COLUMN

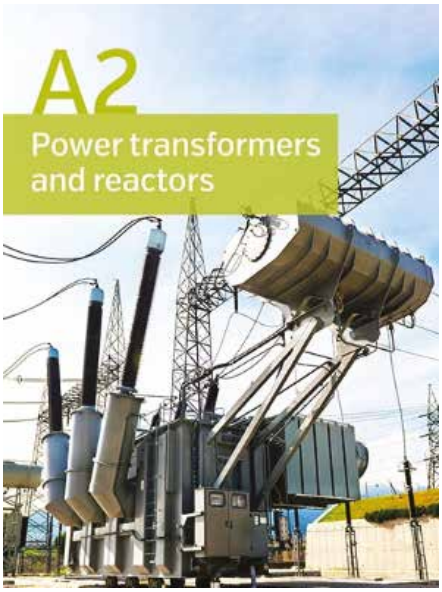
Standards relevant to transformers – Part III

CIGRÉ counts more than 3,500 experts from all around the world working together to optimise the existing equipment and power systems, including transformers

KEYWORDS

standards, brochures, transformers, CIGRÉ

CIGRÉ publishes technical brochures or reports written by experts organised in Work Groups; those materials are valuable engineering guidelines used in practice



CIGRÉ - the council on large electric systems

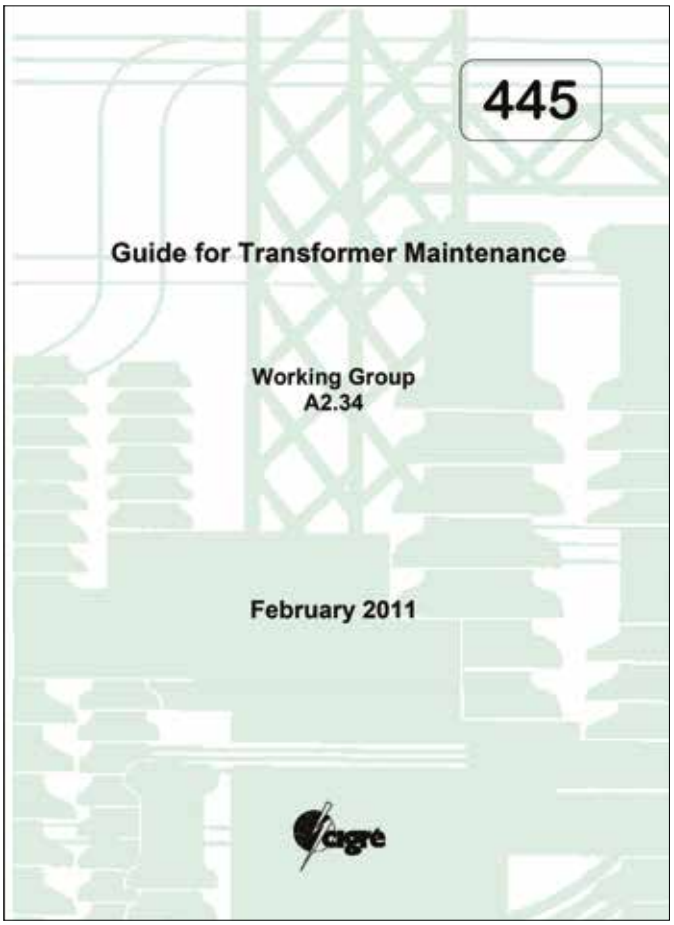
CIGRÉ, the International Council on Large Electric Systems (before the year 2000 the name was the International Conference on Large High Voltage Electric Systems) was founded in 1921. It is an international nonprofit association for promoting collaboration with experts from all around the world by sharing knowledge and joining forces to improve electric power systems of today and tomorrow.

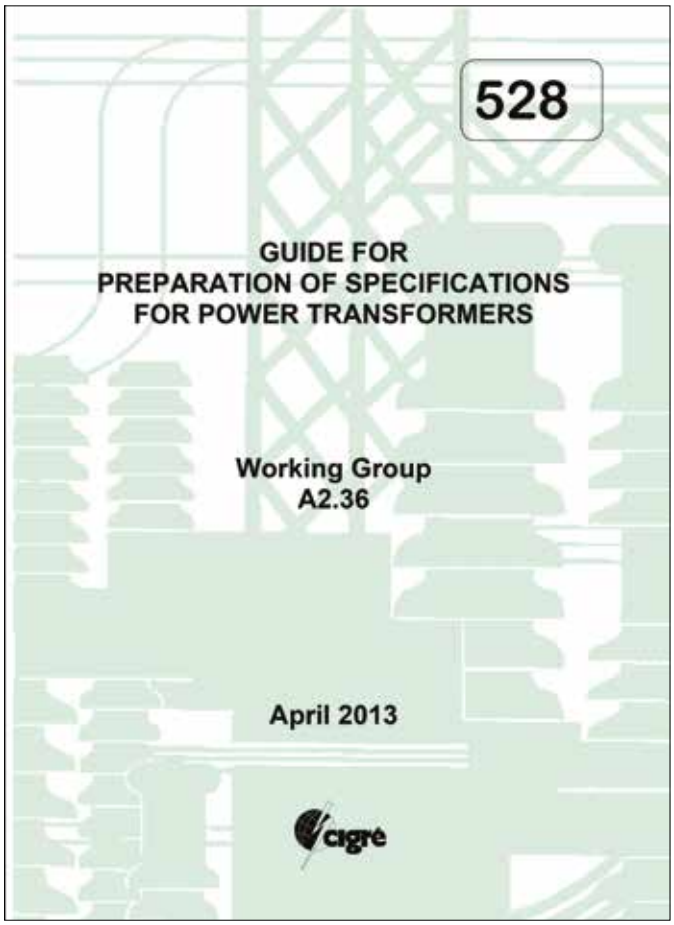
CIGRÉ counts more than 3,500 experts from all around the world, working actively together in structured work programs overseen by the Technical Committee. Their main objectives are to design and deploy the power system for the future, optimise the existing equipment and power systems, respect the environment, and facilitate access to information.

The CIGRÉ Technical Committee (TC) is organised into 16 Study Committees (SC), which in turn consist of several Working Groups (WG), Joint Working Groups (JWG), and Advisory Groups (AG). Most of the technical work is performed in the WGs, which are set up for a limited amount of time and must produce specific deliverables.

Experts appointed in WGs can be either full members (attending the meetings) or corresponding members. The WGs (or the AGs) report through their convener on the progress of the work at the SC annual meeting.

The product of a WG is usually a Technical Brochure, or a Report if the material is regarded as not sufficient for a Brochure. Transformer engineers are generally interested in the Technical Brochures issued by the Study Committee "Transformers" (SC 12 until 2002 and after SC A2) and the Study Committee "Materials and Emerging Test Techniques" (SC D1). The indepen-





dent study committee (SC 12/later A2) for transformers was constituted in 1949. CIGRÉ SC A2 covers design, construction, manufacture, and operation of all types of power transformers, including industrial power transformers, DC converters, phase-shifting transformers, reactors, and transformer accessories such as bushings and tap changers. A selection of CIGRÉ Technical Brochures that are of interest to transformer engineers is listed below. Each of these brochures provides distilled technical knowledge on the subject, collated by global experts as a good tutorial for the in-depth study. CIGRÉ members can get these publications, free of cost, from the CIGRÉ website [1]. Summaries of these brochures are published in the Electra Journal, published bimonthly by CIGRÉ. The Electra executive summaries will enable engineers to grasp the main points and conclusions of the topic covered in the brochure.

Table 1. CIGRÉ technical brochures related to transformers

No & Year	Title	Pages	Working Group
35-1989 (2005)	Monograph on GIS very fast transients	193	33.13.09
39-1990	Guidelines for modelling network elements when calculating transients	26	33.02
50-1995	Interruption of small inductive currents	223	13.02
60-1991	Metal oxide arresters for AC systems	100	33.06
66-1991	Statistical analysis of dielectric test	55	15.01.02
72-1992	Dielectric strength of external insulation	78	33.07
96-1995	Thermal aspects of transformers	165	12.09
105-1996	The mechanical effects of short circuit currents in open air substation	184	23.11
140-1999	Reliable fault clearance and back up protection	399	34.01
170-2000	Static electrification in power transformers	83	12.15.13
156-2000	Guide for customer specifications of transformers above 100 MVA	74	12.15
157 -2000	Effect of particles on transformer dielectric strength	43	12.17
170-2000	Static electrification in power transformers	83	12.15.13
204-2002	Guidelines for design review for transformers of 100 MVA and above	15	12.22
209-2002	Short circuit performance of power transformers	41	12.19
226-2003	Knowledge rules for PD diagnosis in service	91	15.11/33.03.02
227-2003	Life management techniques for power transformers	131	A2.18
240-2004	Analysis of HVDC thyristor converter transformer performance	32	B4.04/A2.1
248-2004	Economics of transformer management	66	2.20
254-2004	Dielectric response methods for diagnostics of power transformers	40	D1.01.09
296-2006	Recent developments in DGA interpretation	31	D1.01/A2.11
298-2006	Guide on transformer lifetime data management	88	A2.23
323-2007	Ageing of cellulose in mineral oil insulated transformers	87	D1.01-10
342-2008	Mechanical condition assessment of transformer windings using frequency response analysis	61	A2.26
343-2008	Recommendations for condition monitoring and condition assessment facilities for transformers	24	A2.27

349-2008	Moisture equilibrium and moisture migration within transformer insulation systems	52	A2.30
366-2008	PD measurements in compliance to IEC 60270	55	D1.33
378-2009	Copper sulphide in transformer insulation	52	A2.32
393-2009	Thermal performance of transformers	103	A2.24
400-2009	Technical requirements for substations exceeding 800 kV	159	B3.22
406-2010	HVDC converter transformers – Design review, test procedures, ageing evaluation, and reliability in service	38	A2/B4.28
407-2010	HVDC converter transformers – Guidelines for conducting design reviews for HVDC converter transformers	22	A2/B4.28
409-2010	Gas monitors for oil-filled equipment	35	D1.01
413-2010	Insulating oil regeneration and dehalogenation	49	D1.01
414-2010	Dielectric response diagnoses for transformer windings	58	D1.01
420-2010	Guidelines for lifetime condition assessment of HV assets and related knowledge rules	65	D1.17
432-2010	Protection relay co-ordination	179	B5.19
436-2010	Experiences in service with new insulating fluids	95	A2.35
443-2011	DGA in non-mineral oils and tap-changers – An improved DGA diagnosis criteria	33	D1.32
444-2011	Guidelines for unconventional PD measurements	58	D1.33
445-2011	Guide for transformer maintenance	123	A2.34
463-2011	Modern techniques for protecting, controlling and monitoring power transformers	218	B5.05
494-2012	Furanic compounds for diagnosis	71	D1.01
502-2012	HV on-site testing with PD measurement	70	D1.33
526-2013	Oxidation stability of insulating fluids	79	D1.30
528-2013	Guide for specifications for power transformers	70	A2.36
529-2013	Guide for design reviews for power transformers	79	A2.36
530-2013	Guide for factory capability assessment for transformers	103	A2.36
537-2013	Guide for transformer fire safety practices	139	A2.33
542-2013	Insulation coordination for UHV systems	289	C4.306
546-2013	Protection, monitoring and control of shunt reactors	198	B5.37
568-2014	Transformer energisation – A study guide	125	C4.307
569-2014	Resonance & ferro- resonance in power networks	170	C4.307
577A-2014	Electrical transient interaction between transformers and the power system – Part 1 – Expertise	175	A2/C4.39
577B-2014	Electrical transient interaction between transformers and the power system – Part 2 – Case studies	123	A2/C4.39
593-2014	Past, present, and future of IEC &IEEE HV and high current testing standards	61	D1.35

609, 2015	Study of converter transients imposed on the HVDC converter transformers	153	B4.51
617-2015	Converter transformer failure data analysis (2003–2012)	56	B4.04
625-2015	Copper sulphide long term mitigation and risk assessment	96	A2.40
630-2015	Guide on transformer intelligent condition monitoring (TICM) systems	140	A2.44
642-2015	Transformer reliability survey	120	A2.37
646-2016	HVDC transformer insulation-oil conductivity	94	A2/D1.41
655-2016	Technology and utilisation of oil immersed shunt reactors	133	A2.48
659-2016	Transformer thermal modelling	188	A2.38
662-2016	Guidelines for PD detection using conventional and unconventional methods	116	D1.37
673-2016	Guide on transformer transportation	173	D A2.42
676-2017	Partial discharges in transformers	162	D D1.29
735-2018	Transformer post-mortem analysis	129	A2.45
738-2018	Ageing of liquid impregnated cellulose for power transformers	94	D1.53
755-2019	Transformer bushing reliability	126	WG A2.43
761-2019	Condition assessment of power transformers	163	WG A2.49
765-2019	Understanding and mitigating corrosion	197	WGD1.71-2019
771-2019	Advances in DGA interpretation	76	JWG D1/A2.47
779-2019	Field experience with transformer solid insulation ageing markers	78	WG A2-D1
783-2019	DGA monitoring systems	51	WG D1/A2.47

In the last few decades, CIGRÉ covered actual hot topics for various fields of transformers technology with great care

Bibliography

[1] CIGRÉ A2 & D1 Study Committees, www.e-cigre.org

[2] CIGRÉ, *The History of CIGRÉ*, Paris, 2011

[3] CIGRÉ, www.cigre.org

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