# AGENDA

| MEETING | NO. OF MEETING | DAY &DATE | TIME | VENUE | MODE |
|---|---|---|---|---|---|
| **Transformers Sectional Committee, ETD 16** | **34th** | **Friday, 06th December 2024** | **1030 h to 1730 h** | **Mimaansa (White Room), BIS HQ** | **Physical** |

**CHAIRMAN:** Shri S. S. Reddy, CPRI **MEMBER SECRETARY**: Shri Abinash Bordoloi, BIS

**Item 0 WELCOME ADDRESS BY THE CHAIRMAN**

**Item 1 CONFIRMATION OF THE MINUTES OF LAST MEETING**

**1.2 ACTION ARISING OUT OF PREVIOUS MEETING**

| Sl. No. | Item No. of Minutes of 33rd Meeting | Subject | Action taken during the last meeting |
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| a. | 2.3 (b) | Co-option Requests of PHD Chamber of Commerce and Industry, New Delhi<br><br>Name of the Nominated Representatives-<br><br>a. Sh. Dev Prakash Goel, Co-Chair MSME Committee<br><br>b. Ms. Kanchan Zutshi, Director | The membership/co-option request of PHD Chamber of Commerce and Industry, New Delhi has been deferred by the committee since one of the representative i.e. Ms. Kanchan Zutshi is not from a technical background since her resume indicates her educational background as Masters in Law, which doesn't meet the criteria for selection of members in Technical Committee.<br><br>The committee has requested for nominations of experts having expertise/experience in the domain of transformers from PHD Chamber of Commerce and Industry.<br><br>***The committee may decide.*** |
| b. | 2.3 (b) | Co-option requests of Eaton India innovation Centre LLP, Pune<br><br>Name of the Nominated Representatives-<br><br>a. Mr. Sunil kumar Ramkumar Singh, Engineer | The membership/co-option request of M/s Eaton India Innovation Centre LLP, Pune has been deferred by the ETD 16 Sectional Committee during the recent meeting of the Sectional Committee since the requisite expertise in the domain of transformers has not been highlighted/indicated in the submitted CVs of the nominated representatives. |

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| | | b. Mr. Santosh Dadasaheb Pachpund, Senior Engineering Manager | The committee has requested for nominations of experts having expertise/experience in the domain of transformers from M/s Eaton India Innovation Centre LLP, Pune.<br><br>***The committee may decide.*** |

**Item 2 REVIEW OF COMPOSITION OF SECTIONAL COMMITTEE, ETD 16**

**2.1.** The composition of the Sectional Committee ETD 16 is given in **ANNEX 1**

**The Committee may review.**

**2.2.** The composition of the Panels and Working Groups under ETD 16 is given in **ANNEX 2**

**The committee may review.**

**2.3 Co-option/Nomination Requests received.**

The following Co-option/Nomination Requests have been received.

| Sl. No. | Name of the Organisation |
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| 1 | All India Transformers Manufacturers Association (AITMA) |

Relevant document is attached at **ANNEX 3**.

**2.4. Sector Wise Classification of ETD 16 Sectional Committee.**

The sector wise classification of ETD 16 Sectional Committee is given at **ANNEX 4.**

**2.5. Status of participation of members in the previous two meetings.**

The status of participation of committee members in the previous two meetings is given in **ANNEX 5.**

***The committee may review.***

**2.6 Performance Evaluation of the Members of ETD 16 Sectional Committee.**

**Item 3 APPROVAL OF DOCUMENTS/AMENDMENTS FOR WIDE CIRCULATION**

| Sl No. | Document No. | Draft Indian Standard | Decision Taken during the last meeting | Remarks |
|---|---|---|---|---|
| **a)** | ETD/16/23039 | Onsite Diagnostic testing of power transformers for condition health assessment | It was informed by the member secretary that comments have been received from Sh. Manas Kundu on the document. The committee decided to refer the comments | Panel P/09 may update the committee. |

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| | | | received from Sh. Manas Kundu on Doc. ETD/16/23039 (Onsite Diagnostic testing of power transformers for condition health assessment) to working Panel P/09 for examination and submit the modified/corrected draft (if required) by 20/09/2024. | |

**Item 4 COMMENTS RECEIVED ON INDIAN STANDARDS**

| Sl. No | Indian Standard | Commentator | Comments | Decision taken during last meeting | Remarks |
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| **a)** | IS 2026 (Part 1): 2011 | Sh. Rahul Ranganathan | 8.2(a) & 8.2(c) may be combined to create another type of oil preservation system.<br><br>Justification<br>8.2(a) describes a system wherein the atmosphere is allowed to come in contact with oil. A moisture-removing breather is fitted, but that does not prove sufficient to handle all the moisture coming in from the atmosphere. 8.2(c) describes an inert gas pressure system WITHOUT any moisture removing breather, Resultantly the moisture already present inside along with the fresh moisture migrating from the paper insulation into the oil will continue to accumulate in the oil tank without any drying out. The requested modification will make the system a sealed type one, with no contact to the atmospheric MOISTURE & | The committee decided to constitute a panel for the revision of IS 2026 (Part 1):2011 and refer the comments received on IS 2026 (Part 1) for examination and providing inputs on the same. | The proposed working group is being constituted.<br><br>*The committee may note.*<br><br>Following Inputs has been received from Sh. Vijaykumaran Moorkath on the comment.<br><br>***"The existing clause is specified in IEC 60076-1 and proposed revision is not required. Online drying system will not be effective for load varying transformers".***<br><br>*The committee may deliberate.* |

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| | | | OXYGEN, and will also continually dry out the moisture from within.<br><br><u>Proposed Change</u><br>*Inert Gas pressure system where an expansion space above the oil is filled with a dry inert gas at slight over-pressure and being connected to a moisture removing breather with an elastic bladder fitted at the bottom of the breather to accommodate gas expansion."*<br><br>*The committee decided to refer the comments received on IS 2026 (Part 1):2011 to Sh. V.K Lakhiani and Sh. Moorkath Vijaykumaran for examination and providing inputs on the same.* | | |
| **b)** | IS 2026 (Part 1): 2011 | Sh. Shivam Aggarwal | Table 1 Sr. No. ii- It is mentioned for Voltage ratio on other tappings, same pair and tappings on further pairs the specified value cannot be less than the lesser value specified for principal tapping which gives the manufacturer liberty to declare any value which can extend up to infinity without any restriction.<br><u>Proposed Change</u><br>*To be agreed but not more than the lesser of the values given in a & b. The committee decided to refer the comments received on IS 2026* | The committee decided to constitute a panel for the revision of IS 2026 (Part 1):2011 and refer the comments received on IS 2026 (Part 1) for examination and providing inputs on the same. | The proposed working group is being constituted. The committee may note.<br><br>*The committee may note.*<br><br>Following Inputs has been received from Sh. Vijaykumaran Moorkath on the comment.<br>*"**The existing clause is same as specified in IEC 60026-Part 1, Table 1. The*** |

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| | | | *(Part 1):2011 to Sh. V.K Lakhiani and Sh. Moorkath Vijaykumaran for examination and providing* inputs on the same. | | ***comments given in the standard ""To be agreed, but tolerance can be above or equal to 15%"" the clause is in order and no revision is required****".*<br><br>*The committee may deliberate*. |
| **c)** | IS 10028 (Part 2): 1981 | Sh. Ravindra Maruti Bhanage | 1. Cl. 1.2- Special purpose transformers such as gas cooled, synthetic liquid insulated, dry and mining transformers, and instrument transformers are excluded from the scope of this code. In such cases, manufacturers' instructions shall be strictly followed. Natural Ester oil filled transformer also to be excluded.<br><br>*Proposed Change- Special purpose transformer such as gas cooled, NATURAL/SYN THETIC ORGANIC ESTER LIQUID IMMERSED, dry type, underground, submersible, hermetically sealed, and mining transformers and instrument transformers are excluded from the scope of this code*. | The committee referred the comments received on IS 10028 (part 2):1981 to Panel P/14 for examination and providing inputs on the same. | Panel P/14 may update the committee. |

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| | | | 2. Cl. 7.7.2- The clause mentions about ' The cable boxes should be filled with compound or oil as required after making connections. PVC and XLPE cable boxes need not be filled with compound or oil". The compound filled or oil filled boxes and PVC cables mentioned in the clause need to be reviewed for replacement or removal.<br><br>*Proposed Change- The cable boxes should be adequately sealed for blocking vermin or rodent entry in box after making connections. FRLS, XLPE cable, and terminations are to be used in boxes.*<br><br>3. In case of transformer capacity 750KVA and above, for feeding medium voltage supply, the method of connection is generally by single core lead covered cable. Bus duct connection is also one of the desirable practices. - The lead covered cable are not being uses or used in rare applications. Hence need review.<br><br>*Proposed Change- In case of transformer capacity 750KVA and above, the method of connection shall be either cables or bus duct of suitable rating.* | | |

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| **d)** | IS 2026 (Part 1):2011 | Ms. Shreya Kumari, Eastern Regional Office, BIS | Cl. 10.1.3 (Special Test)- Determination of sound level is mentioned as per IS 13964 which has already been withdrawn.<br><br>*Proposed Change- Determination of sound level is mentioned as per IS 2026 (Part 10)* | The committee decided to constitute a panel for the revision of IS 2026 (Part 1):2011 and refer the comments received on IS 2026 (Part 1) for examination and providing inputs on the same. | The proposed working group is being constituted.<br><br>*The committee may note.*<br><br>*The committee may note and deliberate.* |
| **e)** | IS 18284:2023 | Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Limited (MPPKVVCL) | Cl. 6.1.1, 6.1.2, 6.1.3- Tolerance for No Load Losses determined pre-repair may be increased from 15 % to 50 % of Original No Load Losses without modification in the Total Load Losses after Repair (i.e. 10 %) | The committee decided to refer the comment to Panel P/01 for examination and providing inputs on the same. | The details are given at **ANNEX 6**<br><br>Panel P/01 may update the committee. |
| **f)** | IS 18284:2023 | BIS, Bhopal Branch Office (BPBO) | Cl. 6.1.1- If the measured no-load losses at the repairer's workshop exceed 15 percent of the original no-load losses (provided by the customer), then the transformer may not be suitable for repair, no repair work shall be undertaken, and the core shall be scrapped. However, the pictorial representation indicates that the transformer shall be scrapped. Therefore, it should be clarified that the core shall be scrapped.<br><br>*Proposed Change- In the pictorial representation, it may be mentioned that the core shall be scrapped.* | The committee decided to refer the comment to Panel P/01 for examination and providing inputs on the same. | Panel P/01 may update the committee. |

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| **g)** | IS 1180 (Part 1): 2014 | Punjab State Power Corporation Ltd | 1. Define Loss Levels for 40 kVA Dry Type Distribution Transformers.<br>2. Define Loss Levels for 40 kVA Distribution Transformers in IS 1180 (Part 1). | --- | The details are given at **ANNEX 7**.<br><br>*The committee may deliberate.* |
| **h)** | Cl. 9 of IS 2026 (Part 3):2009 | Sh. Raunak Sharma, Quality Engineer Torrent Power Ltd, Surat | **Regarding Repetitive Dielectric Test in Transformers**<br><br>If a Distribution Transformer designed at 95 kVp BIL and 36 kV High voltage withstand level, is first tested at Manufacturer's Workshop at 36 kV for 60 seconds, Thereafter, at what voltage level can it be tested again at the time of incoming inspection testing?<br><br>In IS 2026 Part 3 Cl. 9, it is written as "**Repetition of tests required to prove that new transformers, having been factory tested to 7.2, 7.3, and 7.4, continue to meet their requirements of this standard is always performed at 100% of test level."**<br><br>So, if I'm procuring 100 Transformers in a Power Distribution Utility, is it advisable to HV test all the transformers at 100 % test levels again at incoming testing if they are already tested at 100% levels at Manufacturer's | ---- | *The committee may deliberate.* |

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| | | | Workshop?<br>Will there be a significant impact of this 2nd instance of HV testing at 100% levels on insulation of the Transformer?<br><br>Please provide your guidance and valuable advice in this case | | |
| **i)** | IS 1180 (Part 1):2014 | Indian Transformers Manufacturers Association | Secondary Voltage of Distribution Transformers | --- | The details are given at **ANNEX 8**.<br><br>*The committee may deliberate.* |

**Item 5 PRESENT POSITION OF WORK**

**5.1** Programme of work of ETD 16 is given in **ANNEX 9**.

**The committee may note.**

**5.2** Present status of work as identified during previous meetings of ETD 16 are given below:

| Sl no. | IS number/ title/Doc. No. | Decision taken during last meeting | Remarks |
|---|---|---|---|
| i) | IS 2026: Part 10 : Sec 1 :2018 Power transformers Part 10 determination of sound levels (Amendment)<br>**Doc. No- ETD/16/23877** | It was informed that Document was under Printing. | Amendment has been published.<br><br>*The committee may note.* |
| ii) | IS 2026 (Part 21): 2018 Power transformers Part 21 standard requirements terminology and test code for step - Voltage regulators | The committee accepted the request received from Shri Manas Kundu to extend the timeline for submission of comments by 02 months.<br><br>The committee accepted the request of Sh. Manas Kundu to extend the timeline for submission of comments by 01 month. | Following Comments have been received from Sh. Manas Kundu.<br><br>"*The need for Line voltage regulators (or Step Voltage Regulators) in recent times has become less due to easy availability of OLTC fitted Transformers being used in most of the 66, 33, 22 & 11 kV class Distribution feeders. In fact plain reading of the standard IS 2026-Part 21-2018 reveals that* |

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| | | Sh. Manas Kundu informed that the comments would be submitted by 15.09.2024.<br><br>The committee noted and asked Sh. Manas Kundu to submit the comments by 15th September 2024. | *unmindful replication of IEEE Std C57.15:2009 and IEC 60076-21:2011 without required acclimatisation to Indian environment has taken place.*<br><br>*Therefore the utility of this standard going forward, in current market condition, is limited in our opinion. However, for existing old networks, particularly in light of new power quality regulations and supply voltage variation limits being imposed, the utility of this sidelined equipment can't be completely discarded. One such instance is from Tata Power Odisha where they have tendered for LVRs (I have attached the spec for reference).*<br><br>*Besides in few industrial applications these are already in use at some places".*<br><br>The suggestion marked pages of IS 2026 P21 -2018 Draft and the specification of LVR tendered by Tata Power, Odisha have also been submitted. The same are attached at **ANNEX 10**<br><br>*The committee may note and deliberate.* |
| iii) | IS 8447: 1989 Manually operated voltage regulators for domestic use - Specification First Revision | The committee decided to archive the Indian Standard during 32nd ETD 16 Sectional Committee meeting.<br><br>It was informed by Member Secretary during last meeting that archiving was under process. | IS 8447: 1989 has been archived.<br><br>*The committee may note.* |
| iv) | IS 9147 : 1979 Specification for cable sealing boxes for oil - Immersed transformers suitable for paper - Insulated lead sheathed | The committee constituted a panel for the preparation of a draft revision document:<br><br>Shri Rajaram Chennu, CPRI – *Convener* | The panel may update the committee. |

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| | cables for highest system voltages from 12 kV up to and including 36 kV | Shri Kaushik Chowdhury, CESC<br>Shri Rajaram Shinde<br>Shri Tejas Mahale, Scientist C, BIS<br><br>The panel informed during the 32nd meeting that the draft revision document will be submitted by 20/04/2024.<br><br>Sh. Rajaram Chennu informed that the draft is under progress and requested for an extension since some international standards also needs to be referred for finalisation of the draft.<br><br>The committee noted and requested the panel to provide the details of the international standards required to BIS and finalise the draft before the next sectional committee meeting. | |
| v) | IS 10161: 1982 Specification for moving coil voltage regulators.<br><br>**Doc. No- ETD/16/24319** | The committee finalised the document during last meeting. | Document is under Printing.<br><br>*The committee may note.* |
| vi) | IS 12977 : 1990 Arc furnace transformers specification | Sh. Rajaram Shinde was requested to explore IEEE 57.17 and provide the draft standards in 1 month.<br><br>The committee accepted the request of Sh. Rajaram Shinde and granted extension for submission of draft document by 02 months during 32nd ETD 16 Sectional Committee meeting.<br><br>Sh. Rajaram Shinde informed that the draft is under preparation and further inputs are required from the experts of the relevant domain for the completion of the draft.<br><br>The committee decided to constitute a panel consisting of | The Proposed working Group is being constituted. The working group may co-opt experts relevant to the domain with approval of ETD 16 Sectional Committee.<br><br>*The committee may note and deliberate.* |

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| | | experts from the relevant domain in consultation with the chair for preparation of the draft on IS 12977:1990. | |
| vii) | IS 13956 : 1994 Testing transformers - Specification | It was decided to reprint the standards by updating the references if no comments are received from Sh. Rajaram Shinde in 1 month.<br><br>The committee decided to reprint IS 13956:1994.<br><br>It was informed by the Member Secretary during last meeting, that the work was under progress. | Draft is under Process.<br><br>*The committee may note.* |
| viii) | Progress of work in Panel 4<br><br>Revision of IS 3639:1966 (Specification for fittings and accessories for power transformers) | Sh. Rajaram Shinde informed that the work on the draft is under progress and would be submitted within the timeline of 6 months as decided in the 31st Meeting dated 18/12/2023.<br><br>Shri Rajaram Shinde informed that the draft would be submitted by 20/09/2024.<br><br>The committee noted and asked Shri Rajaram Shinde to submit the draft by 20/09/2024 during last meeting. | Shri Rajaram Shinde may update the committee |
| ix) | Progress of work in Panel 11<br>Self-Protection / disconnection device for distribution transformers | The panel informed the committee that CPRI research project is still under progress and the report would be submitted within 3 months.<br><br>The panel informed that the project is still under progress and the report is awaited.<br><br>The committee noted. | The panel may update the current status to the committee. |
| x) | Progress of work in Panel 7 | The panel informed that the draft is ready. The committee decided to circulate the same as P-Draft for 15 | Panel P/07 may update the committee on the prepared draft. |

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| | Inverter Duty transformers | days and wide circulate for 02 months.<br><br>The draft submitted by the panel was presented by the member secretary during the meeting. The committee desired to get the draft reviewed before circulating the same as P-Draft and requested working Panel P/07 to review the draft and submit a report by 20/09/2024. | |
| xi) | Progress of work in Panel 9<br><br>On site diagnostic testing of power transformers.<br><br>**Doc No.-ETD/16/23039** | The draft was finalized during the 32nd Sectional Committee meeting dated 04th April 2024. A few technical comments were received on the finalized draft from Sh. Rajaram Mohan Rao Chennu, CPRI Bengaluru. Considering the technical nature of the comments, the panel meeting was held on 05th June 2024 to review and deliberate on the comments and finalise the draft. The panel was requested to submit the corrected draft. It was also decided to wide circulate the corrected draft for 30 days.<br><br>The corrected draft has been submitted by the panel and the same has been circulated to the committee vide email dated 28/08/2024 for examination and comments on the same. The document may be finalised for wide circulation if no comment is received.<br><br>It was informed by the member secretary in the last meeting that comments have been received from Sh. Manas Kundu on the document. The committee decided to refer the comments received from Sh. Manas Kundu on Doc. ETD/16/23039 (Onsite Diagnostic testing of power transformers for condition health assessment) to | Panel P/09 may update the committee. |

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| | | working Panel P/09 for examination and submit the modified/corrected draft (if required) by 20/09/2024. | |
| xii) | Progress of work in Panel 10<br><br>Dry type distribution transformers | The panel informed that the draft is ready. The committee decided to circulate the same as P-Draft for 15 days and wide circulate for 02 months.<br><br>The draft submitted by the panel was presented by the Member Secretary in the last meeting. The committee desired to get the losses table in the draft reviewed and align with the specifications of Bureau of Energy Efficiency (BEE) for dry type distribution transformers (if any). Ms. Pravatalini Samal, Principal Member (BEE) informed that no BEE specifications were available for the losses of Dry Type Distribution Transformers.<br><br>The committee noted and requested Panel P/10 to review the losses table in the draft and submit report by 20/09/2024. | The loss calculation as submitted by Sh. Manas Kundu and Sh. Nagarjuna Babu is attached at **ANNEX 11 .**<br><br>*The committee may review.* |
| xiii) | Progress of Work in Panel 14<br><br>Revision of IS 10028 series – Code of practice for selection, installation and maintenance of transformers. | It was informed by Sh. Rajarshi Ghosh that the draft will be provided by 31st March 2024. The committee requested Sh. Rajarshi Ghosh to refer CEA guidelines for Distribution Transformer Maintenance and installation.<br><br>The committee decided to provide the panel an extension of 01 month. For submission of the draft. It has also been decided to include Tata Power Distribution Limited in the Panel 14.<br><br>The document submitted by Sh. Rajarshi Ghosh was presented by the member secretary in the last | Panel P/14 may update the committee. |

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| | | meeting. The new additions and corrections to be incorporated in the revision of IS 10028 (Part 1/Part 2/Part 3) were highlighted by Sh. Rajarshi Ghosh.<br><br>It was informed by the member secretary that a comment on IS 10028 (Part 2): 1981 has been received.<br><br>The committee referred the comment to the working panel P/14 for examination and requested to prepare the draft incorporating the corrections/new additions/comment (if found satisfactory) and submit the same within 1 month. | |
| xiv) | Revision of IS 8447: 1989 'Manually operated voltage regulators for domestic use' and IS 8448 : 1989 'Automatic line voltage correctors step type for domestic use' | The committee decided to create a working group convened by Sh. Kapil Sharma (ERDA). Sh. Kapil Sharma was requested to include manufacturers and stakeholders to work in the panel.<br><br>The committee decided to archive IS 8447:1989 during the 32nd meeting dated 04th April 2024.<br><br>It was informed by the member secretary that Archiving was under Process for IS 8447:1989.<br><br>The member secretary presented the review report submitted by Intern Ms. Annu Kumari as given in Annex 8 of the agenda.<br><br>The committee decided to constitute a working Panel for examining the report submitted by intern Ms. Annu Kumari and for preparation of the draft. | a. IS 8447:1989 has been archived.<br><br>The committee may note.<br><br>b. The proposed working group is being constituted for the revision of IS 8448:1989. The working group may co-opt experts relevant to the domain with approval of ETD 16 Sectional Committee.<br><br>*The committee may note and deliberate.* |
| xv) | Revision of IS 2026 (Part 2) | Sh. M Vijaykumaran stated that IEC 60076-2 may be adopted in toto. The committee decided to circulate the draft as P-draft for 15 | The proposed working group is being constituted for the revision of IS 2026 (Part 2):2010. The working group may co-opt experts |

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| | | days and then wide circulate for 02 months.<br><br>The committee noted and decided to constitute a working panel in consultation with the chair for reviewing of IEC 60076-2:2011 and preparation of draft. | relevant to the domain with approval of ETD 16 Sectional Committee.<br><br>*The committee may note and deliberate.* |
| xvi) | IS 2026 (Part 7) Power transformers - Part 7: Loading guide for mineral-oil-immersed power transformers | Sh. M Vijaykumaran stated that IEC 60076-7 may be adopted in toto. The committee decided to circulate the draft as P-draft for 15 days and then wide circulate for 02 months.<br><br>The committee noted and decided to constitute a working panel in consultation with the chair for reviewing of IEC 60076-7:2018 and preparation of the draft. | The proposed working group is being constituted for the revision of IS 2026 (Part 7):2009. The working group may co-opt experts relevant to the domain with approval of ETD 16 Sectional Committee.<br><br>*The committee may note and deliberate.* |
| xvii) | IS 2026 (Part 4) Terminal and tapping markings for power transformers | The committee requested Sh. M Vijaykumaran to find IEC document for adoption.<br><br>Sh. M Vijaykumaran informed that IEC TR 60616: 1978 may be adopted in toto. The committee decided to circulate the draft as - draft for 15 days and then wide circulate for 02 months.<br><br>Adoption of IEC TR 60616:1978 was not agreed by the committee due to its current status of 'Technical Report' and stability date of 2024. The committee decided to wait for the update from the IEC TC 14 on the stability date and status of the document before taking a decision on the adoption.<br>The committee decided to constitute a working panel in consultation with the chair for the revision of IS 2026 (Part 4): 1977. | The proposed working group is being constituted for revision of IS 2026 (Part 4):1977. The working group may co-opt experts relevant to the domain with approval of ETD 16 Sectional Committee.<br><br>*The committee may note and deliberate*. |
| xviii) | Progress of work in Panel 13 for revision of IS 1180 (Part 1) | The committee decided to refer all the comments to WG-01 for consideration during revision of IS 1180 (Part 1) and IS 1180 (Part 3). | WG-01 may update the committee. |

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| | | The Working Group (WG) informed that the comment s have been taken into consideration in the preparation of the working draft for the revision of IS 1180 (Part 1).<br><br>The committee requested the working group WG-01 to submit the draft within 1 month. | |
| xix) | Progress of Work in Panel-15: New Standard on Voltage Regulating Distribution Transformers | The committee constituted the following Panel to work on the document:<br><br>Panel 15:<br><br>Shri M Vijayakumaran, Convener<br>Shri Rajaram Chennu, CPRI<br>Expert from Tata Power<br>Expert from NTPC<br>Expert from CEA<br>Shri Manas Kundu, ICAI<br><br>Sh. Rajaram Chennu informed that the review of IEC 60076-24 is under progress.<br><br>The committee noted and requested Rajaram Chennu to expedite the review.<br><br>Further the committee decided to establish the panel with the experts from the identified organisations in consultation with the chair for the preparation of the draft. | The proposed working group is being constituted for the preparation of draft on Voltage Regulating Distribution Transformers.<br><br>*The committee may note and deliberate.* |
| xx) | New Standard on Essential requirements for Transformer Cores | The committee decided to constitute a panel for working on the subject.<br><br>The committee decided to constitute a working panel to in consultation with the chair for working on the subject. | The proposed working Group is being constituted for the development of New Standard on Essential requirements for Transformer Cores.<br><br>*The committee may note and deliberate.* |

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| xxi) | IEC/IEEE 60214-2: 2019 Tap-changers - Part 2: Application guidelines | Shri S Vyas informed that there are some differences in the nomenclature being used in IEC standard and the nomenclature being followed in the Indian Industry. He suggested that IEC standard may be adopted incorporating the India specific changes.<br><br>The differences in the nomenclature in IEC standard and that being followed in the Indian Industry have been shared. Sh. S Vyas informed that IEC/IEEE 60214-2:2019 can be adopted incorporating the changes as shared. The committee decided to prepare the draft and circulate as p-draft for 15 days and then wide circulate for 2 months.<br><br>Shri S Vyas was not available during the meeting. The differences in the nomenclature in IEC standard and that being followed in the Indian Industry as shared by Sh. S Vyas was presented by the Member Secretary.<br><br>The committee decided to constitute a working panel in consultation with the chair for the preparation of the draft taking consideration of the differences in terminology submitted by Sh. S Vyas during the last meeting. | The proposed working Group is being constituted for the development of New Standard on tap changers.<br><br>*The committee may note and deliberate.* |
| xxii) | IEC 61378-1:2011 Converter transformers - Part 1: Transformers for industrial applications<br><br>IEC 61378-3: 2015 Converter transformers - Part 3: Application guide | The committee decided to request Sh. Subodh Prakash to provide comments on the adoption of IEC standard within two months following the extension request.<br><br>The committee decided to constitute a working panel in consultation with the chair for the preparation of the draft. | The proposed working Group is being constituted for the development of standards on Converter Transformers.<br><br>*The committee may note and deliberate.* |

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| xxiii) | Progress of Work in Panel 6- New standard on Submersible Duty Transformers and Accessories | Sh. Ravindra Bhanage informed that the draft is ready and the committee decided to circulate the draft as P-draft for 01 month.<br><br>Sh. Ravindra Bhanage was not available during the meeting.<br>The draft submitted by Sh. Ravindra Bhanage was presented by the Member Secretary. It was noted that the losses specified in the draft are same with the losses specifications of IS 1180 (Part 1): 2014 and IS 1180 (Part 3): 2021.<br><br>The committee desired to get the losses table in the draft reviewed and requested the working panel P/06 to review the draft and the losses table and submit report by 20/09/2024. | Working Panel P/06 may update the committee. |
| xxiv) | **Doc. Doc. ETD/16/24249 IS 9815 (Part 1):1994**<br><br>Servo Motor Operated Automatic Line Voltage Correctors Part 1 Correctors for Single Phase Applications-Specification-Revision | It was informed by the member secretary in the last meeting that the document is under printing. | Document is under Printing.<br><br>*The committee may note.* |
| xxv) | **Revision of IS 2026 (Part 5): 2006- Power Transformers Part 5- Ability to Withstand Short Circuit** | The committee decided to reaffirm and amend IS 2026 (Part 5): 2011 since the equivalent IEC standard i.e. IEC 60076-5:2006 from which assistance has been taken in the formulation of IS 2026 (Part 5):2011 is unchanged. The work of revision of IEC 60076-5:2006 is under progress at IEC and the stability date of the same is 2026. It has been decided to issue an amendment to table no. 3 of IS 2026 (Part 5):2011 and align with IEC 60076-5: 2006 since the maximum permissible values of the average temperature of each winding for Oil-Immersed | Reaffirmation is under progress.<br><br>The draft amendment is attached at **ANNEX 12** .<br><br>*The committee may review.* |

| | | | |
|---|---|---|---|
| | | transformers is missing in table 3 of IS 2026 (Part 5):2011. | |
| xxvi) | **Standardization of online accessories fitted on Transformer and reactors.** | Sh. C Jayasenan briefed the committee regarding the new work item proposal submitted for the Standardization of online accessories fitted on Transformer and reactors. He informed that the proposal was accepted by BIS. He requested for constitution of a separate working panel for working on the draft instead of including it under existing working Panel 4 constituted for the Revision of IS 3639:1966 (Specification for fittings and accessories for power transformers).<br><br>The committee noted and decides to constitute a working panel in consultation with the chair. The committee also requested Sh. C Jayasenan to identify suitable experts that could be co-opted in the working panel for working on the draft. | The proposed working group is being constituted.<br><br>The CVs of the experts proposed to be co-opted in the working group is attached at **ANNEX 13**.<br><br>*The committee may review and decide.* |

**5.3 Documents under Printing**

| Sl. No. | Document No. | Document title | Document Type |
|---|---|---|---|
| 1 | ETD/16/24249 | Servo Motor Operated Automatic Line Voltage Correctors Part 1 Correctors for Single Phase Applications-Specification. | Revision |

**Item 6 REVIEW/REAFFIRMATION OF INDIAN STANDARDS UNDER ETD 16**

**6.1** The list of Indian Standards due for review is attached at **ANNEX 14**

***The Committee may review.***

**Item 7 NEW WORK ITEMS**

**7.1** The following NWIPs has been taken up for formulation of Indian Standards in **2024-2025**.

***a. Inverter Duty Transformers***
***b. Submersible Duty Transformers and Accessories***

***c. Dry Type Distribution Transformers***
***d. Tap Changers-Application Guide***
***e. Voltage Regulating Distribution Transformers***
***f. Transformers for Static Converters***
***g. Solid State Transformers***

It was informed by the Member Secretary in the last meeting that the work of preparing a Pre-standardization report on 'Solid State Transformers (SST)' was assigned to an Intern i.e. Sh. Apoorv Chauhan during the two months internship programme offered by BIS. The report submitted by the intern was presented during the meeting. It has been concluded in the report by the intern that the report submitted is based on literature review of the research papers and journals available online since it is a developing concept and hence there are no manufactures of SSTs available in India and hence no industrial visit could be carried out for the same.

It was decided to constitute a working panel in consultation with the chair for the evaluation of Pre-Standardisation report on 'Solid State Transformers' submitted by intern Sh. Apoorv Chauhan and submit report on the further course of action on the subject.

The proposed Working Group is being constituted.

***The committee may note and deliberate.***

**7.2 Formulation of New Indian Standard on Sustainable Practices for Transformers Industries and Organisations-Code of Practice.**

It was decided in the last meeting to constitute a working panel in consultation with the chair for initiating work on "Sustainable Practices for Transformers Industries and Organisations-Code of Practice. The proposed working group is being constituted.

The draft framework of the proposed Indian Standard along with the provisions proposed to be incorporated in the draft is attached at **ANNEX 15**.

***The committee may review and deliberate.***

**Item 8 INTERNATIONAL ACTIVITIES**

**8.1** Details of balloting done on the documents received from IEC/TC 14 and IEC/TC 96 received since last meeting are given below:

No documents have been received for balloting from IEC TC 14 and IEC TC 96 since last meeting.

***The committee may note.***

**8.2 Identification of IEC publications for harmonization**

The Indian standards which were formulated/revised based on the IEC standards, are to be reviewed when the corresponding IEC standards are revised.

***The committee may note.***

The list of published IEC Standards and Programme of Work of IEC/TC 14 and IEC/TC 96 is given at **ANNEX 16**

***The committee may note.***

**8.3 Participation of Indian Delegation in the Plenary Meeting of IEC TC 14 held on 21/10/2024 in Edinburgh, United Kingdom.**

The following delegates have participated in the IEC TC 14 Plenary Meeting held on 21/10/2024 in Edinburg (UK).

| Sl. No. | Name of the Delegate and Designation | Name of the Organisation | Mode of Participation |
|---|---|---|---|
| 1 | Sh. Abinash Bordoloi, Sc-C/Dy. Director | Bureau of Indian Standards | Physical |
| 2 | Sh. Rajaram Shinde, Individual Capacity | Individual Capacity | Virtual |

*The Delegates may brief the committee.*

**8.4. Review of Nominated Experts in IEC TC 14 and TC 96**

The nominated experts in IEC TC 14 and TC 96 are given in **ANNEX 17**

***The committee may nominate experts in the working groups under IEC TC 14 and IEC TC 96 in which no experts have been nominated from India.***

**8.5 Review of the Projects under IEC TC 14 and designation of experts.**

The following experts were designated against the Projects mentioned in the table below during the last ETD 16 Sectional Committee meeting.

| Sl. No. | Project No. | Title of the Project | WG/MT/PT | Level of Interest (High/Medium /Low) | Designated Expert |
|---|---|---|---|---|---|
| 1 | 14/1102/NP | Technical guideline for the Application, Specification, and Testing of Phase-Shifting Transformers | MT 60076-57-PST | Medium | Mr. Rajaram Mohan Rao Chennu, CPRI Bengaluru |
| 2 | 14/1115/CD | Power transformers - Part 1: General | MT 60076-1 | High | a. Mr. Rajaram Shinde (In Personal Capacity) |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | b. Mr. Kapil Sharma, ERDA, Vadodara<br><br>c. Mr. Nagarjuna Babu Nannapaneni, Individual Capacity<br><br>d. Mr. Abinash Bordoloi, BIS |
| 3 | 14/1114/CD | Power transformers - Part 2: Temperature rise for liquid-immersed transformers | MT 60076-2 | High | a. Mr. Rajaram Mohan Rao Chennu, CPRI Bengaluru<br><br>b. Mr. Kapil Sharma, ERDA, Vadodara |
| 4 | 14/1079/CD | Power transformers - Part 5: Ability to withstand short circuit | MT 60076-5 | High | a. Mr. Moorkath Vijayakumaran (In Personal capacity)<br><br>b. Mr. Rajaram Mohan Rao Chennu, CPRI Bengaluru<br><br>c. Mr. Ramesh K Patel, National High Power Test Laboratory Pvt. Ltd, Sagar |
| 5 | 14/1123/CD | Power transformers - Part 6: Reactors | MT 60076-6 | High | Mr. C Jayasenan, Siemens Limited, Mumbai |



***The Committee may note and review.***

**8.6 Participation in the Future Meetings of IEC TC 14**

**Item 9 DATE AND PLACE FOR THE NEXT MEETING**

The next meeting will be scheduled in the next quarter in consultation with the Chairman.

**Item 10 TERMS OF REFERENCE FOR RESEARCH AND DEVELOPMENT PROJECTS**

**a) Terms of Reference (ToR) on "Evaluation of Field Efficiency of Dry type transformers and mapping end of life recycling in India"**

The committee requested Sh. Manas Kundu to elaborate the research methodology mentioned in the ToR on Dry Type Transformers and submit the same within 1 month during 32nd Sectional Committee meeting of ETD 16.

It was informed by the Member Secretary in last meeting that the updated ToR is awaited. The committee requested Sh. Manas Kundu to submit the updated ToR incorporating the elaborated research methodology as decided during the 32nd meeting dated 04th April 2024. The committee also requested the member secretary to circulate the updated ToR to the members for review on receipt of the same.

The updated TOR has been received from Sh. Manas Kundu. The same is attached at **ANNEX 18.**

***The committee may review and decide.***

**b) Terms of Reference (ToR) on "Study of Agriculture Connection by Utilities for DT Rating Rationalisation"**

The ToR is attached at **ANNEX 19**

***The committee may review and decide.***

***c)* Terms of Reference (TOR) on "Inverter Duty Transformer Requirements for the Grid Connected Solar Photovoltaic Plants for Reliable and Efficient Operation"**

The TOR is attached at **ANNEX 20**

***The committee may review and decide.***

**Item 11 ANY OTHER BUSINESS**

Discussion on Research Project Proposal on "**Higher level of Electrical Transformers - Higher Carbon Emissions" submitted by All India Transformers Manufacturers Association (AITMA).**

The proposal submitted by AITMA is attached at **ANNEX 21.**

***The committee may deliberate and decide.***

## ANNEX 1

## COMPOSITION OF THE TRANSFORMERS SECTIONAL COMMITTEE, ETD 16

| Sl .No. | Organization | Member Name | Member Email | Role |
|---|---|---|---|---|
| 1 | Central Power Research Institute, Bengaluru | S. Sudhakar Reddy | ssreddy@cpri.in | Chairperson |
| 2 | BSES Rajdhani Power Limited, New Delhi | Supriya Raina | supriya.raina@relianaceada.com | Principal Member |
| | BSES Rajdhani Power Limited, New Delhi | Shri Gopal Nariya | Gopal.Nariya@relianceada.com | Alternate Member |
| 3 | Bharat Heavy Electrical Limited, New Delhi | Shri R K SINGH | rajesh.singh@bhel.in | Principal Member |
| | Bharat Heavy Electrical Limited, New Delhi | Rishikesh Meena | rishikesh@bhel.in | Alternate Member |
| | Bharat Heavy Electrical Limited, New Delhi | Kumar Gopal Krishan | gopal1@bhel.in | Alternate Member |
| 4 | Bureau of Energy Efficiency, New Delhi | Shri Kamran Shaikh | kamran.shaikh@beeindia.gov.in | Alternate Member |
| | Bureau of Energy Efficiency, New Delhi | Pravatanalini Samal | psamal@beeindia.gov.in | Principal Member |
| | Bureau of Energy Efficiency, New Delhi | Bibek Ranjan Patnaik | branjan@beeindia.gov.in | Principal Member |
| 5 | CTR Manufacturing Industries Limited, Ghaziabad | Shri S. A. Vyas | vyas_sa12@yahoo.com | Principal Member |
| | CTR Manufacturing Industries Limited, Ghaziabad | Shri B. D. Raut | bajarangraut@rediffmail.com | Alternate Member |
| | CTR Manufacturing Industries Limited, Ghaziabad | Shri O. C. Kolombkar | onkar_110@yahoo.co.in | Alternate Member |
| 6 | Calcutta Electric Supply Corporation Limited, Kolkata | Shri Koushik Chowdhury | koushik.chowdhury@rpsg.in | Alternate Member |
| | Calcutta Electric Supply Corporation Limited, Kolkata | Shri Rajarshi Ghosh | rajarshi.ghosh@rpsg.in | Principal Member |
| | Calcutta Electric Supply Corporation Limited, Kolkata | Shri Sukalyan Ghosal | sukalyan.ghosal@rp-sg.in | Alternate Member |
| 7 | Cargill India Private Limited, Gurugram | Ms Madhuree Hage | madhuree_Hage@cargill.com | Alternate Member |
| | Cargill India Private Limited, Gurugram | Shri Naveen Jain | Naveen_Jain@cargill.com | Principal Member |
| 8 | Central Electricity Authority, New Delhi | Vandana Singhal | vandana@nic.in | Principal Member |
| | Central Electricity Authority, New Delhi | Pankaj Kumar Verma | kvermap@nic.in | Alternate Member |
| 9 | Central Power Research Institute, Bengaluru | Shri Rajaram Mohan Rao Chennu | rajaram@cpri.in | Principal Member |

| | | | | |
|---|---|---|---|---|
| 10 | Delhi Metro Rail Corporation Limited, Delhi | Ashish Arora | ashish.arora@dmrc.org | Alternate Member |
| | Delhi Metro Rail Corporation Limited, Delhi | Shri Malay Saha | malay_saha@dmrc.org | Principal Member |
| | Development Commissioner Micro-Small and Medium Enterprises | Shri Manoj Khunekar | manoj.khunekar@dcmsme.gov.in | Principal Member |
| 11 | Development Commissioner Micro-Small and Medium Enterprises | Shri Datta A. Potdukhe | datta.potdukhe@dcmsme.gov.in | Alternate Member |
| | E.I. DuPont India Private Limited, Gurugram | Shri Sailesh Porohit | sailesh.purohit@dupont.com | Principal Member |
| 12 | E.I. DuPont India Private Limited, Gurugram | Shri Ravindra Pandey | ravindra.k.pandey@dupont.com | Alternate Member |
| | Electrical Research and Development Association, Vadodara | Shri Kapil Sharma | kapil.sharma@erda.org | Principal Member |
| 13 | Electrical Research and Development Association, Vadodara | Shri Y.I. Pathan | yi.pathan@erda.org | Alternate Member |
| | Gujarat Energy Transmission Corporation Limited, Vadodara | Shri Z.M. Vijapura | jeeqpeng.getco@gebmail.com | Alternate Member |
| 14 | Gujarat Energy Transmission Corporation Limited, Vadodara | Dr. A. J. Chavda | ceengg.getco@gebmail.com | Alternate Member |
| | Hitachi Metals (India) Private Limited, Gurugram | Shri K Thukaram | thukaram.k@india.proterial.com | Principal Member |
| 15 | Hitachi Metals (India) Private Limited, Gurugram | Shri M. Srinivas Chetanya | msrinivas.Chaitanya@hitachimetals.co.in | Alternate Member |
| | Indian Electrical and Electronics Manufacturers Association, New Delhi | Shri Rishabh Joshi | rishabh.joshi@ieema.org | Principal Member |
| 16 | Indian Electrical and Electronics Manufacturers Association, New Delhi | Shri Ashutosh Vasisht | ashutosh.vasisht@ieema.org | Alternate Member |
| | Indian Transformers Manufacturers Association, Vaishali | Shri A. K. Kaul | itma2006@gmail.com | Alternate Member |
| | Indian Transformers Manufacturers Association, Vaishali | Shri Brijpal Singh | brijpal.singh@vijai.co.in | Principal Member |
| 17 | Indian Transformers Manufacturers Association, Vaishali | Shri Movva Sai Krishna | saikrishna.movva@ssel.in | Alternate Member |
| | International Copper Association India, Mumbai | Shri Manas Kundu | manas.kundu@internationalcopper.org | Principal Member |
| 18 | International Copper Association India, Mumbai | Jyotish Pande | jyotish.pande@internationalcopper.org | Alternate Member |
| 19 | Maganatech, Mysore | Ramesh N Shastry | ramesh@magnatech-india.com | Principal Member |

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|---|---|---|---|---|
| | Ministry of Heavy Industries and Public Enterprises, New Delhi | Gaurav Joshi | joshi.gk@gov.in | Alternate Member |
| 20 | Ministry of Heavy Industries and Public Enterprises, New Delhi | Vijay Mittal | vijay.mittal@nic.in | Principal Member |
| | NHPC Ltd. | Shri Manish Gupta | manishgupta@nhpc.nic.in | Principal Member |
| 21 | NHPC Ltd. | Shri Tsering Chosphel | tchosphel@nhpc.nic.in | Alternate Member |
| | NTPC Limited, New Delhi | Shri S.K. Lal | sklal@ntpc.co.in | Alternate Member |
| | NTPC Limited, New Delhi | Shri Koushik Das | koushikdas@ntpc.co.in | Alternate Member |
| 22 | NTPC Limited, New Delhi | Shri Minal Kataria | minalkataria@ntpc.co.in | Principal Member |
| | National High Power Test Laboratory Private Limited, Sagar | Shri Ramesh K Patel | ramesh.patel@nhptl.com | Principal Member |
| 23 | National High Power Test Laboratory Private Limited, Sagar | Shri Rohit Saxena | rohit.saxena@nhptl.com | Alternate Member |
| 24 | National Institute of Technology, Mizoram | Prof Saibal Chatterjee | saibal.eee@nitmz.ac.in | Principal Member |
| | Power Grid Corporation of India, Gurugram | Shari Deo Nath Jha | dnjha@powergrid.in | Principal Member |
| 25 | Power Grid Corporation of India, Gurugram | Shri P R Yadav | prsyadav@powergrid.in | Alternate Member |
| | Savita Oil Technologies Limited, Mumbai | Er. Sanjay G Jagdale | sgjagdale@savita.com | Alternate Member |
| 26 | Savita Oil Technologies Limited, Mumbai | Er. Y V JOSHI | vramesh64@gmail.com | Principal Member |
| | Shri Krsna Sudarshan Urja Private Limited, Jaipur | Shri Ajay Sanghi | ajaysanghi@shrikrsna.com | Principal Member |
| 27 | Shri Krsna Sudarshan Urja Private Limited, Jaipur | Shri Kartik Sanghi | kartik@shrikrsna.com | Alternate Member |
| | Siemens Limited, Mumbai | Shri C. Jayasenan | chinnathambi.jayasenan.ext@siemens-energy.com | Principal Member |
| 28 | Siemens Limited, Mumbai | Shri Shashank Rajaram Kulkarni | shashank-kulkarni.ext@siemens-energy.com | Alternate Member |
| | Tata Power Limited, Mumbai | Shri Pramod Tupe | pbtupe@tatapower.com | Alternate Member |
| | Tata Power Limited, Mumbai | Shri Vinod Sankpal | vasankpal@tatapower.com | Alternate Member |
| 29 | Tata Power Limited, Mumbai | Ravindra Maruti Bhanage | ravindra.bhanage@tatapower.com | Principal Member |
| | Toshiba Transmission and Distribution Systems (India) Private Limited, New Delhi | Shri K.V. Kameswara Rao | kameswararao.kanuru@toshiba-ttdi.com | Principal Member |
| 30 | Toshiba Transmission and Distribution Systems (India) Private Limited, New Delhi | Shri Rohit Ritesh | rohit.ritesh@toshiba-ttdi.com | Alternate Member |

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| | Transcon Industries, Hyderabad | Shri Amar Pal Gampa | amar.gampa@gmail.com | Principal Member |
| 31 | Transcon Industries, Hyderabad | Devraj N | engineering@transconind.com | Alternate Member |
| 32 | IN PERSONAL CAPACITY | Shri Rajaram shinde | rshinde34@hotmail.com | Personal Capacity |
| 33 | IN PERSONAL CAPACITY | Shri V. K. Lakhiani | virendra.lakhiani@gmail.com | Personal Capacity |
| 34 | IN PERSONAL CAPACITY | Shri B N De Bhowmick | barin.de@gmail.com | Personal Capacity |
| 35 | IN PERSONAL CAPACITY | Shri Moorkath Vijayakumaran | vmoorkath@yahoo.co.in | Personal Capacity |
| 36 | IN PERSONAL CAPACITY | Nagarjuna Babu Nannapaneni | nagarjunababu.nannapaneni@gmail.com | Personal Capacity |

## ANNEX 2

**COMPOSITION OF PANELS UNDER TRANSFORMERS SECTIONAL COMMITTEE, ETD 16**

**ETD 16: P1 - Panel for repair of distribution transformers Panel**

| S.No. | Organization | Member Name |
|---|---|---|
| 1 | International Copper Association India, Mumbai | Shri Mayur Karmakar |
| 2 | BSES Rajdhani Power Limited, New Delhi | Shri Gopal Nariya |
| 3 | Calcutta Electric Supply Corporation Limited, Kolkata | Shri Sukalyan Ghosal |
| 4 | Central Power Research Institute, Bengaluru | Shri Rajaram Mohan Rao Chennu |
| 5 | Hitachi Metals (India) Private Limited, Gurugram | Shri K Thukaram |
| 6 | IN INDIVIDUAL CAPACITY | Shri V. K. Lakhiani |
| 7 | Indian Electrical and Electronics Manufacturers Association, New Delhi | Shri J. Pande |
| 8 | Indian Transformers Manufacturers Association, Vaishali | Shri A. K. Kaul |
| 9 | International Copper Association India, Mumbai | Shri Manas Kundu |
| 10 | Tata Power Limited, Mumbai | Shri Pramod Tupe |
| 11 | IN PERSONAL CAPACITY | Shri Rajaram shinde |

| | | |
|---|---|---|
| 12 | IN PERSONAL CAPACITY | Sh P K Mukherjee |
| 13 | IN PERSONAL CAPACITY | Nagarjuna Babu Nannapaneni |

**ETD 16: P4 - Panel for revision of transformer fittings and accessories standard - IS 3639 Panel**

| S.No. | Organization | Member Name |
|---|---|---|
| 1 | IN INDIVIDUAL CAPACITY | Shri Rajaram shinde |
| 2 | CTR Manufacturing Industries Limited, Ghaziabad | Shri S. A. Vyas |
| 3 | Electrical Research and Development Association, Vadodara | Shri Kapil Sharma |
| 4 | GETCO, Vadodara | Shri B.P Soni |
| 5 | Power Grid Corporation of India, Gurugram | Shri B N De Bhowmick |
| 6 | Siemens Limited, Mumbai | Shri C. Jayasenan |
| 7 | IN PERSONAL CAPACITY | Shri V. K. Lakhiani |
| 8 | IN PERSONAL CAPACITY | Nagarjuna Babu Nannapaneni |

**ETD 16: P10 - Panel for formulation of Indian Standard for Dry Type Distribution Transformers Panel**

| S.No. | Organization | Member Name |
|---|---|---|
| 1 | IN INDIVIDUAL CAPACITY | Shri Rajaram shinde |
| 2 | Bureau of Energy Efficiency, New Delhi | Shri Sameer Pandita |
| 3 | Calcutta Electric Supply Corporation Limited, Kolkata | Shri Rajarshi Ghosh |
| 4 | Central Power Research Institute, Bengaluru | Shri S. Sudhakar Reddy |
| 5 | Central Power Research Institute, Bengaluru | Shri Rajaram Mohan Rao Chennu |
| 6 | Dupont, India | Shri Sailesh Purohit |
| 7 | Electrical Research and Development Association, Vadodara | Shri Kapil Sharma |
| 8 | Indian Electrical and Electronics Manufacturers Association, New Delhi | Shri J. Pande |

| | | |
|---|---|---|
| 9 | Indian Electrical and Electronics Manufacturers Association, New Delhi | Shri Uttam Kumar |
| 10 | Indian Transformers Manufacturers Association, Vaishali | Shri A. K. Kaul |
| 11 | International Copper Association India, Mumbai | Shri Mayur Karmakar |
| 12 | Toshiba Transmission and Distribution Systems (India) Private Limited, New Delhi | Shri K.V. Kameswara Rao |
| 13 | IN PERSONAL CAPACITY | Shri V. K. Lakhiani |
| 14 | IN PERSONAL CAPACITY | Shri P.K. Mukherjee |
| 15 | IN PERSONAL CAPACITY | Nagarjuna Babu Nannapaneni |

**ETD 16 : P5 - Panel for revision of tap changers standards - IS 8468 Panel**

| S.No. | Organization | Member Name |
|---|---|---|
| 1 | CTR Manufacturing Industries Limited, Ghaziabad | Shri S. A. Vyas |
| 2 | Central Power Research Institute, Bengaluru | Shri S. Sudhakar Reddy |
| 3 | GETCO, Vadodara | Shri B.P Soni |

**ETD 16 : P7 - Panel for formulation of Indian Standard on Solar Transformers Panel**

| S.No. | Organization | Member Name |
|---|---|---|
| 1 | NTPC Limited, New Delhi | Shri Shiv Shankar Mishra |
| 2 | CTR Manufacturing Industries Limited, Ghaziabad | Shri S. A. Vyas |
| 3 | Hitachi Metals (India) Private Limited, Gurugram | Shri K Thukaram |
| 4 | International Copper Association India, Mumbai | Shri Manas Kundu |
| 5 | International Copper Association India, Mumbai | Shri Mayur Karmakar |
| 6 | Siemens Limited, Mumbai | Shri C. Jayasenan |

| | | |
|---|---|---|
| 7 | IN PERSONAL CAPACITY | Shri Rajaram shinde |
| 8 | IN PERSONAL CAPACITY | Shri V. K. Lakhiani |
| 9 | IN PERSONAL CAPACITY | Nagarjuna Babu Nannapaneni |

**ETD 16 : P9 - Panel for formulation of Indian Standards for On-site diagnostic testing for condition/health assessment of power transformers Panel**

| S.No. | Organization | Member Name |
|---|---|---|
| 1 | In Individual Capacity | Sh. B N De Bhowmick (Convenor) |
| 2 | GETCO, Vadodara | Sh. B P Soni |
| 3 | Savita Oil Technologies Ltd, Mumbai | Sh. Sanjay G Jagdale |
| 4 | Siemens Limited, Mumbai | Sh. C Jayasenan |
| 5 | Tata Power Limited, Mumbai | Sh. Chintamani Chitnis |
| 6 | Power Grid Corporation Ltd, Gurugram | Sh. Deo Nath Jha |
| 7 | Power Grid Corporation Ltd, Gurugram | Sh. P R Yadav |
| 8 | CPRI, Bengaluru | Sh. Rajaram Mohan Rao Chennu |
| 9 | In Individual Capacity | Sh. V K Lakhiani |

**ETD 16 : P11 - Panel for standardization of self protection/disconnection devices for distribution transformers Panel**

| S.No. | Organization | Member Name |
|---|---|---|
| 1 | Central Power Research Institute, Bengaluru | Shri S. Sudhakar Reddy |
| 2 | Electrical Research and Development Association, Vadodara | Shri Kapil Sharma |
| 3 | Transcon Industries, Hyderabad | Shri Amar Pal Gampa |
| 4 | IN PERSONAL CAPACITY | Shri Nagarjuna Babu Nannapaneni |

**ETD 16 : P12 - Panel for providing interpretation/clarification on Indian Standards Panel**

| S.No. | Organization | Member Name |
|---|---|---|
| 1 | Central Power Research Institute, Bengaluru | Shri S. Sudhakar Reddy |
| 2 | NTPC Limited, New Delhi | Shri Venkatesh Vuppuluri |
| 3 | IN PERSONAL CAPACITY | Shri V. K. Lakhiani |
| 4 | IN PERSONAL CAPACITY | Shri Ramchandran Pillai |
| 5 | IN PERSONAL CAPACITY | Shri Moorkath Vijayakumaran |

**ETD 16 : P14 - Panel for revision of IS 10028 series Panel**

| S.No. | Organization | Member Name |
|---|---|---|
| 1 | NTPC Limited, New Delhi | Shri Venkatesh Vuppuluri |
| 2 | National Hydroelectric Power Corporation, Faridabad | Shri Manish Gupta |
| 3 | Power Grid Corporation of India, Gurugram | Shri B N De Bhowmick |
| 4 | IN PERSONAL CAPACITY | Nagarjuna Babu Nannapaneni |

**ETD 16 : P13 - Panel for revision of IS 1180 (Part 1 ) Panel**

| S.No. | Organization | Member Name |
|---|---|---|
| 1 | Calcutta Electric Supply Corporation Limited, Kolkata | Shri Rajarshi Ghosh |
| 2 | Indian Transformers Manufacturers Association, Vaishali | Shri B. Lal |
| 3 | International Copper Association India, Mumbai | Shri Mayur Karmakar |
| 4 | IN PERSONAL CAPACITY | Nagarjuna Babu Nannapaneni |

**ETD 16: P6 - Panel for formulation of new standard on Submersible Duty Transformers and Accessories Panel**

| S.No. | Organization | Member Name |
|---|---|---|
| 2 | Central Power Research Institute, Bengaluru | Shri Rajaram Mohan Rao Chennu |
| 3 | Delhi Metro Rail Corporation Limited, Delhi | Shri Ashish Arora |
| 4 | Hitachi Metals (India) Private Limited, Gurugram | Shri K Thukaram |
| 6 | Tata Power Limited, Mumbai | Shri Ravindra Bhanage |
| 7 | Toshiba Transmission and Distribution Systems (India) Private Limited, New Delhi | Shri K.V. Kameswara Rao |

| Sl. No. | Organization | Member Name | Member Email | Member Phone | Last 2 Meeting Attendance |
|---|---|---|---|---|---|
| 1 | Central Power Research Institute, Bengaluru | S. Sudhakar Reddy | ssreddy@cpri.in | 9449056941 | 2/2 |
| 2 | BSES Rajdhani Power Limited, New Delhi | Supriya Raina | supriya.raina@relianaceada.com | 9891120796 | |
| | | Shri Gopal Nariya | Gopal.Nariya@relianceada.com | 9312710510 | 2/2 |
| 3 | Bureau of Energy Efficiency, New Delhi | Shri Kamran Shaikh | kamran.shaikh@beeindia.gov.in | 8349991974 | |
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## ANNEX 9

**Published Standards**

**Programme of Work**

**ETD16 : Transformers Sectional Committee**

**Scope :** To prepare standards on power and distribution transformers, reactors, onload tap changers, etc, without limitation on voltage or power. Transformer accessories and voltage stablizers, testing transformers and furnace transformers are included. (Instrument transformers, welding transformers and traction transformers are excluded)

**Liaison :**

IEC TC 14 - Power transformers - Participating (P)

IEC TC 96 - Transformers, reactors, power supply units, and combinations thereof - Participating (P)

| SI. No. | IS No. | Title | Reaffirmation Details | No. of Amendments | Degree of Equivalence |
|---|---|---|---|---|---|
| 1. | IS 10028 (Part 1) : 1985 Reviewed In : 2021 | Code of practice for selection, installation and maintenance of transformers: Part 1 selection | July, 2021 | - | Indigenous |
| 2. | IS 10028 (Part 2) : 1981 Reviewed In : 2021 | Code of practice for selection, installation and maintenance of transformers: Part 2 installation | July, 2021 | - | Indigenous |
| 3. | IS 10028 (Part 3) : 1981 Reviewed In : 2018 | Code of practice for selection, installation and maintenance of transformers: Part 3 maintenance | July, 2018 | 1 | Indigenous |
| 4. | IS 10161 : 1982 Reviewed In : 2021 | Specification for moving coil voltage regulators | July, 2021 | - | Indigenous |
| 5. | IS 1180 (Part 1) : 2014 | Outdoor Type Oil Immersed Distribution Transformers | | 4 | Indigenous |

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|---|---|---|---|---|---|
| | Reviewed In : 2019 | Upto and Including 2 500 kVA, 33kV - Specification Part 1 Mineral Oil Immersed (Fourth Revision) | | | |
| 6. | IS 1180 (Part 3) : 2021 | Outdoor/Indoor Type Liquid Immersed Distribution Transformers Up to and Including 2 500 kVA, 33 kV — Specification Part 3 Natural/Synthetic Organic Ester Liquid Immersed | | - | Indigenous |
| 7. | IS 12977 : 1990 Reviewed In : 2019 | Arc furnace transformers specification | November, 2019 | - | Indigenous |
| 8. | IS 13956 : 1994 Reviewed In : 2019 | Testing transformers - Specification | November, 2019 | - | Indigenous |
| 9. | IS 18284 : 2023 | Repair Of Distribution Transformers - Code Of Practice | | - | Indigenous |
| 10. | IS 18444 (Part 57/Sec 1202) : 2024 | Transformers Part 57 Power Transformers Section 1202 Liquid Immersed Phase Shifting Transformers (Iec/Ieee 60076-57-1202 : 2017, Mod) | | - | Modified/Technically Equivalent |
| 11. | IS 18444 (Part 57/Sec 129) : 2024 | Transformers Part 57 Power Transformers Section 129 Transformers For HVDC Applications (IEC/IEEE 60076-57-129 : 2017, MOD) | | - | Modified/Technically Equivalent |
| 12. | IS 18445 : 2024 | Guide for the Application, Specification and Testing of Phase- Shifting Transformers | | - | Modified/Technically Equivalent |
| 13. | IS 2026 (Part 1) : 2011 Reviewed In : 2021 | Power transformers: Part 1 general (Second Revision) | November, 2021 | 1 | Modified/Technically Equivalent |
| 14. | IS 2026 (Part 2) : 2010 Reviewed In : 2020 | Power transformers: Part 2 temperature - Rise (First Revision) | March, 2020 | - | Modified/Technically Equivalent |
| 15. | IS 2026 (Part 3) : 2018 IEC 60076-3 : 2000 | Power transformers: Part 3 insulation levels, dielectric tests and external clearances in air (Fourth Revision) | May, 2023 | 1 | Identical under dual numbering |

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|---|---|---|---|---|---|
| | Reviewed In : 2023 | | | | |
| 16. | IS 2026 (Part 4) : 1977 IEC 60076 Reviewed In : 2021 | Specification for power transformers: Part 4 terminal markings, tappings and connections (First Revision) | November, 2021 | 2 | Identical under dual numbering |
| 17. | IS 2026 (Part 5) : 2011 Reviewed In : 2016 | Power transformers: Part 5 ability to with stand short circuit (First Revision) | December, 2016 | - | Modified/Technically Equivalent |
| 18. | IS 2026 (Part 6) : 2017 IEC 60076-6 : 2007 | Power transformers: Part 6 reactors | | - | Identical under dual numbering |
| 19. | IS 2026 (Part 7) : 2009 IEC 60076-7 Reviewed In : 2019 | Power transformers: Part 7 loading guide for oil - Immersed power transformers | March, 2019 | - | Identical under dual numbering |
| 20. | IS 2026 (Part 8) : 2009 IEC 60076-8 Reviewed In : 2019 | Power transformers: Part 8 application guide | March, 2019 | - | Identical under dual numbering |
| 21. | IS 2026 (Part 10) : 2009 IEC 60076-10 Reviewed In : 2019 | Power transformers: Part 10 determination of sound levels | March, 2019 | - | Identical under dual numbering |
| 22. | IS 2026 (Part 10/Sec 1) : 2018 IEC 60076 -10-1 : 2016 Reviewed In : 2023 | Power Transformers Part 10 Determination of Sound Levels Section 1 Application guide | March, 2023 | 1 | Identical under single numbering |
| 23. | IS 2026 (Part 11) : 2021 IEC 60076-11 : 2018 | Power Transformers Part 11 Dry-Type Transformers | | - | Identical under dual numbering |
| 24. | IS 2026 (Part 12) : 2018 IEC 60076-12 : 2008 Reviewed In : 2023 | Power transformers: Part 12 loading guide for dry - Type power transformers | March, 2023 | - | Identical under dual numbering |

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|---|---|---|---|---|---|
| 25. | IS 2026 (Part 14) : 2018<br>IEC 60076-14 : 2013<br>Reviewed In : 2023 | Power transformers: Part 14 liquid - Immersed power transformers using high - Temperature insulation materials | March, 2023 | - | Identical under dual numbering |
| 26. | IS 2026 (Part 15) : 2018<br>IEC 60076-15 : 2015<br>Reviewed In : 2023 | Power transformers: Part 15 gas - Filled power transformers | March, 2023 | - | Identical under dual numbering |
| 27. | IS 2026 (Part 16) : 2023<br>60076-16 : 2018 | Power transformers: Part 16 transformers for wind turbine applications | | - | Identical under dual numbering |
| 28. | IS 2026 (Part 18) : 2018<br>IEC 60076-18 : 2012 | Power transformers: Part 18 measurement of frequency response | | - | Identical under dual numbering |
| 29. | IS 2026 (Part 19) : 2018<br>IEC 60076-19 : 2013 | Power Transformers Part 19 Rules for the Determination of Uncertainties in the Measurement of the Losses on Power Transformers and Reactors | | - | Identical under dual numbering |
| 30. | IS 2026 (Part 21) : 2018<br>IEC 60076-21 : 2011 | Power transformers: Part 21 standard requirements, terminology and test code for step - Voltage regulators | | - | Identical under dual numbering |
| 31. | IS 3639 : 1966<br>Reviewed In : 2021 | Specification for fittings and accessories for power transformers | July, 2021 | - | Indigenous |
| 32. | IS 5142 : 1969<br>Reviewed In : 2021<br>Reaffirmed but not taken up for revision | Specification for continuously variable voltage auto - Transformers | July, 2021 | 2 | Indigenous |
| 33. | IS/IEC 60076-4 : 2002<br>60076-4 : 2002 | Power Transformers Part 4 Guide to the Lightning Impulse and Switching Impulse Testing ï¿½ Power Transformers and Reactors | | - | Identical under single numbering |
| 34. | IS/IEC 61558-1 : 2017<br>61558-1 | Safety of Transformers, Reactors, Power Supply Units and Combinations Thereof Part 1 General | | - | Identical under single numbering |

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|---|---|---|---|---|---|
| | | Requirements and Tests ( First Revision ) | | | |
| 35. | IS/IEC 61558-2-4) : 2021 61558-2-4 | Safety of Transformers, Reactors, Power Supply Units and Combinations Thereof Part 2 Particular Requirements and Tests for Safety Isolating Transformers and Power Supply Units Incorporating Section 4 Isolating Transformers for General Applications | | - | Identical under single numbering |
| 36. | IS/IEC 61558-2-6) : 2021 61558-2-6 | Safety of Transformers, Reactors, Power Supply Units and Combinations Thereof Part 2 Particular Requirements and Tests for Safety Isolating Transformers and Power Supply Units Incorporating Section 6 Safety Isolating Transformers for General Applications | | - | Identical under single numbering |
| 37. | IS/IEC 61558-2-7 : 2007 IEC 61558_2_7 Reviewed In : 2021 | Safety of power transformers, power supplies reactors and similar products: Part 2 - 7 particular requirements and tests for transformers and power supplies for toys | August, 2021 | - | Identical under single numbering |
| 38. | IS 8447 : 1989 Reviewed In : 2018 Reaffirmed but not taken up for revision | Manually operated voltage regulators for domestic use - Specification (First Revision) | April, 2018 | 1 | Indigenous |
| 39. | IS 8448 : 1989 Reviewed In : 2019 | Automatic line voltage correctors (Step Type) for domestic use - Specification (First Revision) | March, 2019 | 2 | Indigenous |
| 40. | IS 8468 (Part 1) : 2018 IEC 60214-1 : 2014 | Tap - Changers Part 1 Performance Requirements and Test Methods (First Revision) | | - | Identical under dual numbering |

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|---|---|---|---|---|---|
| 41. | IS 8478 : 1977 Reviewed In : 2021 | Application guide for on - Load tap - Changers | July, 2021 | - | Modified/Technically Equivalent |
| 42. | IS 9147 : 1979 Reviewed In : 2021 | Specification for cable sealing boxes for oil - Immersed transformers suitable for paper - Insulated lead sheathed cables for highest system voltages from 12 kV up to and including 36 kV | July, 2021 | - | Modified/Technically Equivalent |
| 43. | IS 9815 (Part 1) : 1994 Reviewed In : 2019 | Servo - Motor operated automatic line voltage correctors: Part 1 correctors for single - Phase applications - Specification (Second Revision) | November, 2019 | - | Indigenous |

## ANNEX 14

## Standards Due for Review

| Sl. No | IS No. | Title of Indian Standard | Degree of Equivalence | Status |
|---|---|---|---|---|
| 1 | IS 10028 : Part 1 : 1985 | Code of practice for selection, installation and maintenance of transformers: Part 1 selection | Indigenous | Draft under Preparation |
| 2 | IS 10028 : Part 2 : 1981 | Code of practice for selection, installation and maintenance of transformers: Part 2 installation | Indigenous | Draft under Preparation |
| 3 | IS 10028 : Part 3 : 1981 | Code of practice for selection, installation and maintenance of transformers: Part 3 maintenance | Indigenous | Draft under Preparation |
| 4 | IS 12977 : 1990 | Arc furnace transformers specification | Indigenous | Draft under Preparation |
| 5 | IS 13956 : 1994 | Testing transformers - Specification | Indigenous | Draft under Preparation |
| 6 | IS 2026 : Part 4 : 1977 | Specification for power transformers: Part 4 terminal markings, tappings and connections (First Revision) | Modified/ Technically Equivalent | Under Review |
| 7 | IS 3639 : 1966 | Specification for fittings and accessories for power transformers | Indigenous | Draft under Preparation |
| 8 | IS 8447 : 1989 | Manually operated voltage regulators for domestic use - Specification (First Revision) | Indigenous | Archived |
| 9 | IS 8448 : 1989 | Automatic line voltage correctors (Step Type) for domestic use - Specification (First Revision) | Indigenous | Under Review |
| 10 | IS 9147 : 1979 | Specification for cable sealing boxes for oil - Immersed transformers suitable for paper - Insulated lead sheathed cables for highest system voltages from 12 kV up to and including 36 kV | Modified/ Technically Equivalent | Under Review |

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| 11 | IS/IEC 61558 : Part 2 : Sec 6 : 1997 | Safety of power transformers, power supply units and similar: Part 2 particular requirement: Sec 6 safety isolating transformers for general use | Identical under Single Numbering | Revised |
| 12 | IS/IEC 61558 : PART 1 : 1997 | Safety of power transformers, power supply units and similar: Part 1 general requirements and tests | Identical under Single Numbering | Revised |
| 13 | IS 10161 : 1982 | Specification for moving coil voltage regulators | Indigenous | Final Draft |
| 14 | IS 9815 : Part 1 : 1994 | Servo - Motor operated automatic line voltage correctors: Part 1 correctors for single - Phase applications - Specification (Second Revision) | Indigenous | Under Printing |
| 15 | IS 5142:1969 | Specification for continuously variable voltage auto - Transformers | Indigenous | Archived |
| 16 | IS 8478 : 1977 | Application guide for on - Load tap - Changers | Modified/ Technically Equivalent | Under Review |
| 17 | IS 13964: 1994 | Methods of measurement of transformer and reactor sound levels | Modified/ Technically Equivalent | Withdrawn |
| 18 | IS 1180 : Part 1 : 2014 | Outdoor Type Oil Immersed Distribution Transformers Upto and Including 2 500 kVA, 33kV - Specification Part 1 Mineral Oil Immersed (Fourth Revision) | Indigenous | Under Review |
| 19 | IS 2026 : Part 2 : 2010 | Power transformers: Part 2 temperature - Rise (First Revision) | Modified/ Technically Equivalent | Under Review |
| 20 | IS 2026 : Part 5 : 2011 | Power transformers: Part 5 ability to with stand short circuit (First Revision) | Modified/ Technically Equivalent | Decision taken for Reaffirmation with Amendment |
| 21 | IS 2026 : Part 8 : 2009/IEC 60076-8:1997 | Power transformers: Part 8 application guide | Identical under Dual Numbering | Decision taken for Reaffirmation |
| 22 | IS 2026 : Part 10 : 2009/IEC 60076-10:2001 | Power transformers: Part 10 determination of sound levels | Identical under Dual Numbering | Final Draft |
| 23 | IS 2026 : PART 7 : 2009/IEC 60076-7:2005 | Power transformers: Part 7 loading guide for oil - Immersed power transformers | Identical under Dual Numbering | Under Review |
| 24 | IS/IEC 61558 : PART 2 : SEC 7 : 2007 | Safety of power transformers, power supplies reactors and similar products: Part 2 - 7 particular requirements and tests for transformers and power supplies for toys | Identical under Single Numbering | Under Review |
| 25 | IS 2026 : Part 6 : 2017/IEC 60076-6:2007 | Power transformers: Part 6 reactors | Identical under Dual Numbering | Decision taken for Reaffirmation |

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| 26 | IS 2026 : Part 18 : 2018/ IEC 60076-18 : 2012 | Power transformers: Part 18 measurement of frequency response | Identical under Dual Numbering | Decision taken for Reaffirmation |
| 27 | IS 2026 : Part 21 : 2018/IEC 60076-21 : 2011 | Power transformers: Part 21 standard requirements, terminology and test code for step - Voltage regulators | Identical under Dual Numbering | Under Review |
| 28 | IS 2026 : Part 19 : 2018/IEC 60076-19:2013 | Power Transformers Part 19 Rules for the Determination of Uncertainties in the Measurement of the Losses on Power Transformers and Reactors | Identical under Dual Numbering | Decision taken for Reaffirmation |
| 29 | IS 8468 : Part 1 : 2018/IEC 60214-1:2014 | Tap - Changers Part 1 Performance Requirements and Test Methods (First Revision) | Identical under Dual Numbering | Decision taken for Reaffirmation |

## Adopted Indian Standards due for Review

| Sl. No. | Title of Indian Standards | IS No. | Status of IEC Standard | Degree of Equivalence |
|---|---|---|---|---|
| 1 | Power transformers: Part 8 application guide | IS 2026 : Part 8 : 2009/ IEC 60076-8:1997 | IEC 60076-8:1997 | Identical under Dual Numbering |
| 2 | Power transformers: Part 7 loading guide for oil - Immersed power transformers | IS 2026 : PART 7 : 2009/ IEC 60076-7:2005 | IEC 60076-7:2018 | Identical under Dual Numbering |
| 3 | Power transformers: Part 6 reactors | IS 2026 : Part 6 : 2017/ IEC 60076-6:2007 | IEC 60076-6:2007 | Identical under Single Numbering |
| 4 | Power transformers: Part 18 measurement of frequency response | IS 2026 : Part 18 : 2018/ IEC 60076-18 : 2012 | IEC 60076-18 : 2012 | Identical under Dual Numbering |
| 5 | Power transformers: Part 21 standard requirements, terminology and test code for step - Voltage regulators | IS 2026 : Part 21 : 2018/ IEC 60076-21: 2011 | IEC 60076-21: 2018 | Identical under Dual Numbering |
| 6 | Power Transformers Part 19 Rules for the Determination of Uncertainties in the Measurement of the Losses on Power Transformers and Reactors | IS 2026 : Part 19 : 2018/ IEC 60076-19:2013 | IEC 60076-19:2013 | Identical under Dual Numbering |
| 7 | Tap - Changers Part 1 Performance Requirements and Test Methods (First Revision) | IS 8468 : Part 1 : 2018/ IEC 60214-1:2014 | IEC 60214-1:2014 | Identical under Dual Numbering |

## ANNEX 16

| TC14 Publications Generated | |
|---|---|
| **Reference** | **Title** |
| IEC 60076-1:2011 | Power transformers - Part 1: General |
| IEC 60076-2:2011 | Power transformers - Part 2: Temperature rise for liquid-immersed transformers |
| IEC 60076-3:2013+AMD1:2018 CSV | Power transformers - Part 3: Insulation levels, dielectric tests and external clearances in air |
| IEC 60076-3:2013 | Power transformers - Part 3: Insulation levels, dielectric tests and external clearances in air |
| IEC 60076-3:2013/AMD1:2018 | Amendment 1 - Power transformers - Part 3: Insulation levels, dielectric tests and external clearances in air |
| IEC 60076-4:2002 | Power transformers - Part 4: Guide to the lightning impulse and switching impulse testing - Power transformers and reactors |
| IEC 60076-5:2006 | Power transformers - Part 5: Ability to withstand short circuit |
| IEC 60076-6:2007 | Power transformers - Part 6: Reactors |
| IEC 60076-7:2018 | Power transformers - Part 7: Loading guide for mineral-oil-immersed power transformers |
| IEC 60076-7:2018 RLV | Power transformers - Part 7: Loading guide for mineral-oil-immersed power transformers |
| IEC 60076-8:1997 | Power transformers - Part 8: Application guide |
| IEC 60076-10:2016 | Power transformers - Part 10: Determination of sound levels |
| IEC 60076-10-1:2016+AMD1:2020 CSV | Power transformers - Part 10-1: Determination of sound levels - Application guide |
| IEC 60076-10-1:2016 | Power transformers - Part 10-1: Determination of sound levels - Application guide |
| IEC 60076-10-1:2016/AMD1:2020 | Amendment 1 - Power transformers - Part 10-1: Determination of sound levels - Application guide |
| IEC 60076-11:2018 | Power transformers - Part 11: Dry-type transformers |
| IEC 60076-11:2018 RLV | Power transformers - Part 11: Dry-type transformers |
| IEC 60076-11:2018/ISH1:2020 | Interpretation sheet 1 - Power transformers - Part 11: Dry-type transformers |
| IEC 60076-11:2018/COR1:2019 | Corrigendum 1 - Power transformers - Part 11: Dry-type transformers |
| IEC 60076-12:2008 | Power transformers - Part 12: Loading guide for dry-type power transformers |
| IEC 60076-13:2006 | Power transformers - Part 13: Self-protected liquid-filled transformers |
| IEC 60076-14:2013 | Power transformers - Part 14: Liquid-immersed power transformers using high-temperature insulation materials |
| IEC 60076-15:2015 | Power transformers - Part 15: Gas-filled power transformers |
| IEC/IEEE 60076-16:2018 | Power transformers - Part 16: Transformers for wind turbine applications |
| IEC/IEEE 60076-16:2018 RLV | Power transformers - Part 16: Transformers for wind turbine applications |

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| IEC 60076-18:2012 | Power transformers - Part 18: Measurement of frequency response |
| IEC TS 60076-19:2013 | Power transformers - Part 19: Rules for the determination of uncertainties in the measurement of the losses on power transformers and reactors |
| IEC 60076-19-1:2023 | Power transformers - Part 19 - 1: Rules for the determination of uncertainties in the measurement of the losses of power transformers |
| IEC TS 60076-20:2017 | Power transformers - Part 20: Energy efficiency |
| IEC TS 60076-20:2017/COR1:2018 | Corrigendum 1 - Power transformers - Part 20: Energy efficiency |
| IEC 60076-21:2018 | Power transformers - Part 21: Standard requirements, terminology, and test code for step-voltage regulators |
| IEC 60076-22-1:2019 | Power transformers - Part 22-1: Power transformer and reactor fittings - Protective devices |
| IEC 60076-22-2:2019 | Power transformers - Part 22-2: Power transformer and reactor fittings - Removable radiators |
| IEC 60076-22-3:2019 | Power transformers - Part 22-3: Power transformer and reactor fittings - Insulating liquid to air heat exchangers |
| IEC 60076-22-4:2019 | Power transformers - Part 22-4: Power transformer and reactor fittings - Insulating liquid to water heat exchangers |
| IEC 60076-22-5:2021 | Power transformers - Part 22-5: Power transformer and reactor fittings - Electric pumps for transformers |
| IEC 60076-22-6:2021 | Power transformers - Part 22-6: Power transformer and reactor fittings - Electric fans for transformers |
| IEC 60076-22-7:2020 | Power transformers - Part 22-7: Power transformer and reactor fittings - Accessories and fittings |
| IEC 60076-22-7:2020/COR1:2023 | Corrigendum 1 - Power transformers - Part 22-7: Power transformer and reactor fittings - Accessories and fittings |
| IEC 60076-22-8:2021 | Power transformers - Part 22-8: Power transformer and reactor fittings - Devices suitable for use in communication networks |
| IEC TS 60076-23:2018 | Power transformers - Part 23: DC magnetic bias suppression devices |
| IEC 60076-24:2020 | Power transformers - Part 24: Specification of voltage regulating distribution transformers (VRDT) |
| IEC 60076-25:2023 | Power transformers - Part 25: Neutral grounding resistors |
| IEC TR 60076-26:2020 | Power transformers - Part 26: Functional requirements of insulating liquids for use in power transformers |
| IEC/IEEE 60076-57-1202:2017 | Power transformers - Part 57-1202: Liquid immersed phase-shifting transformers |
| IEC/IEEE 60076-57-129:2017 | Power transformers - Part 57-129: Transformers for HVDC applications |
| IEC 60214-1:2014 | Tap-changers - Part 1: Performance requirements and test methods |

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| IEC/IEEE 60214-2:2019 | Tap-changers - Part 2: Application guidelines |
| IEC TR 60616:1978 | Terminal and tapping markings for power transformers |
| IEC 61378-1:2011 | Converter transformers - Part 1: Transformers for industrial applications |
| IEC 61378-1:2011/COR1:2012 | Corrigendum 1 - Converter transformers - Part 1: Transformers for industrial applications |
| IEC 61378-3:2015 | Converter transformers - Part 3: Application guide |
| IEC 62032:2012 | Guide for the Application, Specification and Testing of Phase-Shifting Transformers |

| **IEC TC96 publications** | |
|---|---|
| **Reference** | **Title** |
| IEC 61558-1:2017 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 1: General requirements and tests |
| IEC 61558-1:2017 | Safety of transformers, reactors, power supply units and combinations thereof - Part 1: General requirements and tests |
| IEC 61558-2-1:2021 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-1: Particular requirements and tests for separating transformers and power supply units incorporating separating transformers for general applications |
| IEC 61558-2-2:2022 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-2: Particular requirements and tests for control transformers and power supply units incorporating control transformers |
| IEC 61558-2-2:2022 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-2: Particular requirements and tests for control transformers and power supply units incorporating control transformers |
| IEC 61558-2-2:2022 EXV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-2: Particular requirements and tests for control transformers and power supply units incorporating control transformers |
| IEC 61558-2-3:2023 EXV-RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-3: Particular requirements and tests for ignition transformers for gas and oil burners |
| IEC 61558-2-3:2023 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-3: Particular requirements and tests for ignition transformers for gas and oil burners |
| IEC 61558-2-3:2023 EXV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-3: Particular requirements and tests for ignition transformers for gas and oil burners |

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| IEC 61558-2-3:2023 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-3: Particular requirements and tests for ignition transformers for gas and oil burners |
| IEC 61558-2-3:2023/COR1:2023 | Corrigendum 1 - Safety of transformers, reactors, power supply units and combinations thereof - Part 2-3: Particular requirements and tests for ignition transformers for gas and oil burners |
| IEC 61558-2-4:2021 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers for general applications |
| IEC 61558-2-4:2021 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers for general applications |
| IEC 61558-2-5:2024 EXV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-5: Particular requirements and test for transformer for shavers, power supply units for shavers and shaver supply units |
| IEC 61558-2-5:2024 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-5: Particular requirements and test for transformer for shavers, power supply units for shavers and shaver supply units |
| IEC 61558-2-5:2024 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-5: Particular requirements and test for transformer for shavers, power supply units for shavers and shaver supply units |
| IEC 61558-2-5:2024 EXV-RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-5: Particular requirements and test for transformer for shavers, power supply units for shavers and shaver supply units |
| IEC 61558-2-6:2021 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers for general applications |
| IEC 61558-2-6:2021 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers for general applications |
| IEC 61558-2-7:2023 EXV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-7: Particular requirements and tests for transformers and power supply units for toys |

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| IEC 61558-2-7:2023 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-7: Particular requirements and tests for transformers and power supply units for toys |
| IEC 61558-2-7:2023 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-7: Particular requirements and tests for transformers and power supply units for toys |
| IEC 61558-2-7:2023 EXV-RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-7: Particular requirements and tests for transformers and power supply units for toys |
| IEC 61558-2-8:2024 EXV-RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-8: Particular requirements and tests for transformers and power supply units for bells and chimes |
| IEC 61558-2-8:2024 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-8: Particular requirements and tests for transformers and power supply units for bells and chimes |
| IEC 61558-2-8:2024 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-8: Particular requirements and tests for transformers and power supply units for bells and chimes |
| IEC 61558-2-8:2024 EXV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-8: Particular requirements and tests for transformers and power supply units for bells and chimes |
| IEC 61558-2-9:2024 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-9: Particular requirements and tests for transformers and power supply units for class III handlamps |
| IEC 61558-2-9:2024 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-9: Particular requirements and tests for transformers and power supply units for class III handlamps |
| IEC 61558-2-9:2024 EXV-RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-9: Particular requirements and tests for transformers and power supply units for class III handlamps |
| IEC 61558-2-9:2024 EXV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-9: Particular requirements and tests for transformers and power supply units for class III handlamps |
| IEC 61558-2-10:2024 EXV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-10: Particular requirements and tests for separating transformers with high insulation level and separating transformers with output voltages exceeding 1 000 V |
| IEC 61558-2-10:2024 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-10: Particular requirements and tests for separating transformers with high insulation level and separating transformers with output voltages exceeding 1 000 V |

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| IEC 61558-2-10:2024 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-10: Particular requirements and tests for separating transformers with high insulation level and separating transformers with output voltages exceeding 1 000 V |
| IEC 61558-2-10:2024 EXV-RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-10: Particular requirements and tests for separating transformers with high insulation level and separating transformers with output voltages exceeding 1 000 V |
| IEC 61558-2-12:2024 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-12: Particular requirements and tests for constant voltage transformers and power supply units for constant voltage |
| IEC 61558-2-12:2024 EXV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-12: Particular requirements and tests for constant voltage transformers and power supply units for constant voltage |
| IEC 61558-2-12:2024 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-12: Particular requirements and tests for constant voltage transformers and power supply units for constant voltage |
| IEC 61558-2-12:2024 EXV-RLV | Safety of transformers, reactors, power supply units and combination thereof - Part 2-12: Particular requirements and tests for constant voltage transformers and power supply units for constant voltage |
| IEC 61558-2-13:2022 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-13: Particular requirements and tests for auto-transformers and power supply units incorporating auto-transformers for general applications |
| IEC 61558-2-13:2022 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-13: Particular requirements and tests for auto-transformers and power supply units incorporating auto-transformers for general applications |
| IEC 61558-2-13:2022 EXV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-13: Particular requirements and tests for auto-transformers and power supply units incorporating auto-transformers for general applications |
| IEC 61558-2-14:2022 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-14: Particular requirements and tests for variable transformers and power supply units incorporating variable transformers for general applications |

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| IEC 61558-2-14:2022 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-14: Particular requirements and tests for variable transformers and power supply units incorporating variable transformers for general applications |
| IEC 61558-2-15:2022 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-15: Particular requirements and tests for isolating transformers for medical IT systems for the supply of medical locations |
| IEC 61558-2-15:2022 EXV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-15: Particular requirements and tests for isolating transformers for medical IT systems for the supply of medical locations |
| IEC 61558-2-15:2022 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-15: Particular requirements and tests for isolating transformers for medical IT systems for the supply of medical locations |
| IEC 61558-2-16:2021 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units for general applications |
| IEC 61558-2-16:2021/COR1:2023 | Corrigendum 1 - Safety of transformers, reactors, power supply units and combinations thereof - Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units for general applications |
| IEC 61558-2-20:2022 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-20: Particular requirements and tests for small reactors |
| IEC 61558-2-20:2022 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-20: Particular requirements and tests for small reactors |
| IEC 61558-2-23:2024 RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-23: Particular requirements and tests for transformers and power supply units for construction sites |
| IEC 61558-2-23:2024 EXV-RLV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-23: Particular requirements and tests for transformers and power supply units for construction sites |
| IEC 61558-2-23:2024 EXV | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-23: Particular requirements and tests for transformers and power supply units for construction sites |
| IEC 61558-2-23:2024 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-23: Particular requirements and tests for transformers and power supply units for construction sites |

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| IEC 61558-2-26:2013 | Safety of transformers, reactors, power supply units and combinations thereof - Part 2-26: Particular requirements and tests for transformers and power supply units all for saving energy and other purposes |
| IEC 62041:2017 | Transformers, power supplies, reactors and similar products - EMC requirements |

**IEC TC 14 Work Programme**

| Project Reference | Title | Document Reference | Current Stage | Next Stage | Fcst. Publ. Date |
|---|---|---|---|---|---|
| IEC 60076-1 ED4 | Power transformers - Part 1: General | 14/1115/CD | ACDV | TCDV | 2026-02 |
| IEC 60076-2 ED4 | Power transformers - Part 2: Temperature rise for liquid-immersed transformers | 14/1114/CD | ACDV | TCDV | 2026-02 |
| IEC 60076-4 ED2 | Power transformers - Part 4: Lightning impulse and switching impulse tests of power transformers and reactors | 14/1109/CDV | AFDIS | DECFDIS | 2025-06 |
| IEC 60076-5 ED4 | Power transformers - Part 5: Ability to withstand short circuit | 14/1077/RR | CDM | | 2025-12 |
| IEC 60076-6 ED2 | Power transformers - Part 6: Reactors | 14/1123/CD | PCC | | 2026-02 |
| IEC/IEEE 60076-57-135 ED1 | Technical guideline for the Application, Specification, and Testing of Phase-Shifting Transformers | 14/1102/NP | ACD | CD | 2026-11 |

## ANNEX 17

| TC/SC (IEC website) | WG/PT/ MT/JWG | Membership | Titles | ETD | Member Secretary | Expert Nominated |
|---|---|---|---|---|---|---|
| TC 14 | | P | Power transformers | ETD 16 | Abinash Bordoloi | NA |
| | PT 60076-57-135 | | Technical guideline for the Application, Specification, and Testing of Phase-Shifting Transformers | ETD 16 | Abinash Bordoloi | Mr. Rajaram Mohan Rao Chennu, CPRI Bengaluru |
| | MT 60076-1 | | Power transformers - Part 1: General | ETD 16 | Abinash Bordoloi | a. Mr. Kapil Sharma, ERDA, Vadodara<br>b. Mr. Nagarjuna Babu Nannapaneni, Individual Capacity<br>c. Mr Rajaram Ramchandra Shinde<br>d. Mr. Abinash Bordoloi, BIS |
| | MT 60076-2 | | Temperature rise for liquid-immersed transformers | ETD 16 | Abinash Bordoloi | a. Mr. Rajaram Mohan Rao Chennu, CPRI Bengaluru<br>b. Mr. Kapil Sharma, ERDA, Vadodara |
| | MT 60076-3 | | Power transformers - Part 3: Insulation levels, dielectric tests and external clearances in air | ETD 16 | Abinash Bordoloi | a. Mr. C Jayasenan, Siemens Limited, Mumbai<br>b. Mr. Mr. Rajaram Mohan Rao Chennu, CPRI Bengaluru |
| | MT 60076-4 | | Power transformers - Part 4: Guide to the lightning impulse and switching impulse testing - Power transformers and reactors | ETD 16 | Abinash Bordoloi | No |
| | MT 60076-5 | | Ability to withstand short circuit | ETD 16 | Abinash Bordoloi | a. Mr Moorkath Vijayakumaran |

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| | | | | | | b. Mr. Rajaram Mohan Rao Chennu, CPRI Bengaluru<br>c. Mr. Ramesh K Patel, National High Power Test Laboratory Pvt. Ltd, Sagar |
| | MT 60076-6 | | Reactors | ETD 16 | Abinash Bordoloi | Mr. C Jayasenan, Siemens Limited, Mumbai |
| | MT 60076-7 | | Loading guide for oil-immersed power transformers | ETD 16 | Abinash Bordoloi | No |
| | MT 60076-9 | | To revise IEC 60616 | ETD 16 | Abinash Bordoloi | Mr. Moorkath Vijayakumaran, Individual Capacity |
| | MT 60076-14 | | Liquid-immersed power transformers using high-temperature insulation materials | ETD 16 | Abinash Bordoloi | Mr. Sailesh Purohit, E.I Dupont India Pvt. Ltd, Gurugram |
| | MT 60076-16 | | Transformers for wind turbine applications | ETD 16 | Abinash Bordoloi | No |
| | MT 60076-18 | | To revise IEC 60076-18 | ETD 16 | Abinash Bordoloi | a. Mr. Rajaram Mohan Rao Chennu, CPRI Bengaluru<br>b. Mr. Rajaram Shinde, Individual Capacity |
| | MT 60076-19 | | Power transformers - Part 19: Rules for the determination of uncertainties in the measurement of losses in power transformers and reactors | ETD 16 | Abinash Bordoloi | a. Mr. Mr. Rajaram Mohan Rao Chennu, CPRI Bengaluru<br>b. Mr. Rajaram Shinde, Individual Capacity |
| | MT 60076-21 | | Power transformers - Part 21: Standard requirements, terminology, and test code for step-voltage regulators | ETD 16 | Abinash Bordoloi | Mr. Rajaram Capacity, Individual Capacity |

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|---|---|---|---|---|---|---|
| | MT 60076-22 | | Maintenance of IEC 60076-22 series | ETD 16 | Abinash Bordoloi | a. Rajaram Shinde, In Individual Capacity<br>b. Mr. C Jayasenan, Siemens Limited, Mumbai |
| | MT 60076-25 | | Power transformers - Part 25: Neutral grounding resistors - General design requirements and test procedures | ETD 16 | Abinash Bordoloi | No |
| | MT 60076-57-129 | | Power transformers - Part 57-129: HVDC converter transformers | ETD 16 | Abinash Bordoloi | Mr. Rajaram Mohan Rao Chennu, CPRI Bengaluru |
| | MT 60214 | | Tap changers | ETD 16 | Abinash Bordoloi | Mr. S. A. Vyas, CTR Manufacturing Industries Limited, Ghaziabad |
| | TC 36/SC 36A/JWG 7 | | Dimensional bushing standardization Managed by SC 36A | ETD 16 | Abinash Bordoloi | No |
| | AG 39 | | Functional classification of power transformers, reactors and accessories | ETD 16 | Abinash Bordoloi | No |
| | ahG 40 | | Power transformers related to energy transition such as PV, battery storage, e-chargers and hydrogen generation | ETD 16 | Abinash Bordoloi | Mr Rajaram Ramchandra Shinde, In Individual Capacity |
| | JMT 60076-26 | | Functional requirements of insulating liquids for use in power transformers linked to TC 10, TC 15, TC 112 | ETD 16 | Abinash Bordoloi | No |
| | JAHG 8 | | Bushing Application Guide Managed by SC 36A | ETD 16 | Abinash Bordoloi | No |
| TC 96 | | P | Transformers, reactors, power | ETD 16 | Abinash Bordoloi | NA |

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| | | | supply units, and combinations thereof | | | |
| | MT 1 | | MT1 "Maintenance of all publications under the responsibility of TC 96. Revision of IEC 60989 to be introduced in the IEC 61558 Series /WG 1 "Development of new parts 2 of IEC 61558 | ETD 16 | Abinash Bordoloi | Amarpal Gampa |

# ANNEX 18

## TERMS OF REFERENCE FOR R&D PROJECTS

**1. Title of the Project**: Evaluation of Field Efficiency of Dry type transformers and mapping end of life recycling in India

**2. Background:**

a) Technical Committee ET 16 and Division Council ETD - the project is related to;

b) The standard is under development for IS 1180 Series.

c) Rationale for the commissioning of the project –

In India Dry type transformer usage is not very high but since last three years the market shows double digit growth in this segment. This growth is predominantly due to the growth in real estate industry and public infrastructure industries like Metro, Airport etc. Generally, such dry type transformers are used in indoor environment.

However, with huge spurt of renewable energy growth, dry type transformers are used in field with argument like no-maintenance needed.

Keeping national climate action in the backdrop, Energy Efficiency is bottom of pyramid in current era of clean energy transition. Additionally, UN SDG 12 invokes 'responsible production and responsible consumption' as one of the national priorities. India already has declared few path breaking initiative in this area.

Field experience (specially from energy audit and commissioning testing) shows that such dry type transformers in indoor usage are often loaded below 50% thus impacting utilisation of capital invested or facing temperature rise thus requiring additional forced cooling mechanism like blower.

Other area which is seen often in field is failure of dry type transformer in premature manner due to partial discharge that may be caused either by manufacturing defect or by presence of heavy

dust and particulate matters in environment. Using dry type transformer in controlled air-conditioned environment is contradictory to energy efficiency that many commercial entities are vying for e.g data centre again a rapidly growing area.

Experience from developed nations and China indicates that end of life disposal of such dry type of transformer is often technology intensive and unproductive. Hence it is normally used for land filling making it environmentally hazardous.

Since new standard is envisaged these aspects of energy efficiency, responsible usage, recyclability in environmentally benign way are few areas where data or information would help formulation of the standard in effective and contemporary way.

3. **Scope**:
    - Classification/research on various types of dry type transformers in use in India
    - Identification of sample facilities for field survey
    - Preparation of field methodologies, data collection templates, inspection questions
    - Planning for actual survey at various sites
    - Conducting measurements at select sites
    - Conducting field interviews
    - Compilation of various field data and questionnaires
    - Preparation of reports

4. **Expected Deliverables**:
    - The project will highlight the current state of dry type transformer efficiency prevalent in field conditions vs. design specifications at various loading conditions and for different types of dry type transformers.
    - Further the project will focus on various failure mechanisms that occur and attempt to derive correlations with any design / installation lacunae.
    - Lastly the project will serve to provide a report on the disposal mechanisms in use during End of life / failure of dry type transformers and its environmental impact.

5. **Research Methodology**:

**Efficiency Focussed :**

Deep understanding of the variances in raw materials / components used in dry type transformers. Focus group discussions to arrive at methodology of measurements, approach to interviews, content of questionnaires.

Visits to few sites with different types / ratings of dry type transformers and conducting measurements. (2-3)

Analysis of the collected data / questionnaires.

**Recycling Focussed :**

Understanding the current recycling and disposal trends / practices through interviews with focus groups - Utilities, Heavy use segments (Data centers / Metro / Airports), Manufacturers of dry

type transformers, Recyclers/Waste disposal stakeholders (1 to 2 for each group based on availability)

Identification of gaps in the same w.r.t environmental concerns

Suggestions of methods/solutions for effective recycling/disposal for dry type transformers.

**6. Requirement for the CVs:**

The CVs of the persons to be engaged for the project should have energy auditing and pre-commissioning expertise or background. Involvement of dry type transformer designer in the team is must.

**7. Timeline and Method of Progress Review:**

The stagewise timelines including that for the submission of the first draft, final draft and the report should be three to four /five /six months respectively. There should be monthly review mechanism for the review of the progress.

**8. Support BIS will Provide:**

Indicate the support BIS may provide in terms of the standards, other publications, information regarding manufacturers and labs etc.

- BIS Relevant Resources for conducting the study
- Information regarding various manufacturers of dry type transformers and their certifications.
- BIS support and authorisation letter to conduct the field measurements / interviews.
- Research Funding INR 10 Lakhs and 6 Months to begin with

## ANNEX 19

## TERMS OF REFERENCE FOR R&D PROJECTS

1. **Title of the Project**: Study of Agriculture Connection by Utilities for DT Rating Rationalisation

2. **Background:**

a) The project is related to ET 16 Technical Committee and ETD Divisional Council.

b) The project is related to IS 1180 Part 1, Part 3 expected to go under review shortly in coming year.

c) Presently under IS 1180 various standard ratings are referred for outdoor type Oil immersed distribution transformer viz 6.3/10/16/20/25/40/63/100 kVA in 11 kV class and most of agri pump electrification schemes are supported by government schemes from time to time. Legacy approach of utility was to release agri pump electrification connection based on 5HP/3.7 kW standard ratings considering ground water table as conducive. For utility agri connection is just a number to be completed as target agri pump energisation each year. In depth study and impact of such connection on power purchase planning is not robust in many States.

However due to over exploitation of both groundwater as well as cropping pattern which are often not very water efficient many States suffers today from low level of ground water and turning into either yellow or red zone. In other words, it means that water level has gone even below 100 to 300 ft. Besides at many rural areas the voltage quality is far from satisfactory.

These are key reasons for agri pump motor burning and often upsizing of these pumps at local level much in variation from original name plate rating or officially recorded ratings. Obvious affected equipment in distribution chain is the DT that caters to such agri connection. Result is frequent DT failure of lower ratings causing huge economic loss to exchequer, utility as well as economy at large.

Added to above scenario, the utility looses on various areas like:

a) Loss of revenue from fixed charges due to official record of low connected load
b) Loss of operating revenue out of direct agricultural subsidy it receives from the State based on Connected Load and estimated annual operating hours deriving the energy served.
c) Repeated loss of capital due to frequent failure of such lower rating DTs which are made to serve much higher load on ground.
d) Huge cost of carrying inventory for diverse sizes of DT ratings
e) Loss of image among customers for serving unreliable interrupted supply

Despite such losses no scientific assessment is carried by public utilities in India since agri customer presumably is a non-paying customer for the utility due to socio political reasons.

DT failure and DT repair costs India approximately Rs 6000 Cr per annum based on some study estimates earlier. In addition, the ATC loss of Indian utilities are hovering around 14% nationally but

varies from 7% to 30% across diverse States. To reduce these huge losses the utility also adopts to supply HVDS (High Voltage Direct Supply) mode at load to reduce HT:LT ratio in line. However, the NLL per kVA of such lower rating DT does not help in any way to reduce our system loss that reflects as incremental tariff on electricity supply.

Further in recent times to promote RE, as part of our climate change commitment, PM's KUSUM scheme promotes higher capacity of Solar energy driven pumpsets (e.g 12kW/15HP). This creates win win situation both for the farmer ( being able to sell additional solar energy to Grid) and the utility being able to meet their RE portfolio targets. Now a grid connected solar energy driven pumpset of such rating would require at the minimum 25 kVA DT nominal rating.

Since standardisation helps in rationalising such anomalies and address the lacunae existing in current system, it will be worthwhile to undertake a study and investigate such matters for national economic benefit as well as responsive climate conscious step.

3. **Scope**: The scope of project would cover the following activities.
    a) To enable decision making in addressing issue of DT rating rationalisation.
    b) Analyse, considering diverse agricultural landscape, the possible root cause of failures of agri pump load serving DTs and bring out various reasons of frequent DT failures.
    c) To find out whether the original objective of utility have been achieved or not.
    d) To propose recommendations to reduce such failures, to improve specification, rating rationalisation of DTs.
    e) To prepare generic National level guideline of DT ratings to be used for agricultural pump connection, in line with National and international standards and best practices.
    f) To make aware of the intangible losses incurred if any.

4. **Expected Deliverables**: Mention the outcome of the project.

5. **Research Methodology**:

1. Study of current State policy and Water availability etc w.r.t agri pump set electrification and actual all india Statistics giving State wise information.
2. Field based survey in three to four agri dominant State to arrive at the normalised HP rating needed in agri pump sets
3. Gather complete data of lower rating DTs (6.3 kVA to 100 kVA) procured by select State utilities over past ten years and also the DT failure data for such ratings
4. Analysis of data and deriving conclusion on agri pump failure key reasons and it's impact on distribution assets plus overall economy
5. Deliberation with research coordination committee periodically
6. Preparation of report and finalisation of the same within maximum span of six months

**6. Requirement for the CVs:**

Preferred reputed agricultural research institutes familiar with Water Energy nexus and problem of deep tubewell based irrigation through electrically energised pump sets. Experts in electricity distribution sector should be part of this multidisciplinary team.

**7. Timeline and Method of Progress Review:**

a) Desk based literature survey and study of select State policies in this realm – 3 to 4 weeks.
b) Field based sample survey in four agri dominated States – 8-12 weeks
c) Analysis of data and Draft report submission – further 3-4 weeks
d) Deliberation and submission of final report for RC consideration – further 2-4 weeks.

Periodic reporting and progress review every month should be in place.

**8. Support BIS will Provide:**

BIS must provide financial support for carrying out the project.

BIS must provide support in terms of the standards, other publications, information regarding manufacturers and labs etc.