

CENELEC/TC or SC 40XA	Secretariat Finland	Date 09-30-2023
--------------------------	------------------------	--------------------

TC or SC title: Capacitors and EMI suppression components

A Background

A.1 Date of establishment of the TC and a brief historical background

TC 40XA is continuation to CECC WG 3 Capacitors and was established when CECC system was merged with IECQ system in 2003.

A.2 Current scope and working groups

TC 40XA is responsible for the preparation and maintenance of European standards for:

- a. Capacitors, fixed and variable, for use in electronic equipment.
- b. Capacitors, inductors and complete filter units for electromagnetic interference suppression.
- c. Networks and passive integrated circuits containing capacitors, or combinations of resistors, capacitors and inductors.
- d. Electrochemical capacitors for use in electrical and electronic equipment (e.g. Electric double layer capacitors).

There are no active Working Groups.

B Business Environment

B.1 General

Capacitors, resistors and inductors are so called passive components, which together with active components (semiconductors), printed wiring boards, connectors and some other components like filters, switches and fuses are basic building blocks in electronic products.

Capacitors are the largest group of passive components. There are over 2 800 Billion discrete capacitors used annually in electronic products. The value of this business worldwide was over 16 Billion Euros year 2021, and the market is fully global. Capacitor market is showing considerable growth.

The increasing use of electronics in all fields of industry supports a continuous growth in the demand of capacitors and EMI Filters. Information technology is now the main application sector whereas the gradual shift towards the electric car creates a new demand Today's electronic circuits have typically 6 to 25 passive components against each active component (semiconductor), of which half are capacitors, and the active and passive component markets develop "hand in hand".

During the last 20 years five major technological trends have influenced the development of all components and continue to do so: miniaturization, automatic assembly of the components, electronics assembly technology (earlier surface mounting, now growingly embedding of the components), digitalization of the electronics and request for zero defects. These trends have meant a huge challenge in the development of capacitors, which consequently has resulted in a continuous need of standards for new component families and updates of existing specifications, appropriate test methods and requirements.

At the same time the prices of capacitors and filters have declined, in some areas dramatically. This development has forced to large consolidation in the component industry lowering the number of producing companies in the world, and moving the manufacturing industry to low cost countries, especially to China. At the same time also the electronics manufacturing, i.e. the customer industry for components, especially

in consumer products, has moved from Europe, Japan and North-America largely to Asia-Pacific region. New companies have entered the component manufacturing in this region. Nowadays passive components are produced by about 70% in Far East and in particular in Japan, in Taiwan, in China and in South Korea. Slightly less than 25% are manufactured in the USA and about 5% in EMEA.

B.2 Market demand

The “audience” of the standards developed by TC 40XA are the manufacturers of components, the users of the components [set makers = OEMs (Original Equipment Manufacturers), ODMs (Original Design Manufacturers) and EMSs (Electronics Manufacturing Services)], producers of machines for automatic handling and assembly, test houses and certifying bodies (specifically with regard to safety matters).

Capacitor industry and safety test houses are represented in TC 40XA. The OEM-, ODM-, EMS-, and machine producing industries i.e. component users are encouraged to participate more in TC 40XA standardization work along with the component makers.

The growth of electronics production is fastest in the Asia-Pacific region, which has had influence to the number of participating companies in Europe.

There is a continuous need for new standards in the TC 40XA area and at the same time the maintenance of existing standards causes considerable amount of work. This work is mostly done in IEC TC 40, but the European work is supporting TC 40 work, and TC 40XA is also a channel for New Work Item Proposals in IEC.

B.3 Trends in technology

The trends given in B.1 continue to affect the work of TC 40XA also in the future. Due to large increase in hand-held and mobile electronics, and in signal frequencies, the miniaturization of components is an ongoing trend. The smallest discrete capacitors today are 0,25 mm × 0,125 mm × 0,125 mm in volume. The handling of this kind of components needs special packaging and automatic machinery putting also requirements on the capacitors, which should be described in standards.

To further increase the packaging density, more and more components will be embedded in the substrates like printed wiring boards rather than assembled on their surfaces. Very thin (in the range of 150 µm) and small components used in embedding have created totally new requirements for testing and automatic handling. The function of several passive components can also be integrated together in a single passive integrated circuit component. Here the manufacturing technology can be a planar technology on silicon, ceramic or glass, or LTCC (Low Temperature Co-fired Ceramics) technology.

The TC 40XA scope covers wide area of technologies from components to complete filters and also wide range of physical sizes of components, the largest having a volume of cubic decimeters. The increasing use of delicate electronics in all areas of industry has put lot of pressure to protect the electronics of electromagnetic interferences. The need for mains voltage EMI suppression filters also in the industrial area is pushing the voltage ratings up, and creates new requirements for safety components.

In general the cost and size pressures have changed the practices in the electronics design during last years. This means that the established limitations for voltage, current, dissipation and temperature for components are increasingly challenged, and the comprehension of the physical background to these parameters has widely disappeared. This has to be taken into account in the maintenance of existing standards.

The following developments will require appropriate standardization:

- Passive integrated circuits and embedded passives.
- New dielectric materials in the area of capacitors (e.g. Nb capacitors), new electrolytic materials (e.g. new conductive polymers), higher permeability of ferrites for inductors.
- New capacitor technologies, e.g. thin film capacitors.
- Very thin capacitors and resistors for embedded electronics.
- Increasing voltages in EMI filter area.
- Very high frequency test methods for capacitors.
- Electric double layer capacitors, both symmetric and asymmetric technologies, hybrid capacitors combining a capacitor and a battery, and their testing for various applications.

There is an increasing emphasis on environmental issues and restriction on materials used, which should be taken into account during standardization work. The severe pressure to remove from using known, well performing flame retardant materials may influence the ability of safety capacitors to meet self-extinguishing classification tests, and new rules may be needed. The ban of lead has required major changes in the components assembly, partly threatening the applicability of certain components for larger application areas, an issue which will continue to impose changes in the industries.

B.4 Market trends

Market continues to be very volatile. After a good year 2008 the global recession meant clear drop in business for year 2009. 2010 was a year of fast recovery leading to shortage of capacitors and resistors and to increasing prices and better profitability of component producing companies. During the second half of 2011 the market again dropped considerably and this soft market situation has continued through the year 2012. From 2014 onwards the quantities of passive components showed a significant growth again. In early 2020's the volume growth has been healthy, and the volumes are expected stay on high level towards 2025, but the average selling price continues to decrease causing the total market value to stay stable or to drop. The new area of Electric Double Layer Capacitors (EDLCs), so called Super or Ultra capacitors, has started to find mass market applications, and growth here is expected to be fast. New technologies have entered this area causing some confusion among customers in component selection.

The electronics industry is continuing to grow on long term, and there are no known reasons, why the use of capacitors and filters would not continue growing, also. The companies will continue moving production to low cost areas, but this development will slow down. The fast development in the area of electric and hybrid vehicles and renewable energy production (e.g. wind and solar power) will create new applications, requirements and market also for passive components, and this development should be followed carefully. The demarcation line between TC 40XA and SR 33: Capacitors for power electronics, will be challenged because of this new development, and discussions between the respective IEC committees are needed.

The move of the production of electronic equipment from the OEMs to subcontracting (EMS) continues, as well as geographical relocation especially to China. This means a great challenge to find and reach new "audience" for standards, and participants to European standardization work.

B.5 Ecological environment

TC 40XA's main focus is on standards for components as end products, not on manufacturing technologies and materials used. New energy saving equipment / solutions may generate needs for new types of capacitors or filters and their standards.

The trend to ban hazardous substances has had, and may have indirect influence to component standards (e.g. changes in solder materials have forced to change the soldering standards), an issue to be dealt with in the regular maintenance cycles.

B.6 Involvement of societal stakeholders

The work of TC40 XA is open for all interested parties. Due to the nature of the Committee, i.e. product standardization mainly in Business to Business interface, it is difficult to get involvement from social stakeholders. In case of safety standards the Safety Agencies and Governmental Safety Authorities are widely involved in the preparation work.

B.7 Involvement of SMEs

Although among the members of TC40XA are representatives of SMEs, the main contact surface to SMEs happens in National mirror committees, where the majority of participants are from SMEs.

C System approach aspects

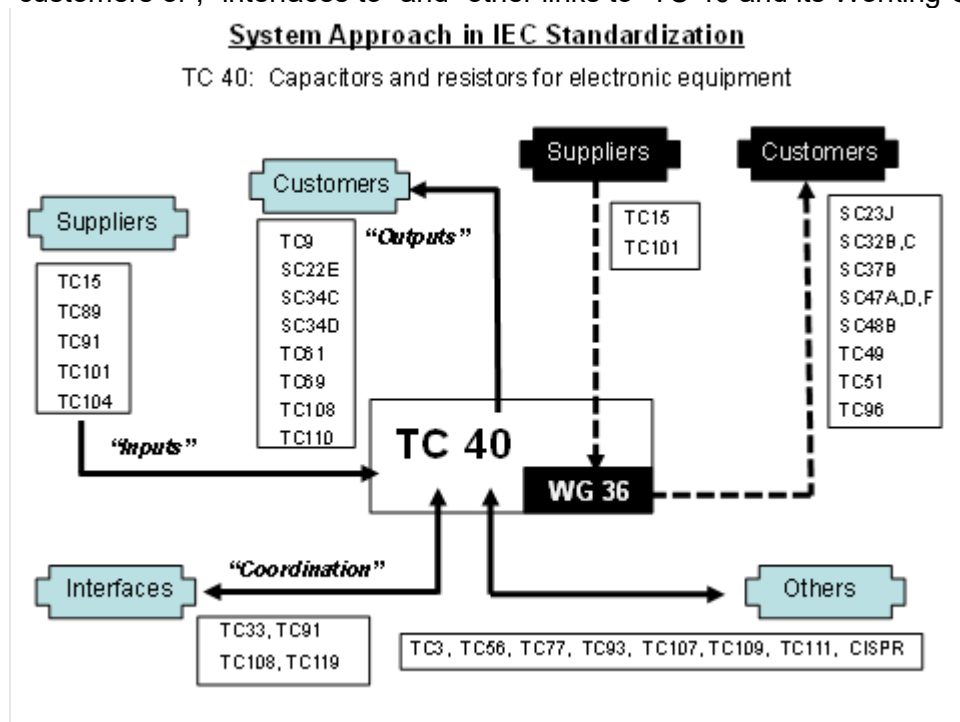
Close liaison is maintained with IEC TC 40 which includes parallel voting enabling IEC documents to be adopted in Europe.

The system approach is fulfilled by following the approach of IEC TC 40, which is described in the following in detail:

TC 40 will actively continue to promote the establishment of liaisons to other committees. Internal IEC liaisons have been established with the following TCs / SCs:

- TC 9: Electrical equipment and systems for railways
- SC 37B: Components for low-voltage surge protection
- SC 34D: Luminaires
- SC 47A: Integrated circuits
- SC 47D: Semiconductor devices packaging
- TC 69: Electric road vehicles and electric industrial trucks
- TC 91: Electronics assembly technology
- TC 101: Electrostatics
- TC 104: Environmental conditions, classification and methods of test
- TC 108: Safety of electronic equipment within the field of audio/video, information technology and communication technology

The System Approach of TC 40 is visualized in the overview below in which “suppliers to”, “customers of”, “interfaces to” and “other links to” TC 40 and its Working Group 36 are shown.



Legend of TCs and SCs mentioned in the System Approach overview

- TC 3 : Information structures, documentation and graphical symbols
- TC 9 : Electrical equipment and systems for railways
- TC 15 : Solid electrical insulating materials
- TC 33 : Power capacitors and their applications
- TC 49 : Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection
- TC 51 : Magnetic components and ferrite materials
- TC 56 : Dependability
- TC 61 : Safety of household and similar electrical appliances
- TC 69 : Electric road vehicles and electric industrial trucks
- TC 77 : Electromagnetic compatibility
- TC 89 : Fire hazard testing
- TC 91 : Electronics assembly technology
- TC 96 : Transformers, reactors, power supply units, and combinations thereof
- TC 101: Electrostatics
- TC 104: Environmental conditions, classification and methods of test
- TC 107: Process management for avionics
- TC 108: Safety of electronic equipment within the field of audio/video, information technology and communication technology

TC 109:	Insulation co-ordination for low-voltage equipment
TC 110:	Electronic display devices
TC 111:	Environmental standardization for electrical and electronic products and systems
TC 119:	Printed electronics
SC 22E :	Stabilized power supplies
SC 23J:	Switches for appliances
SC 32B:	Low-voltage fuses
SC 32C :	Miniature fuses
SC 34C:	Auxiliaries for lambs
SC34D:	Luminaires
SC 37B :	Specific components for surge arresters and surge protective devices
SC 47A :	Integrated circuits
SC 47D :	Semiconductor devices packaging
SC 47F :	Micro-electromechanical systems
SC 48B :	Connectors

D Objectives and strategies (3 to 5 years)

1. Support IEC TC 40 work and European participation in International work
2. Bring to IEC's knowledge New Work Item Proposals growing from European needs

E Action plan

1. Continuous work
2. Continuous work

F Useful links to CENELEC web site

TC 40XA dashboard giving access to Membership, TC/SC Officers, Scope, Liaisons, WG/MT/PT structure, Publications issued and Work and Maintenance Programmes.

TC 40XA web site:

https://standards.cencenelec.eu/dyn/www/f?p=305:7:0:25:::FSP_ORG_ID,FSP_LANG_ID:1258385

Kimmo Saarinen
TC 40 XA Secretary