

Specification for

Current transformers —

(Implementation of
CENELEC HD 553 S2)

UDC 621.314.6

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- Association of Consulting Engineers
- Department of Energy (Electricity Division)
- Electricity Association
- Transmission and Distribution Association (BEAMA Limited)

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National foreword

This British Standard has been prepared under the direction of the Power Electrical Engineering Standards Policy Committee. It implements Harmonization Document HD 553 S2:1993, published by the European Committee for Electrotechnical Standardization (CENELEC) which was derived from IEC 185:1987 plus Amendment No.1 (1990), published by the International Electrotechnical Commission (IEC).

The CENELEC common modifications have been implemented at the appropriate places in the text and are indicated by a side line in the margin. Parts of the original IEC text that have been modified by CENELEC have been quoted in National annex NA.

This British Standard supersedes BS 3938:1973 which is declared obsolescent. Products may continue to be manufactured to BS 3938:1973 until 1 June 1998. A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 40 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.

UDC 621.314.6

Descriptors: Instrument transformer, current transformer, specification, test, marking

English version

Current transformers

(IEC 185:1987 + A1:1990, modified)

Transformateurs de courant
(CEI 185:1987 + A1:1990, modifiés)

Stromwandler
(IEC 185:1987 + A1:1990, modifiziert)

This Harmonization Document was approved by CENELEC on 1993-03-09. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this Harmonization Document on a national level.

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

This Harmonization Document exists in three official versions (English, French, German).

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

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Foreword

At the request of the BTTF 56-3, CENELEC 71st Technical Board decided to submit the international standard IEC 185:1987 and its amendment 1:1990 to the CENELEC Unique Acceptance Procedure (UAP) for acceptance as a Harmonization Document.

The reference documents, together with the common modifications previously accepted for HD 553 S1, were submitted to this procedure in April 1992.

The text of the draft was approved by CENELEC as HD 553 S2 on 9 March 1993.

The following dates were fixed:

- latest date of announcement of the HD at national level (doa) 1993-06-01
- latest date of publication of a harmonized national standard (dop) 1993-12-01
- latest date of withdrawal of conflicting national standards (dow) 1993-12-01

For products which have complied with HD 553 S1:1992 before 1993-12-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1988-12-01.

Annexes designated “normative” are part of the body of the standard. In this standard, Annex ZA (Cross-references) is normative and Annex ZB (B-deviations) is informative.

Common modifications

2 Service conditions

2.1 Ambient air temperatures

Replace by:

— maximum	40 °C
— daily mean, not exceeding	30 °C
— minimum, for indoor type transformers	– 5 °C
— minimum, for class – 25 outdoor type transformers	– 25 °C
— minimum, for class – 40 outdoor type transformers	– 40 °C

In extreme cases, for outdoor transformers, lower minimum ambient temperatures (i.e. – 50 °C) may be required.

3 Definitions

3.16 Add “(U_m)” in the title.

8 Short-time current rating

8.1 Add:

NOTE When a current transformer is a part of another equipment (i.e. switchgear), a rated time other than 1 s may be specified.

10 Insulation requirements

10.1.1 Replace “Tables IIA and IIB” by “Table IIA”.

To Table IIA, add the value $U_m = 100$ kV with the following withstand voltages:

Highest voltage for equipment U_m (r.m.s.)	Rated lightning-impulse withstand voltage (peak)	Rated power-frequency short-duration withstand voltage (r.m.s.)
kV	kV	kV
100	380	150
	450	185

Delete Table IIB.

Move the Note under Table IIE to subclause 10.2.2.

10.2.3 Replace the text by:

If additionally specified, the primary windings shall also be capable of withstanding chopped lightning-impulse voltages as per clause 20.

19 Test of interturn insulation

Replace the text of test procedure A by:

Procedure A

With the secondary winding open-circuited (or connected to a high impedance device which reads peak voltage), a substantially sinusoidal current at a frequency between 40 Hz and 60 Hz (in accordance with IEC Publication 60) and of r.m.s. value equal to the rated primary current (or rated extended current when applicable) shall be applied for 1 min to the primary winding. If the voltage produced at the secondary terminals has a peak value greater than the prescribed test voltage, the applied current shall be reduced accordingly.

Replace the second paragraph of test procedure B by:

The value of the test frequency shall be no greater than ten times the rated frequency; at this frequency value, the prescribed test voltage may be the value obtained at the rated secondary current (extended range current when applicable).

When the test frequency exceeds twice the rated frequency, the duration of the test may be reduced from 1 min as below:

duration of test (in s) = $\frac{\text{twice the rated frequency}}{\text{test frequency}} \times 60 \text{ s}$
with a minimum of 15 s.

20 Chopped lightning-impulse test on primary windings

Modify the value of the chopped impulses as follows:

- a) Windings having $U_m < 300 \text{ kV}$
 - one 100 % full impulse
 - two 115 % chopped impulses
 - fourteen 100 % full impulses
- b) Windings having $U_m \geq 300 \text{ kV}$
 - one 100 % full impulse
 - two 115 % chopped impulses
 - two 100 % full impulses

Add:

Other test voltage values may be agreed upon between purchaser and manufacturer.

22 Terminal markings — General rules

22.2 Add under the table:

Other terminal markings may be used when specified in national standards.

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Chapter I: General requirements applicable to all current transformers

Section 1. General

1 Scope

This standard applies to newly manufactured current transformers for use with electrical measuring instruments and electrical protective devices at frequencies from 15 Hz to 100 Hz.

Although the requirements relate basically to transformers with separate windings they are also applicable, where appropriate, to auto-transformers.

2 Service conditions

Unless otherwise specified, current transformers shall be suitable for use under the following service conditions:

NOTE The manufacturer should be informed if the conditions, including the conditions under which transformers are to be transported, differ from those specified.

2.1 Ambient air temperatures

— maximum	40 °C
— daily mean, not exceeding	30 °C
— minimum, for indoor type transformers	– 5 °C
— minimum, for class – 25 outdoor type transformers	– 25 °C
— minimum, for class – 40 outdoor type transformers	– 40 °C

In extreme cases, for outdoor transformers, lower minimum ambient temperatures (i.e. – 50 °C) may be required.

2.2 Altitude

Up to 1 000 m (3 300 ft) above sea level.

2.3 Atmospheric conditions

Atmospheres which are not heavily polluted.

2.4 System earthing

- 1) Isolated neutral system (see definition Sub-clause 3.18).
- 2) Resonant earthed system (see definition Sub-clause 3.19).
- 3) Earthed neutral system (see definition Sub-clause 3.21):
 - a) Effectively earthed neutral system.
 - b) Non-effectively earthed neutral system.

3 Definitions

For the purposes of this standard, the following definitions shall apply.

Some of the definitions agree with or are similar to those of IEC Publication 50(321): International Electrotechnical Vocabulary (IEV), Chapter 321: Instrument Transformers. These are indicated by the relevant IEV reference numbers in brackets.

3.1

instrument transformer

a transformer intended to supply measuring instruments, meters, relays and other similar apparatus (321-01-01 modified)

3.2

current transformer

an instrument transformer in which the secondary current, in normal conditions of use, is substantially proportional to the primary current and differs in phase from it by an angle which is approximately zero for an appropriate direction of the connections (321-02-01)

3.3**primary winding**

the winding through which flows the current to be transformed

3.4**secondary winding**

the winding which supplies the current circuits of measuring instruments, meters, relays or similar apparatus

3.5**secondary circuit**

the external circuit supplied by the secondary winding of a transformer

3.6**rated primary current**

the value of the primary current on which the performance of the transformer is based (321-01-11 modified)

3.7**rated secondary current**

the value of the secondary current on which the performance of the transformer is based (321-01-15 modified)

3.8**actual transformation ratio**

the ratio of the actual primary current to the actual secondary current (321-01-17 modified)

3.9**rated transformation ratio**

the ratio of the rated primary current to the rated secondary current (321-01-19 modified)

3.10**current error (ratio error)**

the error which a transformer introduces into the measurement of a current and which arises from the fact that the actual transformation ratio is not equal to the rated transformation ratio (321-01-21 modified)

The current error expressed in per cent is given by the formula:

$$\text{Current error \%} = \frac{(K_n I_s - I_p) \times 100}{I_p}$$

where K_n is the rated transformation ratio, I_p is the actual primary current and I_s the actual secondary current when I_p is flowing, under the conditions of measurement

3.11**phase displacement**

the difference in phase between the primary and secondary current vectors, the direction of the vectors being so chosen that the angle is zero for a perfect transformer (321-01-23 modified)

the phase displacement is said to be positive when the secondary current vector *leads* the primary current vector. It is usually expressed in minutes or centiradians

NOTE This definition is strictly correct for sinusoidal currents only.

3.12**accuracy class**

a designation assigned to a current transformer the errors of which remain within specified limits under prescribed conditions of use

3.13**burden**

the impedance of the secondary circuit in ohms and power-factor

the burden is usually expressed as the apparent power in voltamperes absorbed at a specified power-factor and at the rated secondary current

3.14**rated burden**

the value of the burden on which the accuracy requirements of this specification are based

3.15**rated output**

the value of the apparent power (in voltamperes at a specified power-factor) which the transformer is intended to supply to the secondary circuit at the rated secondary current and with rated burden connected to it

3.16**highest voltage (U_m) for equipment**

the highest r.m.s. phase-to-phase voltage for which a transformer is designed in respect of its insulation

3.17**rated insulation level**

the combination of voltage values which characterizes the insulation of a transformer with regard to its capability to withstand dielectric stresses

3.18**isolated neutral system**

a system which has no intentional connection to earth except through indicating, measuring or protective devices of very high impedance

3.19**resonant earthed system (a system earthed through an arc-suppression coil)**

a system earthed through a reactor, the reactance being of such value that during a single line-to-earth fault, the power-frequency inductive current passed by this reactor essentially neutralizes the power-frequency capacitive component of the earth-fault current

NOTE With resonant earthing of a system, the current in the fault is limited to such an extent that an arcing fault in air would be self-extinguishing.

3.20**earthing factor**

at a selected location in a three-phase system (generally the point of installation of an equipment), for a given system layout, is the ratio, expressed as a percentage, of the highest r.m.s. line-to-earth power-frequency voltage on a sound phase at the selected location during a fault to earth affecting one or more phases, to the line-to-line r.m.s. power-frequency voltage which would be obtained at the selected location with the fault removed

3.21**earthed neutral system**

a system in which the neutral is connected to earth, either solidly, or through a resistance or reactance of low enough value to reduce materially transient oscillations and to give a current sufficient for selective earth fault protection:

- a) A system with *effectively-earthed* neutral at a given location is a system characterized by an earthing factor at this point which does not exceed 80 %.

NOTE This condition is obtained in general when, for all system configurations, the ratio of zero-sequence reactance to positive-sequence reactance is less than 3 and the ratio of zero-sequence resistance to positive-sequence reactance is less than one.

- b) A system with *non-effectively* earthed neutral at a given location is a system characterized by an earthing factor at this point that may exceed 80 %.

3.22**exposed installation**

an installation in which the apparatus is subject to overvoltages of atmospheric origin

NOTE Such installations are usually connected to overhead transmission lines, either directly, or through a short length of cable.

3.23**non-exposed installation**

an installation in which the apparatus is not subject to overvoltages of atmospheric origin

NOTE Such installations are usually connected to cable networks.

3.24

rated frequency

the value of the frequency on which the requirements of this standard are based

3.25

rated short-time thermal current (I_{th})

the r.m.s. value of the primary current which a transformer will withstand for one second without suffering harmful effects, the secondary winding being short-circuited

3.26

rated dynamic current (I_{dyn})

the peak value of the primary current which a transformer will withstand, without being damaged electrically or mechanically by the resulting electromagnetic forces, the secondary winding being short-circuited

3.27

rated continuous thermal current

the value of the current which can be permitted to flow continuously in the primary winding, the secondary winding being connected to the rated burden, without the temperature rise exceeding the values specified

Section 2. Rating and performance requirements applicable to all current transformers

4 Standard values of rated primary current

4.1 Single-ratio transformers

The standard values of rated primary currents are:

10 – 12.5 – 15 – 20 – 25 – 30 – 40 – 50 – 60 – 75 amperes,
and their decimal multiples or fractions.

The preferred values are those underlined.

4.2 Multi-ratio transformers

The standard values given in Sub-clause 4.1 refer to the lowest values of rated primary current.

5 Standard values of rated secondary current

The standard values of rated secondary current are 1 A, 2 A and 5 A, but the preferred value is 5 A.

NOTE For transformers intended for delta-connected groups these ratings divided by $\sqrt{3}$ are also standard values.

6 Rated continuous thermal current

Unless otherwise specified, the rated continuous thermal current shall be the rated primary current.
(See Clause 28.)

7 Standard values of rated output

The standard values of rated output up to 30 VA are:

2.5 – 5.0 – 10 – 15 and 30 VA.

Values above 30 VA may be selected to suit the application.

NOTE For a given transformer, provided one of the values of rated output is standard and associated with a standard accuracy class, the declaration of other rated outputs, which may be non-standard values, but associated with other standard accuracy classes, is not precluded.

8 Short-time current ratings

Current transformers supplied with a fixed primary winding or conductor shall comply with the requirements of Sub-clauses 8.1 and 8.2 below.