shall have an overall uncertainty within ± 2 % over its range of use.

10.3 Lightning impulse voltage

A reference measuring system for impulse voltage shall have an overall uncertainty within ± 3 % for the peak value of full impulses and within ± 10 % for the time parameters over its range of use.

10.4 Impulse current

A reference measuring system for impulse current shall have an overall uncertainty within ± 3 % for the peak value and within ± 10 % for the time parameters over its range of use.

10.5 Comparative measurement

The satisfactory performance of a reference measuring system shall be shown by comparative measurements against a reference measuring system traceable to national measurement standards.

Annex A (informative)
Bibliography

IEC 60-2:1994, *High-voltage test techniques — Part 2: Measuring systems.*

Annex ZA (normative)
Other international publications quoted in this standard with the references of the relevant European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

NOTE When the international publication has been modified by CENELEC common modifications, indicated by (mod), the relevant EN/HD applies.

IEC publication	Date	Title	EN/HD	Date
68-1	1988	*Environmental testing* — Part 1: *General and guidance*	EN 60068-1[a]	1994
790	1984	*Oscilloscopes and peak voltmeters for impulse tests*	HD 479 S1	1986
1083-1, mod	1991	*Digital recorders for measurements in high-voltage impulse tests* Part 1: *Requirements for digital recorders*	EN 61083-1	1993
1180-1	1992	*High-voltage test techniques for low-voltage equipment* Part 1: *Definitions, test and procedure requirements*	EN 61180-1	1994

NOTE The requirements of HD 479 S1 and EN 61083-1 may be reduced because the uncertainty limits of this part of 1180 are less stringent than those in HD 588.1 S1, for example, +/– 5 % for peak value (+/– 3 % in HD 588.1 S1)

[a] EN 60068-1 includes the corrigendum October 1988 and A1:1992 to IEC 68-1.

List of references

See national foreword.

BS EN 61180-2:1995 IEC 1180-2: 1994

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