STRATEGIC BUSINESS PLAN (SBP)

IEC/TC or SC	Secretariat	Date
10	IT	2014-01

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Title of TC

TC10 - Fluids for electrotechnical applications

A Background

The scope of TC10 is: "To prepare product specifications, test methods as well as maintenance and use guides for liquid and gaseous dielectrics. Also to prepare specifications and maintenance and use guides for lubricants and control fluids for steam turbines, generators and control systems as well as to assist in the preparation of test methods for such fluids".

TC 10 is one of the oldest IEC Technical Committees, being set up in 1924 with the name "Transformer oils", obviously covering the only practical application of those years. In 1926 the title and the scope were extended to cover "Insulating oils". In 1961, the Chairmen of TC 10 and TC 15 made an agreement that all the problems concerning liquid and gaseous dielectrics would be dealt with by TC 10. This agreement established a permanent liaison between the two IEC committees TC 10 and TC 15. In 1964, it was decided that TC 10 would deal with insulating liquids other than oils and with insulating gases (e.g. askarels, silicone fluids, synthetic dielectrics, sulphur hexafluoride, etc.).

In 1966, three sub-committees were set up to study the different insulating fluids:
• SC 10A: Insulating hydrocarbon oils;
• SC 10B: Insulating liquids other than hydrocarbon oils;
• SC 10C: Insulating gases.

In 1980, the scope was extended to cover lubricants for turbines and control fluids and the title changed to "Fluids for electrotechnical applications". In 1987, the latest reorganisation of TC 10 took place, all the sub-committees were disbanded and all the work undertaken under the responsibility of the Secretary of TC 10.

TC 10 publications (about 50 documents between International Standards and Technical Reports) fall into the following 3 categories :
• Test methods
• Specifications
• Maintenance and use guides

B Business Environment

B.1 General

"Fluids for electrotechnical applications" cover a vast range of apparatus used in the electrical industry, whether in the manufacture of electrical equipment or in the generation, transmission and distribution of electricity. Such fluids range from insulating mineral oils for transformers and cables to synthetic insulating fluids such as polybutenes, aromatic hydrocarbons used in capacitors, silicone fluids, synthetic and natural organic esters and the polychlorobiphenyls which have been so much in the news. In some cases this insulating liquids may contain additives (chemicals) which may increase their performance but can introduce others environmental or health impacts.

Insulating gases, such as sulphur hexafluoride, increasingly used in circuit-breakers and metal-enclosed substations (GIS), have been the subject of a specification and a maintenance and use guide for some 25 years. For this gas it is possible that more stringent restriction will be introduced in the near future.

Finally, these fluids also include lubricants for steam turbines and synthetic fluids (triaryl phosphate esters) used for the control of turbines; specifications and use and maintenance guides are now available for such fluids.

Recently environmental issues have become more and more important globally, especially with regard to health impact, climate changes, natural resources protection, waste reductions, etc. The range of environmental issues has widened and includes whole life cycle of such "fluids for electrotechnical application" treated by TC10. As consequence of this awareness, regulations (local and international), company and product policies have been issued and this means that the TC10 Standards must pay attention to these aspects. Also the same Standards must keep under consideration the safety of the Operators (as in the case of electric and chemical Laboratories).

B.2 Market demand

The standards on electrotechnical fluids prepared by TC 10 – specifications, maintenance and use guides, interpretation guides, etc. – should serve as reference work for the equipment committees (TC 14 – Power transformers, TC 38 – Instrument transformers, TC 33 – Power capacitors, SC 36A – Insulated bushings, TC 17 – Switchgear and controlgear, etc.). IEC TC 10 is made up of experts having the necessary competence in the chemistry and physics of insulating material as well as in electricity. In fact, TC 10 maintains liaisons with the majority of these committees.

Thus, the standards issued by TC 10 are of interest for insulating fluids manufacturers, electrical equipment (transformers, rotating machines, circuit-breakers, switchgears, etc.) manufacturers, engineers in charge of plants operation and control, laboratories, etc.

However, it should be noted that IEC standards are not the only ones covering these fields of activity. At a regional level, American standards (IEEE, ASTM) are widely used as well in some other parts of the world. Attempts are being made by TC 10 to co-operate with these standardization bodies.

In the recent years, the Officers and Experts of IEC TC10 and ASTM D27 (TC for electrical insulating liquids and gases) have participated in each other’s meetings and exchanged on their main activities. Taking into account that - in general - ASTM D27 and IEC TC10 Standards cover the same subject, it is quite obvious to expect that the market demand is to have the same Standards in the different parts of the world.

Inside the IEEE, also some common activities (involving IEC TC10, ASTM D27, IEEE ICDL and CIGRE) have been positively proposed. This cultural dissemination may be very useful in strengthening the use of the Standards, also in the developing Countries and in those of the "New Economy".

B.3 Trends in technology

The constant increase in the power of electrical equipment combined with reductions in size and manufacturing costs means that insulating fluids must satisfy increasingly demanding performance requirements. The product specifications and the use and maintenance guides must be adapted to these requirements.

As also reported in the TC14 SBP, natural esters based insulating fluids started to be used commercially in North America for small transformers and application for larger power transformers is under development. Important applications are known to have been made especially in South America. A significant advantage of this fluid is that it is more environmentally friendly than mineral oil.

Also, more recent technologies allow now to design and to build-up advanced units - like special transformers and shunt reactors - operating at very high temperatures which requires the use of insulating liquids having much higher performances (as, in the present case, the "fire point").

The faster and larger diffusion of on-line and off-line monitoring systems and the needs to have more reliable diagnosis of the HV strategic equipment (which, in general, still use oil-paper insulating systems) require possible rapid standardization of simpler or different tests on the oils. Alternatively, advanced approach to the possible test interpretation on the insulating fluids could be introduced in the Standards to facilitate the use of these on-line and off-line technologies.

B.4 Market trends

New and "more stable" Editions Standards / Guidelines are required for unused mineral oils and for those in service taking also into account the more advanced crude refining process and the higher performance required to the insulating liquids. This effort must be made in very close contact with the Product Committees.

Standards for new insulating liquids, for new or advanced laboratory tests and for more precise diagnostic tools are required.

For the Lab's tests the market wishes ideally to see a contraction in the various and different methods that essentially measure the same things.

New materials, new testing and assessment technology and requirements for enhanced safety and environmental compatibility may also drive the need for revised and new Standards.

For the same reasons, already reported in the Section B.3, the market demand is focused in having a rapid validation with a successive possible standardization of the technology which may increase the reliability and the efficiency of the HV oil-paper insulated units in particular and the overall electrical system in general.

B.5 Ecological environment

The characteristics required for the fluids for electrotechnical applications may negatively influence the environment. Askarels (IEC 60588) are a typical example of such a drawback. Moreover, some of the test methods developed in the past established the use of chemicals which are now considered hazardous. To avoid all these problems, during the TC 10 meeting held in Brussels in 1996, WG 16 "Advisory Group on environmental and safety matters" was set up. This group revised all the standards issued by TC 10 following the principles established in IEC Guide 109 and made proposals to modify every part of the standards which were in contradiction with the ecological best practices. WG 16 report was unanimously approved during TC 10 meeting held in Geneva in 1998 and its proposals and its general inspiring principles were taken into account when preparing new standards or revising the standards concerned.

From now on, when establishing specifications for its Standards, TC 10 considers:
- the labelling of the products related to environmental and health risks;
- appropriate packaging;
- the priority need of recycling and/or regeneration at the end of life;
- the type of waste produced at the end of life and whether the waste can be reused or safely disposed off;
- hazardous emissions when burning (in co-operation with TC 89);
- the rejection of products found to be detrimental to the environment or to produce non-recyclable and/or intractable wastes.

When preparing or revising specifications, maintenance and use guides of products, particular attention will be paid to recommend means to avoid any form of use, production or diffusion of restricted or dangerous substances (including additives), production of pollution during the

operational life (including maintenance operations) or during sampling and transportation of samples for analysis. Also appropriate acceptable methods for the disposal of the insulating liquids, as they are when new, or used, or treated or at the end of life or wastes will be recommended (always in accordance with national or local regulations).

When developing or revising standards dealing with test methods, the use of chemicals known to be detrimental to the environment or presenting health risks for the humans and/or animals will be discouraged. Where substitution or removal of such chemicals is not possible, appropriate warnings and handling procedures will be recommended.

More in general, TC10 consider as of "high priority" all the matters related to the environmental preservation and protection.

C System approach aspects

Transformers and reactors are built not only using insulating liquids (covered by TC10) but also with other materials and technologies (covered by other Committees) which "all together" form a component and then, a part of a power system. They must also exist within the same environment and are subject to testing. Since these aspects are covered by different Committees, the risk is to treat separately each single parts of the "system", with also some possible negative overlapping or contradiction.

An important subject to be shared with other TCs is the standardization of the tests on the insulating liquids/fluids and their interpretation, which may permit to provide very important diagnostic information on the status and the reliability of the "global system", like one transformer, or a bushing or an oil-filled cable, etc..

Consequently the TC10 has believed as essential to establish clear and permanent liaisons with other TCs or other independent bodies operating in the same "system", as reported below:

Component TCs	**IEC/TC14**	Power Transformers
	IEC/TC15	Solid electrical insulating materials
	IEC/SC17A	High-Voltage switchgear and controlgear
	IEC/TC20	Electric cables
	IEC/TC36	Insulators
	IEC/TC38	Instrument transformers
System Committees	**ISO/TC28**	Petroleum products and lubricants
	IEC/TC65	Industrial-process measurement, control and automation
	IEC/TC89	Fire hazard testing
	IEC TC112	Evaluation and qualification of electrical insulating materials and systems
Other	**CIGRE/A2**	Transformers
	CIGRE/D1	Materials and Emerging Test Techniques
	IEC/TC111	Environmental standardization for electrical and electronic products and systems
Other	**ASTM/D27**	(Under development)
	IEEE/DEI Society	(Under development)

D Objectives and strategies (3 to 5 years)

The IEC TC10 key objectives with relative strategy are reported below:

- Maintaining the existing portfolio of Standards and other publications: The strategy already adopted by TC10 to reach this objective is based on the periodical check of the stability dates of each Standards handled by TC10.
- Time stability of the issued Standards: This is a very important objective, required by the market. The strategy adopted by the TC10 is a periodical discussion at each Plenary Meeting on the Standards to maintain or review, remembering the need of a balance of the advancement of the technologies and the impact on the market of any possible revision of each Standard.
- Evaluating of new technological needs: The expertise of the TC10 experts and the close relationship between TC10 and CIGRE and IEEE bodies has allowed and allows - with a recognized efficiency - to evaluate constantly the real need of the market and the development of new technologies.
- Harmonization with ASTM and IEEE Standards: These two standardization bodies have worked for several years quite independently, covering different geographical areas. Actually, it is a reciprocal and constant participation of the IEC (TC10) and ASTM (D27) Officers (and Experts) at their main meetings and activities. This effort is believed to give important results in a short period. The IEEE group (on liquid dielectrics) and the periodical Conferences (like ICDL) organized by the IEEE have greatly helped and still help in sharing the "state of art", thus allowing a greater harmonization between the Standards. This activity is considered as fundamental by the TC10.

  The first tentative to harmonize the IEC and ASTM Standards has been made in 2012-13 by TC10 Officers when revising the IEC TR 61294 "Insulating liquids - Determination of the partial discharges inception voltage (PDIV) - Test procedure". Nevertheless, this tentative failed for the relative low interest in the field and the small participation of Experts. In the nearest future this effort will be made again. To facilitate exchange of information among the Experts participating in IEC and/or ASTM activities, a Special Issue on "Dielectric Liquids" of the IEEE Transaction on Dielectrics and Electrical Insulation has been already scheduled for the second part of the 2015.
- Ensuring good customer/supplier relationship with IEC product TC/SCs: The issue of a "good" Standard is a warranty of a good relationship between Customers and Suppliers. This is the way that TC10 trusts to be followed.

E Action plan

TC10 action plan may summarized as follows:

- to continue to progress on all projects in development as quickly as time and resources allow to meet the forecast publication dates;
- to complete agreed maintenance and review schedules on time to ensure timely publication of any amendments and revisions;
- to monitor on a continuous basis all IEC procedural changes and integrate relevant changes into the TC10 workflow;
- to respond to all technical enquiries in a timely manner;
- to establish a plan for improving market relevance and provide it to the members prior to the next plenary meeting.

F Useful links to IEC web site

IEC TC 10 dashboard home page provides information on the Scope, Structure, Membership, Liaisons, Projects, Publications and Working Documents.

Name or signature of the Secretary

Massimo POMPILI, IEC TC10 Secretary