

व्यापक परिचाला में संशोधन मसौदा

प्रलेख प्रेषण संज्ञापन
संदर्भ दिनांक
ईटी १६ /टी-१, /टी-२५ ०३-०६-२०१०

तकनीकी समिति: ईटी १६

प्रेषती:

- १। ईटी १६ के सभी सदस्य,
- २। विद्युत तकनीकी विभाग परिषद के सभी सदस्य, तथा
- ३। रूचि रखने वाले अन्य सभी निकाय

महोदय,

कृप्या निम्नलिखित मसौदे संलग्न हैं

प्रलेख संख्या

शीर्षक

प्रलेख : ईटी १६ (६११७)

बाहय-रंग तीन फेजी वितरण ट्रांसफार्मर 100
kVA 11 kV तक एवं सहित भाग 1 सीलड सहित

प्रलेख : ईटी १६ (६११८)

बाहय-रंग तीन फेजी वितरण : ट्रांसफार्मर 100
kVA 11 kV तक एवं सहित भाग 2 सीलड टाइप

कृप्या इन मसौदों का अवलोकन करें और अपनी सम्मतियाँ यह बताते हुए भेजें कि अंततः यदि ये भारतीय मानक के रूप में प्रकाशित हो जाएँ तो इन पर अमल करने में आपके व्यवसाय अथवा कारोबार में क्या कठिनाइयाँ आ सकती हैं।

सम्मतियाँ भेजो की अंतिम तारीख ३१ ०७ २०१०।

सम्मतियाँ यदि कोई हों तो कृप्या अगले पृष्ठ पर दिए पत्र में अधोहस्ताक्षरी को उपरिलिखित पते पर भेज दें।

धयवाद,

भवदीय,

(आर के त्रेहन)

वैज्ञानिक 'एफ' एवं प्रमुख (विद्युततकनीकी)

संलग्न: उपरिलिखित

**DRAFT IN
WIDE CIRCULATION**

DOCUMENT DESPATCH ADVICE

Our Ref

Date

ET 16/T-1, T-25

03-06-2010

TECHNICAL COMMITTEE : ET 16

ADDRESSED TO:

1. All Members of Transformers Sectional Committee, ET 16;
2. All Members of Electrotechnical Division Council; and
3. All Interested.

Dear Sir(s),

Please find enclosed a copy of the following draft:

Doc: No.	Title
ET 16 (6117)	Outdoor type three-phasae distribution transformers upto and including 100 KVA 11 KV: Part 1 Non-sealed type (Fourth revision)
ET 16 (6118)	Outdoor type three-phasae distribution transformers upto and including 100 KVA 11 KV: Part 2 : Sealed type (Second revision)

Kindly examine this draft and forward your views stating any difficulties which you are likely to experience in your business or profession, if this is finally adopted as **STANDARD**.

Comments, if any, may please be made in the format given overleaf and mailed to the undersigned.

Last date for comments: **31-07-2010**.

Thanking you,

Yours faithfully

(R.K. Trehan)
Sc 'F' & Head (Electrotechnical)

Encl: As above

Transformers Sectional Committee, ET 16

0. FOREWORD

0.1 This Indian Standard IS 1180 (Part 1): 2007 (Fourth Revision) was adopted by the Bureau of Indian Standards on the recommendations of Transformer Sectional Committee, ET16 and approval of the Electrotechnical Division Council (to be added later).

0.2 Indian Standard IS 1180(Part 1) was first published in 1958 and subsequently revised in 1964 (First Revision), 1981 (Second Revision) and 1989 (Third Revision).

This Fourth Revision has been brought out to take into account of the experience gained since the last revision of the standard particularly in terms of maximum losses which have now been aligned with the minimum energy performance standards for distribution transformers recommended by Bureau of Energy Efficiency (BEE) also taking cognizance of the fact that energy conservation standards for distribution transformers have the vast potential of savings in view of their usage in bulk.

0.3 Although IS 2026 “Power Transformers” includes the range of transformers covered by this standard, yet, it has been decided to retain the latter, considering the advantages of having a standard which has simplified the requirements in the distribution transformer range covered by it.

However, for various common requirements, normative references have been made to IS 2026 “Power Transformers” which is, therefore, a necessary adjunct to this standard.

0.4 Besides improvement in loss levels and temperature rises, this standard, also enhances scope of existing standard from 100 kVA, 11 kV to 200 kVA, 33 kV. Also, corrugated tank construction in line with international practice is also included as an alternative.

0.5 The requirements of sealed type outdoor distribution transformers of similar voltage and kVA ratings are covered in Part-2 of this standard which is also revised on similar lines.

0.6 In the preparation of this standard, assistance has been derived from REC Specification 11/1976 (R-1993) issued by the Rural Electrification Corporation Ltd., APDRP Technical Specification for such transformers and CBIP Manual on Transformers Publication 295.

0.7 This standard is intended to cover the generic technical specifications and it does not include all the necessary provisions of a contract. However, the standard calls for agreement between purchaser and manufacturer under **8.1, 11.2, 12.1.1 and 18.1**.

0.8 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 ‘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.

For BIS Use Only

BUREAU OF INDIAN STANDARDS

Draft *Indian Standard*
**OUTDOOR TYPE THREE-PHASE
DISTRIBUTION TRANSFORMERS
UPTO AND INCLUDING 200 kVA, 33 kV**

PART 1 NON-SEALED TYPE

[*Fourth Revision* of IS 1180(Part 1)]

1. SCOPE

- 1.1 This standard (Part I) specifies the requirements and tests for oil-immersed, naturally air-cooled, three phase, double-wound non-sealed type outdoor distribution transformers of ratings up to and including 200 kVA, for use on systems with nominal system voltages up to and including 33 kV.

2. NORMATIVE REFERENCES

- 2.1 The Indian Standards listed in Annex A are necessary adjuncts to this standard.

3. TERMINOLOGY

- 3.1 For the purpose of this standard, the definitions given in IS 1885 : Part 38 shall apply.

4. SERVICE CONDITIONS

- 4.1 The provisions of 1.2 of IS 2026 : Part 1 shall apply.

5. RATINGS

5.1 kVA Ratings

The standard ratings shall be as per Table-1 given below :

Nominal System Voltage	Standard Ratings
Up to 11 kV	16, 25, 63, 100, 160 and 200 kVA
22 kV	63, 100, 160 and 200 kVA
33 kV	100, 160 and 200 kVA

Table 1 : Standard Ratings

5.2 Rated Frequency

The rated frequency shall be 50 Hz.

5.3 Nominal System Voltage

Nominal system voltage shall be chosen from the following :

HV - 3.3, 6.6, 11, 22 & 33 kV

LV - 433V

Rated Basic Insulation Level (BIL) - Refer Table-2 below

Table-2 : Rated BIL

Nominal System Voltage (kV)	Rated BIL (kVp)
33	170
22	125
11	75
6.6	60
3.3	40

6. NO-LOAD VOLTAGE RATIOS

6.1 The no-load voltage ratios shall be as follows:

3 300/433-250, 6 600/433-250, 11 000/433-250, 22 000/433-250 and 33 000/433-250 V

Note : LV may be rated for 415-240V for 25 kVA and below.

7. WINDING CONNECTIONS AND PHASE DISPLACEMENT

7.1 The primary winding shall be connected delta and the secondary winding star [vector symbol, Dyn 11 (see IS 2026 :Part 1)], so as to produce, a positive phase displacement of 30° from the primary to the secondary vectors of the same phase. The neutral of the secondary winding shall be brought out to a separate insulated terminal.

8. TAPPING RANGES AND TAPPING METHODS

8.1 No taps are normally required to be provided, unless specifically desired by the purchaser.

8.2 The standard tapping ranges, when taps are provided, shall be as follows:

Above 25 kVA Rating

Winding tapped	Primary
Number of tappings	5

Tappings at $\pm 2\frac{1}{2}$ and
 ± 5 percent

- 8.2.1 Tap-changing shall be carried out with the transformer off-circuit by means of links or by means of an externally-operated switch with mechanical locking device and a position indicator. Arrangement for pad-locking shall be provided:

9. TRANSFORMER TANK

9.1 Construction

- 9.1.1 Transformer tank can be of plain tank configuration with/without radiator fins or round/elliptical cooling tubes. The tank can also be made of corrugated panels also used for cooling.

- 9.1.2 The transformer tank shall be of adequate strength to withstand positive and negative pressures built up inside the tank while the transformer is in operation. The transformer tank covers shall be bolted with tank rim so as to make a leak-proof joint.

- 9.1.3 All welding operations shall be carried out by qualified welders.

- 9.2 All hardware exposed to atmosphere shall be hot dip galvanized/or of stainless steel.

- 9.3 Gaskets wherever used shall conform to Type III as per IS 11149/Type C as per IS 4253 : Part 2.

- 9.4 Inside of tank shall be painted with varnish or oil resistant paint. External paint work shall be subject to agreement between the user and the transformer manufacturer.

10. TRANSFORMERS OIL

- 10.1 The transformer oil shall comply with the requirements of IS 335.

11. FITTINGS

11.1 Standard Fittings

The following standard fittings shall be provided:

- a) Two earthing terminals with the symbol \perp ;
- b) Oil level gauge indicating oil level minimum, 35°C and maximum operating temperature;
Note : Minimum and maximum positions correspond to the operating temperature of -5°C and 90°C respectively.
- c) Air release device;
- d) Rating and terminal marking plates non-detachable;
- e) Plain breathing device which would not permit ingress of rain water and insects;
- f) Drain cum sampling valve ($\frac{3}{4}$ nominal size thread)preferably steel with plug;
- g) Thermometer pocket with cap (for transformers of rating above 25 kVA);
and

- h) Oil filling hole having (1- ¼ " nominal size thread) with cover (for transformers without conservator)

Notes :The bottom drain valve and filling hole be used for filtration purpose also.

11.2 Optional Fittings

The following shall be available as extra fittings at the option of the purchaser if specified when inviting tenders :

- a) Dehydrating breather in lieu of plain breathing device
- b) Filter valve (1¼ nominal size thread)
- c) Thermometer pocket (for transformers of rating 25 kVA and below)
- d) Pressure relief device or explosion vent
- e) Arcing horns or suitable rating lightning arrestors for HT side – 3 Nos.
- f) Bird Guard
- g) Terminal connectors

11.3 Conservators

- 11.3.1 On Transformers of ratings above 63 kVA with rectangular/elliptical plain tank the provision of conservators is obligatory. For other ratings Transformer manufacturers may adopt their standard practice. For corrugated tank conservator is not required.
- 11.3.2 When a conservator is provided, oil gauge and the plain or dehydrating breathing device shall be fixed to the conservator which shall also be provided with a drain plug and a filling hole (1¼" normal size thread) with cover. The capacity of a conservator tank shall be designed keeping in view the total quantity of oil and its contraction and expansion due to temperature variations. In addition the cover of main tank shall be provided with an air release plug to enable air trapped within to be released, unless the conservator is so located as to eliminate the possibility of air being trapped within the main tank.
- 11.3.3 The inside diameter of the pipe connecting the conservator to the main tank should be within 20 to 50 mm and it should be projected into the conservator so that its end is approximately 20 mm above the bottom of the conservator so as to create a sump for collection of impurities. The minimum oil level (corresponding to -5 deg C) should be above the sump level.

TERMINAL ARRANGEMENT & CLEARANCES

- 12.1 The transformers shall be fitted on high voltage and low voltage sides with outdoor type bushings of appropriate voltage and current ratings. The high voltage bushings (3 Nos.) shall conform to IS 2099. The low voltage bushings (4 Nos.) shall conform to IS 7421. Alternatively, the low voltage side may be made suitable for adoption of PVC / XLPE cable of suitable size.

12.1.1 If required by the purchaser a suitable cable-end box may be provided on the secondary side.

12.2 The dimensions of bushings of the following voltage classes shall conform to Indian Standards mentioned against them:

Voltage Class	<i>For Procelain Parts</i>	<i>For Metal Parts</i>
Up to 1.1 kV bushings	IS 3347 (Part1/Sec 1) : 1979	IS 3347 (Part1/Sec2) : 1979
3.6 kV bushings	IS 3347 (Part 2/Sec 1) : 1979	IS 3347 (Part 2/Sec 2) : 1979
12 kV bushings	IS 3347 (Part 3/Sec 1) : 1982	IS 3347 (Part 3/Sec 2) : 1982
24 kV bushings	IS 3347 (Part4/Sec 1) : 1982	IS 3347 (Part 4/sec 2): 1979
36 kV bushings	IS 3347 (Part 5/Sec.1) :1979	IS 3347 (Part 5/Sec.1): 1979

12.2.1 The minimum phase-to-phase and phase-to-earth external clearances for LV & HV bushings shall be as per Table 3 below :

Nominal System Voltage	Phase to Phase external clearance in mm	Phase to earth external clearance in mm
Upto 1.1kV	75	40
11 kV	280	140
22 kV	330	230
33 kV	350	320

Table 3 : External (Air) Clearances

Note : Higher clearances have been recommended to avoid birdage.

12.2.2 For transformers with cable-end box/connection chamber arrangement on LV side, the phase-to-phase and phase-to-earth clearance shall be not less than 45 mm and 20 mm respectively.

12.2.3 Connectors

Wherever specified, suitable bimetallic connectors (clamp type) shall be provided on both HV and LV side for making sound terminations.

12.3 Marking and Relative Positions of Terminals

Appropriate characters in accordance with IS 2026:Part 1 shall be indelibly marked upon or adjacent to terminals.

MOUNTING ARRANGEMENT

- 13.1 The under-base of all transformers shall be provided with two 75 x 40 mm channels 460 mm long as shown in Fig. 1 to make them suitable for fixing to a platform or plinth.

Fig. 1 Mounting Dimensions of Transformer

- 13.2 Pole mounting arrangement may be alternatively provided in for which type C adapter plates are for direct pole mounting of transformers having type C support lugs, subject to the stress limitations of the supporting structure. These adapter plates are not suitable for use with transformers weighing in excess of 2000 pounds as follows :

Fig. A 1 Adapter Plates

14 LIMITS OF TEMPERATURE-RISE

The permissible temperature-rise shall not exceed the limits of 40°C (when measured by resistance method) for transformer winding and 35°C (measured by thermometer) in top oil when tested in accordance with IS 2026 :Part 2.

15 LOSSES AND IMPEDANCE VALUES

15.1 Losses

Under any situation, for transformers up to 11 000/433 -250 V, the total losses (no-load + load losses at 75°C) at rated full load condition and total losses at 50% of load condition shall not exceed the values given below.

<i>Rating</i>	<i>Max. total losses at 50% of kVA rating</i>	<i>Max. total losses at 100% of kVA rating</i>
kVA	W	W
16	150	480
25	210	695
63	380	1250
100	520	1800
160	770	2200
200	890	2700

15.1.1 For transformers having voltage class above 11kV & up to 22 kV the permissible total loss values shall be 7.5% higher than the values mentioned in the above table for transformers up to 11 kV class.

15.1.2 For transformers having voltage class above 22 kV & up to 33 kV the permissible total loss values shall be 10 % higher than the values mentioned in the above table for transformers up to 11 kV class.

15.2 Impedance

The recommended impedance at 75°C is 4.5 %.

16. TOLERANCES

16.1 The tolerance on electrical performance (excluding losses) shall be as given in IS 2026 :Part I : 2007.

17. ABILITY OF TRANSFORMERS TO WITHSTAND EXTERNAL SHORT-CIRCUIT

17.1 The performance of transformer under external short-circuit conditions shall be in accordance with IS 2026 :Part 5.

18. EFFICIENCY AND REGULATION

18.1 When statements of efficiency and regulations are required they shall be based on loading at the rated kVA and unity power factor (and other power factors, if agreed between the purchaser and the manufacturer) and computed in accordance with Annex B and C respectively.

19. MARKING

19.1 Rating Plate

Each transformer shall be provided with non-detachable rating plate of weather proof material, fitted, in a visible position, showing the information given in Fig. 2. The entries on the rating plate shall be indelibly marked (for example, by etching, engraving or stamping).

Fig. 2 Rating Plate

19.2 **Terminal Marking Plate**

Each transformer shall be provided with a terminal marking plate in accordance with Fig. 3 or 4 whichever is applicable.

Fig. 3 Terminal Marking Plate for Transformers with Tapes

Fig. 4 Terminal Marking Plate for Transformers Without Taps

19.3 The rating and terminal marking plates may be combined into one plate at the option of the manufacturers.

20. **INFORMATION REQUIRED WITH ENQUIRY AND ORDER**

20.1 The information to be supplied to the manufacturer with enquiry and order by the purchaser shall be in accordance with Annex A of IS 2026 :Part I.

21 **TESTS**

21.1 **General**

The requirements given in 10.1 of IS 2026:Part I shall apply.

21.2 All the tests listed under 21.3, 21.4, 21.5 and 21.6 shall be carried out in accordance with the provisions of the clauses and standards given in the parentheses.

21.3 **Routine Tests**

The following shall constitute the routine tests:

- a) Measurement of winding resistance (IS 2026 :Part I)
- b) Measurement of voltage ratio and check of phase displacement (IS 2026: Part I)
- c) Measurement of short-circuit impedance (principal tapping, when applicable) and load loss at 50% and 100% load (IS 2026 :Part I)

- d) Measurement of no-load loss and current (IS 2026:Part I)
- e) Measurement of insulation resistance (IS 2026:Part I)
- f) Induced over-voltage withstand test (IS 2026 :Part 3)
- g) Separate-source voltage withstand test (IS 2026 :Part 3)
- h) Air pressure test (see 21.7.1 in case of plain tank and 21.7.2 in case of corrugated tank)
- i) Oil leakage test for corrugated tanks (see 21.7.3)

21.4 **Type Tests**

The following shall constitute the type tests:

- a) Lightning impulse test (IS 2026:Part 3)
- b) Temperature-rise test (IS 2026:Part 2)
- c) Short-circuit test (IS 2026 :Part 5)
- d) Air pressure test (*see 21.7*)
- e) No load current at 112.5% voltage (see 23.2)

21.5 **Special Tests**

The following shall constitute the special tests :

- a) Determination of sound levels (IS 2026:Part 10-1)

21.6 **Acceptance Tests**

The following acceptance tests shall be performed to prove that the transformer meets conditions laid down in the customer specification/contract in addition to routine tests as per 21.3.

- a) Paint adhesion test
- b) BDV and Moisture content of oil in the transformer (IS 335)

21.7 *Air Pressure Test (Type test) for Plain Tanks*

The tank shall be fixed with a dummy cover with all fittings including bushings in position and shall be subjected to air pressure of 35 kPa above atmospheric

pressure for 30 minutes. The permanent deflection of flat plate, after pressure has been released, shall not exceed the values given below:

<i>Length of Plate</i>	<i>Deflection</i>
Up to 750 mm	5 mm
751 to 1250 mm	6.5 mm

21.7.1 *Air pressure test (routine) (for plain tanks)*

The transformer with bolted cover and with all fittings including bushings in position shall be tested at a pressure of 35 kPa above atmosphere pressure maintained inside the tank for 10 minutes.

There should be no leakage at any point.

21.7.2 *Air pressure (routine) for corrugated tanks*

The corrugated transformer tank shall be tested for air pressure of 15 kPa above atmosphere pressure maintained inside the tank. There should be no leakage at any point.

21.7.3 *Oil leakage test (Routine for corrugated tanks)*

Tank with corrugations shall be tested for oil leakage test a pressure of 15 kPa measured at the top of the tank. There should be no leakage at any point.

22. **Permissible Flux Density and Over fluxing**

22.1 The maximum flux density in any part of the core and yoke at rated voltage and frequency shall be such that the flux density with simultaneous + 12.5% combined voltage and frequency variation from rated voltage and frequency shall not exceed 1.9 Tesla.

22.2 No load current shall not exceed 3% of full load current and will be measured by energizing the transformer at 433 volts, 50 Hz on the secondary. Increase of voltage of 433 volts by 12.5% shall not increase the no load current by Max. 6% of full load current.

ANNEX A
(Clause 2.1)

LIST OF REFERRED INDIAN STANDARDS

IS No.	Title
IS 1885 :Part 38 : 1993	Electrotechnical vocabulary: Part 38: Power Transformers (second revision)
IS 2026 :	Power transformers
Part 1 : 2007	General (Third Revision)
Part 2 : 2007	Temperature rise (Third Revision)
Part 3 :2007	Insulation level and dielectric tests and external clearances in air (Fourth Revision)
Part 5 : 2007	Ability to withstand short circuit
Part 8 : 2007	Application Guide
Part 10-1:	Determination of sound levels
IS : 2099 : 1986	Specification for bushings for alternative voltages above 1 000 volts (second revision)
IS :3347	Dimensions for porcelain transformer bushings for use in normal and polluted atmosphere
(Part 1/Sec 1&2) : 1979	Part 1: Up to and including 1 kV bushings, Section 1 Porcelain parts, and Section 2 Metal parts
(Part 2/Sec 1 &2) : 1979	Part 2 : 3.6 kV bushings, Section I Porcelain parts, and Section 2 Metal parts
(Part 3/Sec (1 &2) :1982	Part 3: 12 & 17.5 kV bushings, Section 1 Porcelain parts and Section 2 Metal parts
(Part 4/Sec 1 &2) :1982	Part 4 : 24 kV Bushings, Section1 Porcelain parts and Section 2 Metal parts
(Part 5/Sec 1&2) :1979	Part 5 : 36 kV Bushings, Section 1 Porcelain parts and Section 2 Metal parts
IS 7421 : 1974	Specification for porcelain bushings for alternating voltages up to and including 1 000V
IS 335 :1983	Specification for new insulating oils for transformers and switchgear (third revision)
IS 8999 : 1979	Gauging practice for pipe threads where pressure tight joints are required on the threads
IS 554 : 1975	Dimensions for pipe threads where pressure tight joints are required on the threads (second revision)
IS 3639-1966	Specification for fittings and accessories for Power Transformers (under revision)

ANNEX B
(Clause 18.1)

METHOD OF DECLARING EFFICIENCY

B-1 EFFICIENCY

B-1.1 The efficiency to be declared is the ratio of the output in kW to the sum of the output in kW and the following losses :

- a) No-load loss, which is considered to be constant at all loads : and
- b) Load loss, which varies with load.

The total loss, on load is the sum of (a) and (b).

ANNEX C
(Clause 18.1)

CALCULATION OF INHERENT VOLTAGE REGULATION

C-1 INHERENT VOLTAGE REGULATION

C-1.1 The inherent voltage regulation from no-load to a load of any assumed value and power factor may be computed from the impedance voltage and corresponding load loss measured with rated current in the winding (see also IS 10561 : 1983)

Let

- I = rated current in winding excited;
 E = rated voltage of winding excited;
 I_{SC} = current measured in winding excited
 E_{ZSC} = voltage measured across winding excited (impedance voltage);
 P_{SC} = watts measured across winding excited

$$E_{XSC} = \text{reactance voltage} = \sqrt{E_{ZSC}^2 - \left(\frac{P_{SC}}{I_{SC}}\right)^2}$$

P = P_{SC} corrected to 75°C, and from current I_{SC} to I ;

$$E_x = E_{XSC} \times \frac{I}{I_{SC}}$$

$$E_r = \frac{P}{I}$$

C-1.2 For rated load at unity power factor, the percentage regulation is approximately equal to

$$E_r\% + \frac{(E_x\%)^2}{200}$$

$$E_x\% = 100 E_x/E;$$

$$E_r\% = 100 E_r/E$$

$$n = I_a/I; \text{ and}$$

I_a = current in the winding excited during the short circuit tests corresponding to that obtained when loading at the assumed load on the output side and with rated voltage on the input side.

C-1.3 For rated load any power factor $\cos \phi$, the percentage regulation is approximately equal to:

$$\frac{E_r\% \cos \phi + E_x\% \sin \phi + (E_x\% \cos \phi - E_r\% \sin \phi)^2}{200}$$

C-1.4 For any assumed load other than rated load and unity power factor, the percentage regulation is approximately equal to;

$$\frac{n.E_r\% + (n.E_x\%)^2}{200}$$

C-1.5 For any assumed load other than rated load and at any power factor $\cos \phi$, the percentage regulation is approximately equal to:

$$\frac{n.E_r\% \cos \phi + n.E_x\% \sin \phi + (n.E_x\% \cos \phi - n.E_r\% \sin \phi)^2}{200}$$

C-1.6 The above formulae are sufficiently accurate for transformers covered by this specification.

Bureau of Indian Standards

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Review of Indian Standards

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.

The Indian Standard has been developed from Doc: NO. ETD 16 (3030)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Headquarters		Telegrams: Manaksanstha (Common to all offices)
Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi – 110002. Tele: 323 0131, 323 3375, 323 9402		
Regional Offices:		Telephone
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg New Delhi – 110002.	323 7617, 323 3841
Eastern	: 1/14, C.I.T. Scheme VII M, V.I.P. Road, Maniktola Calcutta – 700054	337 8499, 337, 8561, 337 8626, 337 9120
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