



BSI Standards Publication

High-voltage test techniques — Charge-based measurement of partial discharges

National foreword

This British Standard is the UK implementation of EN IEC 60270:2025. It is identical to IEC 60270:2025. It supersedes BS EN 60270:2001+A1:2016, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/42, Testing techniques for high voltages and currents.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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English Version

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Techniques des essais à haute tension - Mesurages des
décharges partielles fondés sur les charges
(IEC 60270:2025)

Hochspannungs-Prüftechnik - Ladungsbasierte Messung
von Teilentladungen
(IEC 60270:2025)

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

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European foreword

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This document supersedes EN 60270:2001 and all of its amendments and corrigenda (if any).

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The text of the International Standard IEC 60270:2025 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60034-18-41	NOTE	Approved as EN 60034-18-41
IEC 60034-18-42	NOTE	Approved as EN 60034-18-42
IEC 60034-27-1	NOTE	Approved as EN IEC 60034-27-1
IEC 60076-3	NOTE	Approved as EN 60076-3
IEC 60137	NOTE	Approved as EN 60137
IEC 61558-1	NOTE	Approved as EN IEC 61558-1
IEC 62068	NOTE	Approved as EN 62068
CISPR 16-1-1:2019	NOTE	Approved as EN IEC 55016-1-1:2019 (not modified)
IEC 60567	NOTE	Approved as EN IEC 60567
IEC 60599	NOTE	Approved as EN IEC 60599
IEC 61181:2007	NOTE	Approved as EN 61181:2007 (not modified)

Annex ZA
(normative)

**Normative references to international publications
with their corresponding European publications**

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60060-2	-	High-voltage test techniques - Part 2: Measuring systems	EN IEC 60060-2	-

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HIGH-VOLTAGE TEST TECHNIQUES – CHARGE-BASED
MEASUREMENT OF PARTIAL DISCHARGES**

FOREWORD

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IEC 60270 has been prepared by IEC technical committee 42: High-voltage and high-current test techniques. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2000 and Amendment 1:2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Title modified.
- b) Use with alternating voltages up to 500 Hz or with direct voltage.
- c) Clear focus on charge-based partial discharge measurements.
- d) Streamlined performance checks for partial discharge measurement system components.
- e) Improved normative Annex A for performance tests on calibrators.
- f) Revised and new informative Annexes.

The text of this International Standard is based on the following documents:

Draft	Report on voting
42/452/FDIS	42/456/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

In a future revision, this document will seek horizontal publication status in accordance with IEC Guide 108.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

HIGH-VOLTAGE TEST TECHNIQUES – CHARGE-BASED MEASUREMENT OF PARTIAL DISCHARGES

1 Scope

This document is applicable to the charge-based measurement of partial discharges which occur in electrical apparatus, components or systems when tested with alternating voltages (AC) up to 500 Hz or with direct voltage (DC).

This document:

- defines the terms used;
- defines the quantities to be measured;
- describes the measurement frequencies as well as the test and measuring circuits which may be used;
- defines analogue and digital measuring methods required for common applications;
- specifies methods for calibration and requirements of instruments used for calibration;
- gives guidance on test procedures;
- gives some assistance concerning the discrimination of partial discharges from external interference.

The provisions of this document are used in the drafting of specifications relating to partial discharge measurements for specific power apparatus. It deals with electrical measurements of impulsive (short-duration) partial discharges, but reference is also made to non-electrical methods primarily used for partial discharge location (see Annex F). Diagnosis of the behaviour of specific power apparatus can be aided by digital processing of partial discharge data (see Annex E) and also by non-electrical methods that are primarily used for partial discharge location (see Annex F).

This document is primarily concerned with electrical measurement of partial discharge in terms of apparent charge for specific power apparatus made during tests with alternating voltage, but specific problems which arise when tests are made with direct voltage are considered in Clause 11.

The terminology, definitions, basic test circuits and procedures often also apply to tests at other PD measurement frequencies, but special test procedures and measuring system characteristics which are not considered in this document may be required. For measurements at higher frequency ranges, see IEC TS 62478 [5]¹.

Annex A provides normative requirements for performance tests on calibrators.

NOTE This document defines and provides guidance for charge-based direct electrical PD measurements at the terminals of the equipment under test, differentiating from other PD measurement and detection methods, e.g. acoustic PD techniques or electromagnetic methods in elevated frequency ranges, e.g. ultra-high frequency (UHF).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies.

¹ Numbers in square brackets refer to the Bibliography.

For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60060-2, *High-voltage test techniques – Part 2: Measuring systems*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

partial discharge

PD

localized electrical discharge that only partially bridges the insulation between conductors and which can occur adjacent to a conductor

Note 1 to entry: Partial discharges are in general a consequence of local electrical stress concentrations in the insulation or on the surface of the insulation. Generally, such discharges appear as pulses having a duration of much less than 1 μ s. More continuous forms can, however, occur, such as the so-called pulse-less discharges in gaseous dielectrics. This kind of discharge will normally not be detected by the measurement methods described in this document.

Note 2 to entry: "Corona" is a form of partial discharge that occurs in gaseous media around conductors which are remote from solid or liquid insulation. "Corona" should not be used as a general term for all forms of PD.

Note 3 to entry: Partial discharges are accompanied by emission of acoustic transients (sound), electromagnetic waves, optical signals (light), heat, and associated chemical reactions. For further information, see Annex F.

3.2

partial discharge pulse

PD pulse

signal produced by a partial discharge occurring within the object under test, measured using suitable detector circuits introduced into the test circuit

Note 1 to entry: A partial discharge which occurs in the test object produces a current pulse at its origin. A detector in accordance with the provisions of this document produces a current or a voltage signal at its output proportional to the charge of the PD pulse.

3.3

quantities related to partial discharge pulses

3.3.1

apparent charge

q

<of a PD pulse> charge which, if injected between the terminals of the test object in a specified test circuit, would result in the same reading on the measuring instrument as the PD pulse itself, typically expressed in units of picocoulombs (pC) or nanocoulombs (nC)

Note 1 to entry: The apparent charge is not equal to the amount of charge locally involved at the site of the discharge, which cannot be measured directly.

3.3.2

pulse repetition rate

n

ratio between the total number of PD pulses recorded in a selected time interval and the duration of this time interval

Note 1 to entry: In practice, only pulses above a specified magnitude or within a specified range of magnitudes are considered.

3.3.3

pulse repetition frequency

N

number of partial discharge pulses per second, in the case of equidistant pulses

3.3.4

phase angle ϕ_i and time t_i

<of occurrence of a PD pulse> given by

$$\phi_i = 360 (t_i/T)$$

where:

t_i is the time measured between the preceding positive going zero crossing of the test voltage and the partial discharge pulse, and

T is the period of the test voltage, with the phase angle being expressed in degrees (°)

3.3.5

average apparent discharge current

I

derived quantity consisting of the sum of the absolute values of individual apparent charge magnitudes q_i during a chosen reference time interval T_{ref} divided by this time interval:

$$I = \frac{1}{T_{\text{ref}}} (|q_1| + |q_2| + \dots + |q_i|)$$

Note 1 to entry: Average apparent discharge current is generally expressed in coulombs per second (C/s) or in amperes (A).

3.3.6

apparent discharge power

P

derived quantity consisting of the average pulse power fed into the terminals of the test object due to apparent charge magnitudes q_i during a chosen reference time interval T_{ref} :

$$P = \frac{1}{T_{\text{ref}}} (q_1 u_1 + q_2 u_2 + \dots + q_i u_i)$$

where $u_1, u_2, \dots, u_i$ are the instantaneous values of the test voltage at the instants of occurrence t_i of the individual apparent charge magnitudes q_i ;

Note 1 to entry: The sign of the individual values shall be observed

Note 2 to entry: Apparent discharge power is generally expressed in watts (W).

3.3.7**radio interference****radio disturbance meter**

specialized measurement receiver utilizing weighted quasi-peak RF measurements on frequency B in accordance with CISPR 16-1

Note 1 to entry: This type of instrument was commonly known as 'RIV' or 'radio interference voltage' or 'radio influence voltage' meter in earlier times, having been applied to search for HV equipment producing high levels of corona which in turn would interfere with LW and MW broadcast transmission.

3.3.8**radio disturbance voltage** U_{RDV}

output reading of a radio interference meter

Note 1 to entry: See 4.6 and Annex D.

Note 2 to entry: Radio disturbance voltage is generally expressed in μV .

3.4**largest repeatedly occurring PD magnitude** Q_{IEC}

value recorded by a measuring system which has the pulse train response as specified in 4.3.3, commonly realized by a quasi-peak detector or a digital emulation of such a circuit, applicable for AC voltages

3.5**peak apparent charge** Q_{pk}

largest value recorded by a PD measuring system, commonly realized by a peak detector or a digital emulation of such circuit, applicable for DC voltages

3.6**specified partial discharge magnitude**

largest magnitude of any quantity related to PD pulses permitted in a test object at a specified voltage following a specified conditioning and test procedure

Note 1 to entry: For alternating voltage tests, this is the largest repeatedly occurring apparent charge Q_{IEC}

Note 2 to entry: The magnitude of any PD pulse quantity can vary stochastically in successive cycles and also show a general increase or decrease with time of voltage application. The specified PD magnitude, the test procedure and also the test circuit and instrumentation should therefore be appropriately defined by the relevant equipment committee(s).

3.7**background noise and interference/disturbances**

extraneous signals detected during PD tests, which are not of interest because they are not signals caused by PD originating in the test object

Note 1 to entry: Background or electrical noise is defined as originating in the PD measurement equipment itself, e.g. thermal, shot, 1/f noise in resistors and amplifiers.

Note 2 to entry: Interference or disturbances can originate from external sources such as motor drives, thyristor control circuits, terrestrial AM broadcast stations, etc. Moreover, external interference can also arise due to partial discharges external to the test object; such PD-like interference can be extremely challenging to differentiate from PD signals within the test object. Refer to Annex G for further information.

3.8**test voltages related to partial discharge pulse quantities**

Note 1 to entry: Voltages as defined in e.g. IEC 60060-1.

3.8.1**partial discharge inception voltage** U_i

applied voltage at which repetitive partial discharges are first observed in the test object, after being gradually increased from a lower value at which no partial discharges are observed

Note 1 to entry: In practice, the lowest applied voltage at which the magnitude of a PD pulse quantity becomes equal to or exceeds a specified minimum value

Note 2 to entry: For tests with direct voltage, special considerations are necessary for the determination of U_i . See Clause 11.

3.8.2**partial discharge extinction voltage** U_e

applied voltage at which repetitive partial discharges cease to occur in the test object, after being gradually decreased from a higher value at which PD pulse quantities are observed

Note 1 to entry: In practice, the applied voltage at which the magnitude of a chosen PD pulse quantity becomes equal to, or less than, a specified low value

Note 2 to entry: For tests with direct voltage, special considerations are necessary for the determination of U_e . See Clause 11.

3.8.3**partial discharge test voltage**

specified voltage, applied in a specified partial discharge test procedure, during which the test object shall not produce PD exceeding a specified partial discharge magnitude

Note 1 to entry: Partial discharges are usually measured at AC sinusoidal waveform. In real conditions, the test voltage also contains harmonics that modify the shape of the voltage waveform and can thus be considered as a disturbance affecting the PD pulse parameters and PD phase-resolved patterns. Such disturbances should be taken into account and documented during PD measurements. See Annex G for further information.

3.9**partial discharge measuring system**

coupling device, a transmission system and a partial discharge measuring instrument

3.10**measuring system characteristics****3.10.1****transfer impedance** $Z(f)$

ratio of the output voltage amplitude to a constant input current amplitude as a function of frequency f when the input is sinusoidal

3.10.2**lower and upper limit frequencies** f_1 and f_2

frequencies at which the transfer impedance $Z(f)$ has fallen by 6 dB from the peak pass-band value

3.10.3**mid-band frequency** f_m

given by:

$$f_m = \frac{f_1 + f_2}{2}$$

3.10.4 mid-band frequency bandwidth

Δf
given by:

$$\Delta f = f_2 - f_1$$

3.10.5 superposition error

error caused when successive PD pulses overlap one another due to the time interval between successive pulses being less than the duration (settling time) of a single pulse response

Note 1 to entry: Superposition error is also known as 'pulse pile-up'. See Annex E.

Note 2 to entry: Superposition errors can be additive or subtractive depending on the pulse repetition rate of the incoming pulses in combination with the transient response of the detector circuit elements. In practical circuits, both types will occur due to the random nature of the pulse repetition rate. However, since measurements are based on the largest repeatedly occurring PD magnitude, usually only the additive superposition errors will be measured

Note 3 to entry: Superposition errors can attain levels of 100 % or more depending on the pulse repetition rate and the characteristics of the measuring system.

3.10.6 pulse resolution time

t_{res}

shortest time interval between two consecutive PD pulses within which the PD measurement instrument is still able to resolve two separate pulses and for which the peak value of the resulting response does not change by more than 10 % of the value for a single pulse

Note 1 to entry: The pulse resolution time t_{res} is an indication of the PD measuring system's ability to resolve successive PD pulses and is inversely proportional to the lower cut-off frequency f_1 of the PD measurement bandwidth.

Note 2 to entry: It is recommended that the pulse resolution time be measured for the whole test circuit, as well as for the measuring system, as superposition errors can be caused by the test object, for example reflections from cable ends. Specifying the procedure for handling superposition errors and particularly, the allowable tolerances including their signs, is the responsibility of the relevant equipment technical committee(s).

3.10.7 dead time

t_{DT}

time period following successful digital acquisition of a PD pulse during which the instrument does not accept or acquire signals or neglect detected pulses

Note 1 to entry: Dead time is closely related to pulse resolution time.

Note 2 to entry: Especially for strongly oscillatory input signals, dead time is introduced in order to avoid false or repeat triggering on successive oscillatory remnants of the same pulse.

3.10.8 noise modulation

superimposition of an actual PD pulse with a simultaneously occurring noise signal leading to an incorrect registering of the peak amplitude of the PD signal

Note 1 to entry: Such noise modulation occurs when calibrating and measuring low amplitude PD pulses close to the noise floor and can cause apparent non-linearities in such cases.

3.10.9**integration error of apparent charge measurement**

error which occurs when the upper frequency limit of the PD current pulse amplitude-spectrum is lower than:

- the upper cut-off frequency of a wideband measuring system; or
- the mid-band frequency of a narrow-band measuring system

See Figure 4.

Note 1 to entry: If required for a special type of apparatus, the relevant equipment committee(s) are urged to specify more restrictive values for f_1 and f_2 to minimize the integration error.

3.11**digital partial discharge instruments**

digital signal processing techniques used for acquisition and evaluation of PD pulses

Note 1 to entry: See Annex E.

3.12**scale factor**

k

factor by which the value of the instrument reading is to be multiplied to obtain the value of the input quantity

Note 1 to entry: In modern digital PD measurement instruments, the scale factor is usually automatically calculated and set internally. After calibration, the instruments display the result of the multiplication with the internal scale factor k .

3.13**accumulated apparent charge**

q_a

sum of the apparent charge q of all individual pulses exceeding a specified threshold level, and occurring during a specified time interval Δt

3.14**PD pulse count**

m

total number of PD pulses which exceed a specified threshold level within a specified time interval Δt

3.15**phase-resolved PD pattern****PRPD pattern**

display of the apparent charge q versus the phase angle φ_i of the PD pulses recorded during a specified time interval Δt

Note 1 to entry: See Annex E Figure E.3.

4 Test circuits and measuring systems**4.1 General requirements**

Basic test circuits and measuring systems for partial discharge quantities are described in Clause 4, and information on the operating principle of these circuits and systems is provided. The test circuit and measuring system shall be calibrated as specified in Clause 5 and shall meet the requirements specified in Clause 7.

The relevant equipment committee(s) might also recommend a particular test circuit to be used for particular test objects. It is recommended that the equipment committee(s) use apparent charge as the quantity to be measured wherever possible, but other derived quantities may be used in particular specific situations.

A number of derived quantities such as ‘PD pulse repetition rate n ’, ‘average apparent discharge current’, ‘apparent discharge power’, etc. can be derived using appropriate algorithms employed by the charge-based PD measurement instrument, either in real-time or via post-processing. These derived quantities can be desirable for characterizing or quantifying certain aspects of the test object’s PD behaviour, i.e. assessing risk or fulfilling acceptance criteria, and might be specified by the relevant equipment committee(s).

If not otherwise specified by the relevant equipment committee(s), any of the test circuits mentioned in 4.2 and any of the measuring systems as specified in 4.3 are acceptable. In each case, the most significant characteristics of the measuring system (3.10) as applied shall be recorded.

For tests with direct voltage, see Clause 11.

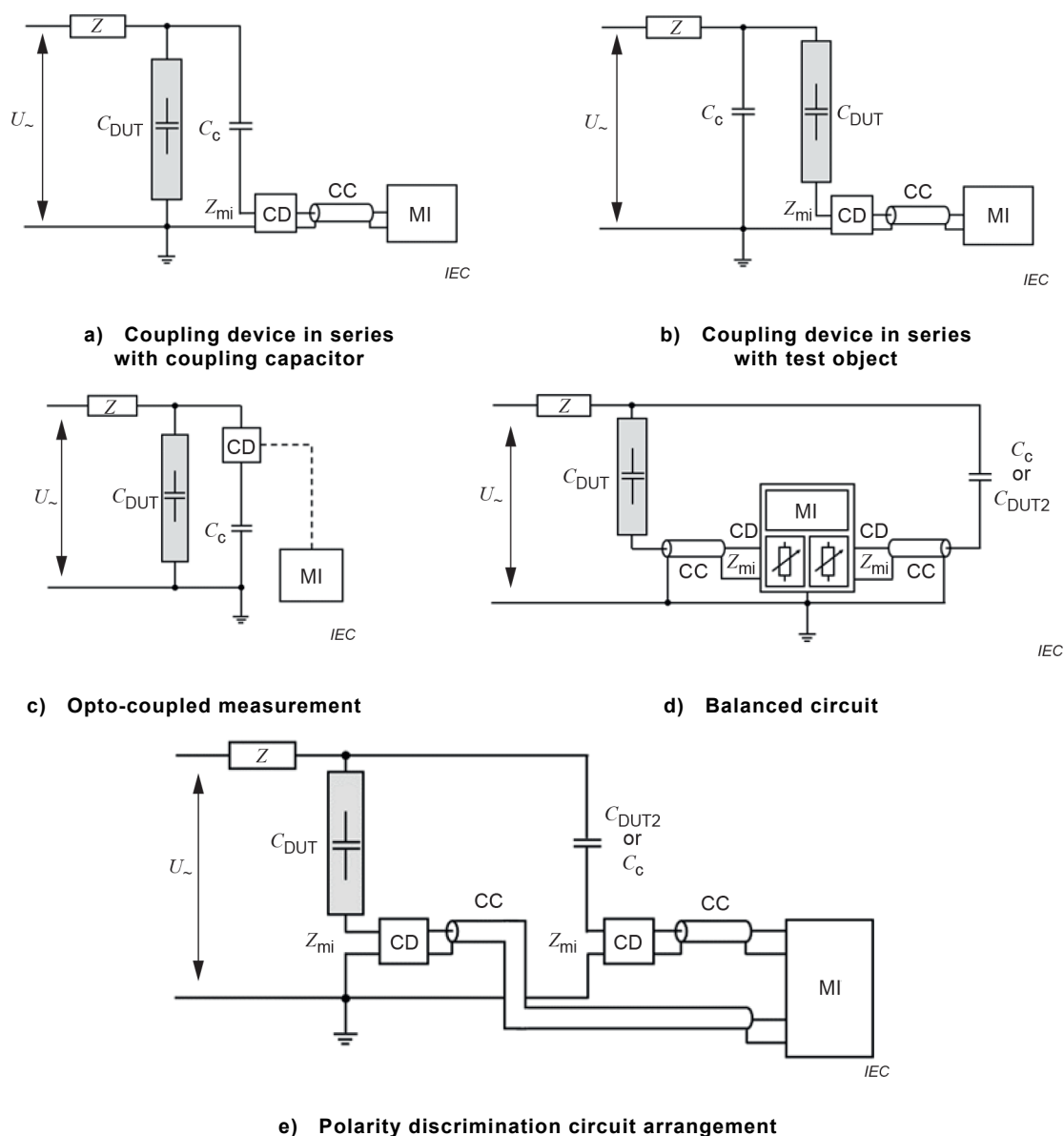
4.2 Test circuits for alternating voltages

Most circuits in use for partial discharge measurements can be derived from one or other of the basic circuits, which are shown in Figure 1. Some variations of these circuits are shown in Figure 2 and Figure 3. Each of these circuits consists mainly of:

- a test object, which can usually be regarded as a capacitance C_{DUT} (see Annex C);
- a coupling capacitor C_c , which shall be of low inductance design, or a second test object C_{DUT2} , which shall be similar to the test object C_{DUT} . C_c or C_{DUT2} shall exhibit a sufficiently low level of partial discharges at the specified test voltage to allow the measurement of the specified partial discharge magnitude. A higher level of partial discharges can be tolerated if the measuring system is capable of distinguishing the discharges from the test object and the coupling capacitor and measuring them separately;
- a measuring system with its input impedance Z_{mi} (and sometimes, for balanced circuit arrangements, a second input impedance);
- a high-voltage supply, with sufficiently low level of background noise (see also Clause 9 and Clause 10) to allow the specified partial discharge magnitude to be measured at the specified test voltage;
- high-voltage connections, with sufficiently low level of background noise (see also Clause 9 and Clause 10) to allow the specified partial discharge magnitude to be measured at the specified test voltage;
- low-voltage connections, with sufficiently low inductance to permit good conductance of the PD pulses, typically a copper conductor with a large surface area (flat band, tape, mesh, etc.), and the connections should be kept as short as practicable;
- a ‘blocking impedance’ (filter) may be introduced at the high voltage supply input connection to the PD measurement circuit whose purpose is to reduce or eliminate interference originating in either the HV power supply itself or the high-voltage connections, or both.

NOTE For each of the basic PD test circuits shown in Figure 1, Figure 2, and Figure 3, the coupling device of the measuring system can also be placed at the high-voltage terminal side, so that the positions of the coupling device with C_{DUT} or C_c are exchanged; then, optical links are used for the interconnection of the coupling device with the instrument, as indicated in Figure 1c.

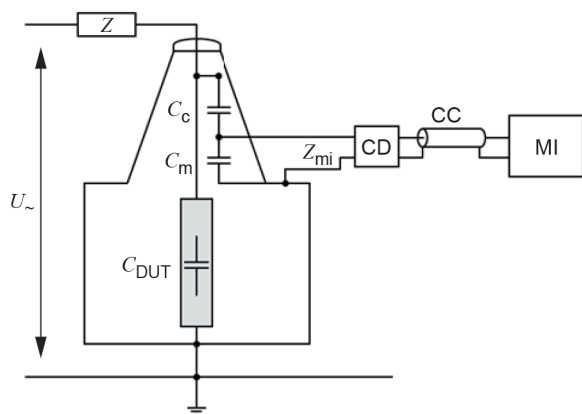
Additional information and particular characteristics of the different test circuits are considered in Annex B and Annex G.



Key

$U_{\sim}$	high-voltage supply
Z_{mi}	input impedance of measuring system
CC	connecting cable
C_{DUT}	device(s) under test, the test object
C_c	coupling capacitor
CD	coupling device
MI	measuring instrument
Z	blocking impedance or filter
OL	optical link (Figure 1c only)

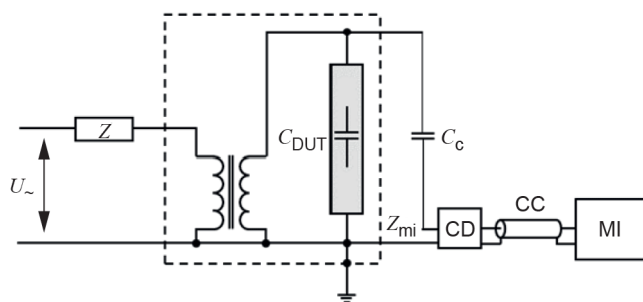
Figure 1 – Basic partial discharge test circuits



IEC

Key

- $U_{\sim}$ low- or high voltage supply
 Z_{mi} input impedance of measuring system
 CC connecting cable
 C_c coupling capacitor
 C_m capacitance in parallel to Z_{mi}
 CD coupling device
 C_{DUT} device under test, the test object
 MI measuring instrument
 Z blocking impedance or filter

Figure 2 – Test circuit for measurement at a bushing tap

IEC

Key

- $U_{\sim}$ low- or high voltage supply
 Z_{mi} input impedance of measuring system
 CC connecting cable
 C_c coupling capacitor
 CD coupling device
 C_{DUT} device under test, the test object
 MI measuring instrument
 Z blocking impedance or filter

Figure 3 – Test circuit for measuring self-excited test objects

4.3 Measuring systems for apparent charge

4.3.1 General

Partial discharge measuring systems can be divided into the subsystems: coupling device, transmission system (for example, connecting cable or optical link) and measuring instrument. In general, the transmission system does not contribute to the circuit characteristics and will thus not be taken into consideration.

4.3.2 Coupling device or ‘quadripole’

The coupling device is an integral part of the measuring system and test circuit, with components specifically designed to achieve the optimum sensitivity with a specific test circuit. Different coupling devices may thus be used in conjunction with a single measuring instrument.

The coupling device is an active or passive four-terminal network (‘quadripole’) whose function is to convert the current i_{PD} , arising from PD in the test object and circulating in the specified test circuit through coupling capacitor C_c , to an output voltage. This output voltage signal is then transmitted to the PD measuring instrument by means of a transmission system. The coupling device is normally designed so that its frequency response prevents the test voltage frequency and its harmonics from reaching the PD measuring instrument.

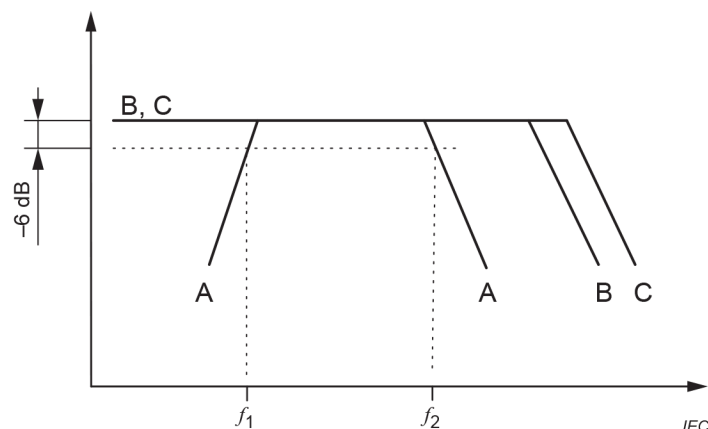
NOTE Though the frequency response of an individual coupling device is not of general interest, the magnitude and frequency characteristics of the input impedance are of importance as this impedance interacts with C_c and C_{DUT} and is thus an essential part of the test circuit.

It is recommended to keep interconnecting leads between the coupling device and the test object as short as practicable, so as to minimize effects on the detection bandwidth as well as susceptibility to external disturbances.

The relevant equipment committee(s) might provide recommendations concerning the withstand capability of components in the specified test circuit in the case of breakdown (flashover) if such information is available.

4.3.3 Pulse train response of instruments for the measurement of apparent charge

Provided the amplitude frequency spectrum of the input pulses is constant at least within the bandwidth Δf of the measuring system (see Figure 4), the response of the instrument is a voltage pulse with a peak value proportional to the (unipolar) charge of the input pulse. The shape, duration and the peak value of this output pulse are determined by the transfer impedance $Z(f)$ of the measuring system. Thus, the shape and duration of the output pulse can be completely different from that of the input signal.



Key

- A bandpass of the PD measuring system
- B typical amplitude frequency spectrum of the PD pulse at the DUT terminals
- C amplitude frequency spectrum of calibration pulse
- f_1 lower limit frequency
- f_2 upper limit frequency (≤ 1 MHz)

Figure 4 – Correct relationship between amplitude and frequency to minimize integration errors for a wide-band system

Display of the individual output voltage pulses on the screen of an oscilloscope can assist in recognizing the origin of partial discharges and in distinguishing them from disturbances (see Clause 10). The voltage pulses shall be displayed either on a linear time-base which is triggered by the test voltage, or on a sinusoidal time base synchronized with the test voltage frequency or an elliptical time-base which rotates synchronously with the test voltage frequency.

In addition, it is particularly recommended that an indicating instrument or recorder shall be used to quantify the largest repeatedly occurring PD magnitude. The reading of such instruments, when used in testing with alternating voltage, shall be based on an analogue peak detection circuit, or digital peak detection by software, with a very short electrical charge time constant and an electrical discharge time constant not longer than 0,44 s. Independent of the type of display used in such instruments, the following requirements apply.

The response of the system to a pulse train consisting of equally large equidistant pulses q_0 with a known pulse repetition frequency N , shall be such that the reading R of the instrument indicates magnitudes as given in Table 1. The range and gain of the instrument are assumed to be adjusted to read full scale or 100 % for $N = 100$. The calibrator used to produce the pulses shall conform to the requirements of Clause 5. The specified response may be obtained either by analogue or by digital signal processing.

Table 1 – Pulse train response of PD instruments

N (1/s):	0,1	0,2	0,5	1	2	5	10	50	≥ 100
R (%):	>2	>5	>17	>35	>55	>76	>85	>94	>95
	<8	<12	<27	<45	<65	<86	<95	<104	<105

This characteristic is necessary to establish compatibility of readings obtained with different types of instruments. The requirement is to be fulfilled on all ranges. Instruments already in use at the date of issue of this document are not required to comply with these requirements; however, the actual values for $R(N)$ should be given.