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Indian Standard

CURRENT TRANSFORMERS — SPECIFICATION

PART 2 MEASURING CURRENT TRANSFORMERS

(Second Revision)

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Price Group 2

FOREWORD

This Indian Standard (Part 2) was adopted by the Bureau of Indian Standards, after the draft finalized by the Instrument Transformers Sectional Committee had been approved by the Electrotechnical Division Council.

This standard was first published in 1964 and revised in 1981. This revision has been undertaken to bring it in line with the latest developments at the international level.

This standard has been published in four parts:

Part 1 General requirements,

Part 2 Measuring current transformers,

Part 3 Protective current transformers, and

Part 4 Protective current transformers of special purpose applications.

Some information on use of current transformers for the dual purpose of protection and measurement is given in Annex A.

In the preparation of this standard, assistance has been derived from the following:

IEC Pub 185 (1987) Current transformers; published by International Electrotechnical Commission.

BS 3938 : 1973 Specification for current transformers with latest amendments; published by British Standards Institution.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CURRENT TRANSFORMERS — SPECIFICATION

PART 2 MEASURING CURRENT TRANSFORMERS

(Second Revision)

1 SCOPE

This standard (Part 2) covers the specific requirements for measuring current transformers for use with measuring and indicating instruments, integrating meters and similar apparatus. It also applies to the measuring cores of multi-core current transformers.

2 TERMINOLOGY

2.0 For the purpose of this standard, the following definitions, in addition to those covered in Part 1 of this standard, shall apply.

2.1 Measuring Current Transformer

A current transformer intended to supply indicating instruments, integrating meters and similar apparatus.

2.2 Instrument Security Factor (FS)

The ratio of instrument limit primary current to the rated primary current.

NOTE — In the event of system fault currents flowing through the primary winding of a current transformer, the safety of apparatus supplied by the transformer is greatest when the value of the instrument security factor (FS) is small.

2.3 Rated Instrument Limit Primary Current (IPL)

The value of the minimum primary current at which the composite error of the measuring current transformer is equal to or greater than 10 percent, the secondary burden being equal to the rated burden.

NOTE — The composite error should be greater than 10 percent in order to protect the apparatus supplied by the current transformer against the high currents produced in the event of system fault.

2.4 Composite Error

Under steady state conditions, the rms value of the difference between :

a) the instantaneous values of the primary current, and

b) the instantaneous values of the actual secondary current multiplied by the rated transformation ratio.

The positive signs of the primary and secondary currents are corresponding to the convention for terminal markings.

The composite error E_c is generally expressed as a percentage of the rms values of the primary current according to the formula:

$$E_c = \frac{100}{I_p}\sqrt{\frac{1}{T}\int_0^T (K_n.i_s - i_p)^2\,dt}$$

where

K_n = rated transformation ratio,

I_p = rms value of the primary current,

i_p = instantaneous value of the primary current,

i_s = instantaneous value of the secondary current, and

T = duration of one cycle.

2.5 Secondary Limiting e.m.f.

The product of the instrument security factor (FS), the rated secondary current and the vectorial sum of the rated burden and the impedance of the secondary winding.

2.6 Exciting Current

The rms value of the current taken by the secondary winding of a current transformer when a sinusoidal voltage of rated frequency is applied to the secondary terminals, the primary and any other windings being open-circuited.

3 ACCURACY CLASS

The accuracy class shall be designated by the highest permissible percentage current error at rated current for that accuracy class.

3.1 Standard Accuracy Classes

The standard accuracy classes for measuring current transformers shall be:

0.1, 0.2, 0.5, 1, 3 and 5

3.2 Special Application Accuracy Classes

For the special application in connection only with special electricity meters which measure accurately at a current between 50 mA and 6 A (that is, between 1 percent and 120 percent of the rated current of 5 A), the special application accuracy classes shall be 0.2 S and 0.5 S. These classes shall apply only for the rated

secondary current of 5 A and for the ratios 25/5, 50/5 and 100/5 and their decimal multiples.

3.3 Limits of Current Error and Phase Displacement

3.3.1 *For the Standard Accuracy Classes* 0.1, 0.2, 0.5 *and* 1

The current error and phase displacement at rated frequency shall not exceed the value given in Table 1A when the secondary burden has any value from 25 percent to 100 percent of the rated burden.

3.3.2 *For Standard Accuracy Classes* 3 *and* 5

The current error at rated frequency shall not exceed the values given in Table 1B when the secondary burden has any value from 50 percent to 100 percent of the rated burden.

3.3.3 *For the Special Application Accuracy Classes* 0.2S *and* 0.5S

The current error and phase displacement at rated frequency shall not exceed the value given in Table 1C when the secondary burden has any value from 25 percent to 100 percent of the rated burden.

3.3.4 The secondary burden used for test purposes shall have a power factor of 0.8 lagging except that when the burden is less than 5 VA, a power factor of 1 may be used. In no case shall the test burden be less than 1 VA.

4 EXTENDED CURRENT RATING

4.1 Current transformers of standard accuracy classes 0.1 to 1.0 may, if agreed between purchaser and manufacturer, have an extended rating provided they comply with the following:

a) The rated continuous thermal current (*see* Part 1) shall be the rated extended primary current, and

b) The limits of current error and phase displacement prescribed for 120 percent of rated primary current given in Table 1A shall be retained up to the rated extended primary current.

4.2 The standard values of rated extended primary current shall be 120, 150 and 200 percent of the rated primary current.

Table 1B Limits of Error for Standard Accuracy Classes 3 and 5

(*Clause* 3.3.2)

Accuracy Class	± Percentage Current (Ratio) Error at Percentage of Rated Current	
	50	120
(1)	(2)	(3)
3	3	3
5	5	5

NOTE — Limits of phase displacement are not specified for Class 3 and Class 5.

5 INSTRUMENT SECURITY FACTOR (FS)

5.1 The maximum value of the instrument security factor should be decided by agreement between the purchaser and the supplier.

6 MARKING

6.1 The following particulars shall be marked in addition to those required by Part 1 of this standard:

a) Rated output followed by the accuracy class (for example, 15 VA class 0.5 or 15/0.5);

b) In case of current transformers having an extended current rating, the rating in (a) shall be followed by the extended current rating (for example, 15 VA class 0.5 Ext. 150 percent or 15/0.5 Ext. 150 percent); and

c) Rated instrument security factor (e.g. FS 10).

6.2 In the case of current transformers required to meet combination of output and accuracy classes, the necessary information should be given.

Table 1A Limits of Error for Standard Accuracy Classes 0.1, 0.2, 0.5 and 1

(*Clause* 3.3.1)

Accuracy Class	± Percentage Current (Ratio) Error at Percentage of Rated Current				± Phase Displacement in Minutes at Percentage of Rated Current			
	5	20	100	120	5	20	100	120
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0.1	0.4	0.2	0.1	0.1	15	8	5	5
0.2	0.75	0.35	0.2	0.2	30	15	10	10
0.5	1.5	0.75	0.5	0.5	90	45	30	30
1.0	3.0	1.5	1.0	1.0	180	90	60	60

Table 1C Limits of Error for Special Application Accuracy Classes 0.2S and 0.5S

(*Clause* 3.3.3)

Accuracy Class	± Percentage Current (Ratio) Error at Percentage of Rated Current					± Phase Displacement in Minutes at Percentage of Rated Current				
	1	5	20	100	120	1	5	20	100	120
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
0.2S	0.75	0.35	0.2	0.2	0.2	30	15	10	10	10
0.5S	1.5	0.75	0.5	0.5	0.5	90	45	30	30	30

7 TESTS

7.0 The tests given in **7.1** and **7.2** shall be carried out in addition to the tests given in Part 1 of this standard.

7.1 Type Tests

7.1.1 *Accuracy Test*

The measuring current transformer shall be tested for compliance with **3**.

7.1.1.1 *For current transformers of Classes* 0.1, 0.2, 0.5, 1, 0.25 and 0.55

The test shall be made at each value of the current given in Tables 1A or 1C at 25 percent and 100 percent of the rated burden. Transformers having extended current rating greater than 120 percent shall be tested at the rated extended primary current instead of at 120 percent of the rated current.

7.1.1.2 *For current transformers of Classes* 3 *and* 5

The test shall be made at each value of the current given in Table 1B at 50 percent and 100 percent of the rated burden.

7.1.2 *Instrument Security Current Test*

The test may be made by the following indirect method:

With the primary winding open-circuited, the secondary winding is energized at rated frequency by a substantially sinusoidal voltage having an rms value equal to the secondary limiting emf. The resulting excitation current (I_{exc}), expressed as a percentage of the rated secondary current (I_{sn}) multiplied by the rated instrument security factor FS, shall be equal to or exceed the rated value of composite error by 10 percent:

$$\frac{I_{exc}}{I_{sn}.\,FS} \quad 100 \geq 10 \text{ percent}$$

NOTES

1 In calculating the secondary limiting e.m.f., the secondary winding impedance should be assumed to be equal to the secondary winding resistance measured at room temperature and corrected to 75°C.

2 It is a great advantage of the indirect test that high currents are not necessary (for instance 30 000 A at a primary rated current of 3 000 A and an instrument security factor 10) and also no burdens which must be constructed for 50 A. The effect of the return primary conductors is not physically effective in the indirect test. Under service conditions the effect can only enlarge the composite error, which is desirable for the safety of the apparatus supplied by the measuring transformer. Should this result of measurement be called into question, a controlling measurement shall be performed with the direct test method given in Part 3 of the standard, the result of which shall be then mandatory.

7.2 Routine Test

7.2.1 The routine test for accuracy shall be same as the type test in accordance with **7.1.1** but shall be carried out only at the percentage of rated currents shown in Table 2.

Table 2 Test Currents for Routine Tests

(*Clause* 7.2.1)

Class	Percentage of Rated Current			
(1)	(2)	(3)	(4)	(5)
0.1 and 0.2	120	100	20	5
0.2 S	120	20	5	1
0.5 and 1.0	120	20	—	—
0.5 S	120	20	—	—
3 and 5	120	50	—	—

ANNEX A
(Foreword)

USE OF CURRENT TRANSFORMERS FOR THE DUAL PURPOSE OF PROTECTION AND MEASUREMENT

A-1 The requirements for a protective current transformer differ radically from those for a measuring current transformer. A measuring current transformer has to be accurate within the specified working range of rated current. Accuracy is not required on high overcurrent. It is, in fact, an advantage if the transformer saturates at a moderate overcurrent since this tends to relieve the measuring instruments of the severe strain caused by heavy overcurrent. A protective current transformer on the other hand is not usually required to be accurate below rated current, but it has to be accurate within the appropriate limits at all higher values of current up to the rated accuracy limit primary current.

It follows that the difficulties of producing a dual-purpose current transformers are accentuated when high accuracy is required for measuring purposes and/or when a high accuracy limit factor is needed for protective purposes.

A-2 The question of using a single transformer for the dual purpose of protection and measurement can be decided by considering all relevant factors, such as design, cost, space, and the capability of the instruments of withstanding high currents.

A-3 A current transformer for the purpose of protection and measurement, will have both a protection and a measurement rating.

A-4 When such a transformer is used for both purposes simultaneously and the rated burdens for measurement and protection differ, the total connected burden shall not exceed the lower of the two rated burdens.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'.

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