SMB/6887/R

STRATEGIC BUSINESS PLAN (SBP)

IEC/TC OR SC:	SECRETARIAT:	DATE:
14	**GB**	**September 2019**

Please ensure this form is annexed to the Report to the Standardization Management Board if it has been prepared during a meeting, or sent to the Central Office promptly after its contents have been agreed by the committee.

A. STATE TITLE AND SCOPE OF TC

The scope of TC 14 covers the technical requirements for the specification, manufacture and testing of power transformers and similar equipment such as reactors and phase shifting transformers primarily for electricity generation, transmission and distribution. The scope is very wide in terms of transformer size starting at 1kVA and extending to the highest powers and voltages, but it does not cover transformers that would normally be supplied to domestic consumers or generally any transformer with a highest voltage less than 1100V. Some TC 14 standards may however be applied to low voltage relatively high power transformers for industrial use. The wide scope covers both smaller transformers that are made in large quantities to standard designs, for example for distribution applications and large or special transformers that are designed and built to individual requirements.

Although the majority of transformers built to TC 14 standards are made of conventional materials and are covered by the 'basic' set of standards in the IEC 60076 series, standards have been developed to cover the expanding range of transformer technology including dry, gas-filled and high temperature types.

Transformers for special applications such as high voltage DC transmission, industrial applications, wind turbines and phase shifting transformers are catered for with their own standards or guides.

TC 14 produces a number of guides that set out important information relevant to the application of the standards and transformers in general.

Although standards for most components and materials used in transformer construction are covered by other committees, TC 14 produces standards for tap-changers, and work has now started on standards for other components.

Many tests and measurements made on transformers and referred to in TC 14 standards are based on the work of other committees adapted to the specific requirements as required. Where specific tests or measurements are required that are not covered by other committees these are included in the work of TC 14, in particular for temperature rise, short circuit and frequency response.

Some small transformer applications are covered by TC 96 in respect of safety aspects. TC 14 does not cover the safety requirements that would apply to consumer products. There are however some low voltage (400V) transformers for industrial application that can be specified to TC 14 standards. The scopes of TC 14 and TC 96 have been aligned.

IEC/TC 14 was created by the Committee of Action in 1939 and first met in 1949.

B. MANAGEMENT STRUCTURE OF THE TC

The list of TC 14 Working Groups, Project Teams and Maintenance Teams is available at: www.iec.ch/dyn/www/f?p=103:29:0::::FSP_ORG_ID:1224#1

C. BUSINESS ENVIRONMENT

Power transformers are produced and procured widely across frontiers without problems. This trade relies on international standards against which transformers can be purchased, manufactured, tested and inspected. Demand for power transformers is strong across the range of power and voltage, both to accommodate growing demand for electricity and to replace ageing units. Generally power transformers have a low rate of problems in service indicating the overall adequacy of these standards.

D. MARKET DEMAND

TC 14 standards are used globally by utilities, consultants and project management companies as the basis for the specification of power transformers. The main applications being distribution networks, transmission networks, power stations, HVDC links, wind farms, other renewable generation and railway electrification trackside equipment. There is a good spread of active representation between customers and manufacturers represented in the TC and its working groups. There is only a limited supply of experts available for active participation and this must limit the number of projects running in parallel at any time. Maintenance of standards is required to both make them more useable and to accommodate changes in best practice and technology. TC 14 standards are adopted as national standards in many countries. To promote global trade, TC 14 is committed to cooperation with the IEEE Transformers Committee on providing a common set of technical requirements wherever possible.

E. TRENDS IN TECHNOLOGY AND IN THE MARKET

Although power transformers are a technologically mature product, increasing demand for and reliance on electrical power is driving an increase in the range of applications.

There is an increasing market demand for transformers with low fire risk that can be used in densely inhabited areas. This has resulted in the introduction of power transformers using high fire point fluids (for example synthetic esters and silicone fluid) or SF_6 for both insulation and cooling. The widespread introduction of power electronics equipment is affecting the harmonic content of the load currents handled by the equipment and the switching transients. The standards provide limits for the normal expectation for harmonic loading and guidance on specification if these limits are exceeded, but as the use of power electronic equipment increases it may be necessary to consider this aspect in more detail.

There is a growing market interest in the introduction of high temperature insulation as a complete system (for example in traction transformers) or in part (for example in furnace transformers or mobile transformers). The high temperature insulation could be used in combination with conventional cellulose insulation in oil or as a replacement for cellulose in a synthetic liquid insulation system. Standards are in place to cover this requirement.

Natural Ester based insulating fluids are now being used commercially. A significant advantage of this fluid is that it is more environmentally friendly than mineral oil. Fluid standards are the responsibility of TC 10 but any need for consequential changes in TC 14 standards will be monitored.

Energy conservation is becoming increasingly important to customers and regulators. There is growing pressure to ensure an optimum balance between first cost and electrical loss. Transformer standards need to take this into account and facilitate the right choice for a particular circumstance, in particular by defining methods of expressing efficiency and providing benchmark figures. Specific work on this is in progress.

Innovation is occurring in the use of transformer technology, particularly in developing units that perform multiple functions, such as phase shifting and voltage transformation, combining transformers or phase shifters and reactors, combining generators and transformers and the UPFC (unified power flow controller) concept. If the demand for these applications is sufficient, transformer standards will need to be updated or extended to accommodate them, particularly with respect to testing.

The demand from customers for reliable low-maintenance transformers together with good asset management information means, monitoring and remote control systems need to be integrated into transformer designs. There is also a need to co-ordinate the monitoring and control interface with the substation systems. Some specific provisions are anticipated in updated standards.

The interaction between transformers and the rest of the system, particularly with regard to switching transients, DC currents and resonant conditions needs careful study. The adequacy of the transformer, system and insulation co-ordination design and testing is essential to ensure good service performance. Test levels must reflect service stresses across the whole range of frequencies. Work is ongoing on this subject in CIGRE and results will be considered in the transformer standards.

Renewable energy generation applications including wind, solar, fuel cell, tidal and wave energy schemes impose particular environmental and electrical stresses on transformers. Where there is a high demand, this needs to be recognised in standards. Additionally the increase in embedded generation and the application of ‘smart grid’ technology may have an impact on transformer specification which will need to be recognised in the standards.

Vacuum switch technology is being more widely adopted to reduce maintenance on tap-changers and this has been taken into account in forthcoming standard and guide revisions.

Market trends:

New and revised standards are required to cover the expanding range of applications and requirements, especially those relating to renewable energy generation, the increasing use of power electronics in networks, the drive for higher transmission voltages, lower losses and possibly requirements for new nuclear generation. New materials, new testing and assessment technology and requirements for enhanced safety and environmental compatibility also drive the need for new and revised standards.

Trends in trade in power transformers have been quite strongly towards globalisation of supply, particularly for large units which are regularly shipped between continents. Continuing strong demand for transformers for both replacement and new projects is reinforcing the need for global standards. The trend towards globalisation appears to be continuing, although rising transport costs may eventually become a factor.

Ecological environment:

Materials used in the manufacture of transformers are well contained and most are fully recyclable. Mineral oil is probably the material that requires the most environmental care and more expensive alternatives are available for particular applications. Environmental concerns are a legitimate subject for inclusion in specifications and this is to be recognised in the standards.

The noise generated by transformers is becoming more important due to environmental requirements, in particular load noise. The means for specifying and measuring noise emissions is provided by TC 14 standards.

Electrical losses in transformers are an environmental issue indirectly in terms of carbon emissions. TC 14 standards give the methods of specification and measurement of losses. Work is now in hand on a standard for transformer efficiency.

F. SYSTEMS APPROACH ASPECTS (REFERENCE - AC/33/2013)

Component committees (TC14 role of customer)	IEC TC 10	Fluids for electrotechnical applications
	IEC SC 36A	Insulated bushings
	IEC TC 55	Winding wires
	IEC TC 68	Magnetic alloys and steels
	IEC TC 112	Evaluation and qualification of electrical insulating materials and systems
System committees (TC14 role of supplier)	IEC TC 8	Systems aspects for electrical energy supply
	IEC TC 9	Electrical equipment and systems for railways
	IEC TC 82	Solar photovoltaic energy systems
	IEC TC 88	Wind Turbines
	IEC TC 105	Fuel cell technologies
	IEC TC114	Marine energy, wave tidal and other water current converters
	IEC TC 115	High voltage direct current transmission >100kVDC
	IEC TC 117	Solar thermal electric plants
	IEC TC 122	UHV AC transmission systems
Other committees	IEC TC 28	Insulation co-ordination
	IEC TC 37	Surge arresters
	IEC TC 38	Instrument Transformers
	IEC TC 42	High voltage testing techniques
	IEC TC 70	Degrees of protection provided by enclosures
	IEC TC 89	Fire Hazard testing
	IEC TC 95	Measuring relays and protection equipment
	IEC TC 96	Transformers, reactors, power supply units and combinations thereof
	IEC TC 104	Environmental conditions classification and methods of test

G. Conformity Assessment

TC 14 standards do not directly address conformity assessment issues.

H. Horizontal issues

I. 3-5 Year Projected Strategic Objectives, Actions, Target Dates

The basic documents should all be reviewed and current by the end of the next 5 year period. Work is starting on revisions of IEC 60076 parts 1 and 2. Revision of Part 3 is complete and Part 5 is under review. Other existing standards will be reviewed as required.

Joint developments with IEEE are either completed or already in process as follows:

- IEC 60076-57-1202 *Phase Shifting transformers* dual logo with IEEE was published in 2017

- IEC 60076-21 *Step-voltage regulators*, dual logo with IEEE was published in 2018

The revision of IEC 60076-16 *Transformers for wind turbine applications* was published in 2018

IEC 61378-2 has been revised in conjunction with IEEE to become a dual logo standard IEC/IEEE 60076-57-129 *Power transformers - Part 57-129: Transformers for HVDC applications*.

IEC/IEEE 60214-2 ED2 *Tap-changers - Part 2: Application Guide* has been revised in conjunction with IEEE to become a dual logo standard

The CENELEC EN 50216 series for transformer components and CENELEC work on Voltage regulating distribution transformers are being developed as IEC standards.

Insulating fluid is of particular importance to power transformers and it is intended that TC 14 will work closely with TC10 to ensure standards are available that meet the requirements of the industry. This applies particularly to chemical compatibility and the performance of fluids in large volumes and at high voltages. An Ad hoc group has been established to promote this work.

Strategic Objectives 3-5 years	Actions to support the strategic objectives	Target Date(s) to complete the actions
Where possible expertise will be shared with and standards will be co-operatively developed with the IEEE standards committee.	Develop IEC IEEE 60076-15 *Step-voltage regulators*	Completed
	Revise IEC IEEE 60076-16 *Transformers for wind turbine applications*	Completed
Work closely with CENELEC TC 14	Publish IEC standards based on CENELEC EN 50216 series	2020
	Publish IEC standard based on CENELEC Voltage regulating distribution transformers	2020
Note: The progress on the actions should be reported in the RSMB.		