



ABSTRACT

This part of the column covers a list of standards on the range of accessories used with power transformers and reactors. These standards apply to a wide range of accessories and fittings mounted on power transformers and reactors. They outline the service conditions and mechanical requirements common to all the accessories, as well as operational requirements specific to each device.

KEYWORDS

transformers accessories, reactors, IEC standard, IEEE standard, Indian standard

A wide number of national and international standards cover the application, specifications and performance requirements of the transformer's accessories

Standards relevant to transformers - Part IX

Accessories

1. Introduction

Every transformer and reactor is equipped with a variety of accessories meeting the interface to the grid, cooling, voltage regulation, monitoring and

protection of equipment. Proper functioning of these accessories is essential to ensure the reliability of equipment during service. A wide number of national and international standards cover the application, specifications and per-

formance requirements of these accessories. The present paper summarises available standards and technical brochures related to the above aspects of transformer accessories for immediate reference.

2. Standards

Subject	IEC Standard / CIGRE TB	ANSI / IEEE standard	Indian standard
Specification for fittings and accessories for power transformers			IS 3639 - 1966
Power transformers and reactor fittings – protective devices	60076-22-1 Ed. 1.0 2019		
Power transformers and reactor fittings – removable radiators	60076-22-2 Ed. 1.0 2019		
Power transformers and reactor fittings – insulating liquid to air heat exchangers	60076-22-3 Ed. 1.0 2019		
Power transformers and reactor fittings – insulating liquid to water heat exchangers	60076-22-4 Ed. 1.0 2019		IS 6088 - 1988
Power transformers and reactor fittings – electric pumps for transformers	60076-22-5 Ed. 1.0 2021		
Power transformers and reactor fittings – electric fans for transformers	60076-22-6 Ed 1.0 2021		
Power transformers and reactor fittings – accessories and fittings	60076-22-7 Ed. 1.0 2020		
Power transformers and reactor fittings – devices suitable for use in communication networking	60076-22-8 Ed. 1.0 2021		

Subject	IEC Standard / CIGRE TB	ANSI / IEEE standard	Indian standard
<p>Bushing – general specifications</p> <p>Bushings for AC voltage 1 kV and below</p> <p>Bushings – LV</p> <p>Bushings – dimensions of porcelain for heavy polluted atmospheres – 12–36 kV</p> <p>Bushings – dimensions of porcelain for heavy polluted atmospheres – 52 kV</p>	60137 Ed. 7.0 - 2017 (2008) / COR1 2018	C57.19.00 - 2004	<p>IS/IEC 6013 - 2017</p> <p>IS 7421 - 1988</p> <p>IS 3347 series (multiple parts)</p> <p>IS 8603 - 2008</p> <p>IS 8603 (Part 4) - 2003</p>
<p>Bushing – Performance characteristics and dimensions</p> <p>Capacitance graded bushings 52–420 kV for transformers – specifications and dimensions (CENELEC standard)</p> <p>OIP condenser bushings – dimensions and requirements</p> <p>Power transformer and reactor bushing – dimensions (Canadian standard)</p>		<p>C57.19.01 - 2017 (2000)</p> <p>CLC/TS 50458-2006</p> <p>CAN/CSA C88.1 - 2018 (1996)</p>	IS 12676 - 1989
Bushing – HV DC bushing	65700-19-03 Ed. 1.0 - 2014 (62199 - 2004)	65700-19-03 Ed. 1.0 - 2014	
Bushings – High current transformer bushings > 5 kA used in bus enclosures		C57.19.04 - 2018	
Power apparatus bushing application guide		C57.19.100 - 2012 (1995)	
<p>Bushing terminal dimensions</p> <p>permissible terminal temperature rise for terminal pad</p>	<p>60518 - 1975 (withdrawn)</p> <p>62271-301 Ed. 2.0 – 2009 (2004)</p> <p>60943-Ed. 2.1 - 2009 (1989) -a guidance concerning the permissible temperature rise for parts of electrical equipment, in particular for terminals.</p>		
Bushings – selection and dimensioning of insulators for polluted conditions	<p>60071-2 Ed. 4.0 – 2018 (1996),</p> <p>IEC/TS 60815-1, 2, 3 and 4 - 2008/2016 Ed. 1.0</p> <p>Part 1 – definitions Part 2 – ceramic and glass insulators</p> <p>Part 3 – polymer insulators</p> <p>Part 4 – insulators for DC systems</p> <p>CIGRE Brochures 158 and 361</p>		
Bushings – seismic qualifications	<p>TS 61463 Ed. 2.0 - 2016 (2000)</p> <p>Seismic calculations for bushing</p>	IEEE 693-2018 (2005) - shake table test for Um > 138 kV	
<p>Bushings – tests</p> <p>Artificial pollution tests for HV AC insulators</p>	60507 Ed 3.0 - 2003 (1991)		IS1448 (Part 10) – 2015

Subject	IEC Standard / CIGRE TB	ANSI / IEEE standard	Indian standard
Bushings – polymeric insulators – general definitions, test methods and acceptance criteria	62217 Ed. 2.0 - 2012 (2005)		
Bushings – composite hollow insulators	61462 Ed. 1.0 - 2007		
Bushings – hollow insulators: ceramic and glass	62155-Ed. 1.0 - 2003		
Bushings – EN standards			
Porcelaine, 1–52 kV, Amps: 250–3150 A	EN 50180-Parts 1, 2 and 3 - 2015		
Plug in type, 1–52 kV, Amps: 250–2,500 A	EN 50181 - 2010		
24 and 36 kV, 5 and 8 kA high current bushings	EN 50243 - 2002		
Cable box bushings up to 36 kV	EN 50336 - 2021		
1 kV, 250 A–5 kA outdoor porcelain bushings for transformers	EN 50386 - 2010		
1 kV, 1.25–5 kA bus bar moulded in door type bushings	EN 50387 - 2002		
Separable insulated connector system (2.5–35 kV)		386-2016 (1995)	
Application guide for separable insulated connectors		1215 - 2013	
Cable connection to HV switchgear	62271-209 - 2019 Ed 2.0 (2007) (earlier 60859)		
GIS > 52 kV	62271-203 - 2022 Ed 3.0 (2011)	1300 - 2011	
Direct connection between transformer and GIS	62271-211: 2014 Ed 1.0 (TR 61639 - 1996)		
Cable boxes for oil-filled transformers (12–36 kV)	(BS 2562 -1979 R2017) -with compound or oil filling		IS:9147-1979 (PICC cable connection) CBIP manual 317 - 2013 – Section A – Clause 12
Unfilled enclosures for the dry termination of HV cables of transformers and reactors			BS 6435 - 1984 (withdrawn)
Oil immersed cable connection assemblies for transformers -Um 72.5-550 kV – fluid-filled cable terminations	EN 50299-1 - 2014		
Same as above – dry-type cable terminations	EN 50299-2 - 2014		
Power cables and accessories (cable terminations)	60840 – Ed 5.0 - 2020 (2011) (30 kV–150 kV) 62067 - Ed 3.0 - 2022 (2011) (150–550 kV)		
Cable cleats for electrical installations	61914 – Ed 3.0–2021 (2015)		
Medium power transformers up to 3.15 MVA, 36 kV with HV and LV cable boxes (air-filled)	EN 50588-2 - 2018		
General requirements	EN 50588-3 - 2018		
Same as above – with type 1 cable boxes	EN 50588-4 - 2018 (superseding EN50464-2-1; 2-2; 2-3)		
Same as above –with type 2 cable boxes			

Subject	IEC Standard / CIGRE TB	ANSI / IEEE standard	Indian standard
Metal enclosed bus		C37.23 - 2015	CBIP manual 318 - 2013
Control cabinet		C57.148 - 2020 (2011)	
Control switchboards		C37.21 - 2017 (2005)	
Fasteners – stainless steel bolt Nut	ISO3506-1 - 2020 ISO 3506-2 - 2020		
Fasteners – steel Hexagonal screws Nuts Plain washers grade A Plain washers grade C Conical spring washers	ISO4017 - 2022 ISO4032 - 2012 ISO7093-1 - 2000 ISO 7093-2 - 2000 DIN 6796 - 2009		
Fasteners – surface treatment Electroplating of steel Zinc flake coating – steel Hot dip galvanizing system – steel Passivation of stainless steel	ISO4042 - 2022 ISO10683 - 2018 ISO 10684 - 2004 ISO 16048 - 2003		
Induction voltage regulator	60076-21 Ed. 2.0 - 2018 (2011)	C57.15 - 2009 (1999)	IS 2026 Part 21 (2018)
Instrument transformer General requirement CT VT Combined CVT Low power instrument transformer Electronic VT Electronic CT Interface for IT Low power passive CT Low power passive VT Standalone merging unit	61869 series (60044 series) 61869-1 Ed. 1.0 - 2007 61869-2 Ed. 1.0 - 2012 61869-3 Ed. 1.0 - 2011 61869-4 Ed. 1.0 - 2013 61869-5 Ed. 1.0 - 2011 61869-6 Ed. 1.0 - 2016 60044-7 Ed. 1.0 - 1999 60044-8 Ed. 1.0 - 2002 61869-9 Ed. 1.0 - 2016 61869-10 Ed. 1.0 - 2017 61869-11 Ed. 1.0 - 2017 61869-13 Ed. 1.0 - 2021		
Ladder - fixed	ISO 14122-4 - 2016		
Platinum resistance Thermometer / sensor	60751 Ed. 3.0 - 2022 (2008)	C57.147 – 2008	
DC magnetic bias suppression devices	TS 60076-23 Ed. 1.0 - 2018		

Subject	IEC Standard / CIGRE TB	ANSI / IEEE standard	Indian standard
Reactors specifications	60076-6 Ed. 1.0 - 2007	C57.21 - 2021 (2008) (shunt)	
Reactors – Dry-type		C57.16 - 2011 (1996)	
Reactors – HV DC smoothing		IEEE 1277 - 2020 (2010)	
Tap-changers – performance requirements and test methods	60214-1ed2.0 2014 (2003)	C57.131-2012	8468-2018 / IEC 60214-1: 2014
Tap-changers – application guide	IEC/IEEE 60214-2 Ed 2.0 2019 (2004)		8478-1977
Tap-changers – functional life tests on switch contacts in oil		C57.157-2015	
Valves – industrial control Terminology	60534-1 ED 3.0 2005 (1987)		
Flow capacity	60534-2 (3 parts)		
Face-to-face – mounting dimensions	60534-3 (3 parts)		
Inspection and testing	60534-4 – Ed. 4.0 – 2021 (2006)		
Marking	60534-5 Ed. 2.0 – 2004 (2001)		
Control valve data sheet	60537-7 sheet Ed. 2.0 – 2010 (1988)		

Accessories are used as the interface to the grid connection, cooling, voltage regulation, monitoring and protection, and their proper functioning is essential for the transformers and reactors' operation

3. Conclusion

The proper functioning of accessories is essential for the functioning of transformers and reactors. This paper has summarised various international / national standards covering transformer accessories as a ready reference to transformer designers and users.

Authors



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