

International Trends in Superconductivity Standardization

IEA Technology Collaboration Programme on High-Temperature Superconductivity

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Abstract

The increasing deployment of high-temperature superconducting (HTS) technologies in the power sector is creating a growing need for internationally recognized standards to support integration, performance assessment, and market acceptance. Standardization is widely regarded as a key enabler for overcoming barriers to HTS commercialization, including system operation modes, reliability concerns, and stakeholder confidence.

This paper provides an overview of international trends in superconductivity standardization from the perspective of the IEA Technology Collaboration Programme on High-Temperature Superconductivity (HTS TCP). The roles of major organizations, including IEC, VAMAS, CIGRE, and IEEE, are reviewed, with particular focus on IEC Technical Committee 90 (TC90), which leads most international standardization activities in the field. The paper highlights how pre-standardization studies and Round Robin Tests have supported the development of measurement methods and technical requirements for superconducting materials, wires, and power devices.

We present an overview of the current international standards framework, including the IEC 61788 series and IEC 63075 for HTS power cables. Emerging topics such as MgB_2 conductors, quantum technologies, and future energy infrastructures are also discussed. The analysis confirms that a robust standardization framework is essential to accelerate the transition of superconducting technologies from demonstration projects to widespread deployment, supporting the objectives of the new 2026-2031 HTS TCP Strategic Plan.

Why Do Superconductors Need Standardization, and How is the HTS TCP Addressing It?

Superconductivity applications are increasing fast and their industrial applications are becoming increasingly relevant. Some Low Temperature Superconductors (LTS) applications concerned with medical environment have started being available on the market many years ago, but this is not the case with those technologies based on High Temperature Superconductors (HTS).

The International Energy Agency HTS Technology Collaboration Program[1] represents an international platform for sharing information about HTS applications with the aim of assessing the benefits of high-temperature superconducting applications for power grids and prompting their widespread diffusion in power systems. Its experts have long been analysing the challenges associated with the integration and the commercialization of those applications. The main barriers identified include the complexity of integrating HTS components into the grid due to the need for cryogenic systems, the high initial investment costs, and the lack of proven long-term reliability. While ongoing research and demonstration projects are expected to contribute significantly to addressing the latter two challenges, the development of dedicated standards is widely regarded as a key enabler for overcoming the integration-related barriers and increase acceptance throughout the market. We recognize that HTS cables are likely to be the most advanced in terms of Technology Readiness Level (TRL) among HTS applications (see the IEA HTS Application roadmap), but they have been considered not mature enough for several years due to the lack of proper standardization. The case of HTS cables is quite illustrative of the advancement state of HTS technologies: some of them have been advancing in last decades from the material stage to the device development, thus arriving in the so-called “death zone” before the real market breakthrough.

The HTS TCP has already recognized the importance of standardization for the adoption of HTS technologies in the power grid and of the relationship between the Committee and the Standardization Bodies.[2] In 2026, the HTS TCP decided to finalize and disseminate to a wide community an informative

[1] www.ieahts.org

[2] *Angeli, G., Marchionini, B. G., Yamada, Y., Ohsaki, H., & Martini, L., "Technology Collaboration Programme on High-Temperature Superconductivity (HTS): HTS Applications and the Need for International Standardization Activity", IEEE Transactions on Applied Superconductivity, Vol. 28, No. 4, June 2018, Article 5400604, pp. 1-4. DOI: 10.1109/TASC.2018.2793857*

document streaming the international trends in superconductivity standardization. The main goal is prompting the next steps toward the finalization of a consolidated standard apparatus.

Standardization Landscape

A huge world opens in front of us when we talk about standardization, so we must start with basic information that will define the general framework where discussion will be developed. Generally speaking, standards are not intended to fully specify an item, or to provide a thorough scientific-technical elaboration on a subject, but they're aimed at defining the minimum requirements in order to meet certain well-defined objectives (e.g., to guarantee a certain degree of interoperability or a minimum level of performance). The processes are inspired mainly by the six principles of the Technical Barriers to Trade (TBT) Committee of the Word Trade Organization (WTO): Transparency, Openness, Impartiality and consensus, Effectiveness and relevance, Coherence, and Development dimension. Standards are not compulsory, on the contrary, regulations are legally mandatory and they often are based on standards. The technical landscape is plenty of standardization organisms, generally referred to as SDOs (Standard Development Organizations), but just few of them are recognized by regulatory systems (e.g. European Commission) as providers of standards: those are known as "recognized SDOs". When it happens that legislation is based on any standard, that standard is called "de jure"; however, there are also standards generally accepted by market with an important practical impact, but not used as basis by regulations, that are called "de facto" standards.

Regulation (EU) No 1025/2012 of the European Parliament and of the Council designates CEN, CENELEC and ETSI as the European Standardization Organizations (ESOs). At worldwide level, where electrotechnical sector is concerned, the SDO of reference is the International Electrotechnical Commission-IEC (other recognized SDO are, e.g., ISO and ITU). Since the most relevant for the forthcoming discussion is IEC, it is worth defining one of its main organisms. The SMB (Standardization Management Board) is the body that is responsible for deciding which standardization activities should be pursued within the IEC. It typically meets twice a year and is composed of representatives from 15 countries, of which 7 hold permanent seats and 8 serve on a rotating basis. SMB is one of the most important bodies inside IEC, but it is not the only one. In Figure 1, a graphical representation of the IEC structure is shown.

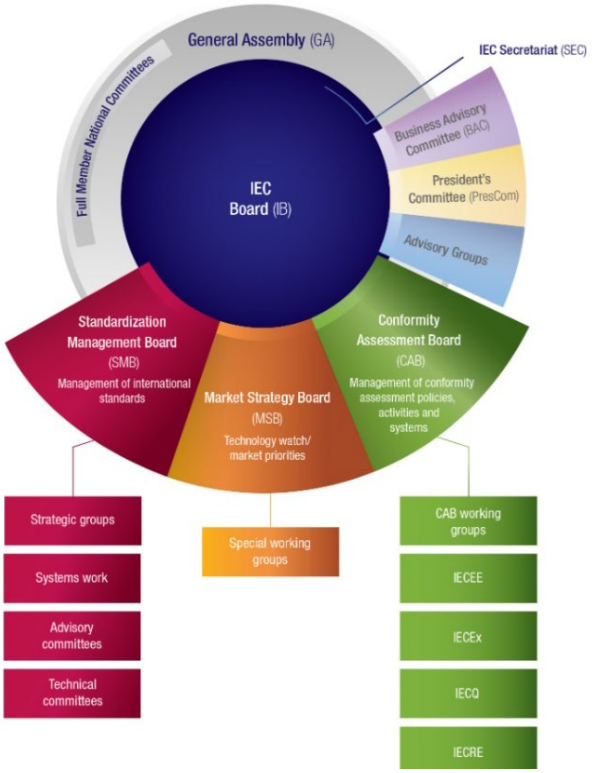


Figure 1. IEC internal organization[1]

Superconductors have been addressed by IEC for several years and in 1989 a dedicated Technical Committee (TC90) was completely dedicated to them. TC90 has been strongly benefiting from a wide range of pre-standardization studies, that are covered by two different liaisons: VAMAS and CIGRE.

VAMAS (Versailles Project on Advanced Materials and Standards) has been active since 1986 in pre-standardization studies mainly focused on materials and in 1989 it registered a liaison with the TC90, established exactly in the same year. The first step was the creation of TWA (Technical Working Area) 6 on Superconducting and Cryogenic Structural Materials, but in 1993 it was split into two part giving birth to the TWA (Technical Working Area) 16, that was completely dedicated to superconducting materials[3] because of the increased growth in technical activities resulting from the discovery of high temperature superconductivity in oxides. Nowadays the ongoing projects for TWA16 are:

[3] https://www.vamas.org/twa16/

- Measurement method for critical current of oxide superconductors under tensile load
- Critical current measurement in MgB2 superconductors
- Room Temperature Tensile Test for MgB2 superconductive wires
- Surface resistance measurement of superconducting thin films

CIGRE was established in 1921 with a particular focus on electrical systems and equipment issues. Traditionally three CIGRE Study Committees (SC) have been covering superconductivity arguments in some extents: A3, High voltage equipment; B2, Insulated cables; and D1, Materials and emerging test techniques. Usually, SCs establish WGs to study agreed items following a three-year program, whose main outcome is the publication of a Technical Brochure. In last decades, the technical brochures dedicated to superconductivity are the following:

- N 846 - Electrical insulation systems at cryogenic temperatures – 2021
- N 644 - Common characteristics and emerging test techniques for high temperature superconducting power equipment – 2015
- N 538 - Recommendations for testing of superconducting cables – 2013
- N 418 - Status of Development and Field Test Experience with High-Temperature Superconducting Power Systems - 2010
- N 229 - High Temperature Superconducting (HTS) cable systems – 2003
- N 199 - Superconducting cables. Impact on network and structure and control – 2002

One example of the liaison between TC90 and CIGRE is given by the experience of superconducting cables. Due to the increasing relevance continuously gained by superconducting cables prototypes, TC20 (the technical committee on conventional cables) and TC90 started talking in 2008 and they asked CIGRE to conduct a pre-standardization activity. As a result, CIGRE created the WG B1.31 whose main outcome was the CIGRE Technical Brochure N 538 - *Recommendations for testing of superconducting cables* (2013). On this basis in 2012 TC20 and TC90 created the joint project team 63075 to start a standardization activity on superconducting cables[4]. Looking at the outcomes of this first experience, it's worth noticing that they are still continuing nowadays, in fact the last Strategic Business Plan edited in 2024 explicitly states the liaison with TC20 to study superconducting cables and the new SMB, that will be finalized in occasion of the upcoming TC plenary meeting in October 2026, is likely to include again this topic.

As last note about liaisons, it is important to underline the establishment of the new Joint Technical Committee IEC/ISO JTC 3 on Quantum Technologies. It was approved in late 2025 (SMB/8694/SBP) and it confirms the relevance that quantum technology (e.g. Quantum Computing, Quantum Communications, Quantum Sensing and Imaging, Quantum Metrology, Quantum Cryptography and Post-quantum Cryptography) has been keeping on gaining in last years.

How does TC90 actually work

TC90 is divided into working groups that are specialized on measurement techniques of different superconducting properties; in case the standardization of a particular device is considered, TC90, as already seen above, tends to establish liaison with the relevant TC to establish a joint working group (SMB/7424/R, 31/08/2021). So far, a major part of standardization activities has been focused on measurement methods, but in last decade significant attention has been also devoted to devices. At present, 14 working groups cover the field of superconductivity and related properties: terminology, critical current of Nb-Ti, Nb3Sn, composite superconductors, residual resistivity ratio, copper ratio, mechanical

[4] *Martini, L., Angeli, G., Breschi, M., Chaud, X., Nishijima, G., Osamura, K., Shin, H. S., Zhang, Y., Koizumi, T., Iijima, Y., Fukushima, T., Nagaishi, T., & Kiss, T. (2018). "Standardization Activity on Superconducting Cables." IEEE Transactions on Applied Superconductivity, vol. 28, no. 4, June 2018, Art. no. 0601305. doi: 10.1109/TASC.2018.2809683.*

property, surface resistance and AC loss, temperature of bulk superconductors, ancillary systems for superconductors, superconducting wires general characteristics, superconducting electronic devices. Membership is composed by 9 Participating countries (P-members) and 18 Observer countries (O-members). P-members have the possibility to propose new standardization projects focused on topics of interest not yet covered by ongoing documents. A typical standardization process has an average duration of 3 years and it is composed of the steps reported in Figure 2.



Figure 2. Standardization process general layout and main steps (AI-generated)

Round Robin Tests (RRT)

Standardization in all scientific fields proceeds through the progressive consolidation of measurement methods that are reproduced and compared by different laboratories. Round Robin Tests (RRT) are the main concrete means through which this consolidation is made up and therefore they are the most important road that takes standardization from the experimental research field to the publication of an international standard. In TC 90 several RRTs have been organized over the years, and this paragraph will focus on three of them, in particular:

- Critical Current Measurement of RE-Ba-Cu-O Superconducting Tapes[5]
- International round robin test for tensile testing HTS wires at cryogenic temperatures[6]
- Critical Current of Superconducting Cable[7]

Standardization in superconductivity started from considering measurements methods. This is reflected in the development of RRT and in fact two out of three above-mentioned experiences are focused on HTS wires properties: the older one dated 2018 covers critical current measurement in ReBCO tapes, the second one date 2019 is focused on mechanical properties of HTS wires. It is worth stating that the RRT on mechanical properties at cryogenic temperatures was based on previous experience of the RRT on mechanical properties of HTS wires at room temperature[8]. The third RRT dated 2021 represents a change in this trend since it is focused on a whole device, in particular BSCCO based HTS cables and measurement of their critical current. Again, a measurement method, but focused on one of the applications that are most closed to the market breakthrough. The brief timeline of the idea behind this RRT is worthy of mention: on the wave of several superconducting cables demonstrator projects ongoing in the world, the CIGRE Working Group B1.31 published in 2013 the Technical Brochure “Recommendations for testing of superconducting cables” where critical current measurement was included in the set of suggested tests. Based on this pre-standardization activity, IEC published the international standard on HTS-AC

[5] *Nishijima, G., Osamura, K., Nagaishi, T., Fukushima, T., Iijima, Y., Koizumi, T., Zhang, Y., Breschi, M., Chaud, X., Shin, H.-S., & Kiss, T. (2018). International Round Robin Test for Critical Current Measurement of RE-Ba-Cu-O Superconducting Tapes. IEEE Transactions on Applied Superconductivity, 28(4), 1-5. https://doi.org/10.1109/TASC.2018.2801329.*

[6] *Bagrets, N., Anvar, V. A., Chiesa, L., Delgado, M. A., McRae, D. M., Nijhuis, A., Nishijima, G., Osamura, K., Shin, H. S., Walsh, R. P., Weiss, K.-P., Zhang, Y., Zhao, Y., & Zhao, Z. (2019). International round robin test for tensile testing HTS wires at cryogenic temperatures. Superconductor Science and Technology, 32(2), 024005. https://doi.org/10.1088/1361-6668/aaf619.*

[7] *Osamura, K., Nishijima, G., Chaud, X., Breschi, M., Shin, H.-S., Zhang, Y., Nagaishi, T., Koizumi, T., Iijima, Y., Fukushima, T., & Kiss, T. (2021). Round Robin Test of Critical Current of Superconducting Cable. IEEE Transactions on Applied Superconductivity, 31(5), Article 9500205. https://doi.org/10.1109/TASC.2021.3052188.*

[8] *Osamura, K., Shin, H.-S., Weiss, K.-P., Nyilas, A., Nijhuis, A., Yamamoto, K., Machiya, S., & Nishijima, G. (2014). International round robin test for mechanical properties of REBCO superconductive tapes at room temperature. Superconductor Science and Technology, 27(8), 085009. https://doi.org/10.1088/0953-2048/27/8/085009.*

power cables and their accessories (test methods and requirements) in 2018 stating that also the test measurement of DC critical current was recommended[8]. The Japanese technical committee started to address the critical current measurement in HTS cables in 2018 focusing on BSCCO-based cables and sharing two two-meter-long samples among three different institutions. In the measurement protocol, also the exponent *n* was included in measurement results. In Table 1, a summary of the three RRTs is reported.

Table 1. Comparisons among the three considered RRTs

Round Robin Test	N. test samples	N. involved laboratories	General framework
Ic ReBCO tapes	4 for each laboratory	10 laboratories from 5 countries	VAMAS TWA16
Tensile strength ReBCO tapes	6 (5 REBCO + 1 BSCCO)	8 laboratories from 5 countries	VAMAS TWA16
Ic BSCCO cables	2 (2 meter long each)	3 laboratories from Japan	IEC TC90

In the time when authors are writing this paper, further RRT experiences are on their way to being submitted to the TC90 for approval. The main idea is that new materials are becoming important for power applications, such as MgB_2. Being the critical temperature around 39 K, it belongs neither to HTS nor to LTS, but it is very cheap if compared with other superconductors. It may be kept cooled by means of liquid hydrogen and this opens the way to hybrid applications in which electrical and chemical energy may be transported at the same time: this is the case of MgB_2-based cables, that could be able to transport electric energy through the superconducting wires and at the same time chemical energy through the liquid hydrogen flowing inside the cryostat to cool the superconductor. Hence, there is the need to also cover MgB_2 with a proper standardization apparatus, as already done with LTS superconductors (NbTi, Nb_3Sn) and in part also with HTS (ReBCO, BSCCO). As already mentioned, the first step is addressing the measurement of main properties, for this reason two New Work Item Proposals are in preparation with the aim to be presented during the TC90 Plenary Session scheduled in October 2026: the first focused on MgB_2 Ic measurement, the second on MgB_2 AC losses measurement by the direct electric method.

International Standards.

Once given a general outlook of what the standardization activity means, it is straightforward to wonder what the final results of such an activity are. Looking at the actual status of TC90, we find that the standardization series dedicated to superconductivity is the 61788, which is composed of 27 international standards. In Table 2, the list of the 27 international standards on superconductivity is reported. As already anticipated, the major part is focused on properties measurements and only 4 out of 27 may be considered product standards: IEC 61788-14: 2010 (Superconducting power devices - General requirements for characteristic tests of current leads designed for powering superconducting devices), IEC TR 61788-20:2014 (Superconducting wires - Categories of practical superconducting wires - General characteristics and guidance), IEC 61788-21:2015 (Superconductivity - Part 21: Superconducting wires - Test methods for practical superconducting wires - General characteristics and guidance), IEC 61788-22-1:2017 (Superconducting electronic devices - Generic specification for sensors and detectors).

Table 1. Summary of the international standards actually ongoing on superconductivity

Reference	Title
IEC 61788-1:2006	Superconductivity - Part 1: Critical current measurement - DC critical current of Nb-Ti composite superconductors
IEC 61788-2:2006	Superconductivity - Part 2: Critical current measurement - DC critical current of Nb_3Sn composite superconductors
IEC 61788-3:2006	Superconductivity - Part 3: Critical current measurement - DC critical current of Ag- and/or Ag alloy-sheathed Bi-2212 and Bi-2223 oxide superconductors
IEC 61788-4:2020	Superconductivity - Part 4: Residual resistance ratio measurement - Residual resistance ratio of Nb-Ti and Nb_3Sn composite superconductors

IEC 61788-5:2013	Superconductivity - Part 5: Matrix to superconductor volume ratio measurement - Copper to superconductor volume ratio of Cu/Nb-Ti composite superconducting wires
IEC 61788-6:2011	Superconductivity - Part 6: Mechanical properties measurement - Room temperature tensile test of Cu/Nb-Ti composite superconductors
IEC 61788-7:2020	Superconductivity - Part 7: Electronic characteristic measurements - Surface resistance of high-temperature superconductors at microwave frequencies
IEC 61788-8:2010	Superconductivity - Part 8: AC loss measurements - Total AC loss measurement of round superconducting wires exposed to a transverse alternating magnetic field at liquid helium temperature by a pickup coil method
IEC 61788-9:2005	Superconductivity - Part 9: Measurements for bulk high temperature superconductors - Trapped flux density of large grain oxide superconductors
IEC 61788-10:2006	Superconductivity - Part 10: Critical temperature measurement - Critical temperature of composite superconductors by a resistance method
IEC 61788-12:2013	Superconductivity - Part 12: Matrix to superconductor volume ratio measurement - Copper to non-copper volume ratio of Nb_3Sn composite superconducting wires
IEC 61788-13:2012	Superconductivity - Part 13: AC loss measurements - Magnetometer methods for hysteresis loss in superconducting multifilamentary composites
IEC 61788-14:2010	Superconductivity - Part 14: Superconducting power devices - General requirements for characteristic tests of current leads designed for powering superconducting devices
IEC 61788-15:2026	Superconductivity - Part 15: Electronic characteristic measurements - Intrinsic surface impedance of superconductor films at microwave frequencies
IEC 61788-16:2013	Superconductivity - Part 16: Electronic characteristic measurements - Power-dependent surface resistance of superconductors at microwave frequencies
IEC 61788-17:2021	Superconductivity - Part 17: Electronic characteristic measurements - Local critical current density and its distribution in large-area superconducting films
IEC 61788-18:2013	Superconductivity - Part 18: Mechanical properties measurement - Room temperature tensile test of Ag- and/or Ag alloy-sheathed Bi-2223 and Bi-2212 composite superconductors
IEC 61788-19:2013	Superconductivity - Part 19: Mechanical properties measurement - Room temperature tensile test of reacted Nb_3Sn composite superconductors
IEC TR 61788-20:2014	Superconductivity - Part 20: Superconducting wires - Categories of practical superconducting wires - General characteristics and guidance
IEC 61788-21:2015	Superconductivity - Part 21: Superconducting wires - Test methods for practical superconducting wires - General characteristics and guidance
IEC 61788-22-1:2017	Superconductivity - Part 22-1: Superconducting electronic devices - Generic specification for sensors and detectors
IEC 61788-22-2:2021	Superconductivity - Part 22-2: Normal state resistance and critical current measurement - High-Tc Josephson junction
IEC 61788-22-3:2022	Superconductivity - Part 22-3: Superconducting strip photon detector - Dark count rate
IEC 61788-23:2024	Superconductivity - Part 23: Residual resistance ratio measurement - Residual resistance ratio of cavity-grade Nb superconductors
IEC 61788-24:2018	Superconductivity - Part 24: Critical current measurement - Retained critical current after double bending at room temperature of Ag-sheathed Bi-2223 superconducting wires
IEC 61788-25:2018	Superconductivity - Part 25: Mechanical properties measurement - Room temperature tensile test on REBCO wires
IEC 61788-26:2020	Superconductivity - Part 26: Critical current measurement - DC critical current of RE-Ba-Cu-O composite superconductors
IEC 61788-27:2025	Superconductivity - Part 27: Twist pitch measurement of practical superconducting wires - Twist pitch measurement of Nb-Ti/Cu and Nb-Sn/Cu composite superconductors

Looking at the near future, we cannot ignore that superconductivity is explicitly mentioned in the work of the Standardization Evaluation Group 14 (SEG 14) on quantum technologies launched by the IEC SMB[9] in early 2023. SEG 14 was charged with investigating needs for standardization in quantum technologies, evaluating technical capabilities and applications, investigating current research and technology activities, considering also superconductors as an enabling technology for quantum computing. Based on SEG14 recommendations, the IEC/ISO JTC 3 on Quantum Technologies (already mentioned in Standardization Landscape section) was created, therefore the concrete possibility exists that in the next future a new international standard on quantum electronics may include a part dedicated to superconductivity.

Looking outside the 61788 series, one very relevant initiative is represented by IEC 63075:2019 (Superconducting AC power cables and their accessories for rated voltages from 6 kV to 500 kV - Test methods and requirements). It is the results of the joint activity between TC20 and TC90 carried-out by the PT 63075 (already mentioned in Standardization Landscape section) and its goal is specifying test methods and requirements for high-temperature superconducting AC power cable systems and their accessories for fixed installations and for rated voltages from 6 kV up to and including 500 kV.[10] An addition to the IEC 63075:2019 that could be considered are specifications of operation modes under faults in the accessory systems, such full cable current with loss of cooling, loss of vacuum or loss of control system, and the appropriate actions to bring the cable in a safe idling mode awaiting restart or repair. Procedures for testing these functionalities can be added to IEC 63075:2019, as well as methods for estimating the impact of such fault conditions on the further operation of the cable. These accessory systems are not present for normal power cables, so their fault condition should be analyzed to ensure a target availability of the superconducting cable.

Another accessory, a cooling system, will require a described type test. There needs to be operation and restart schematics for any faults. For example, there needs to be testing of the insulation of a conventional insulation system for those HTS cables with a cold dielectric. This might need to be specified in some categories after how critical the impregnation of the insulation material is for the cable system. There are a major difference in how HTS cables are HV tested compared to what the industry are expecting, and this should also be addressed in future work.

If we investigate outside the IEC framework, it is easy to find the document IEEE C37.302-2015 (Guide for Fault Current Limiter (FCL) Testing of FCLs Rated above 1000 V AC). It is not a real standardization document, but a guide for testing SFCL devices prepared by the IEEE working group on switchgears, that was approved in December 2015 and published in May 2016. We note in this case that the date of publication is coherent with the years in which on one hand Superconducting Fault Current Limiter (SFCL) devices were being tested in several projects worldwide, on the other hand no specific rule for testing them. The guide doesn't focus only on SFCL, but they are an important part of the document. It is interesting to underline that the case of SFCLs followed the opposite way respect to the classical IEC standards, that is usually made of the following steps: RRT, measurement method fixed, measurement standard published, possibly product standard finalized. On the contrary, SFCLs seemed to arrive at the prototype development before a standardization apparatus was at least drafted, therefore the need of a common technical guide became urgent very soon. The follow-up was different comparing SFCLs to cables, in fact the document IEC 63075:2019 is still now the main reference when superconducting cables are to be tested and for example it was used to test the Superlink Project superconducting cables[11], whereas the guide IEEE C37.302-2015[12] has been inactivated since March 2026. Inactivation doesn't mean that it cannot be used anymore, but the working group is not going to update it anymore and to the author's knowledge it is not clear yet if a new document will supersede it in the next future.

[9] https://qpf.org/iec-seg14-quantum-technologies/
[10] https://webstore.iec.ch/en/publication/32012
[11] *Holte, O., Thidemann, C., Pitzer, M., Kunert, J., Kozaris, B., & Willén, D. (2026). Qualification Testing of the 110 kV SuperLink to IEC 63075. IEEE Transactions on Applied Superconductivity, vol. 36, no. 5, August 2026, Art. no. 5401404, pp. 1-4. IEEE. https://doi.org/10.1109/TASC.2026.3673229.*
[12] https://standards.ieee.org/ieee/C37.302/4922/

Conclusions

This paper aims to provide a general outlook about the standardization activity in the superconductivity sector. The first step was discussing why standardization is important for superconductivity and what need it is supposed to meet; after that some information about the standardization landscape was summarized. The paper proceeds in line with the typical steps characterizing the standardization process: after having exposed how TC90 works, the pre-standardization activity was considered both in CIGRE and in VAMAS; pre-standardization is typically characterized by the organization of Round Robin Tests and three of them were compared to give an idea of their main characteristics; international standards were then considered and the list of standards nowadays in course of validity was provided and some interesting tips were pointed-out. Finally, attention was drawn outside IEC and a comparison between the case of cables and SFCL was made.

The HTS TCP is facing a new five-year term (2026-2031). The new Strategic Plan is centred on the present transition from technology components to integrated systems, moving from individual HTS devices toward complete system solution, focusing on demonstrators designed to solve specific grid challenges, evaluating HTS as an enabling technology for future energy infrastructures. In the following the main strategic themes of this Plan are presented:

- Update State-of-the-Art on HTS application in the power grids: a flagship document will build on the previous HTS Readiness Maps[13] with the aim of serving as a foundational reference for the sector.
- Sustainability as a core focus: a major innovation of the new strategic period is the emphasis on the three pillars of sustainability (Environmental, Economic and Social) that will be investigated.
- Understanding stakeholders' needs: gathering the perspectives of the main stakeholders (Transmission and Distribution System Operators, utilities, manufacturers, policymakers, potential investors)
- Best practices and knowledge-sharing: given the rapid increase in HTS demonstration projects worldwide, the HTS TCP intends to collect and disseminate lessons learned on topics such as cryogenic systems, HTS cable economics, design, installation, and operational and maintenance practices in relation to a target design lifetime, and data centre applications.
- Monitoring emerging application areas: beyond traditional power-grid applications, the HTS TCP will closely follow developments in data centres, fusion energy, quantum computing, MRI and advanced magnet systems, hydrogen-energy infrastructures. These sectors are expected to drive manufacturing scale, reduce costs, and accelerate the diffusion of HTS technologies into the power sector.
- Standardization and Market Readiness: the HTS TCP recognizes that standards are crucial for commercialization and will continue to monitor IEC and CIGRE activities, identify gaps in current standards, support the development of technical frameworks suitable for superconducting technologies operating under cryogenic conditions.

[13] *chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://ieahts.org/downloads/Industrial-HTS-readiness-map-FINAL-Draft-12.12.23.pdf*

Join the IEA HTS TCP

As reported in IEA's website[14], "*The Technology Collaboration Programme (TCP) is a unique global network that drives cutting-edge energy technology research through international cooperation. By bringing together governments, industries, and leading experts, the TCP accelerates energy innovation and helps shape the future of energy solutions to support global energy security and economic growth*." The Contracting Parties to these Programmes are countries represented by designated experts. To broaden its expertise and enhance the effectiveness of its work, the HTS TCP welcomes new partners. Visit the HTS TCP website to check whether your country is already involved[15] and to learn how you can become part of this international expert community[16].

[14] *https://www.iea.org/programmes/technology-collaboration-programme*
[15] *https://ieahts.org/about-us/contact-info/*
[16] *https://ieahts.org/about-us/strategic-direction/*