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Electrical test methods for electric cables -- Part 2: Partial discharge tests

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Elektrische Prüfverfahren für Starkstromkabel -- Teil 2: Teilentladungsprüfungen

Méthodes d'essais électriques pour les câbles électriques -- Partie 2: Essais de décharges partielles

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Electrical test methods for electric cables Part 2: Partial discharge tests (IEC 60885-2:1987)

Méthodes d'essais électriques pour les câbles électriques Partie 2: Essais de décharges partielles (CEI 60885-2:1987)

Elektrische Prüfverfahren für Starkstromkabel Teil 2: Teilentladungsprüfungen (IEC 60885-2:1987)

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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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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

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Foreword

The text of the International Standard IEC 60885-2:1987, prepared by IEC TC 20, Electric cables, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 60885-2 on 2003-09-01.

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)	2004-09-01
- latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2006-09-01

Annexes designated "normative" are part of the body of the standard.
In this standard, Annex ZA is normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60885-2:1987 was approved by CENELEC as a European Standard without any modification.

ELECTRICAL TEST METHODS FOR ELECTRIC CABLES

Part 2: Partial discharge tests

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1. Scope

The purpose of the test is to determine the partial discharge magnitude at a specified voltage and with a given sensitivity.

2. Definitions

For the purpose of this method, the definitions given in IEC Publication 270: Partial Discharge Measurements, apply.

The following definitions are of particular relevance:

a) apparent charge, q, or discharge magnitude (Sub-clause 3.2.2 of IEC Publication 270);

b) response ratio and sensitivity (Sub-clauses 4.2 and 4.3 herein).

3. Test apparatus

3.1 *Equipment*

The equipment consists of a high-voltage power supply having a kilovolt-ampere capacity adequate for the length of cable under test, a voltmeter for high voltages, a partial discharge measuring device and a discharge calibrator. All components of the test equipment shall have a sufficiently low noise level to achieve the required sensitivity.

3.2 *Test circuit and instruments*

The partial discharge measuring device consists of a test circuit (see IEC Publication 270), an oscilloscope and, if desired, an indicating instrument, in conjunction with suitable amplifying equipment to indicate the existence of partial discharges and to detect individual discharge pulses.

4. Calibration and checking

4.1 *Calibration method*

The "charge transfer" method of calibration shall be used in accordance with Sub-clause 5.2.1 of IEC Publication 270. Further guidance for the use of discharge calibrators is found in CIGRÉ Report 1968-2101, Appendix III. In this method, a calibration device is connected directly across one end of the cable to be tested to inject predetermined charges into the test object.

The calibration discharge, q_{cal}, is equal to the product of the calibration pulse amplitude ΔU (in volts) and the coupling capacitance, C_{cal}, of the calibrator (in farads) as long as this capacitance is small compared with the capacitance of the test object, C_x.

The characteristics of the calibrating pulse shall conform to Sub-clause 5.2.1 of IEC Publication 270 and CIGRÉ Report 1968-2101, Appendix III, Section III.

4.2 *Response ratio*

With the cable to be tested connected to the detection circuit, the detection response sensitivity of the apparatus shall be checked with the calibrating pulse injected first at one end of the cable and then at the other. The lowest response in these two cases is taken as the overall response to establish the response ratio k (where k is the number of picocoulombs of the calibrating pulse per millimetre deflection on an oscilloscope screen, or the ratio of picocoulombs of the calibrating pulse to the deflection in picocoulombs (pC) of a picocoulomb-meter).

4.3 *Sensitivity*

a) The sensitivity of the test circuit (with the given instruments) is defined as the minimum detectable discharge pulse, q_{min}, (in picocoulombs) that can be seen in the presence of background noise.

In order to be detectable, a discharge pulse shall be at least twice the apparent noise height, h_n (h_n is the noise magnitude in millimetres if an oscilloscope is used, or the noise deflection in picocoulombs if a picocoulomb-meter is used).

Therefore, $q_{min} = 2\, k \cdot h_n$ (pC).

b) For routine tests, the sensitivity shall be 20 pC or less for polyethylene (PE), cross-linked polyethylene (XLPE), ethylene-propylene rubber (EPR), butyl rubber (butyl) and 40 pC or less for polyvinyl chloride (PVC).

For type tests, the sensitivity shall be 5 pC or less for all materials.

4.4 *Particular provisions for long lengths of cable*

On long lengths of cable (greater than 100 m), particular provisions are necessary to prevent errors caused by the superposition of travelling waves (see CIGRÉ Report 1968-2101, Appendix IV).

Note. – A separate test method should form Part 3 of IEC Publication 885.

4.5 *Calibrating capacitors and calibrating signals*

Unless the calibrating capacitor is rated for use at the test voltages involved, it is necessary for the primary calibration circuit to be disconnected before the high-voltage test transformer is energized. The amplifier gain shall not be readjusted after this has been done, unless a means is provided for a continuous display of a suitable calibrating signal throughout the test.

Such a means may be as follows:

a) the calibrating capacitor may be full-voltage rated and may form part of the primary calibration circuit which need not, in this case, be disconnected before the high-voltage test transformer is energized, or

b) a secondary calibrator can be used additionally. This calibrator is connected to the input of the detector. In this case, the amplitude of the secondary pulse response shall be precalibrated against the primary calibrating circuit before the latter circuit is disconnected and the high-voltage test transformer is energized, in accordance with CIGRÉ Report 1968-2101, Appendix III, Section I, Sub-clause 1.2.

5. **Test procedure**

The test voltage shall be applied between conductor and screen. It shall be raised to and held, for not more than 1 min, at a value which is 0.25 U_0 above the voltage at which the measurement of partial discharge is to be made (where U_0 is the rated voltage of the cable).

For example, if the relevant cable standard requires the partial discharge to be measured at 1.5 U_0, the voltage shall first be raised to 1.75 U_0.

The test voltage shall then be gradually reduced to, and the measurement of partial discharge made at, the voltage specified for the measurement in the relevant cable standard.

Annex ZA
(normative)

Normative references to international publications with their corresponding 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 (including amendments).

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

Publication	Year	Title	EN/HD	Year
IEC 60270	1981	Partial discharge measurements	- 1)	-

1) IEC 60270:2000 is harmonized as EN 60270:2001.