



IEC/TC OR SC: <b>TC 112</b>	SECRETARIAT: <b>DE</b>	DATE: <b>2021-11</b>
--------------------------------	---------------------------	-------------------------

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

Are there any new or emerging trends in technology that will impact the scope and work activities of the TC? Please describe briefly.

Do you need to update your scope to reflect new and emerging technologies? If yes, will these changes impact another TC's scope or work activities?

If yes, describe how these will impact another TC(s) and list the TC(s) it would impact

**Title:** Evaluation and qualification of electrical insulating materials and systems

**Scope:** To prepare International Standards covering methods of evaluation and qualification for electrical and electronic insulating materials, and electrical insulation systems. Horizontal Safety Function: Test methods for resistance to tracking.

**NOTE:** An electrical insulating material has negligibly low electric conductivity, used to separate conducting parts at different electrical potentials. An electrical insulating system is an insulating structure containing one or more electrical insulating materials together with associated conducting parts employed in an electrotechnical device.

### B. MANAGEMENT STRUCTURE OF THE TC

Describe the management structure of the TC (use of an organizational chart is acceptable) (should be integrated by CO automatically) and, if relevant (for example an unusual structure is used), provide the rationale as to why this structure is used.

Note: Check if the information on the IEC website is complete.

When was the last time the TC reviewed its management structure? Describe any changes made. When does the TC intend to review its current management structure? In the future, will the TC change the current structure, for example due to new and emerging technologies, product withdrawal, change in regulations etc. Please describe.

Make sure the overview includes:

- any joint working groups with other committees,
- any special groups like advisory groups, editing groups, etc.

Current Management Structure of TC 112 with working groups, excluding project teams or maintenance teams:

**TC 112**  
 Chair: Johan Smit, NL  
 Secretary: Bernd Komanschek, DE

**AG 11  
 Advisory Group**  
 Convenor: Johan Smit, NL  
 Convenor: Bernd Komanschek, DE

**WG 1  
 Thermal Endurance**  
 Convenor:  
 Roger Wicks, US

**WG 2  
 Radiation**  
 Convenor:  
 David Rouison, CA

**WG 3  
 Electric Strength**  
 Convenor:  
 Stefan Kornhuber, DE

**WG 4  
 Dielectric / Resistive  
 Properties**  
 Convenor:  
 Hansgeorg Haupt, DE

**WG 5  
 Tracking**  
 Convenor:  
 Bernd Komanschek, DE

**WG 6  
 General methods of  
 evaluation of electrical  
 insulation systems**  
 Convenor:  
 Ed van Vooren, US

**WG 7  
 Statistics**  
 Convenor:  
 Howard Sedding, CA

**WG 8  
 Various Material  
 Properties**  
 Convenor:  
 Yasuhiro Tanaka, JP

Current TC 112 projects:

WG	Project IEC	Short description
1	60216-5	Determination of relative thermal endurance index (RTI) of an insulating material
1	60216-6	Determination of thermal endurance indices (TI and RTI) of an insulating material using the fixed time frame method
1	TS 60216-7-1	Accelerated determination of relative thermal endurance using analytical test methods (RTEA) - Instructions for calculations based on activation energy
1	TR 60216-7-2	Results of the round robin tests to validate procedures of IEC TS 60216-7-1 by non-isothermal kinetic analysis of thermogravimetric data
2	60544-5	Procedures for assessment of ageing in service
3	60243-2	Additional requirements for tests using direct voltage
3	TS 61934	Electrical measurement of partial discharges (PD) under short rise time and repetitive voltage impulses
4	62631-1	Dielectric and resistive properties of solid insulating materials - Part 1: General
4	62631-2-1	Relative permittivity and dissipation factor - Technical Frequencies (0,1 Hz - 10 MHz) - AC Methods
4	62631-2-2	Relative permittivity and dielectric dissipation factor – High frequencies (1 MHz to 300 MHz) - AC Methods
4	62631-3-1	Volume resistance and volume resistivity - General method
4	62631-3-2	Surface resistance and surface resistivity
4	62631-3-12	Determination of resistive properties (DC Methods) – Volume resistance and volume resistivity, method for casting resins

5	60587	Test methods for evaluating resistance to tracking and erosion
5	TR 62039	Selection guide for polymeric materials for outdoor use under HV stress
6	61857-33	Multifactor evaluation with increased factors at elevated temperature
6	61857-41	Specific requirements for electrical insulation systems for use in dry-type high-voltage transformers with operating voltages of 1kV and above
6	61857-42	Specific requirements for evaluation of an EIS used for road transportation applications
6	63177	Test method for compatibility of construction materials with electrical insulating liquids

Note: The information on the IEC website is complete with up-to-date projects.

The TC 112 last reviewed its management structure in October 2020 and the following changes were implemented since then. The convenor of WG 2 and WG 7 Mr. Hisaaki Kudoh retired and was replaced by Mr. David Rouison for WG 2 and Mr. Howard Sedding for WG 7. The Chair Johan Smit stepped down as convenor of WG 6 and was replaced by Mr. Ed van Vooren. The review of the management structure performed in October 2020 can be found in the revised TC 112 GWP.

It is not foreseen that the TC 112 will have any major changes in its current structure due to new and emerging technologies, product withdrawals or changes in regulations.

#### C. BUSINESS ENVIRONMENT

Provide the rationale for the market relevance of the future standards being produced in the TC.

If readily available, provide an indication of global or regional sales of products or services related to the TC/SC work and state the source of the data.

Specify if standards will be significantly effective for assessing regulatory compliance.

Methods of Test for Electrical Insulating Materials (EIM) and Electrical Insulation Systems (EIS) covers testing of thermal endurance, electrical strength, radiation, resistance to tracking, dielectric and resistive properties, evaluation of electrical insulation systems, space charge measurements, partial discharge measurements. The whole range of materials and combinations with electric conductors (electrical insulation systems) starting from glass and ceramic, sleeving and press boards, films and laminates, mica products and tapes, and ending up with varnishes and resins are concerned. Insulating materials and systems are used in the field of electrical power generation, transmission and distribution, in electrical motors and transformers, in all kind of electrical and electronic appliances and electrical equipment. Appropriate selection and methods of use of insulating materials enhance the reliability and safety of electrical equipment.

Electrical insulation systems are generally the limiting component in establishing service life. This service life is a critical performance parameter for users in determining the economic viability of equipment. TC 112 is developing the tools to make these EIS evaluations and cooperates with product TCs to assure the EIS qualification procedures are of relevance to specific products.

#### D. MARKET DEMAND

Provide a list of likely customers of the standards (suppliers, specifiers, testing bodies, regulators, installers, other TC/SC's etc.). Do not specify company names, only categories of customers.

Equipment TCs, manufacturers, and testing laboratories are using TC 112's standards to evaluate electrical insulation materials and systems to assure acceptable service life of existing and new/modified EIS, in new environments and when subjected to new or multifactor stresses. The demand for these evaluations comes from the ultimate users who consider service life an essential parameter when purchasing new equipment. It is essential to the user that EIS be evaluated using the same basic test procedure for all products. System tests are essential e.g. in the case of high value products or for life evaluation. These tests are usually performed using models of the whole

product or models of part of the product. In some cases, parts of the product may be used as a model. Electrical Insulation systems are elements of according products.

A relatively small number of manufacturers, the most important of which are multinationals, produce basic electrical insulating materials which are sold through local and regional distributors and fabricators. The materials and user technologies are well-established and globally similar. The market for these insulating materials exceeds 10 billion US\$ per year. Innovation is driven by manufacturers' efforts to better serve specific market segments. Standards of TC 112 are widely used all over the world. For example, test methods for thermal classification and resistance to tracking, especially for determining the thermal ratings of both materials and systems and comparative tracking resistance of materials respectively, are some of the most important tools for determining the suitability of electrical insulating systems and materials and thus some of the most important design criteria. Customers of TC 112 reside in all parts of the product life cycle, being insulating materials manufacturers, equipment manufacturers and specification, testing and user institutions.

#### E. SUSTAINABLE DEVELOPMENT GOALS

INDICATE THE SUSTAINABLE DEVELOPMENT GOALS (SDGs) THAT ARE ADDRESSED BY WORK WITHIN THE TC/SC. INDICATE EACH SDG INDICATOR AFFECTED (REFERENCE SPREADSHEET AVAILABLE AT <https://www.iec.ch/SDG/>), AND PROVIDE SPECIFIC INFORMATION ABOUT HOW THE TC/SC IS ADDRESSING THE SDG. CONSIDER BOTH DIRECT AND INDIRECT IMPACTS OF THE WORK OF THE TC/SC.

- |  |  |
|--|--|
| <input type="checkbox"/> <b>GOAL 1:</b> No Poverty                                       | <input type="checkbox"/> <b>GOAL 10:</b> Reduced Inequality                              |
| <input type="checkbox"/> <b>GOAL 2:</b> Zero Hunger                                      | <input checked="" type="checkbox"/> <b>GOAL 11:</b> Sustainable Cities and Communities   |
| <input type="checkbox"/> <b>GOAL 3:</b> Good Health and Well-being                       | <input checked="" type="checkbox"/> <b>GOAL 12:</b> Responsible Consumption & Production |
| <input type="checkbox"/> <b>GOAL 4:</b> Quality Education                                | <input type="checkbox"/> <b>GOAL 13:</b> Climate Action                                  |
| <input type="checkbox"/> <b>GOAL 5:</b> Gender Equality                                  | <input type="checkbox"/> <b>GOAL 14:</b> Life Below Water                                |
| <input type="checkbox"/> <b>GOAL 6:</b> Clean Water and Sanitation                       | <input type="checkbox"/> <b>GOAL 15:</b> Life on Land                                    |
| <input checked="" type="checkbox"/> <b>GOAL 7:</b> Affordable and Clean Energy           | <input type="checkbox"/> <b>GOAL 16:</b> Peace, Justice Strong Institutions              |
| <input type="checkbox"/> <b>GOAL 8:</b> Decent Work & Economic Growth                    | <input type="checkbox"/> <b>GOAL 17:</b> Partnerships to achieve the Goals               |
| <input checked="" type="checkbox"/> <b>GOAL 9:</b> Industry, Innovation & Infrastructure |  |

The standards developed by TC 112 are being used by industry in order to build the new power supply infrastructures (Goal 9) which are required to produce and transmit clean energy, like Solar and Wind (Goal 7) and to build sustainable communities (Goal 11) using safe electrical insulating materials and systems in products like transformers and cable accessories. The high quality demanded by our standards support the responsible production of products, ensuring a long lifetime and therefore a responsible consumption of raw materials (Goal 12).

#### F. TRENDS IN TECHNOLOGY AND IN THE MARKET

If any, indicate the current or expected trends in the technology or in the market covered by the products of your TC/SC.

Evaluation procedures of TC 112 are generic in nature and aren't easily affected by soft changes, so apart from maintenance a major part of the work in clause B resides. In particular the EIS concept serves the industry to evaluate if new substitutes, processing, or something new could influence product life. However, breakthroughs in material technology or by smarter systems will cause necessity to extend our specific publications to align with brand new concepts, conditions or legislation (e.g. compact design, cryogenic condition, banned materials). Major technological trends that potentially have an important impact on TC 112's work are:

- **New material/polymer formulations** which enter the market for electrical insulation systems call for fast screening methods to categorize fitness for use and compatibility testing.
- **New technology for nano-structured dielectrics** with exceptional thermal and electrical properties due to interfacial characteristics, which have to be tested.
- **High-temperature superconductor technology** applicable to power and medical industry requiring suitable **cryogenic electrical insulation systems** to be verified.
- **Development of biodegradable insulation fluids** replacing mineral oils currently used in liquid impregnated insulation systems e.g. in HV transformer and cables.

- **Replacement of SF<sub>6</sub>** in medium and high voltage gas insulated switch gear banned by upcoming legislation; alternative gas insulation systems lack long term performance evaluation.
- **Development of high-performance materials, e.g. fibre reinforced polymers, natural esters**, requiring tests at elevated thermal, mechanical, electrical or chemical stresses.
- **Harsh operational work environments, in particular off-shore or corrosion conditions**, for which multifactor tests need further development.
- **Intermittent renewable power generation and consumption** causing varying thermal loads and overloads of the EIS.
- **Hidden factors of influence, e.g.** power electronics or switching operations potentially causing transients accelerating EIS degradation.
- **Introduction of DC equipment over all voltage ranges** from low voltage appliances (batteries, photovoltaics) to long distance underground/submarine cabling, overhead lines and VSC technology up to ultra-high voltages, at all levels requiring verified DC insulation systems and DC PD phenomena.
- **Measurement procedures for DC related properties** such as conductivity, space charge formation and electrical breakdown strength under multifactor stresses (TEMA).
- **Electrification of the transportation industry** requiring adaptation of test methods for thermal/electrical endurance over exposure times appropriate to the automotive work environment.
- **Future industry trend to monitor product condition from fabrication to lifelong service**, with sensor technologies and property statistics kept within requirements, to be defined.
- **Advanced diagnostic techniques** becoming part of EIS test procedures, e.g. modern partial discharge detection methods in time and phase domains with pattern recognition.
- **Trend towards more circularity**, leading to other choices of combinations of materials and (eco)designs (e.g. transformers). Compatibility test requirements in case recycled materials are used in new products ask for attention.
- **Increasing sustainability, environmental concerns and carbon-footprint legislation** bringing about EIS changes of which minor and major status of modifications impacts need to be qualified.

#### G. SYSTEMS APPROACH ASPECTS (SEE DIRECTIVES PART 1 ANNEX SP)

Does your TC/SC have a need for a systems approach?

If so:

- Will the Systems work be in a single TC or in multiple TCs?
- Will a Standardization Evaluation Group (SEG), Systems Committee (SyC), or Systems Resource Group be required?
- Is your TC/SC work of relevance to ISO?
- Is or are there fora or consortia working in parallel to IEC? Is there a chance to integrate this work in your TC/SC?

This should not only be restricted to the customer/supplier relationships with other TC/SCs indicating types of co-operation (e.g. liaisons, joint working groups) but be of a more generic nature.

An EIS is an integrated part of a product or system, therefore its testing is not an evaluation of the total product. The latter remains subject to the responsible product TC. With the EIS-concept as building blocks of any electrical equipment, TC 112 fulfils in general a role to assure insulation reliability and safety in the given operating environment of a product. In that regard TC 112 has a horizontal function to support product committees as supplier of generic and applied standards. As shown in the table below, TC 112 operates as supplier and as customer to specialized or basic

TC's, thereby liaising with other organizations. TC 112 is also monitoring the system committees SyC on LVDC and the advisory committee ACEA on environmental aspects.

TC 112 relationships:

Component committees (IEC TC 112 - role of a customer)	IEC TC 10	Fluids for Electrotechnical Application
	IEC TC 15	Solid electrical insulating materials
	IEC TC 23	Electrical accessories
	IEC TC 55	Winding wires
	IEC TC 89	Fire hazard testing
	IEC TC 101	Electrostatics
Other system committees (IEC TC 112 - the role of a supplier)	IEC TC 2	Rotating machinery
	IEC TC 14	Power Transformers
	IEC SC 17A	High-voltage switchgear and controlgear
	IEC TC 36	Insulators
	IEC SC 45A	Instrumentation, control and electrical power systems of nuclear facilities
	IEC TC 96	Transformers, Reactors, Power Supply Units and combinations thereof
	IEC SC 121A	Low-voltage switchgear and controlgear
Other committees	IEC TC 42	High-Voltage and high-current testing techniques
	IEC TC 109	Insulation coordination for low voltage equipment
	CIGRE SC D1	Materials and emerging test techniques
	ISO TC 22 SC 32	Road vehicles - Electrical and electronic components and general system aspects
	ISO TC 61 SC 2	Plastics - Mechanical properties

#### H. CONFORMITY ASSESSMENT

With reference to Clause 33 of Part 2 of the ISO/IEC directives, are all your publications in line with the requirements related to conformity assessment aspects?

Will the TC/SC publications be used for IEC Conformity Assessment Systems (IECEE, IECEx, IECQ, IECRE)?

Will any of your standards include test specifications, reproducible test requirements, and test methods?

Are there likely to be special conformity assessment requirements generated by any standards projects? If yes, list which projects.

All of TC 112 publications are in line with the requirements related to conformity assessment aspects and suitable to be used for IEC Conformity Assessment Systems. TC 112 standards include test specifications, reproducible test requirements and test methods, which also cover basic safety aspects as well as providing guidance on test methods. IEC 60112 also follows the IEC GUIDE 104:2019 'The preparation of safety publications and the use of basic safety publications and group safety publications.

**I. 3-5 YEAR PROJECTED STRATEGIC OBJECTIVES, ACTIONS, TARGET DATES**

STRATEGIC OBJECTIVES 3-5 YEARS	ACTIONS TO SUPPORT THE STRATEGIC OBJECTIVES	TARGET DATE(S) TO COMPLETE THE ACTIONS
Future IEC 61857-42: Electrical insulation systems - Procedures for thermal evaluation - Part 42: Specific requirements for evaluation of an electrical insulation system (EIS) used for road transportation applications	Strategic direction on Electric Insulation Systems (EIS) for Electric Vehicles (EV), supported by WG 6.	Expected 2023
Future IEC 62631-3-12: Dielectric and resistive properties of solid insulating materials – Determination of resistive properties (DC Methods) – Volume resistance and volume resistivity, method for casting resins	Strategic direction on DC methods, supported by WG 4.	Expected 2024
Future IEC 63177: Test method for compatibility of construction materials with electrical insulating liquids	New strategic direction on compatibility, supported by WG 6.	Expected 2023

Note: The progress on the actions should be reported in the RSMB.