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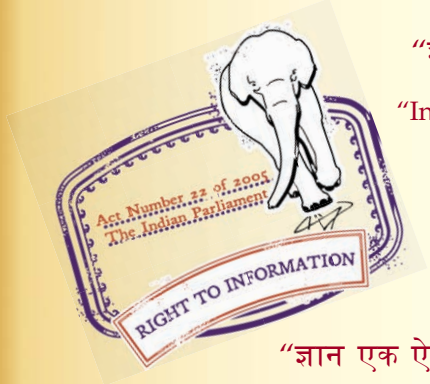

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"Knowledge is such a treasure which cannot be stolen"

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IS : 3151 - 1982

(Reaffirmed 2001)

Indian Standard

SPECIFICATION FOR EARTHING TRANSFORMERS

(First Revision)

Second Reprint JULY 1991

UDC 621.314.21:621.316.99

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 3

October 1982

Indian Standard

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(First Revision)

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Indian Standard

SPECIFICATION FOR EARTHING TRANSFORMERS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 26 April 1982, after the draft finalized by the Transformers Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 Earthing transformers provide artificial neutral and are used for the following purposes:

a) To earth an otherwise unearthed system;

b) To connect an arc suppression coil; and

c) To limit the current during a line to earth fault due to the impedance of the coils and the possible additional resistors, permitting selective protection.

0.2.1 Earthing transformers may be connected in any of the manners given below:

a) Inter connected star (zig-zag)/-

b) Inter connected star (zig-zag)/star

c) Inter connected star (zig-zag)/delta

d) Star/delta

Wherever secondary winding is provided, it can be used for supplying an auxiliary load.

0.3 This standard was first published in 1965. The revision has been carried out to take into account the experience gained in the field since the publication of earlier version.

0.4 The importance of carrying out short-circuit test on earthing transformers is realized. However, in view of limiting testing facilities for carrying out such tests in this country, this test has been included as a special test to be done by mutual agreement between the purchaser and the manufacturer (*see* **6.2**).

0.5 This standard is to be read in conjunction with IS : 2026 (Part I)-1977*, IS : 2026 (Part II)-1977†, IS : 2026 (Part III)-1981‡, and IS : 2026 (Part IV)-1977§ to which a reference has been made. Should, however, any deviation exist between the requirements of IS : 2026 (Part I)-1977*, IS : 2026 (Part II)-1977†, IS : 2026 (Part III)-1981‡, IS : 2026 (Part IV)-1977§ and those of this standard, the provisions of the latter shall apply.

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

IEC Publication 289 (1968) — Reactors issued by International Electrotechnical Commission.

BS 4944:1973 Reactors, arc suppression coils and earthing transformers for electric power system issued by British Standards Institution.

0.7 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, shall be rounded off in accordance with IS : 2-1960‖. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies the requirements and tests for oil-immersed and dry type earthing transformers.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

*Specification for power transformers: Part I General (*first revision*).

†Specification for power transformers: Part II Temperature-rise (*first revision*).

‡Specification for power transformers: Part III Insulation level and dielectric test (*second revision*).

§Specification for power transformers: Part IV Terminal marking, tappings and connections (*first revision*).

‖Rules for rounding off numerical values (*revised*).

2.1 Rated Voltage — The voltage for which the earthing transformer is designed. Unless system operating conditions justify the selection of a higher value, the rated voltage is equal to the line-to-line nominal voltage of the associated system.

2.2 Continuous Rated Current — The continuous maximum permissible current in the neutral in permanent duty conditions, the apparatus being energized at rated voltage and frequency. This quantity is specified only when the apparatus is designed for the connection of single phase loads between the neutral and the line terminals. A continuous rated current in 3 phases may be specified when a load is connected to a secondary winding.

2.3 Rated Short-Time Current — The fault current through the neutral which the apparatus is designed to carry for a specified duration.

2.4 Zero-Sequence Impedance — The impedance in ohms per phase at rated frequency corresponding at the appropriate reference temperature to the flow of rated short time current between the line terminals connected together and the neutral.

3. REQUIREMENTS

3.1 General — In addition to the requirements given in this standard, the earthing transformers shall also conform to the requirements of IS : 2026 (Part I)-1977*, IS : 2026 (Part II)-1977†, IS : 2026 (Part III)-1981‡ and IS : 2026 (Part IV)-1977§, wherever applicable.

3.2 Ability to Withstand Rated Short-Time Current

3.2.1 Earthing transformers shall be capable of withstanding the rated short-time current for a period of 30 seconds, unless otherwise specified.

3.3 Temperature Rise

3.3.0 The permissible temperature-rise of earthing transformers shall correspond to the respective purpose of use.

3.3.1 In the case of earthing transformers for auxiliary loading the temperature-rise shall be the same as those for transformers [*see* IS : 2026 (Part II)-1977†].

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*Specification for power transformers: Part I General (*first revision*).

†Specification for power transformers: Part II Temperature-rise (*first revision*).

‡Specification for power transformers: Part III Insulation level and dielectric tests (*second revision*).

§Specification for power transformers: Part IV Terminal marking, tappings and connections (*first revision*).

3.3.2 In the case of earthing transformers for connection to arc suppression coil, the permissible temperature-rise shall be the same for which the arc suppression coil is designed.

3.3.3 If the earthing transformer limits the earth fault current, the temperature-rise shall be the same as for a transformer during short-circuit. This can be ascertained by calculating the values of temperature in accordance with **9.1.5** of IS : 2026 (Part I)-1977*.

4. TOLERANCES

4.1 The following tolerances shall be permissible:

a) Zero sequence impedance with auxiliary winding open (if provided)	$^{+\ 20}_{-\ 0}$ percent of declared value
b) No load losses	In accordance with Table 7 of IS : 2026 (Part I)-1977*
c) Load losses and impedance voltage (in case of an auxiliary winding being present)	

5. RATING PLATE

5.1 The following information shall be given on the rating plate of the earthing transformers:

a) Kind of transformer (earthing transformer);
b) Number of this standard, Ref IS : 3151;
c) Name of the manufacturer;
d) Manufacturer's serial number;
e) Year of manufacture;
f) Number of phases;
g) Rated frequency;
h) Rated voltages;
j) Connection symbol;
k) Type of cooling;
m) Total mass;
n) Mass and volume of insulating oil or class of insulation (for dry transformers), as applicable;

*Specification for power transformers: Part I General (*first revision*).

p) Temperature rise;

q) Insulation levels;

r) Transportation mass (for transformers exceeding 5 tonne mass);

s) Untanking mass (for transformers exceeding 5 tonne mass);

t) Insulating liquid (if not mineral oil);

u) Rated short time current and duration; and

v) Measured zero-sequence impedance.

5.1.1 The following information shall also be marked when unit supplies an auxiliary load:

a) Rated continuous current;

b) Rated kVA; and

c) Percentage impedance voltage (two winding).

5.2 The earthing transformers may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

6. TESTS

6.0 General — Tests shall be conducted in accordance with IS : 2026 (Part I)-1977*, IS : 2026 (Part II)-1977†, IS : 2026 (Part III)-1981‡ and IS : 2026 (Part IV)-1977§, unless otherwise specified.

6.1 Classification of Tests

6.1.1 *Type Tests* — The following shall constitute type tests:

a) Measurement of winding resistance,

b) Measurement of no-load loss and no-load current,

*Specification for power transformers: Part I General (*first revision*).

†Specification for power transformers: Part II Temperature-rise (*first revision*).

‡Specification for power transformers: Part III Insulation level dielectric tests (*second revision*).

§Specification for power transformers: Part IV Terminal markings, tappings and connections (*first revision*).

c) Measurement of zero-sequence impedance,

d) Measurement of insulation resistance,

e) Induced voltage withstand test,

f) Separate source voltage withstand test,

g) Lightning impulse voltage withstand test,

h) Temperature rise (**3.3**).

6.1.1.1 The following tests shall also be applicable when the unit supplies an auxiliary load:

a) Measurement of impedance voltage and load losses, and

b) Voltage ratio and voltage vector relationship.

6.1.2 *Routine Tests* — The following shall constitute routine tests:

a) Measurement of winding resistance,

b) Measurement of no-load loss and no-load current,

c) Measurement of zero-sequence impedance,

d) Measurement of insulation resistance,

e) Induced voltage withstand test, and

f) Separate source voltage withstand test.

6.1.2.1 The following routine tests shall also be applicable when the unit supplies an auxiliary load:

a) Impedance voltage and load loss, and

b) Voltage ratio and voltage vector relationship.

6.1.3 *Special Test* — When agreed between the purchaser and the supplier short circuit test may be carried out as a special test in accordance with **6.2**.

6.2 Short-Circuit Test

6.2.1 This is a special type test which may be carried out by mutual agreement between the purchaser and the supplier. Type test certificates may be accepted in lieu of the type test.

6.2.2 The earthing transformer shall be excited at rated voltage from a three-phase supply and a line-to-earth fault shall be applied by connecting one line terminal to the neutral either directly or through the earthing impedance as appropriate, in such a manner as to obtain maximum asymmetry on the first half wave of the fault current Ten short-circuit applications shall be made at suitable intervals, each for the duration of 0·2 seconds (10 cycles).

6.2.2.1 The ability of the earthing transformer to withstand the test shall be determined in the same manner as specified in IS : 2026 (Part I)-1977*.

6.2.2.2 For earthing transformers employed to connect an arc-suppression coil two short-circuit applications are deemed sufficient.

NOTE — By agreement between the purchaser and the supplier, a three-phase test may be replaced by a single-phase test of equal severity.

6.2.3 In case auxiliary winding is used in transformer for supplying an auxiliary load, subject to agreement between the purchaser and the supplier, as an alternate to tests of **6.2.2**, the transformer may be tested for short circuit test in accordance with IS : 2026 (Part I)-1977*. In that case the transformer shall be excited at rated voltage from a three-phase supply and auxiliary winding shall be short circuited.

*Specification for power transformers: Part I General (*first revision*).

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