STANDARDIZATION

- IS 1180 (PART 1) – OUTDOOR TYPE OIL IMMERSED DISTRIBUTION TRANSFORMERS UPTO AND INCLUDING 2500 KVA, 33KV
The National Standards Body of India

Bureau of Indian Standards (BIS) took over work of Indian Standards Institution (ISI) through enactment of BIS Act (1986) by the Indian Parliament

ISI was set up in 1947 as a registered society, under a Government of India resolution.
The Bureau of Indian Standards was established on 1 April 1987 under BIS Act, 1986 as a statutory body.
Focus of The Presentation

- Objectives of BIS

- Process of developing Standardization culture
  Involvement of all concerned in the process of Standardization through consensus

- Need for developing/improvement in Standards on distribution transformers

- Areas covered in Standard of distribution transformers

- Thrust on new areas as well as enhancement of the scope of the earlier version of distribution transformers

- Need to give wider coverage in key area of activities
OBJECTIVES

- Harmonious development of
  - Standards
  - Marking
  - Quality Certification
- Provide new thrust to
  - Standardization
  - Quality Control
- To evolve a National Strategy for according recognition to standards and integrating them with growth and development of production and exports
STANDARDIZATION SPACE

LEVEL

INTERNATIONAL --
REGIONAL --
NATIONAL --
ASSOCIATION --
COMPANY --
INDIVIDUAL --

SUBJECT

ENGINEERING
INDUSTRY
COMMERCE
SCIENCE
EDUCATION
TRANSPORT
HOUSING/BUILDING
FOOD
AGRICULTURE
FORESTRY
TEXTILES
CHEMICALS

ASPECT

-- NOMENCLATURE
-- SPECIFICATION
-- SAMPLING & INSPECTION
-- TEST & ANALYSIS
-- SYMBOLS
-- CODE OF PRACTICE
-- MODEL FORM OF CONTRACT OR AGREEMENT
STANDARDIZATION SET UP

- Standard formulation activity of Bureau is functioning under Standard Advisory Committee.

- There are 14 Technical Sectors under SAC and each of these sector has a Division Council (ETDC, LITDC etc.)

- Electro technical Division Council (ETDC) is responsible for national standardization in the field of Electrotechnology.
Structure for development of Standards
BASIC CONSIDERATIONS IN EVOLVING STANDARDS

- Consensus Principle
- Access to International Technology
- Research & Development
- Availability of indigenous materials & technology
- Co-ordination with other Levels of Standardization
- Consultations involving all Stakeholders
- Documents sent for public comments before finalization & also hosted on BIS web site
Standards are developed with following in mind

- Safety
- Ease of use and adaptability
- Simple Technology
- Value for money products
- Energy Efficiency & Environment
39 Sectional Committees addressing the diverse standardization needs of the Nation in the field of Electrotechnology.

Number of Indian Standards 1467

Harmonized with IEC/ISO standards

Dual No. (IS/IEC.. : ..) 351

Technically equivalent 411
(IS and IEC with | )
INDIAN STANDARDS ON DISTRIBUTION TRANSFORMERS

• IS 1180(Part 1): 1989: Outdoor type three phase distribution transformers upto and including 100kVA 11 kV Part 1: Non sealed type.
• IS 1180(Part 2): 1989: Outdoor type three phase distribution transformers upto and including 100kVA 11 kV Part 2: Sealed type.
REVISED VERSION OF IS ON DISTRIBUTION TRANSFORMERS

- **IS 1180(Part 1): 2014** - Outdoor type, insulated liquid immersed Distribution Transformers upto and including 2500 kVA, 33kV (Part 1: Mineral Oil Immersed)
SCOPE

• SPECIFIES REQUIREMENTS AND TESTS INCLUDING STANDARD LOSS LEVELS OF MINERAL OIL IMMERSED, NATURAL AIR COOLED, OUTDOOR TYPE, DOUBLE WOUND DISTRIBUTION TRANSFORMERS FOR USE IN POWER DISTRIBUTION SYSTEMS WITH NOMINAL SYSTEM VOLTAGES UPTO AND INCLUDING 33Kv AND OF FOLLOWING TYPES AND RATINGS:
Contd....

- a) Three Phase ratings upto and including 200KVA both non sealed type and sealed type.
- b) Three Phase ratings higher than 200KVA upto and including 2500KVA both non sealed type and sealed type.
- Single Phase ratings upto and including 25KVA sealed type.
Distribution Transformers

- A Distribution Transformer is a transformer that provides the final voltage transformation in the electric power distribution system, stepping down the voltage used in the distribution lines to the level used by the customers.
Non Sealed Type Transformers

- A transformer which has a conservator and a breather for breathing out and breathing in with expansion and contraction of oil with temperature. The transformer tank body and cover are bolted / clamped / welded type. The tank can also be of corrugated construction.
Sealed Type Transformers

• A transformer which is non-breathing that is so sealed that normally there is no significant interchange between its contents and the external atmosphere. No conservator is provided. Such a transformer may or may not have a cushion of dry air (or inert gas for example; Nitrogen, IS 1747).
Two Categories of SEALED TRANSFORMERS

• a) Transformers in which the total volume of oil together with air (or inert gas) or any combination thereof, remains constant over the temperature range.

b.) Transformers in which the total volume of oil, air (or inert gas) or any combination thereof, varies over the temperature range and this variation is accommodated by a sealed flexible container (corrugated tank) or a flexible membrane.

• Sealed type transformers usually have a bolted / clamped / welded cover construction.
STANDARD RATINGS

*(Clause 6.1)*

<table>
<thead>
<tr>
<th>Nominal System Voltage</th>
<th>Standard Ratings (kVA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to and including 11 kV -</td>
<td>*6.3,*10,16, *20,25, *40,63, 100, 160 and 200</td>
</tr>
<tr>
<td>Above 11 kV up to and including 22 kV -</td>
<td>63, 100, 160 and 200</td>
</tr>
<tr>
<td>Above 22 kV up to and including 33 kV -</td>
<td>100, 160 and 200</td>
</tr>
<tr>
<td>NOTE - * ratings are non-preferred</td>
<td></td>
</tr>
</tbody>
</table>
# BASIC INSULATION LEVEL (BIL)

*(Clause 6.4)*

<table>
<thead>
<tr>
<th>Nominal System Voltage (kV)</th>
<th>Rated BIL (kVp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3</td>
<td>40</td>
</tr>
<tr>
<td>6.6</td>
<td>60</td>
</tr>
<tr>
<td>11</td>
<td>75</td>
</tr>
<tr>
<td>22</td>
<td>125</td>
</tr>
<tr>
<td>33</td>
<td>170</td>
</tr>
</tbody>
</table>
NO LOAD VOLTAGE RATIOS

- 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- Secondary voltage may be selected as 415-240 V, subject to agreement between User and Supplier
MAXIMUM TOTAL LOSSES & IMPEDANCE VALUES upto 11 kV class transformers

<table>
<thead>
<tr>
<th>S.No</th>
<th>Rating (kVA)</th>
<th>Impedance (percent)</th>
<th>Max. Total Loss (W)</th>
<th>50 % Load</th>
<th>100 % Load</th>
<th>50 % Load</th>
<th>100 % Load</th>
<th>50 % Load</th>
<th>100 % Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4.5</td>
<td></td>
<td>Energy Efficiency Level 1</td>
<td>Energy Efficiency Level 2</td>
<td>Energy Efficiency Level 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>16</td>
<td>4.5</td>
<td></td>
<td>150</td>
<td>480</td>
<td>135</td>
<td>440</td>
<td>120</td>
<td>400</td>
</tr>
<tr>
<td>ii</td>
<td>25</td>
<td>4.5</td>
<td></td>
<td>210</td>
<td>695</td>
<td>190</td>
<td>635</td>
<td>175</td>
<td>595</td>
</tr>
<tr>
<td>iii</td>
<td>63</td>
<td>4.5</td>
<td></td>
<td>380</td>
<td>1250</td>
<td>340</td>
<td>1140</td>
<td>300</td>
<td>1050</td>
</tr>
<tr>
<td>iv</td>
<td>100</td>
<td>4.5</td>
<td></td>
<td>520</td>
<td>1800</td>
<td>475</td>
<td>1650</td>
<td>435</td>
<td>1500</td>
</tr>
<tr>
<td>v</td>
<td>160</td>
<td>4.5</td>
<td></td>
<td>770</td>
<td>2200</td>
<td>670</td>
<td>1950</td>
<td>570</td>
<td>1700</td>
</tr>
<tr>
<td>vi</td>
<td>200</td>
<td>4.5</td>
<td></td>
<td>890</td>
<td>2700</td>
<td>780</td>
<td>2300</td>
<td>670</td>
<td>2100</td>
</tr>
</tbody>
</table>
LOSSES & IMPEDANCE VALUES above 11 kV and 22 kV class Transformers

* For transformers having voltage class above 11 kV and up to and including 22 kV, the permissible total loss values shall not exceed by 5 percent of the maximum total loss values mentioned in above table.

• For transformers having voltage class above 22 kV and up to and including 33 kV, the permissible total loss values shall not exceed by 7 ½ percent of the maximum total loss values mentioned in above table
• The recommended impedance at 75ºC for different ratings is as per above Table
Limits Of Temperature Rise

• The type of cooling shall be type ONAN as per IS 2026 (Part 2).

• 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) for top oil when tested in accordance with IS 2026 (Part 2).
Three Phase Distribution Transformers Higher than 200kVA upto and including 2500 kVA

- Standard Ratings-
- Up to and including 11 kV - 250, 315, 400, 500, 630, 1000, 1250, 1600, 2000 and 2500.
- Above 11 kV up to and including 22 kV - 250, 315, 400, 500, 630, 1000, 1250, 1600, 2000 and 2500.
- Above 22 kV up to and including 33 kV - 250, 315, 400, 500, 630, 1000, 1250, 1600, 2000 and 2500.
Nominal System Voltage

- Nominal system voltage shall be chosen from the following:
  - HV - 3.3, 6.6, 11, 22 & 33 kV
  - LV - 415V
Limits of Temperature Rise

• The type of cooling shall be ONAN as per IS 2026 (Part 2)

• The permissible temperature-rise shall not exceed the limits of 45°C when measured by resistance method for transformer winding and 40°C measured by thermometer for top oil when tested in accordance with The type of cooling shall be ONAN as per IS 2026 (Part 2)
Single Phase Distribution Transformers upto and incl. 25 kVA sealed type.

- **Standard Ratings:**
  - Input Voltage
    - 11 kV
    - 22 kV
    - 33 kV
  - kVA Rating
    - 5,10,16 & 25
    - 10,16 & 25
    - 16 & 25

**Nominal System Voltages**
- Nominal system voltage shall be chosen from the following:
  - HV 11, 22 and 33 kV
  - LV 415V (240 V, 1 Phase)
Limits of Temperature Rise

- The type of cooling shall be ONAN as per IS 2026 (Part 2)

- 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 for top oil when tested in accordance with IS 2026 (Part 2).
Standard Materials

- Major material used in the transformer shall conform to the following Indian Standards:
  - Cold Rolled Grain Oriented electrical steel – IS 3024
  - Amorphous core material – (IS under preparation)
  - Copper/Aluminum conductor – IS 191, IS 1897, IS 7404, IS 12444, IS 13730/IS 6162 series as given in Annex A.
  - Kraft paper – IS 9335 series as given in Annex A.
  - Press Board – IS 1576
  - Mineral oil – IS 335 (Note: use of other insulating liquids namely natural ester, synthetic organic ester - IS 16081 subject to agreement between User and Supplier)
Tests

• Routine Tests (to be conducted on all units)

  The following shall constitute the routine tests:
• Measurement of winding resistance (IS 2026 Part 1)

• Measurement of voltage ratio and check of phase displacement (IS 2026 Part 1)

• Measurement of short-circuit impedance (principal tapping, when applicable) and load loss at 50% and 100% load (IS 2026 Part 1)

• Measurement of no-load loss and current (IS 2026 Part 1)

• Measurement of insulation resistance (IS 2026 Part 1)

• Induced over-voltage withstand test (IS 2026 Part 3)

• Separate-source voltage withstand test (IS 2026 Part 3)

• Pressure test } Additional Tests

• }

• Oil leakage test }
Contd....

- **Type Tests:** to be conducted on one unit
- The following shall constitute the type tests:

- Lightning impulse test (IS 2026: Part 3)
- Temperature-rise test (IS 2026: Part 2)

- **NOTE** - Maximum measured total loss (No load at rated excitation + load loss at maximum current tap converted to 75 °C reference temperature) at 100 percent loading shall be supplied during temperature rise test.

- Short-circuit withstand test (IS 2026 :Part 5) (up to 200 kVA)
  - **NOTE** - Routine tests before and after short circuit test shall be conducted as per IS 2026 (Part 1)
- Pressure test (see 21.5)
• Special Tests: (to be conducted on one unit)

The following shall constitute the special tests which shall be carried out by mutual agreement between the User and Supplier.

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

b) Short-circuit withstand test (IS 2026: Part 5) (above 200 kVA)

NOTE - Routine tests before and after short circuit test shall be conducted as per IS 2026 (Part 1)

c) No load current at 112.5% voltage (see 5.9.3)

d) Paint adhesion test

The test is performed as per ASTM D3359 (Standard Test Methods for measuring adhesion by Tape test).

e) BDV and Moisture content of oil in the transformer (IS 335)

NOTE   Tests at d) and e) may be carried out on more than one unit subject to agreement between user and supplier
Method of Declaring Efficiency

**EFFICIENCY**

1. The efficiency to be declared is the ratio of the output in kW to the input in kW and calculated as under.

   \[
   \text{Efficiency} = \frac{\text{output}}{\text{input}} = \frac{\text{input} - \text{total losses}}{\text{input}}
   \]

2. Total losses comprise:
   - No-load loss, which is considered to be constant at all loads; and
   - Load loss, which varies with load.

3. The total loss, on load is the sum of above losses.
Inherent Voltage regulation

- 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.
NORMAL INFORMATION

The following information should be given in all cases:

• Particulars of the specification to be complied with;
• Application of Transformer e.g. normal Distribution Transformer, Solar duty, wind application, Motor starting etc.
• Single or three phase unit;
• Number of phases in system;
• Frequency;
• Indoor or outdoor type;
• Type of cooling;
• Rated power (in kVA)
• Rated voltages (for each winding);
• State if tappings are required and if on-load or off-circuit tap-changers, or links are required.
• Highest voltage for equipment (for each winding);
• Method of system earthing (for each winding);
• Insulation level (for each winding), power frequency test level/impulse level;
• Connection symbol;
• Neutral terminals, if required (for each winding) and their insulation level to earth;
• Special requirements of installation, assembly, transport and handling;
• Fittings required and an indication of the side from which meters, rating plates, oil-level indicator, etc. may be readable.
SPECIAL INFORMATION

- The following additional information may be required to be given:

- If a lightning impulse voltage test is required, whether or not the test is to include chopped waves [see IS 2026 (Part 3)].

- Impedance voltage at rated current, if specific value is required;

- Altitude above mean sea-level, if in excess of 1 000 m;

- Whether transformers will be subjected to frequent overcurrent, for example, furnace transformers and traction feeding transformers;

- Any other exceptional service conditions;

- Whether noise level measurement is to be carried out;

- Vacuum withstand of the transformer tank, if a specific value is required;

- Type of Tap-changer controls required (if OLTC is provided);

- Type of mounting for example pole mounted, ground mounted etc.

- Any other appropriate information, including reference to any special tests not referred to above which may be required.
The Gazette of India

Extraordinary
Part II- Section 3- Subsection (II)
No 216, New Delhi Monday, January 27, 2014
MINISTRY OF HEAVY INDUSTRIES AND PUBLIC ENTERPRISES ORDER
New Delhi, the 27th January, 2014

(1) This Order may be called the Electrical Transformers (Quality Control) Order, 2014.

(2) This Order shall come into force after six months from the date of its publication in the Official Gazette.
Schedule

- List of Electrical Transformers under mandatory Bureau of Indian Standards certification

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Indian Standard number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IS 1180(Part 1):1989</td>
<td>Outdoor type three-phase Distribution Transformers upto and including 100 KVA 11 KV: Part 1 Non-sealed type (third revision)</td>
</tr>
<tr>
<td>2</td>
<td>IS 1180(Part 2):1989</td>
<td>Outdoor type three-phase Distribution Transformers upto and including 100 KVA 11 KV: Part 2 (Sealed type) (first revision)</td>
</tr>
</tbody>
</table>
The Gazette of India
Extraordinary,
New Delhi, July 21, 2014
IS 1180(Part1):2014

• Date of Establishment : 19 July 2014

(1) This Order may be called the Electrical Transformers (Quality Control) Order, 2014.

(2) It shall come into force on the 1st day of February, 2015.

2. In the Electrical Transformers (Quality Control) Order, 2014,—
   (i) in paragraph 2, clause (e), the words “or repairs” shall be omitted;
   (ii) for the Schedule, the following Schedule shall be substituted, namely:—
## SCHEDULE

[See paragraph 2(f)]

List of Electrical Transformers under mandatory Bureau of Indian Standards certification

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Indian Standard number (Latest version)</th>
<th>Title</th>
<th>ITC (HS) Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>IS 1180(Part 1):2014</td>
<td><strong>Outdoor type oil immersed Distribution Transformers upto and including 2500 KVA, 33KV - specification Part 1 Mineral oil immersed</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(a) Three-phase ratings upto and including 200 KVA both Non-sealed type and sealed type.</td>
<td></td>
<td>85043100</td>
</tr>
<tr>
<td></td>
<td>(b) Three phase ratings higher than 200 KVA upto and including 2500 KVA both non-sealed type and sealed type.</td>
<td></td>
<td>85043200</td>
</tr>
<tr>
<td></td>
<td>(c) Single phase ratings upto and including 25 KVA sealed type.</td>
<td></td>
<td>85043300</td>
</tr>
</tbody>
</table>

[F.No.5(2)/2009-PE.XI (Vol.II)]

AMBUJ SHARMA, Addl. Secy.
THANK YOU