

Report on “Standardization activities (v2)”

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Abstract

Generally, the present deliverable provides an overview of the standardization landscape related to CIRC-UIITS and the standardization actions carried out within the project and therefore summarizes the results of Task 5.3 – standardization activities.

Knowledge of existing standards is crucial for the project as it ensures compliance with existing standards. A dashboard comprising 444 potentially relevant standards was created, enabling both specific searches and identification of standardization gaps, which form the basis for WP5 activities - T5.3. This deliverable utilizes the dashboard to describe international and European standardization activities related to CIRC-UIITS, with a focus on high-relevance areas. It also lists relevant standards and provides an overview of TCs working on CIRC-UIITS-related standards, highlighting potential contribution opportunities. The importance of focusing on specific areas such as semiconductor devices, printed electronics, environmental management, and circular economy is emphasized.

In the second half of the project, the focus was on developing and implementing a standardization strategy for CIRC-UIITS. For this purpose, a workshop was held to analyze the need for standardization and thus the existence of possible standardization gaps in connection with CIRC-UIITS work. Within this workshop five highly relevant standardization potentials were identified, which built the basis for the standardization strategy of CIRC-UIITS. Various standardization activities were undertaken to enhance the project's impact and support the long-term dissemination of project results by transferring them into standardization. Figure 1 shows an overview of standardization activities carried out under task 5.3.

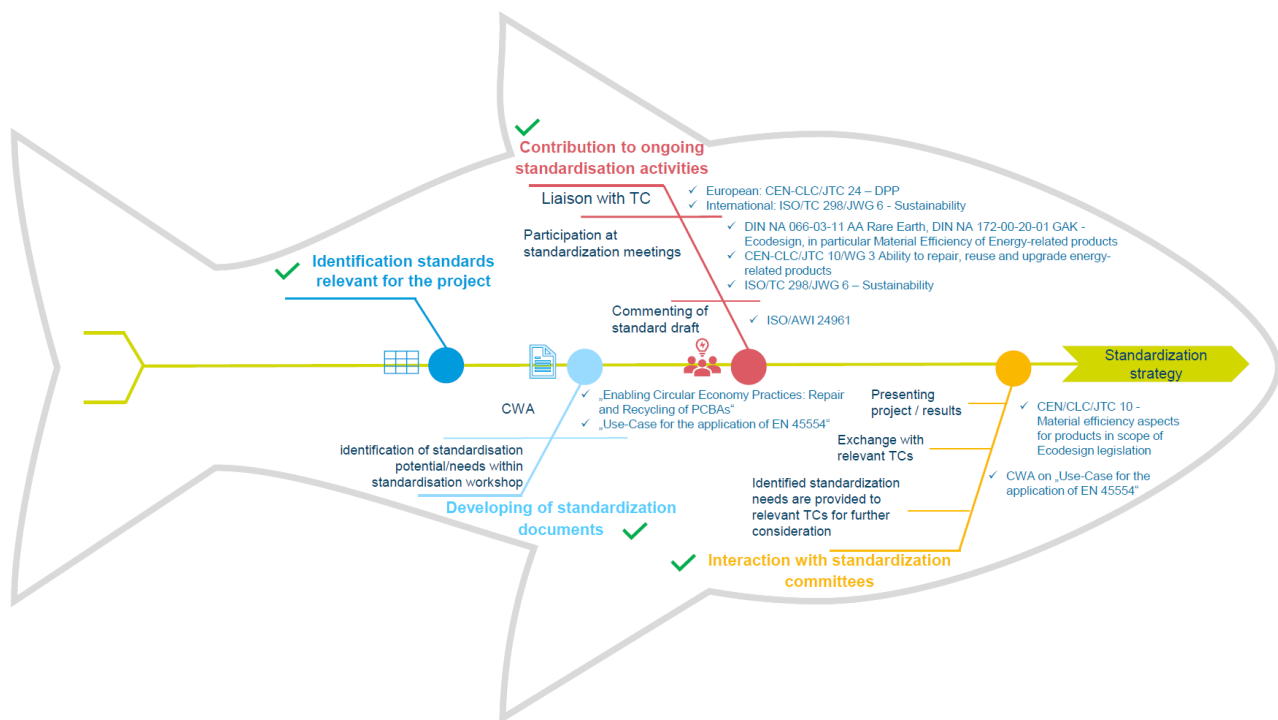


Figure 1: Fishbone diagram to visualize the standardization strategy of CIRC-UIITS and activities carried out in CIRC-UIITS

One of the initiatives was establishing a liaison with CEN-CLC/JTC 24 - DPP, which provided direct insights into European standardization activities ensuring the alignment and consideration during project developments. Additionally, the project contributed to the ISO draft ISO/AWI 24961, which addresses

sustainability concerning rare earths and lithium across the value chain, including concentration, extraction, separation, conversion, recycling, and reuse. CIRC-UIITS reviewed and commented on this ISO draft standard, and the comments were successfully incorporated into the developing document. Moreover, the project initiated the development of two standardization documents (CWAs) – CWA 18311 ‘Enabling Circular Economy Practices: Repair and Recycling of PCBAs’ & CWA 18313 ‘Use-case for the application of EN 45554 in the automotive industry’ – addressing two topics related to the implementation of the ESPR regulation. These documents were developed through open workshops, fostering collaborative efforts and innovative strategies. Intensive interaction with the relevant standardization committees such as CEN-CLC/JTC 10 took place throughout the project duration to ensure that the project remained up to date and contributed to the broader industrial and regulatory standardization efforts.

Overall, the project and the activities carried out as part of T5.3 had a significant impact on the standardization landscape as well as on ongoing standardization activities. Those activities will also support future standardization work by providing valuable insights that ultimately support the future of sustainability and efficiency in this sector.

List of acronyms

Acronym	Description
AFNOR	Association française de normalisation (engl.: French Standardization Association)
ANSI	American National Standards Institute
BSI	British Standards Institution, Federal Office for Information Security
CD	Committee draft
CEI	Comitato Elettrotecnico Italiano (engl.: Italian Electrotechnical Committee)
CEN	Comité Européen de Normalisation (engl. : European Committee for Standardisation)
CEN-CLC/JTC	CEN-CENELEC Joint Technical Committee
CENELEC	Comité Européen de Normalisation Électrotechnique (engl. : European Committee for Electrotechnical Standardization)
CWA	CEN Workshop Agreement
DAmD	Draft Amendment
DIN	Deutsches Institut für Normung e.V. (engl.: German Institute for Standardization)
DIS	Draft International Standard
DKE	Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE (engl.: German Commission for Electrotechnical, Electronics, and Information Technologies of DIN and VDE)
DPP	Digital product passport
EFTA	European Free Trade Association
EN standard	European standard
ETSI/ISG CDM	Industry specification group (ISG) European common information sharing environment service and data model (CDM)
EU	European Union
FDIS	Final draft international standard
ICS	International Classification for Standards

Acronym	Description
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
ITU	International Telecommunication Union
IWA	International Workshop Agreement
JTC	Joint Technical Committee
JWG	Joint Working Group
MT	Maintenance Team
NA	Normausschuss (engl.: standardization committee)
NSB	National Standardization Body
PT	Project Team
R&I	Research and Innovation
SC	Subcommittee
SDO	Standards Developing Organization
TC	Technical Committee
TMBG	Technical Management Board - Groups
TR	Technical Report
TS	Technical Specification
UK	United Kingdom
UNE	Asociación Española de Normalización (engl.: Spanish Association for Standardization)
US	United States
VDA	Verband der Automobilindustrie (engl.: German Association of the Automotive Industry)
VDA QMC	Qualitäts Management Center im Verband der Automobilindustrie e. V. (engl.: German Association of the Automotive Industry Quality Management Center)
WG	Working Group
WP	Work Package

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1. Introduction

1.1. Overview

Standardization¹ is of great importance both at national and European level. Although European standardization activities are in the foreground of the EU-funded research project CIRC-UIITS, which is coordinated by POLIMI, international and relevant national standardization is presented, as a transnational harmonization of standardization documents is considered highly relevant and is the basis for the common economic area in the European Union.

CIRC-UIITS is about the circular integration of reverse supply chains for reuse of industrially relevant semiconductors. Thus, it is essential to ensure the applicability, trust, and conformity of CIRC-UIITS. Therefore, it is necessary that the project’s solutions are compliant with standards, technical specifications, and procedures. This is a crucial aspect to guarantee that the developed solution / system is working properly, and the project results are trustworthy. For this reason, CIRC-UIITS has integrated standardization as an essential element of the project. Regarding the work structure of CIRC-UIITS (see also Figure 2), standardization is integrated in the task 5.3 – Standardization activities in WP5 – Exploitation, standardization & business modelling & business modelling.

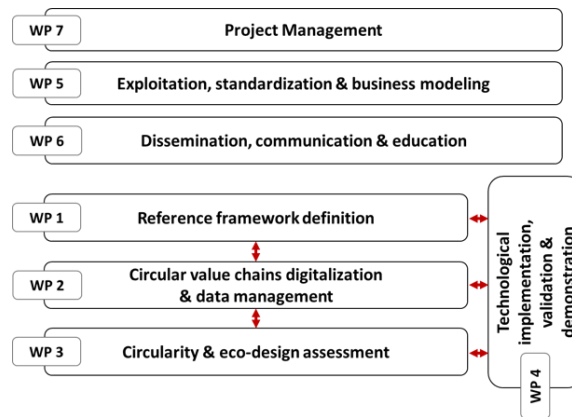


Figure 2: Project structure of CIRC-UIITS²

One objective of this task was to create a well-grounded documentation/overview of the current standards and standardization documents as well as relevant technical committees on national, European, and international level related to the project. This overview of the state of the art of the standardization landscape ensured the compliance of the project’s results with what is already on the market. The knowledge about existing standards is of importance for the project consortium to align its products, processes, services, and solutions with the current state of the art. The identification of relevant technical committees was the basis for the direct transfer of CIRC-UIITS results into ongoing standardization activities.

The present deliverable 5.4 serves an update on the previous deliverable 5.2 and is the second version of it. Therefore, the document provides an overview of the standardization landscape and highlights the most relevant standards for CIRC-UIITS as well as their impact and implication. In addition to D5.2, this deliverable presents, the standardization strategy for CIRC-UIITS and describes the standardization activities that have been carried out in detail.

¹ Standardization covers all types of standardization documents and is used here in general manner.

² adapted from grant agreement 101091490 - CIRC-UIITS

1.2. Contribution to other WPs

Besides the necessity to know about ongoing standardization activities, this knowledge also provides the opportunity to raise awareness for standardization needs in this area. Therefore, this deliverable supports the activities in WP 6 – Dissemination, communication, & education.

A big aim of standardization in research projects such as CIRC-UIITS is to support the transfer of project results into the market, which goes hand in hand with activities also in WP6 – Dissemination, Communication & Education.

As standardization is no stand-alone task, but depends on project developments and results, almost every WP is connected to this task. Especially project results from WP 2, 3 and 4 served as a basis for the development of a CEN Workshop Agreement (CWA) regarding the application of an EN standard (see clause 6.4.2).

2. Document structure (updated)

This document, D5.4 Report on 'Standardization Activities (v2)', serves as an updated version of its predecessor, D5.2 Report on 'Standardization Activities (v1)'. While some sections remain unchanged, most have undergone revision, indicated by 'updated', and new content has been added, highlighted as 'new'.

The basic principles of standardization are presented in this report (see clause 3) as well as the different facets of standardization at national (subclause 3.3), European (subclause 3.4), and international level (subclause 3.5). Subsequently, the various types of standardization documents (subclause 3.6), the function of standardization in the context of research projects (subclause 3.7), and the process for creating a CEN Workshop Agreement (CWA) (subclause 3.6.3) are presented in more detail. The results of the standardization research are presented by explaining the approach to the standards research (subclause 4.3) and finally by giving an overview of the related standardization landscape (clause 5). Besides a general overview of the standardization landscape of CIRC-UIITS (subclause 5.1), the relevant international (subclause 5.2) and European activities (subclause 5.3) are examined. The standards highlighted as highly relevant for the project are focused more closely, especially with regard to CIRC-UIITS (subclause 5.5). So-called “consortial standards” (subclause 3.6.4) also have a strong relation to CIRC-UIITS and therefore, the relation of selected additional standards developing consortia is described (subclause 5.4).

The overview of relevant standards established a foundational basis for the standardization potential workshop conducted (subclause 4.5). The standardization strategy developed from this foundation is detailed in clause 6. This strategy comprises various actions, each outlined in separate subclauses: interaction with the standardization community (see subclause 6.1), identification and description of standardization ideas and potentials identified (see subclause 6.2) and the execution of standardization activities, including contributing to ongoing efforts (see subclause 6.3) and the development of two CWAs (see subclause 6.4). Clause 7 concludes the deliverable by summarizing the activities and placing them in the context of European and international standardization.

3. Basics of standardization

3.1. General

Within **CIRC-UIITS** the standardization part supported the development of project results. Therefore, it was important to clarify the characteristics of a standard.

In general, a standard is a consensus-based document that is approved by a recognized body or organization, reflecting the state of the art. It should be based on the consolidated results of science, technology, and experience, and aim to promote optimal community benefits.³

Standardization is used to agree on terminologies, methodologies, requirements, characteristics, etc. in specific areas to make a product, process, or service fit for its purpose. Thus, standardization can drive innovative outcomes by agreeing on common product requirements such as interoperability, quality or safety, and provide guidelines for achieving them. Standardization supports the development of a generic language, which is understandable for everyone and thus helps to create a common basis. The result of the standardization process is a document, which provides rules, guidelines or characteristics for activities or their results.

3.2. Standard developing organizations

An essential aspect of standardization is to ensure that standardization documents do not contradict each other, especially since European and international standardization have gained significant importance. This is reflected in DIN's statistics, which show that European and international standards account for 90% of all standardization projects nowadays. The following clauses give a brief description of the framework of formal standardization on international, European, and national level. Figure 3 provides an general overview of the different types and levels of standardization.

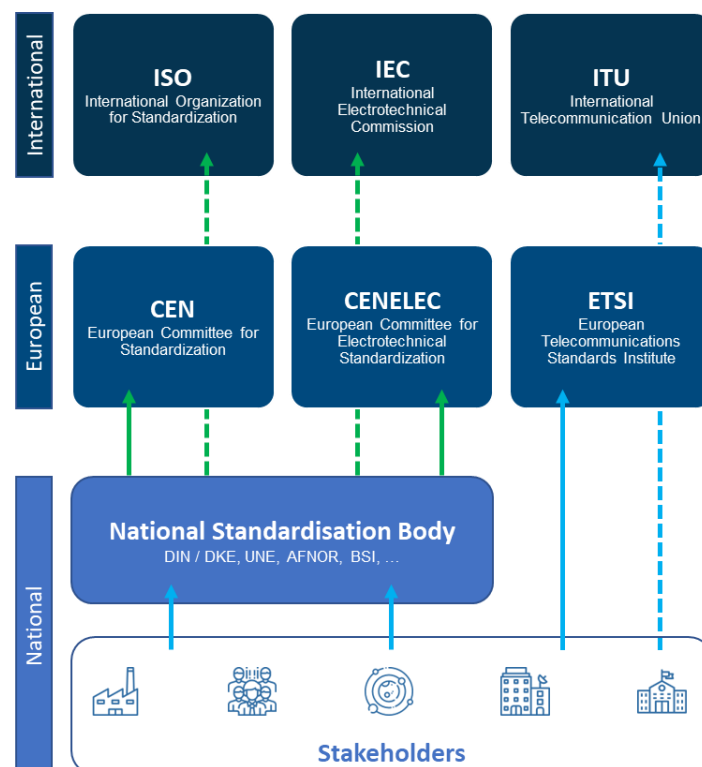


Figure 3: Overview of the organizational structure of the standardization world

³ ISO/IEC, „ISO/IEC Guide 2:2004: Standardization and related activities - General vocabulary,“ 2004

3.3. National standardization

On national level, there are different structures and standardization bodies in different countries, as e. g. German Institute for Standardization (DIN), German Commission for Electrotechnical, Electronic, and Information Technologies (DKE), Italian Electrotechnical Committee (CEI), Spanish standardization body (UNE), the French Standardization Association (AFNOR) and the British Standards Institute (BSI). In general, each country has one or more recognized national standardization bodies (NSB). Within the NSB's experts from different stakeholders, e.g. from organizations belonging to industry, commerce, the public sector, or research, are developing national standards. These NSBs are also responsible for keeping the national standardization repository updated.

To represent national positions at European or international level, so-called mirror-committees are set up and coordinated by the NSBs. In these national committees, the work and existing results of corresponding European and international standardization committees are discussed, a national opinion is developed, and the final drafts of standards are agreed upon. When European or international draft standards are published for comment, the mirror committees also vote on whether the standard should be published or not.

Here it is important to mention, that experts working on European or international level need to be members of the national mirror committee and must be delegated by these committees.

3.4. European standardization

The main goal of European standardization is the development of European standards, that are valid and accepted within the EU. These European standards are the basis for the European single market. The European standardization organizations CEN⁴ (European Committee for Standardization), CENELEC⁴ (European Committee for Electrotechnical Standardization), and ETSI⁵ (European Telecommunications Standards Institute) are responsible for the organisation of European standardization work. CEN is responsible for all non-electronic activities and CENELEC for electrotechnical standardization activities, while ETSI is responsible for the standardization activities in the field of telecommunication at European level.

There is a particularly close cooperation between CEN and CENELEC, which are made up of national standardization organisations from the EU and EFTA (European Free Trade Association) member states, as well as states seeking membership. In contrast, the members of ETSI are directly European companies, institutes, and organizations.

The so-called delegation principle applies to CEN and CENELEC. This means, that the mirror committees of the national standardization bodies of their member states, send national experts to the technical committees and workings groups at CEN or CENELEC to develop European standards. The European standard (EN) will only be published, when a sufficiently large majority of the national standardization organisations has approved the final draft.

European standards (EN) must automatically be adopted by member states of the EU and opposing national standards must be withdrawn. As a result of this mandatory adoption, the EN standards in Germany then become DIN EN standards (e.g. DIN EN 16575). There are situations in which it is possible to complement EN standards with additional national standards, for instance to set more detailed requirements to meet specific needs of the member state.

European specifications are referred to as CWA as well as CEN TS or CENELEC TS, depending on the type of development and their adoption by the member states is voluntary (e.g. DIN CEN/TS 17045), unlike the adoption of European Standards.

⁴ <https://www.cencenelec.eu/> , last viewed on 28.11.2023

⁵ www.etsi.org , last viewed on 28.11.2023



3.5. International standardization

The international standardization organisations ISO⁶ (International Organization for Standardization), IEC⁷ (International Electrotechnical Commission), and ITU⁸ (International Telecommunication Union) are responsible for the organisation of international standardization work. ISO is responsible for all non-electronic and IEC for electrotechnical standardization activities, while the ITU is in charge of standardization activities in the field of telecommunications.

ISO and IEC are made up of the national standardization organizations, with e.g. DIN and DKE representing German interests on an international level. The ITU, on the other hand, is a special unit of the United Nations, whose 191 member states develop recommendations together with companies from the private sector and other regional and national organisations. Only when they are adopted by normative organizations such as ISO, ANSI (USA) or ETSI as well as by national regulatory authorities, such as the Federal Network Agency in Germany, they acquire the character of standards.

The so-called delegation principle also applies to ISO and IEC, meaning that the national standardization organisations send their experts to the working groups and technical committees of the international standardization bodies. An international standard (ISO) is only accepted, when a sufficiently large majority of the national standardization organisations has voted for its draft. International specifications are called IWA as well as ISO TS or IEC TS, depending on the type of development.

In contrast to European standardization, there is no obligation to adopt international standards in national standards. However, since internationally applicable standards are relevant for international trade or for global stakeholders, conflicting national or European standards should be avoided. There is the possibility of transferring international standards in European and national standards. The resulting documents have the characteristics and names listed in Table 1, depending on the background. There are also parallel processes for developing standards at international and European level. It is possible to directly develop EN ISO or EN IEC standards without first developing the standard on international level and then adopting it at European level.

Table 1: Names of international standards depending on their adoption level.

Name	Description
ISO XXXXX	International standard adopted on neither national nor European level
DIN ISO XXXXX	International standard adopted only on national (Germany) level
DIN EN ISO XXXXX	International standard adopted on European and national level

3.6. Standardization documents

3.6.1. General

There are several types of standardization documents that differ in their development process, the degree of consensus to be reached, and the openness to participation (Figure 4). Standardization documents describe products, systems or services by defining their characteristics and requirements and in many cases are publicly available.

⁶ www.iso.org, last viewed on 28.11.2023

⁷ <https://www.iec.ch>, last viewed on 28.11.2023

⁸ <https://www.itu.int>, last viewed on 28.11.2023



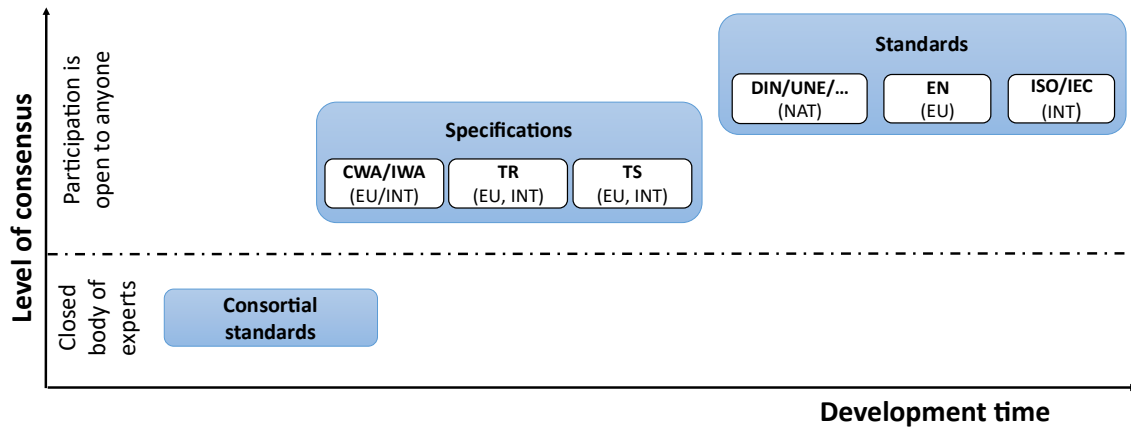


Figure 4: Types of standardization documents

3.6.2. Standard

Standards in the narrower sense are developed within the formal standardization system where all interested parties have to be included in the development process of the document and consensus, meaning the general agreement of all participants and the lack of sustained objection to central content, must be reached. Therefore, a public commenting phase is mandatory in the development of standards. The main objective of the consensus is to take into account the views of all interested parties concerned and to dispel any counter-arguments. The development of a European standard is shown in Figure 5.

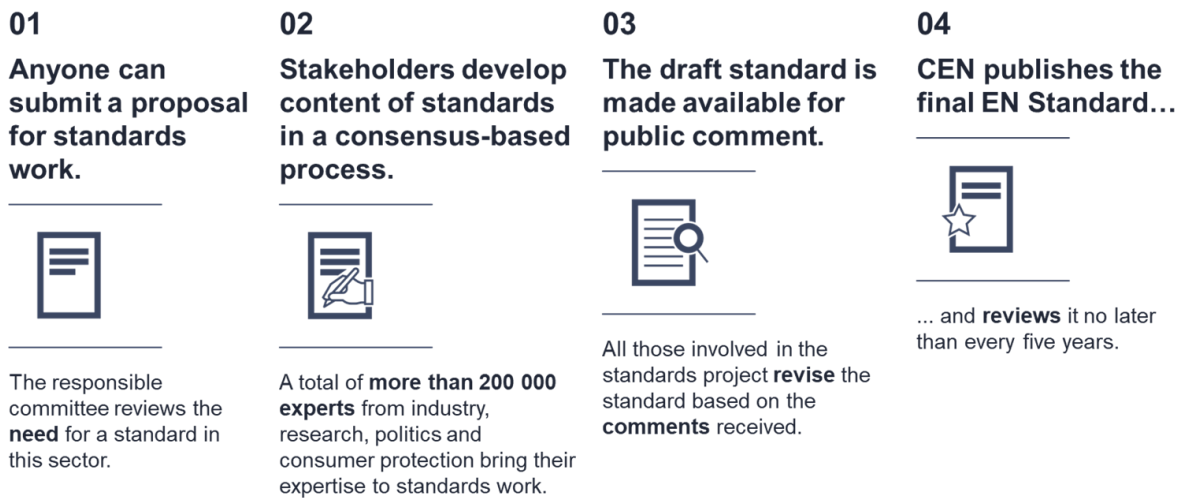


Figure 5: Development of a standard

First of all, anyone who has identified a need for a standard can submit a proposal for a new standard. In most cases this has to be done via the national mirror committee. The associated standards committee evaluates the need and whether standardization activities are already taking place or if standards that cover the described need exist. If the need is confirmed, a standard is then developed in a standardization committee. Attention is paid to a balanced composition of these committees with all interested parties concerned (science, consumers, industry, ...) in order to guarantee the neutrality of the documents. A final draft, approved by the standards committee, is then released for public comment. All comments have to be discussed before the final standard is approved by the standardization committee. Due to the high level of transparency and the involvement of the public, the development time increases from national to European and international level. National standards usually require 18 months to develop, while the development of European and international standards normally takes more than two years due to the involvement of the

national standardization bodies.⁹ Due to the high degree of consensus, standards have a high level of acceptance in society.

3.6.3. Specification

To better understand the difference between the various standardization documents, the terms specification and standard are used. However in many cases both documents will be called standards. In contrast to a standard created in consensus, the standardization activities in research projects focus mainly on the development of **specifications**. Compared to a standard, consensus is not mandatory in specifications and the involvement of all interested parties is not obligatory. The development of a specification, e. g. CWA on European level, is shown in Figure 6.



Figure 6: Development of a specification

Anyone can submit an application to develop a specification. The scope of the specification will be compared with the existing standardization repository. If no conflicting standards exist, the standardization organization publishes the business plan for public comment and a call for cooperation from interested organizations. In contrast to standards, specifications are created in workshops (temporary committee). A standardization organisation acts as a secretary to ensure the procedural requirements and to support the members of the workshops in developing the specification. The workshop also decides whether a draft should be published for comment and once a specification has been successfully adopted by the workshop, the specification will be published.

There are different types of specifications. A Workshop Agreement on European (CEN/CENELEC Workshop Agreement, CWA) or international (International Workshop Agreement, IWA) level is developed in a temporary workshop, which is designed to meet an immediate need and forms the basis for future standardization activities led by a national standardization body. Even if there are not as strict rules for developing a specification as there are for standards, it is important to ensure the coherence of the standardization regulations to protect the credibility of international, European, and national standardization. The workshop is open to direct participation by anyone who is interested in the development of the agreement but consensus is not required. The development of a Workshop Agreement is fast and flexible, on average between 10 and 12 months and therefore also attractive for research projects.

⁹ <https://www.iso.org/developing-standards.html>, last viewed on 28.11.2023

Temporary workshops also develop national specifications, such as DIN SPECs (e.g., DIN SPEC 91392) in Germany.

Specifications can also be developed within standards committees if, for example, no final consensus can be reached. These documents are then referred to as CEN or ISO TS (Technical Specifications). A TS on European level may not conflict with a European standard but conflicting national standards may continue to exist. Technical Reports (TR) are de-facto documents that are developed and approved by a technical committee. A TR provides information on technical content and standardization work.

3.6.4. Consortial standards

Regarding the development time, the fastest ones are **consortial standards** (see Figure 4), also called industry, informal or de-facto standards. Among other things, they are characterised by the fact that not all interested parties need to be included in the development process. These closed group of experts can be, e.g. industry-specific consortia that have been formed from different companies. Although these documents have some characteristics of a standardization document, such as defined procedures or documentation rules, consortial standards are often not freely accessible and are developed in private.

3.7. Standardization in research projects like CIRC-UIITS

It is crucial for an R&I project to know the state of the art in the areas relevant for or connected to the project. Since standards reflect this state of the art in a specific area it is essential for R&I projects to have an overview of the standardization landscape related to the project. This knowledge enables the project to tailor its results or findings to current market requirements and helps ensure that they are interoperable with existing solutions. R&I projects need to consider the developments within other relevant activities. Irrespective of the technical merits of the R&I project developments, these efforts will be inconsequential if developed in isolation and the market decides to follow another path.

Furthermore, the knowledge about related standards also enables the R&I project to overcome additional challenges and go beyond the current state of the art. On the one hand, an overview of the related standardization landscape offers an R&I project the advantages described above. On the other hand, awareness is raised on where standardization is still needed. This opportunity can be used by the R&I project to implement project results in already ongoing standardization activities or by developing new standards from project results.

All these aspects also apply for CIRC-UIITS, which shows that standardization plays an important role. The European research framework program Horizon Europe addresses the topic of standardization in a series of calls for proposals.

4. Methodology

4.1. Training “Basics on Standardization”

In order to gain a sufficient basis for the upcoming standardization tasks within the consortium, a training “basics in standardization” was performed in the beginning of the project. More details which points were addressed can be found in the predecessor document D5.2 Report on “Standardization activities (v1) (subclause 4.1).

4.2. Survey on partner’s expertise regarding standardization and keyword collection

The basis for providing a standardization landscape for the consortium is the standards research where all the relevant standards for the project are collected. The first step to performing this standards research was to get an overview of the partners' knowledge, activities, and expectations regarding standardization within CIRC-UIITS. In this context, a survey was conducted, where the partners were asked to answer questions about their expertise on standardization. More information on the survey can be found in the predecessor document D5.2 (subclause 4.2).

In order to provide the consortium with an overview of already existing standards and standards under development in the areas relevant for CIRC-UIITS, a standards research was conducted. For this reason, keywords were collected from the project partners as part of the survey described above. The partners were asked for which specific areas/topics they would like to get an overview of the available standards, which led to the identification of four relevant topics: *Circular Economy*, *Digitalization*, *Industry*, and *Quality Management*. The keywords were matched to the identified topics and are listed in Table 2. The keywords were used to identify standardization documents and other TC's related to CIRC-UIITS. They were also used to search for existing standards (standards research), using the standards data base Nautos¹⁰. To identify further standards of interest, the standards research was extended to modifications and alternatives to the keywords provided by the partners.

Table 2: From CIRC-UIITS partners supplied keywords.

Topic: Circular Economy	
Environment	Sustainable manufacturing
CO ₂ standards	Eco design
KPI for sustainability	disposal/purchase technical equipment - machine disposal
Circularity	LCA (Life cycle assessment)
Material impact (depending on origin)	Digital product passport
Plastics recycling	disassembly
Metal recycling	Circular economy
recycling	Repair/ing
Critical materials	Efficient production
Circularity indicator	CA (Circularity Assessment)
LCS (Life Cycle Sustainability)	
Topic: Digitalization	
Data sharing	IoT communication protocols
Data spaces	
Topic: Industry	
Automotive	Printed electronics
Mass electronics	Electronic components testing/reuse/disassembly
Electronic components desoldering	Electrochemical reliability testing (SIR, Emigration, Damp Heat)
Cobots	Thermomechanical testing (Vibration, T Shock)
Topic: Quality management	
Compliance testing	Certification process
Risk management	Quality management system
Safety standards	Product performance standards
System analysis	Supply chain management
Manufacturer/supplier information standards	Cybersecurity
Safety (protocols)	robots

¹⁰ <https://nautos.de/>, DIN internal databases to perform the research of standards, standards under development, and further standardisation activities. last viewed on 01.03.2024

4.3. Standards research

This clause describes how the standardization landscape relevant for CIRC-UIITS was developed. A standardization landscape for a specific topic provides an overview of the existing standards relevant and related to the defined topic(s). Such an overview of the standardization landscape should raise awareness among the project partners on what already exists on the market and prevents them from re-inventing the wheel. Further, the standardization landscape provides the basis for further standardization activities of the project. The approach to developing the standardization landscape is shown in Figure 7.

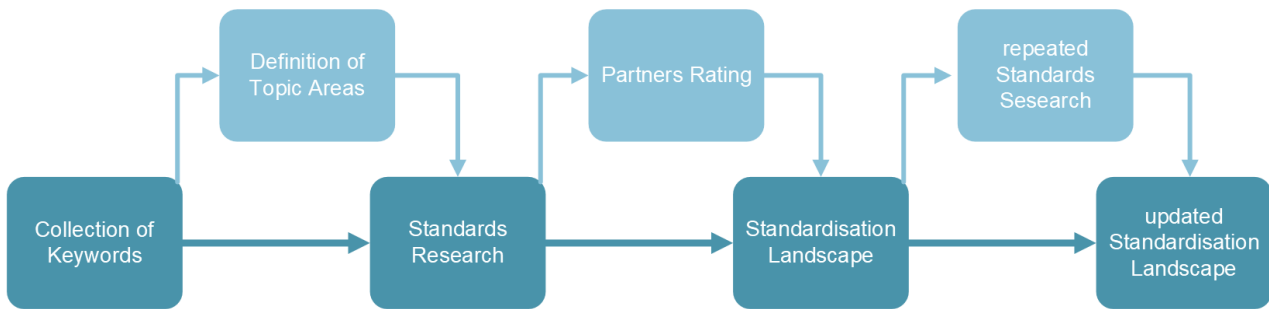


Figure 7: Steps for the development of the standardization landscape within CIRC-UIITS

The identified keywords were used to search for existing standards and standards under development. For the standard research, mainly the search engine Nautos was used to find formal standards. The database includes national standards as well as standards from the European organisations CEN, CENELEC, ETSI, and international organizations such as ISO, IEC, and ITU. Technical documents and reports on these levels have been considered for the analysis. In case of national standards, it should be noted that due to language barriers mostly those providing at least one English title have been considered. All the hits from the Nautos search, using the different keywords, resulted in a list of 395 standards.

Besides the keywords used for the Nautos research, organisations that are no standardization body and developing consortial standards were also mentioned by the project partners. These are listed in the subclause 5.4 Standards developing consortia.

An analysis and assessment of the most relevant and important standards to CIRC-UIITS was conducted by the consortium. The identification of those standards was done by filtering the list of standards by keywords relevant for the specific areas and an individual evaluation based on the title as well as the abstract of the standards. Based on the partners expertise, at least three partner organizations were chosen to evaluate the preliminary lists of standards relevant to their topic of expertise. The following Table 3 shows which partner organization evaluated the standards lists for which topic:

Table 3: List of partners who have evaluated and rated the list of standards per topic.

Topic	Circular Economy	Digitalization	Industry	Quality Management
partner	SAT	OFFIS	ALPHA	CRF
	Polimi	Innovalia	BESU	Continental
	Bosch	TXT	CRF	Whirlpool
	SUPSI		TNO	
			Continental	
			Bosch	
			Whirlpool	
			Traxxon	

The standards were rated according to their relevance and partners could choose between the following criteria: relevant, not relevant, already used within CIRC-UIITS. This way 395 standards developed by standardization organizations such as DIN, CEN/CENELEC, ISO etc. were highlighted as relevant for the project in the first half of the project.

These standards represent the first overview of the standardization landscape for CIRC-UIITS and were therefore shared with the partners in form of a dashboard (Figure 8) among the whole consortium.

An initial version of the dashboard with all relevant standards was provided in February 2024. The dashboard is an Excel template, which was developed specifically for the research of standards and provides an overview of the main information regarding the relevant standards. It can be used to search for specific standards by keywords or to get an overview of the standards within a specific ICS (International Classification for Standards) field or developed by a specific technical committee. The ICS is intended to serve as a structure for catalogues of international, regional, and national standards and other normative documents, and as a basis for standing-order systems for international, regional, and national standards.¹¹ This dashboard was shared within the whole CIRC-UIITS consortium. An explanation of how standards of interest can be identified using this dashboard was given in a virtual meeting at the end of February. 24 people participated in this meeting.

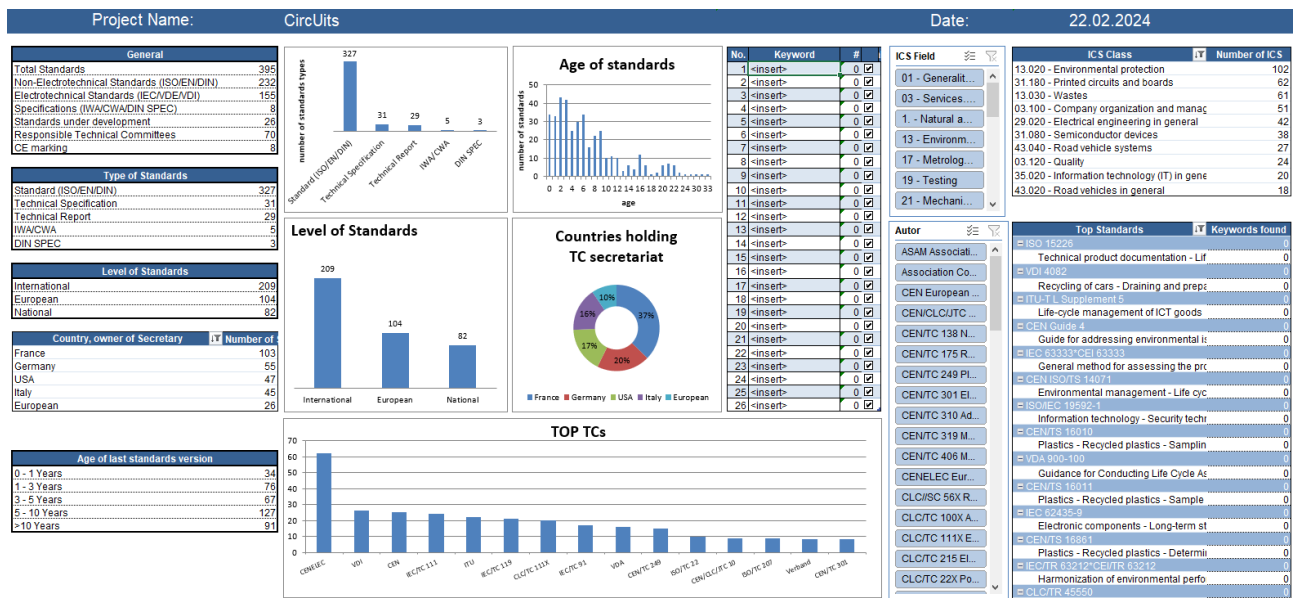


Figure 8: Dashboard with the relevant standards for CIRC-UIITS

4.4. Updated standards research (new)

Since the development of standards does not stand still, the dashboard was updated in November 2024. A standards research was repeated to ensure that the latest standards could be implemented during the development period of the CIRC-UIITS tools, following the same process as described in detail above. New standards that have been published and could be relevant to the project as well as changed standards were incorporated in the updated standardization landscape. Withdrawn standards were removed from the

¹¹ International Classification for Standards, 2015; Available at: [chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.iso.org/files/live/sites/isoorg/files/archive/pdf/en/international_classification_for_standards.pdf](https://www.iso.org/files/live/sites/isoorg/files/archive/pdf/en/international_classification_for_standards.pdf); last viewed on 24.11.2023



standards dashboard. This way 444 standards developed by standardization organizations such as DIN, CEN/CENELEC, ISO etc. were highlighted as relevant for CIRC-UIITS in November 2024.

These standards represent the second overview of the standardization landscape for CIRC-UIITS and were therefore shared with the partners of the consortium in the form of an updated dashboard. All standards are listed in a complete list in Annex 1.

17 standards were provided to the CIRC-UIITS consortium (see Annex 2).

4.5. Standardization potential workshop: identification of potential needs/gaps within standardization

After providing the consortium with an overview of currently existing standards within the fields of interest, the next step was to develop a standardization strategy for the project. This strategy defines how the project could become active in standardization to ensure a sufficient transfer of project results into standardization.

To develop a suitable standardization strategy for CIRC-UIITS, it is essential to get an idea of which challenges the project partners are currently facing and where standardization could help to tackle these challenges. To find this out, a standardization potential workshop was conducted. To achieve synergies, the workshop of two research projects in which DIN is involved as standardization partner (CIRC-UIITS GA No.: 101091490 and ALICIA GA No.: 101091577) was combined. Both projects are funded by the European Commission within the Horizon Europe Framework and are part of the following topic: HORIZON-CL4-2022-TWIN-TRANSITION-01-07 - *Digital tools to support the engineering of a Circular Economy*. The research project ALICIA aims to design and develop a circular manufacturing ecosystem including a machine-readable ontology and an AI-matchmaking engine so that production resources will be traded and reused to their maximum utility in between factories in Europe.¹² Due to the overlapping topics discussed in the projects, the idea was to possibly initiate activities involving partners from both projects.

In a three-hour virtual workshop, the project partners identified several needs in standardization and ideas for how project results could support standardization. The workshop had 21 participants from 14 different organizations from the project CIRC-UIITS and 15 participants from 10 different organizations from the project ALICIA. The workshop was performed by using the tool “Conceptboard”¹³, which serves as a virtual whiteboard. The use of this instrument enabled the partners to work simultaneously.

Figure 9 shows the agenda of the workshop.

¹² <https://cordis.europa.eu/project/id/101091577?isPreviewer=1>, last viewed on 17.06.2024

¹³ <https://conceptboard.com/de>

Agenda standardization potential workshop

Time (CET)	Description	Contributors
1:00 – 1:10 pm	1) Welcome & Introduction	DIN
1:10 – 1:25 pm	2) Presentation of CircUits and ALICIA	POLIMI, TUM
1:25 – 1:45 pm	3) Familiarization with „Conceptboard“ & Introduction round (interactive)	All participants
1:45 – 2:15 pm	4) Basics on standardization (interactive)	All participants
2:15 – 2:30 pm	Break	All participants
2:30 – 2:35 pm	Group photo	All participants
2:35 – 2:45 pm	5) „Back to the future“ – What does a successful project look like?	DIN
2:45 – 3:00 pm	6) Relevant technical committees for possible contribution (interactive)	All participants
3:00 – 3:45 pm	7) Standardization potentials <ul style="list-style-type: none"> • Identification of challenges & identification of potentials (interactive) • Presentation of ideas (DIN) • Rating of ideas (interactive) 	All participants
3:45 – 3:55 pm	8) Outlook and next steps	DIN
3:55 – 4:00 pm	Feedback	All participants



Figure 9: Agenda standardization potential workshop with CIRC-UIITS

After a short introduction, where the aim of the workshop was explained, the project coordinators of the two participating projects – POLIMI (CIRC-UIITS) and TUM (ALICIA) – presented the objectives of the respective projects to the workshop participants. After that, the workshop participants had the opportunity to familiarize themselves with the Conceptboard by creating and filling out “Sticky notes” and naming “Avatars”. These tools were introduced and explained, as their use was essential for the workshop. During the next agenda point “Basics on standardization”, the workshop continued with an exercise and questions on standardization to familiarize the participants with the Conceptboard, to keep the audiences’ attention, and to dive into the concepts of standardization. For this purpose, the workshop participants were asked to answer the following questions by using sticky notes:

- *“What is standardization?”*
- *“Why is standardization important for R&I projects?”*
- *“Where are standards developed?”*
- *“What type of standardization documents do you know?”*

The questions and answers were discussed by DIN (see annex 5). The workshop participants showed great interest and answered the questions very well. This confirms that most of the project partners are interested in standardization and are aware of at least the basics of standardization. In addition, questions raised by the workshop participants relating to standardization were discussed and answered which also shows an interest in standardization processes and how to get involved. A big aim of involving a standardization partner in a research project is also to raise awareness for standardization and to create a foundation of knowledge about standardization.

After a short break DIN took the participants to the final review meeting via an imagination game and showed what a successful project related to standardization activities could look like. For this purpose, a fishbone diagram was used (Figure 10), which shows the possible options for a research project to participate in standardization and to ensure a transfer of project results into standardization.



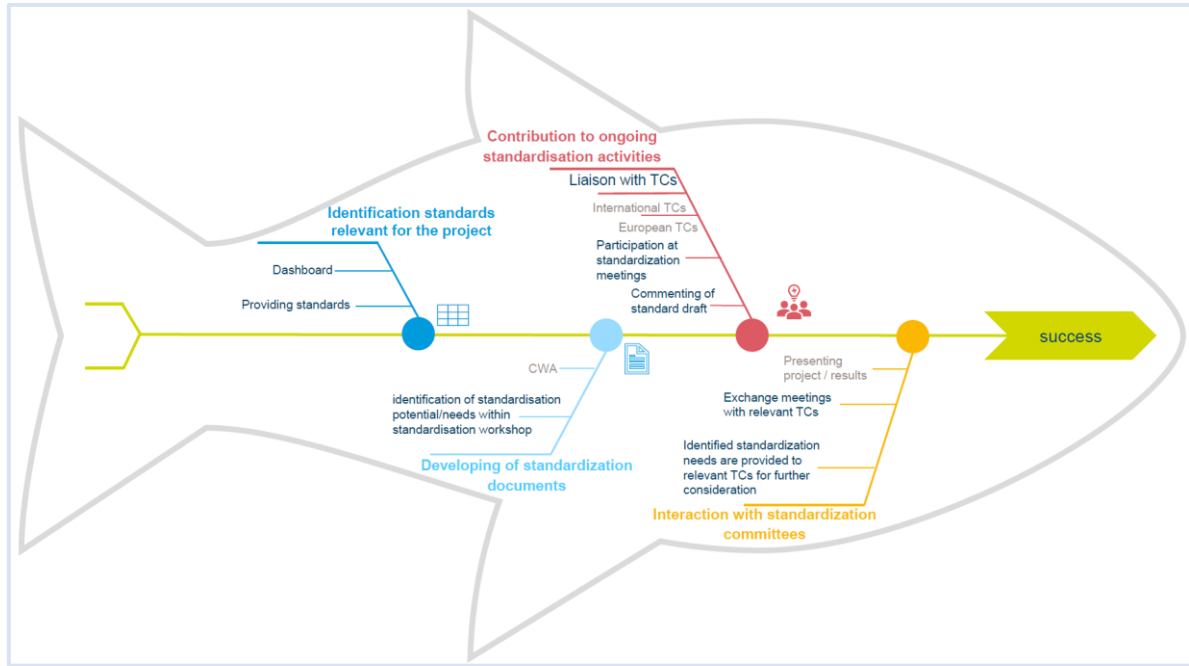


Figure 10: Fishbone diagram to show the options for how to make a project successful in relation to standardization. It shows possible options for a research project to participate in standardization.

This technique was used to get the audience’s attention and to explain in a more visual way which options/activities are possible and aimed at within CIRC-UIITS.

At the standardization potential workshop, the partners were asked which technical committees they would be interested in working with, as a first step to decide which activities to focus on. For this purpose, the relevant TC’s described in subchapter 5.2 *Standardization activities on international level* and 5.3 *Standardization activities on European level* were displayed on the Conceptboard as relevant and the

partners were asked to put their avatar on the TCs interesting to them (see Figure 11).

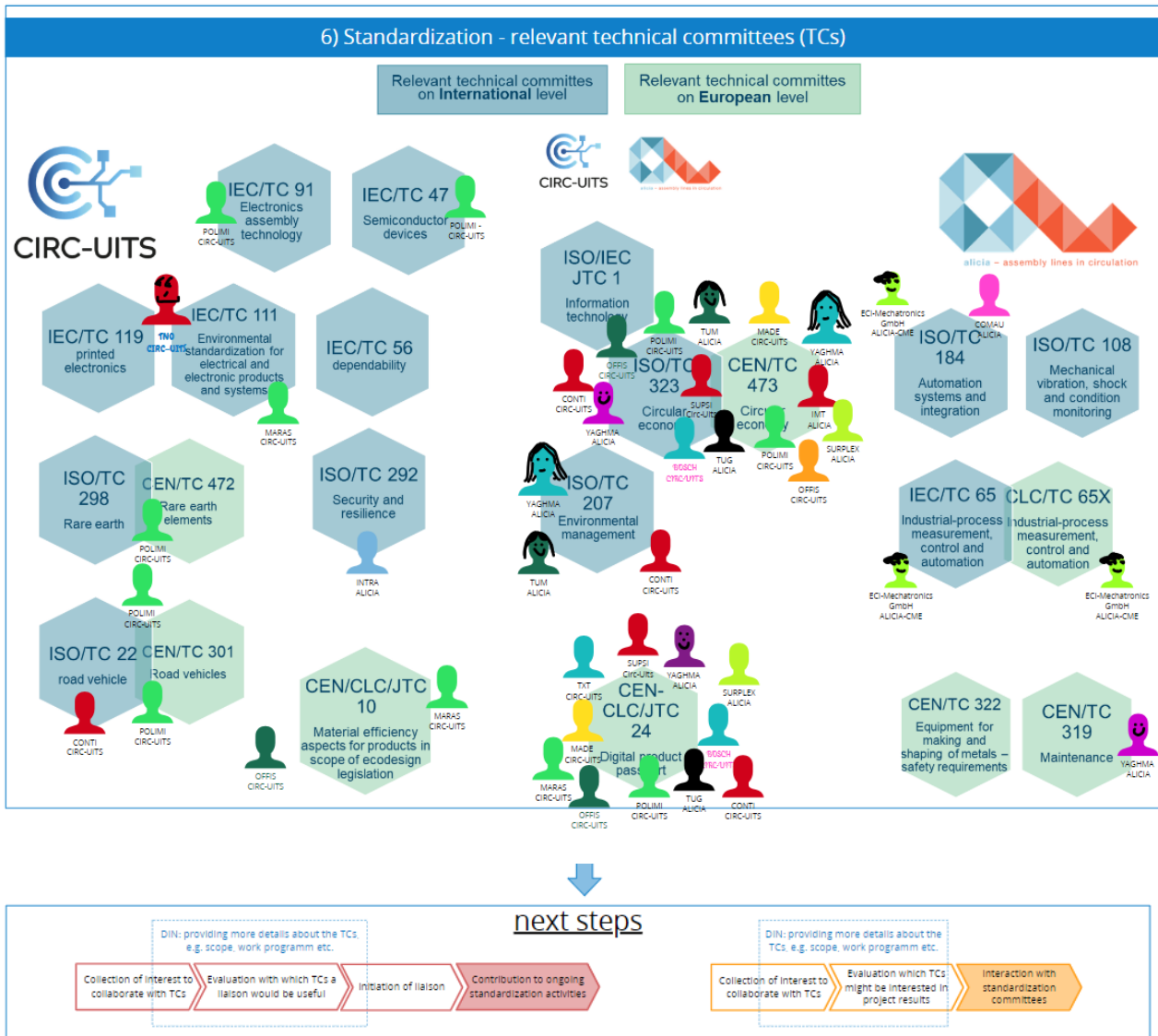


Figure 11: Excerpt from the workshop Conceptboard in which the partners were asked to put their avatars on the TCs they are interested in. Personal data are anonymized.

After the project partners explained their interest in the different TCs, the next steps in terms of interacting with relevant TCs were explained to the workshop audience and include the following major steps:

1. DIN will get an overview of who is interested in which TC.
2. DIN invites the relevant partners to discuss further details of the TC of interest.
3. DIN and project partners will evaluate which kind of contribution could be useful and determine the next steps.

The following Table 4 shows which partners declared their interest in which TCs.

Table 4: Relevant TCs and partners who are interested in corresponding TCs.

TC	TC title(s)	Interested partner
IEC/TC 47	Semiconductor devices	POLIMI
IEC/TC 91	Electronics assembly technology	POLIMI
IEC/TC 111	Environmental standardization for electrical and electronical products and systems	MARAS
IEC/TC 119	Printed electronics	TNO
ISO/TC 22 – CEN/TC 301	Road vehicles	POLIMI, Conti
ISO/TC 207	Environmental management	CONTI
ISO/TC 298 – CEN/TC 472	Rare earth	POLIMI
ISO/TC 323 – CEN/TC 473	Circular Economy	POLIMI, CONTI, OFFIS, SUPSI, BOSCH, MADE
CEN/CLC/JTC 10	Material efficiency aspects for production in scope of ecodesign legislation	OFFIS, MARAS
CEN-CLC/JTC 24	Digital product passport	POLIMI, MARAS, TXT, SUPSI, BOSCH, CONTI, MADE, OFFIS

For each TC listed above, DIN listed the scope, the structure including sub committees and their scope, and working groups, and the active work items, which are in an early stage so a contribution from CIRC-UIITS would be possible, in a survey. The consortium was asked to participate in the survey and provide feedback on which active standardization work they would like to contribute. In the next step, DIN and the relevant partners evaluated the survey and decided how to get involved in current standardization activities.

To get an idea which challenges the project partners are currently facing and where standardization could help to tackle these challenges, the Conceptboard was used to collect first ideas during the standardization potential workshop. The partners were asked to think about needs/potentials/challenges with the help of the following questions:

- *Is there anything within CIRC-UIITS/ALICIA you need to agree on with other partners, e. g. related to interoperability or compatibility? Could this become a standard outside the project?*
- *Do you sometimes discuss the quality of results in your field with your colleagues? Could a standard set minimum requirements?*
- *Are you facing problems communicating your findings? Do your colleagues understand you when you are explaining your work? Could a terminology standard help?*
- *Is there a methodology / process / result within CIRC-UIITS/ALICIA you would like to recommend to someone outside the project to work with?*

The partner created “Sticky notes” on which they wrote their thoughts on these questions.

As there are different types of standards, e.g., terminology standards, testing standards, product standards, etc. (See annex 3), the partners were asked to think about what type of standard their idea could be realized as. For this purpose, they were asked to try to sort their ideas into a matrix containing the different types of standards (five rows) and thematic categories (five columns) (see Figure 12). The following topics were given to the partners: *Industry, Circular Economy, Digitalization, Quality management and others*

Within these topic areas, they were asked to assign their standardization ideas, gaps or challenges to the various types of standardization documents.

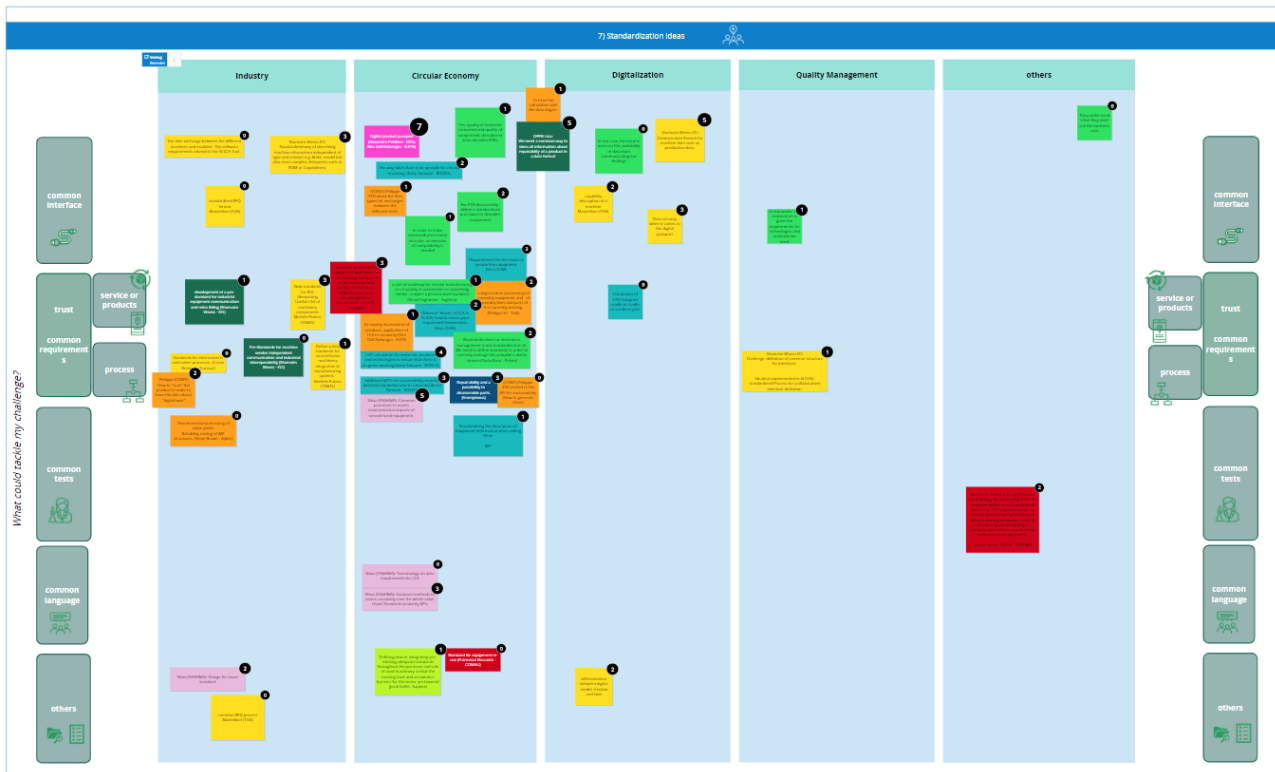


Figure 12: Matrix (types of standardization documents x topics) in which the partners have sorted their ideas. The content of this image is not the subject of the figure and does not have to be readable.

DIN presented the ideas to the workshop audience and after each idea asked them whether the partner would like to explain the idea further or whether there are comments from the audience. After collecting many ideas, the next step was to rank and prioritize these ideas. For this purpose, each person from both projects had five votes to determine their favorite ideas independently, regardless of which project the idea came from.

Figure 13 shows the ideas with the most votes that were identified within the CIRC-UIITS project. To find out which person is willing and able to contribute to which idea, they had assigned themselves to the top ideas.

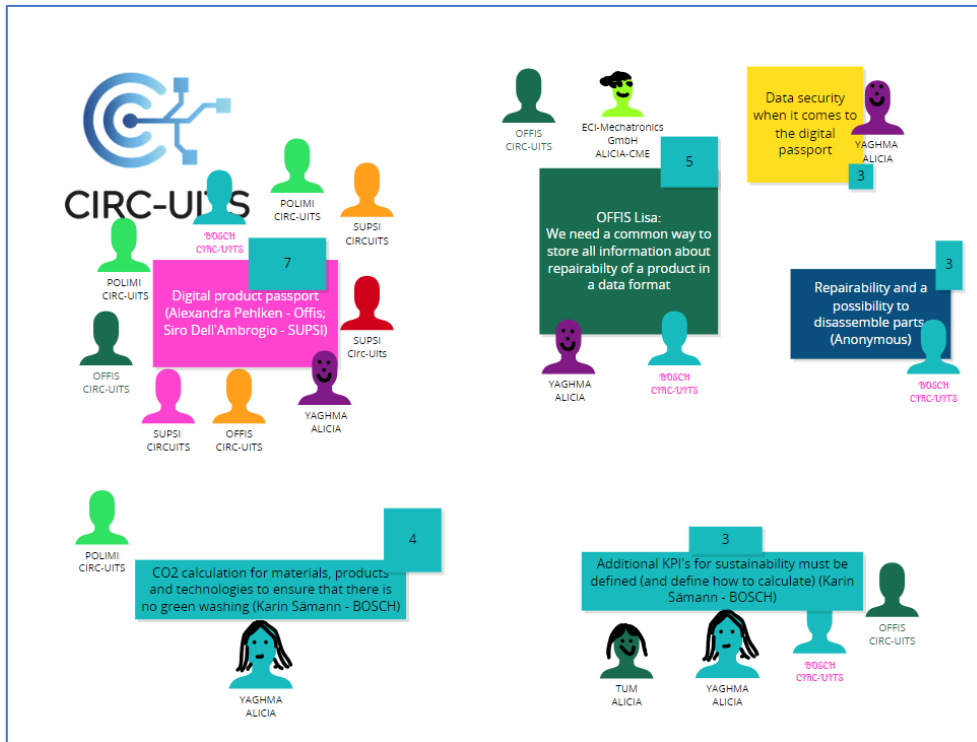


Figure 13: The ideas proposed by the CIRC-UIITS project and voted for most by all workshop participants. Personal data are anonymized.

After the workshop five ideas were identified and further pursued (see also subchapter 6.2 Standardization potentials).

The next steps regarding advancement of the ideas are the following:

- DIN checks whether standards / active work items exist that cover the ideas;
- DIN invites relevant partners to further develop the ideas (interested partners are free to join);
- Project partners further develop the ideas.

The workshop was closed with an outlook and an explanation of next steps. In the end, the workshop participants had the chance to express their feedback on the workshop. The final Conceptboard can be accessed via the following link: <https://app.conceptboard.eu/board/h3xk-gg0f-zbem-rx6e-9sd7>

In order to further develop the first ideas and refine the search for already existing standardization works, the partners who expressed their interest to contribute to the ideas, were invited to separate meetings.

If there is no document currently addressing the standardization need identified in the project and project results could fill in this gap, a possible option could be the development of an own standardization document, e.g., a CEN Workshop Agreement (CWA). To describe the identified potentials in more detail, the relevant partners were asked the following questions in the context of the potential development of an own standardization document (e.g., CWA)¹⁴:

- What could the CWA be about? What could be the scope of the CWA?
- Which challenge should be tackled by developing a CWA? (in order to address the background and objectives)

¹⁴ Questions are from the proposal form to initiate a CEN Workshop Agreement

- Which elements could be and need to be included in the CWA?
- Who could be the target project group of the CWA? And could this document also be important for other stakeholders?

The next steps for each standardization potential are described later in the document (see subchapter 6.2).

4.6. CEN Workshop Agreements (new)

Within CIRC-UIITS two CEN Workshop Agreements (CWA) were developed. The next subclause describes the methodology of the development of the two CWAs in detail.

In general, the process to develop a CWA is based on the CEN-CENELEC Guide 29¹⁵. A CWA is a great tool for research projects for a long-term dissemination of project results by developing a standardization document in the project lifetime. The development of a CWA is in general an open process, which means that a temporary workshop will be formed especially for the aim of developing a CWA on a specific topic, and all interested stakeholders can participate in the development of this document. Figure 14 illustrates the CWA process according to CEN-CENELEC Guide 29.

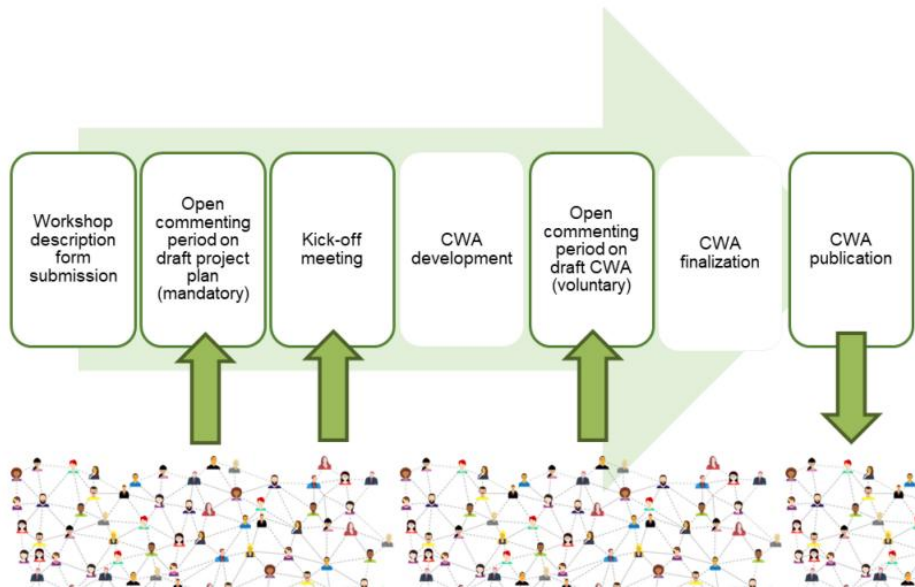


Figure 14: Illustration of the CWA process, Source: CEN-CLC Guide 29¹⁵

The development of a CWA starts with the initiation phase. The aim of this phase is to inform the relevant technical committees and the public about the idea and the plan to develop a standardization document regarding this topic by filling in and publishing a workshop description form (project plan). The workshop project plan is then publicly available for at least 30 days on the CEN-CENELEC website. During this phase, the public can provide comments on the planned CWA. If no objections are received, the kick-off meeting will take place to constitute the workshop consortium and start the development of the CWA. In the kick-off meeting, the general rules for the collaborative work to develop a CWA are described and the main idea of the content is explained to all participants. If comments are received during the publication phase of the project plan, those comments will be discussed during the kick-off meeting. In dedicated workshop meetings the content of the CWA is discussed and new tasks for the next meeting are determined. After finalizing the content of the document, an open commenting period on the draft CWA can take place. This step is voluntary, but highly recommended. During this step, the public as well as relevant TCs have the chance to

¹⁵ <https://www.cencenelec.eu/media/Guides/CEN-CLC/cenclcguid29.pdf>

provide comments on the final draft document. After the commenting period, a final meeting takes place, in which all are invited who provided comments in addition to the workshop consortium. Comments can be discussed and last final changes to the document can be made. In the end, editorial adaptations according to the rules to create a standardization document takes place and the publication phase starts.

The CWA is a publicly available document and can be downloaded free of charge from the CEN-CENELEC website. A published CWA has a maximum lifespan of six years. After three years, the document is reviewed to determine whether the content still corresponds to the state of the art or should be revised or withdrawn. This applies if new standards are published in the meantime that contradict each other. CWAs can form the basis for future standards, and this option will be reviewed during the lifetime of the CWA. If there is no option to continue using the CWA in a standard, the CWA must be withdrawn after six years at the latest.

Within CIRC-UIITS two CWAs were developed. Table 5 shows the details of the workshops.

Table 5: Information about CWAs developed within CIRC-UIITS

	CWA 18311	CWA 18313
Workshop title	‘Enabling Circular Economy Practices: Repair and Recycling of PCBAs’ (Previous: ‘Digital Product Passport for Printed Circuit Boards’ ¹⁶)	‘Use-case for the application of EN 45554 in the automotive industry’ ¹⁷
Project plan	https://www.cencenelec.eu/media/CEN-CENELEC/News/Workshops/2024/2024-11-25-DigitalProductPassport/annex1-ws-description-dpponpcb.pdf	https://www.cencenelec.eu/media/CEN-CENELEC/News/Workshops/2025/2025-03-13-Automotive/doc02_ws_description_proposal_cwa_use-case_en45554.pdf + preliminary draft CWA ¹⁸
Project plan commenting phase	2024-11-25 until 2025-01-10	2025-03-13 until 2025-04-17
Kick-off meeting	2025-01-20 (agenda)	2025-01-20 (agenda)
Participants at kick-off meeting	31 persons from 21 organizations (incl. 16 project external organizations)	17 persons from 13 different organizations (incl. 9 project external organizations)
Workshop participants	53 persons (36 project external persons)	17 persons (12 project external persons)
Number of workshop meetings	8	4
Open commenting period	2025-08-22 until 2025-09-26 (draft CWA) ¹⁹	2025-08-08 until 2025-09-22 (draft CWA) ²⁰
CWA approval date	2025-10-24	2025-11-27

¹⁶ Website announcement: https://www.cencenelec.eu/news-events/news/2024/workshop/2024-11-25_digitalproductpassport/, last viewed on 2025-08-18

¹⁷ Website announcement: <https://www.cencenelec.eu/news-events/news/2025/workshop/2025-03-13-automotive/>, last viewed on 2025-08-18

¹⁸ Preliminary CWA draft: https://www.cencenelec.eu/media/CEN-CENELEC/News/Workshops/2025/2025-03-13-Automotive/ws_cwa_usecase_of_en45554_preliminary_draft.pdf

¹⁹ Draft CWA: https://www.cencenelec.eu/media/CEN-CENELEC/News/Workshops/2025/2025-08-22_PCBAs/draft_cwa_-_enabling_ce_practices.pdf, last viewed on 2025-11-14

²⁰ Draft CWA: https://www.cencenelec.eu/media/CEN-CENELEC/News/Workshops/2025/2025-08-08_Automotive/draft_ws_cwa_usc.pdf, last viewed on 2025-11-14



DIN held the secretary of those two workshops. The responsibilities of the workshop secretary can be found in the CEN-CLC Guide 29 Annex A. Both CWAs will be publicly available in the [CWA download area](#) after final publication by CEN-CENELEC.

5. Overview of the CIRC-UIITS standardization landscape (updated)

This section gives an overview of the updated standardization landscape related to CIRC-UIITS. Besides providing a general overview of standards which could be relevant for the project, relevant standardization committees that are active in the fields are also listed. As a basis for this analysis the dashboard described in subclause 4.3 was used.

5.1. General

The dashboard is also used to provide some general information on standards that might be relevant to CIRC-UIITS. The majority (54%, 241 in total) of the standards was developed on international level, whereas around 25% (112 in total) originated on European level and the minority of below 20% (91 in total) on national level. The reason for a smaller number of national standards added to the standardization dashboard compared to the number of European and international standards is because national standards were mostly excluded during the standards research. CIRC-UIITS is a European research project and therefore individual national standards are of secondary importance for the first overview of the standardization landscape. National standards will be added to this overview in accordance with the needs of the project partners. Therefore, only standards on international and European level are looked at in the following subclause. 81% (358 in total) of the documents included in the dashboard are standards in the narrower sense (see subclause 3.6.2) like ISO- / EN- or national standards whereas the rest are specifications. Nearly 40% of the documents were published within the last 5 years.

The standards related to the CIRC-UIITS project cover a wide range of different areas. Based on the ICS fields, an overview of the different areas can be given (Table 6). For this overview only ICS fields which are assigned to at least 50 standards are listed in Table 6.

Table 6: Overview of the number of standards in the different ICS fields.

ICS Main field	ICS Sub field	Number of standards
03 – Services. Company organization. Management and quality. Administration. Transport. Sociology	03.100 – Company organizations and management. Management systems.	55
	03.120 – Quality	26
	03.080 – Service	4
13 – Environment. Health protection. Safety	13.020 – Environmental protection	109
	13.030 – Wastes	63
	13.300 – Protection against dangerous goods	2
	13.220 – Protection against fire	1
	13.320 – Alarm and warning systems	1
29 – Electrical engineering	29.020 – Electrical engineering in general	37
	29.100 – components for electrical equipment	8

ICS Main field	ICS Sub field	Number of standards
	29.035 – Insulating materials	6
	29.220 – Galvanic cells and batteries	7
	29.140 – Lamps and related equipment	2
	29.160 – Rotary machinery	1
	29.120 – Electrical accessories	1
31 – Electronics	31.180 – Printed CIRC-UIITS and boards	67
	31.080 – Semiconductor devices	42
	31.020 – Electronic components in general	10
	31.190 – Electronic components assemblies	11
	31.200 – Integrated CIRC-UIITS. Microelectronics	8
	31.120 – Electronic display devices	2
	31.240 – Mechanical structures for electronic equipment	2
31.220 – Electromechanical components for electronic and telecommunications equipment	1	
43 – Road vehicles	43.040 – Road vehicle systems	27
	43.020 – Road vehicle in general	18
	43.180 – diagnostics, maintenance and test equipment	6
	43.120 – Electric road vehicles	3
	43.060 – Internal combustion engines for road vehicles	1

These standards are part of 23 different ICS fields, with ICS field 13, ICS field 31, and ICS field 03 being the most present ones. It is important to keep in mind that one standard can be part of several different ICS fields.

5.2. Standardization activities on international level (updated)

From the standards which could be relevant for CIRC-UIITS, 241 documents on international level were included in the project dashboard. The main technical committees, which are responsible for these standards, are listed in Table 7 and are described in the following. Only TC's that published more than five standards of the ones included in the dashboard are listed and described below.

Table 7: List of international standardization technical committees responsible for the most standards included in the dashboard.

TC number	TC title
ISO/TC 22	Road vehicles
ISO/TC 207	Environmental management
ISO/TC 298	Rare earth
ISO/IEC JTC 1	Information technology
IEC/TC 47	Semiconductor devices
IEC/TC 56	Dependability
IEC/TC 91	Electronics assembly technology
IEC/TC 111	Environmental standardization for electrical and electronic products and systems
IEC/TC 119	Printed electronics
ITU	International telecommunication union

In the following, the relevant technical committees are described with regard to their scope, structure, number of published standards, and currently active work items.

Technical committees are usually divided into several sub committees (SC), which in turn are divided into working groups (WG). The actual development of standardization documents usually takes place at working group level. If two working groups from different TCs work together on the development of standards, they combine their work in a joint working group (JWG).

[ISO/TC 22 Road vehicles](#)

ISO/TC 22 develops standards related to all aspects for all types of road vehicles and their interfaces approved for operation on public roads for the whole life cycle concerning safety, security, sustainability, compatibility, interchangeability, maintenance, evaluation of performance and quality.²¹ The TC is divided into eleven sub committees (SCs), five working groups (WGs), and five joint working groups (JWGs). The groups most relevant for CIRC-UIITS are listed below:

- *ISO/TC 22/SC 32 – Electrical and electronic components and general system aspects*
165 ISO standards are currently published by SC 32 and 60 ISO standards are currently under development.
- *ISO/TC 22/SC 33 – Vehicle dynamics, chassis components and driving automation systems testing*
131 ISO standards are currently published by SC 33 and 26 ISO standards are currently under development.
- *ISO/TC 22/SC 37 - Electrically propelled vehicles*
33 ISO standards are currently published by SC 37 and 14 ISO standards are currently under development. The most relevant active work item is the following one: ISO/AWI 25027 - Electrically

²¹ <https://www.iso.org/committee/46706.html>, last viewed on 25.08.2025

propelled road vehicles — Methodology for the carbon footprint calculation of traction lithium-ion batteries at the stage of use [Stage Code²²: 20.00 - New project registered in TC/SC work programme].

ISO/TC 207 Environmental management

ISO/TC 207 deals with standardization in the field of environmental management to address environmental and climate impacts. Related social and economic aspects are included.²³ The TC is divided into six SCs and seven WGs. The groups most relevant for CIRC-UIITS are listed below:

- ISO/TC 207/SC 1 – Environmental management systems
- ISO/TC 207/SC 3 – Environmental labeling
- ISO/TC 207/SC 5 – Life cycle assessment
 - o JWG 14 – secondary materials
 - o TG 2 – circular economy coordination
 - o WG 12 – life cycle assessment – requirements and guidelines
 - o WG 15 – Social life cycle assessments
- ISO/TC 207/TG 2 – Circular economy coordination

The TC has currently published 72 ISO standards and 22 are currently under development. The standards under development most relevant for CIRC-UIITS with their respective stage code²² are listed in Table 8:

Table 8: List of relevant standards under development by ISO/TC 207.

Document number	Document title	Responsible SC	Stage code ²²
ISO/DIS 14001	Environmental management systems — Requirements with guidance for use	SC 1	40.99
ISO/DIS 14002-3	Environmental management systems — Guidelines for using ISO 14001 to address environmental aspects and conditions within an environmental topic area — Part 3: Climate	SC 1	40.00
ISO/CD 14002-4	Environmental management systems — Guidelines for using ISO 14001 to address environmental aspects and conditions within an environmental topic area — Part 4: Resources and waste	SC 1	30.20
ISO/DIS 14021	Environmental statements and programmes for products — Self-declared claims	SC 3	40.60
ISO/DIS 14024	Environmental statements and programmes for products — Ecolabels	SC 3	40.60
ISO/DIS 14025	Environmental statement and programmes for products — Environmental product declarations	SC 3	40.60
ISO/WD 14077.2	Environmental management — Life cycle assessment — Requirements and guidelines for application of Chain of Custody (CoC) approaches in Life Cycle Assessment (LCA)	SC 5	20.20

²² <https://www.iso.org/committee/5259148.html>, last viewed on 25.08.2025, The stage codes describe the working status of a standardization document. The meaning of each stage code can be found in annex 4.

²³ <https://www.iso.org/committee/54808.html>, last viewed on 25.08.2025

ISO/TC 298 Rare earth

Rare earth mining, concentration, extraction, separation, and conversion to useful rare earth compounds/materials are key aspects of standardization by ISO/TC 298.²⁴ The TC is divided into five WGs. The WGs most relevant for CIRC-UIITS are listed below:

- *ISO/TC 298/JWG 6 – Sustainability*
- *ISO/TC 298/WG 2 – Elements recycling*
- *ISO/TC 298/WG 3 – Traceability, Packaging and Labelling*

The TC has 13 ISO standards currently published and seven ISO standards are under development. The standards under development most relevant for CIRC-UIITS with their respective stage code are listed in Table 9:

Table 9: List of relevant standards under development by ISO/TC 298.

Document number	Document title	Stage code ²²
ISO/24457	Specifications for recycling of neodymium iron boron sintered permanent magnets	30.20
ISO/AWI 24961	Rare earths and lithium sustainability across the value chain: concentration, extraction, separation, conversion, recycling and reuse	20.20
ISO/AWI 25191	Rare Earth - Guidance for data collection and validation for the calculation of carbon footprint	20.20

ISO/IEC JTC 1 Information technology

The ISO/IEC JTC 1 is a joint technical committee between ISO and IEC dealing with standardization in the field of information technology. The committee is divided into 23 SCs, 17 WGs, and one JWG.²⁵ The groups most relevant for CIRC-UIITS are listed below:

- *ISO/IEC JTC 1/SC 27 – Information security, cybersecurity and privacy protection*
253 international standards are currently published by SC 27 and 75 international standards are currently under development.
- *ISO/IEC JTC 1/SC 39 – Sustainability, IT and data centers*
31 international standards are currently published by SC 39 and ten international standards are currently under development.
- *ISO/IEC JTC 1/SC 41 – Internet of things and digital twin*
52 international standards are currently published by SC 41 and 25 international standards are currently under development.

The standards under development most relevant for CIRC-UIITS are listed in Table 10Table 11:

²⁴ <https://www.iso.org/committee/5902483.html>, last viewed on 25.08.2025

²⁵ <https://www.iso.org/committee/45020.html>, last viewed on 25.08.2025



Table 10: List of relevant standards under development by ISO/IEC JTC 1.

Document number	Document title	Responsible SC	Stage code ²²
ISO/IEC AWI TS 27568	Security and privacy of digital twins	SC 27	20.00
ISO/IEC DIS 2700	Information security, cybersecurity and privacy protection — Information security management systems — Overview	SC 27	40.20
ISO/IEC DIS 15408-1	Information security, cybersecurity and privacy protection — Evaluation criteria for IT security — Part 1: Introduction and general model	SC 27	40.99
ISO/IEC DIS 15408-2	Information security, cybersecurity and privacy protection — Evaluation criteria for IT security — Part 2: Security functional components	SC 27	40.99
ISO/IEC AWI TR 25953	Information technology — IT and sustainability - AI and sustainable provisioning of IT and data centres	SC 39	20.00
ISO/IEC DTS 20125	Information technology – Digital services ecodesign – Ecopractices for life cycle stages	SC 39	50.00
ISO/IEC AWI 30153	Digital twin — Guidelines for digital entity modeling	SC 41	10.99
ISO/IEC AWI 20924	Internet of Things (IoT) and digital twin — Vocabulary	SC 41	20.00
ISO/IEC AWI 21823-1	Internet of things (IoT) — Interoperability for IoT systems — Part 1: Framework	SC 41	20.00
ISO/IEC AWI 30141	Internet of Things (IoT) — Reference architecture	SC 41	20.00
ISO/IEC AWI TR 30189-2	Guidance on the integration of IoT and digital twins in data spaces	SC 41	20.00
ISO/IEC CD 30151	Digital twin — Extraction and transactions of data components	SC 41	30.00
ISO/IEC CD 30188	Digital Twin — Reference architecture	SC 41	30.00

[IEC/TC 47 Semiconductor devices](#)

IEC/TC 47 is responsible for standardization related to design, manufacture, use, and reuse of discrete semiconductor devices, integrated CIRC-UIITS, display devices, sensors, electronic component assemblies, interface requirements, and microelectromechanical devices, using environmentally sound practices.²⁶ The committee is divided into four SCs, six WGs, and one PT. The groups most relevant for CIRC-UIITS are listed below:

- IEC/TC 47/SC 47A – Integrated CIRC-UIITS
- IEC/TC 47/SC 47E – Discrete semiconductor devices
- IEC/TC 47/WG 2 – Semiconductor Device Test Methods and Guidelines - Mechanical, Climatic and Storage

²⁶ https://www.iec.ch/dyn/www/f?p=103:7:0:::FSP_ORG_ID,FSP_LANG_ID:1251,25, last viewed on 25.08.2025

- IEC/TC 47/WG 6 – Incubating Working Group

133 IEC standards are currently published by IEC/TC 47 and 33 are currently under development. The standards under development most relevant for CIRC-UIITS are listed in Table 11:

Table 11: List of relevant standards under development by IEC/TC 47.

Document number	Document title	Responsible group
IEC 60749-21 ED3	Semiconductor devices - Mechanical and climatic test methods - Part 21: Solderability	WG 2
IEC 63287-4 ED1	Semiconductor devices - Guidelines for reliability qualification plans - Part 4: Early failure assessment	WG 2

IEC/TC 56 Dependability

IEC/TC 56 deals with standardization related to dependability. Dependability can be expressed in terms of core attributes of availability, reliability, maintainability, and supportability that are tailored to application-specific functional and service attributes. TC 56 standards are related to products, processes, and management activities. The standards provide systematic methods and tools for dependability assessment, technical risk assessment and management of services and systems throughout their life cycles.²⁷ The ISO/TC 56 is divided into four WGs, five project teams (PTs), two JWGs and 19 Maintenance teams (MTs). The groups most relevant for CIRC-UIITS are listed below:

- IEC/TC 56/WG 2 – Dependability technique
- IEC/TC 56/ WG 3 – Management and systems
- IEC/TC 57/PT 2.26 – Electric components – Reliability – Reference failure rates at reference conditions
- IEC/TC 56/PT 3.27 – Dependability management – Application guide – Availability
- IEC/TC 56/PT 60300-3-18 Dependability management – Application guide – Guide on Reliability
- IEC/TC 56/MT 62960 – Dependability reviews during the life cycle
- IEC/TC 56/MT 14 – Maintenance of IEC 60300-3-10 (WG 3)
- IEC/TC 56/MT 33 – Maintenance of IEC 62309
- IEC/TC 56/TC 1/JWG 2 - Joint Working Group to undertake the development of an IEV part on terminology relating to the circular economy (in particular material efficiency) Managed by TC 1 (Terminology)

58 IEC standards are currently published by IEC/TC 56 and 12 are currently under development. The standard under development most relevant for CIRC-UIITS are the following:

Table 12: List of relevant standards under development by IEC/TC 56.

Document number	Document title	Responsible group
IEC 62402-1 ED1	Obsolescence management Part 1: Policy, plan and process	MT 20
IEC 62402-3 ED1	Obsolescence Management Part 3: Exchange of information regarding change and discontinuance of products	MT 20

²⁷ https://www.iec.ch/dyn/www/?p=103:7:507638254073105:::FSP_ORG_ID,FSP_LANG_ID:1270,25, last viewed on 25.08.2025



[IEC/TC 91 Electronics assembly technology](#)

IEC/TC 91 deals with standardization in the context of design, manufacturing and testing of electronic assemblies including the requirements and tests for materials and components used to manufacture circuit boards and electronic assemblies, as well as the formats of electronic data and libraries for describing these products and processes.²⁸ The TC is divided into ten WGs and one JWG. The WGs most relevant for CIRC-UIITS are listed below:

- *IEC/TC 91/WG 1 – Requirements for electronic components*
- *IEC/TC 91/WG 2 – Requirements for electronics assemblies*
- *IEC/TC 91/WG 3 – Measuring and test methods for electronics assemblies*
- *IEC/TC 91/WG 4 – Printed boards and materials*
- *IEC/TC 91/WG 10 – Measuring and test methods for CIRC-UIITS boards and circuit board materials*
- *IEC/TC 91/WG 12 – Design methodology and data transfer of circuit boards and circuit board assemblies*

211 IEC standards are currently published by IEC/TC 91 and 25 are currently under development. The standards under development most relevant for CIRC-UIITS are listed in Table 13.

Table 13: List of relevant standards under development by IEC/TC 91.

Document number	Document title	Responsible group
PWI 91-7	Protection of electronic assemblies - Qualification of coatings	WG 3
PNW 91-2067 ED1	Sintering assembly technology - Part 1: Generic description	WG 2
IEC 61190-1-3 ED4	Attachment materials for electronic assembly - Part 1-3: Requirements for electronic grade solder alloys and fluxed and non-fluxed solid solder for electronic soldering applications	WG 2
IEC 63516 ED1	Fixed folding durability test method for flexible opto-electric circuit boards	WG 10

[IEC/TC 111 Environmental standardization for electrical and electronic products and systems](#)

IEC/TC 111 deals with standardization in the context of environmental aspects including preparing guidelines, basic and horizontal standards in close cooperation with product committees of IEC, which remain autonomous in dealing with the environmental aspects relevant to their products.²⁹ The TC is structured into seven WGs, three MTs, and four JWGs. The groups most relevant for CIRC-UIITS are listed below:

- *IEC/TC 111/WG 3 – Test methods of certain substances*
- *IEC/TC 111/WG 5 – Assessment of circular content in products*
- *IEC/TC 111/WG 15 – Product category rules for LCA of electrical and electronic products and systems*
- *IEC/TC 111/WG 18 – End-of-life management and assessment*
- *ICE/TC 111/WG 20 – Guidance on material circularity considerations in environmentally conscious design*

²⁸ https://www.iec.ch/dyn/www/f?p=103:7:0:::FSP_ORG_ID,FSP_LANG_ID:1286,25, last viewed on 25.08.2025

²⁹ https://www.iec.ch/dyn/www/f?p=103:7:0:::FSP_ORG_ID,FSP_LANG_ID:1314,25, last viewed on 25.08.2025



- IEC/TC 111/WG 111-1 (temporary) - General methods for the assessment of durability and lifecycle extension of products - Ability to repair, reuse and upgrade (RRU)
- IEC/TC 111/TC 1/JWG 2 – Joint Working Group to undertake the development of an IEV part on terminology relating to the circular economy (in particular material efficiency) Managed by TC 1
- TC 3/SC 3D/JWG 112 – Digitalization and data exchange of Carbon Footprint of Products (CFP) and other product environmental impact categories Managed by SC 3D

35 IEC standards are currently published by IEC/TC 111 and 16 are currently under development. Table 14 shows the active work items that could be of interest for CIRC-UIITS.

Table 14: List of relevant standards under development by IEC/TC 111.

Document number	Document title	Responsible group
IEC 63333-3 ED1	Assessment of circular content in products - Part 3: Proportion of recycled materials (Proposed Horizontal Publication)	WG 5
IEC 62635 ED1	Assessment of material recoverability rate of products	WG 18
IEC 63395 ED1	Sustainable management of waste electrical and electronic equipment (e-waste) - Proposed Horizontal Publication	WG 18
IEC 624747 ED3	Material declaration for products of and for the electrotechnical industry	WG 19
PNW 111-829 ED1	General methods for the assessment of product durability - Part 2: Ability to repair, reuse and upgrade (RRU)	WG 111-1

IEC/TC 119 Printed electronics

IEC/TC 119 is responsible for standardization of terminology, materials, processes, equipment, products and health / safety / sustainability in the field of printed electronics.³⁰ The TC is structured into seven WGs. The groups most relevant for CIRC-UIITS are listed below:

- IEC/TC 119/WG 2 – Materials
- IEC/TC 119/WG 3 – Equipment
- IEC/TC 119/WG 4 – Printability
- IEC/TC 119/ahG 6 – Sustainability

43 IEC standards are currently published and 19 are currently under development.

In addition to the relevant TCs listed in the dashboard, the following TC is of interest for CIRC-UIITS.

ISO/TC 323 Circular economy

This committee deals with standardization in the field of Circular Economy to develop frameworks, guidance, supporting tools and requirements for the implementation of activities of all involved organizations, to maximize the contribution to sustainable development³¹. The TC is structured into six WGs. The groups most relevant for CIRC-UIITS are listed below:

- ISO/TC 323/WG 2 – Practical approaches to develop and implement Circular Economy

³⁰ https://www.iec.ch/dyn/www/f?p=103:7:0:::FSP_ORG_ID:8679, last viewed on 25.08.2025

³¹ <https://www.iso.org/committee/7203984.html>, last viewed on 25.08.2025

There is also a joint working group with ISO/TC 207/SC 5/WG 14 which could be relevant for CIRC-UIITS.

- *Joint ISO/TC 207/SC 5 - ISO/TC 323 WG: Secondary materials*

Five ISO standard are published, and two standards are currently under development (see Table 15).

Table 15: List of relevant standards under development by ISO/TC 323.

Document number	Document title	Stage code ²²
ISO/AWI 25819	Circular economy — Organizing a value network towards circularity	20.00
ISO/DTR 59031	Circular economy — Performance-based approach — Analysis of case studies	50.00

5.3. Standardization activities on European level (updated)

Of the standards that could be relevant for CIRC-UIITS, 112 documents at European level were included in the project dashboard. The main technical committees, which are responsible for these standards, are listed in Table 16 and are described in the following. Only TC's that published more than five standards of the ones included in the dashboard, are listed and described below.

Table 16: List of international standardization technical committees responsible for the most standards included in the dashboard.

TC number	TC title
CEN/CLC/JTC 10	Material efficiency aspects for products in scope of Ecodesign legislation
CEN/TC 249	Plastics
CEN/TC 301	Road vehicles
CLC/TC 111X	Environment

[CEN/CLC/JTC 10 Material efficiency aspects for products in scope of Ecodesign legislation](#)

The CEN/CLC/JTC 10 deals with standardization topics related to material efficiency aspects for products within the scope of the Ecodesign Directive 2009/125/EC. This includes aspects such as assessment methods, design rules, dematerialization, digitalization and transfer of information on a variety of material efficiency topics e.g. extending product lifetime, ability to reuse components or recycle materials³² from products at End-of-Life and use of reused components and/or recycled materials in products.³³ The committee is divided into eight WGs. The groups most relevant for CIRC-UIITS are listed below:

- *CEN/CLC/JTC 10/WG 2 – Durability*
- *CEN/CLC/JTC 10/WG 3 – Ability to repair, reuse and upgrade energy-related products*
- *CEN/CLC/JTC 10/WG 4 – Ability to remanufacture and method for determining the proportion of reused components in products*

³² Includes coverage of the European Commission defined list of Critical Raw Materials (CRM).

³³ https://standards.cencenelec.eu/dyn/www/f?p=205:7:0:::FSP_ORG_ID:2240017&cs=18A65BEA4289B745403E9407952618CE3, last viewed on 25.08.2025

- CEN/CLC/JTC 10/WG 5 – Ability to recycle and recover energy-related products, recycled material content of energy-related products
- CEN/CLC/JTC 10/WG 6 – Documentation and/or marking regarding information relating to material efficiency of the product
- CEN/CLC/JTC 10/WG 8 – Circular Design

Ten European standards are currently published by CEN/CLC/JTC 10 and two European standard are currently under development – prEN 45553 – *General method for assessing the ability of a product to be remanufactured or refurbished* and prEN 45558 rev - *General method to declare the use of critical raw materials in products*.

CEN/TC 301 Road vehicles

The European standardization committee CEN/TC 301 deals with standardization aspects related to road vehicles answering European mandates. European mandates are standardization requests from the European Commission to the European Standardization Organizations in order to draw up and adopt European Standards or European standardization deliverables in support of EU policy.³⁴ Due to a globally acting automotive industry, the CEN/TC 301 also deals with the adoption of standardization projects at the international level (ISO/TC 22 Road vehicles).³⁵ The committee is divided into eight WGs. The groups most relevant for CIRC-UIITS are listed below:

- CEN/TC 301/WG 17 – Plastics recycling and sustainability for road vehicles
- CEN/TC 301/WG 6 – M/421 Vehicle OBD, repair and maintenance information

36 European standards are currently published, and eleven European standards are currently under development. No standards of particular interest for the project are currently being developed.

CLC/TC 111X Environment

CLC/TC 111X deals with standardization related to environmental aspects for electrical and electronic products and systems to reduce impacts and improve energy and resource efficiency of electrotechnical activities/products/systems on the natural environment. Product TCs remain autonomous in dealing with environmental aspects relevant to the products included in their scope, but CLC/TC 111X assists product committees in the elaboration of environmental requirements of product standards to foster common technical approaches and solutions for similar problems and thus promote consistency in CENELEC standards.³⁶ The committee is divided into seven WGs. The groups most relevant for CIRC-UIITS are listed below:

- CLC/TC 111X/WG 06 – WEEE Recycling Standards
- CLC/TC 111X/WG 08 – Method for quantitative eco design via life cycle assessment and environmental declarations through product category rules for EEE
- CLC/TC 111X/WG 08 – Task Force to prepare the NWIP for revision of EN 50419
- CLC/TC 111X/WG 12 – Design for Plastics Recycling

39 European standards are currently published under CLC/TC 111X, and 16 standards are under development Table 17. Most of them are European adoptions of international IEC standards, which were developed by IEC/TC 111.

³⁴ https://single-market-economy.ec.europa.eu/single-market/european-standards_en, last viewed on 25.08.2025

³⁵ https://standards.cencenelec.eu/dyn/www/f?p=205:7:0:::FSP_ORG_ID:6282&cs=143E88F87F7332721DB845C9598BE20D0, last viewed on 25.08.2025

³⁶ https://standards.cencenelec.eu/dyn/www/f?p=305:7:0:25:::FSP_ORG_ID,FSP_LANG_ID:1258637, last viewed on 25.08.2025



Table 17: List of relevant standards under development by CLC/TC 111X.

Document number	Document title	Status
prEN 50614	Requirements for the preparing for re-use of waste electrical and electronic equipment	preliminary
prEN 50625-1	Collection, logistics & treatment requirements for WEEE - Part 1: General treatment requirements	Under approval
CLC/prTS 50625-3-1	Collection, logistics & treatment requirements for WEEE - Part 3-1: Specification for de-pollution - General	Under drafting
CLC/prTS 50752	Design for recycling guidelines for styrenics and polyolefins products and parts in electrical and electronic equipment, with focus on ABS, PP and PS	Under drafting
CLC/prTS 50XXX	Product Category Rules for Material Efficiency Assessment	Preliminary

In addition to the relevant TCs listed in the dashboard, the following TCs are of interest for CIRC-UIITS.

[CEN-CLC/JTC 24 Digital Product Passport \(DPP\)](#)

The European joint technical committee DPP was founded in September 2023 to establish the necessary standardization infrastructure and coordinate the work related to the upcoming political initiatives. The committee will produce results for the introduction of the DPP and the data-providing ecosystem while ensuring cross-sector and cross-system interoperability. The new JTC will not develop sector-specific norms and standards for the DPP system or DPP data, which already fall within the responsibility of other CEN and CENELEC TCs. Future standardization documents should tackle issues like unique identifiers, data carriers, connections between physical and digital formats, access rights, interoperability, data handling, storage, authentication, and security.

There are four different working groups dealing with different aspects regarding a DPP:

- [CEN/CLC/JTC 24/WG 1: Strategic Advisory Group](#)
- [CEN/CLC/JTC 24/WG 2: Unique identifiers and data carriers](#)
- [CEN/CLC/JTC 24/WG 3: Security](#)
- [CEN/CLC/JTC 24/WG 4: Interoperability framework](#)

JTC 24 has not published any standards yet, however, eight standards are currently under development and will be published soon (see Table 18).³⁷

Table 18: Standards under development from CEN/CLC/JTC 24.

Document number	Document title	Status
prEN 18216	Digital product passport - Data exchange protocols	Under Approval
prEN 18219	Digital product passport - Unique identifiers	Under Approval

³⁷ https://standards.cencenelec.eu/dyn/www/?p=305:7:0:25:::FSP_ORG_ID,FSP_LANG_ID:3342699, last viewed on 05.12.2025



Document number	Document title	Status
prEN 18220	Digital product passport - Data carriers	Under Approval
prEN 18221	Digital product passport - data storage, archiving, and data persistence	Under Approval
prEN 18222	Digital Product Passport - Application Programming Interfaces (APIs) for the product passport lifecycle management and searchability	Under Approval
prEN 18223	Digital Product Passport - System interoperability	Under Approval
prEN 18239	Digital Product Passport - access rights management, information system security, and business confidentiality	Under Approval
prEN 18246	Digital product passport - Data authentication, reliability and integrity	Under Approval

CEN/TC 473 Circular economy

The TC is responsible for standardization in the field of Circular Economy to develop horizontal standards that address European specific prerequisites, legislation, and policy. The standards aim to provide guidance, recommendations, requirements, methodologies, and tools to implement, support and measure the transition towards a Circular Economy at an organizational level. The deliverables aim to complement international and European standardization in the advancement in the transition towards a Circular Economy, while contributing to sustainable development.³⁸

CEN/TC 473 has not published any standards yet, and five standards are currently under development (see Table 19).

Table 19: Standards under development from CEN/TC 473.

Document number	Document title	Status
prCEN/TC XXX (WI=00473002)	Circular Economy – Practical information and guidance for the implementation of ISO 59004 in Europe	Under drafting
prCEN/TS XXX (WI=00473001)	Circular economy - Guidance on the implementation of ISO 59010 with consideration of European policies and regulations	Under drafting
prEN XXX (WI=00473003)	Circular Economy - Product-related data and information sharing along value networks	Under drafting
(WI=00473005)	Remanufacturing (Reman) – Quality classification for circular processes	Under drafting
(WI=00473004)	Circular Economy – Extended Producer Responsibility (EPR) – Requirements and guidelines for Producer Responsibility Organizations (PRO)	Under drafting

³⁸ https://standards.cencenelec.eu/dyn/www/f?p=205:7:0:::FSP_ORG_ID:3326686&cs=1FB6C33369B0F6BEA8BA7EFC7B26D4309, last viewed on 05.12.2025

5.4. Standards developing consortia (updated)

Global Electronics Association (former IPC international)

IPC International is a global association supporting OEMs, EMS, PCB manufacturers, cable and wire harness manufacturers, and electronics industry suppliers in the context of better electronics. Through standards and certifications, education, and training they provide solutions for the industry. Over 300 standards are covering nearly every stage of the electronics product development cycle, and 3000 experts from electronic industry participating in the development of these standards.³⁹ On the following website the existing standards can be searched: <https://shop.electronics.org/taxonomy/term/547>

5.5. Standards related to CIRC-UIITS (updated)

The standardization landscape relevant for CIRC-UIITS contains 444 standards developed by standardization organizations such as DIN, CEN/CENELEC, ISO etc. In this section an overview is given about the most important standards for the identified and most relevant areas of the project – Industry, Circular Economy, Quality management, and Digitalization. In the area of industry, circular economy and quality management, the top standards contain three or more keywords per area either in the abstract, title, or search terms. As only three keywords were used in the field of digitization during the standards research, the list of top standards includes standards that contain two or more keywords either in the abstract, in the title or in the search terms.

The list of all relevant standards can be found in annex 1. In addition, the technical committee responsible of each standard is listed. In the upcoming month, the CIRC-UIITS partners will be asked which standards they use for their work in the project. If there are standards that they would like to use but do not have access to, DIN made them available. 17 standards were made available to align project developments with state-of-the-art.

5.5.1. Area “Industry” (updated)

The area “industry” is the second largest field in terms of relevant standards related to the project CIRC-UIITS. 136 standards are addressing the topic industry, especially in the field of automotive, printed electronics and testing. The following Table 20 shows the most relevant standards related to CIRC-UIITS in the area “industry”.

Table 20: List of top standards relevant in the area of “industry”, cells marked in blue represent standards under development.

Document number	Document title	Publication date	Responsible TC
FprEN 62899-1	IEC 62899-1, Ed. 1: Printed electronics - Materials - Part 1: Substrates	Draft	CENELEC
IEC 62899-101	Printed electronics - Part 101: Terminology - Vocabulary	2019-10-00	IEC/TC 119
IEC 62899-201	Printed electronics - Part 201: Materials - Substrates	2016-02-00	IEC/TC 119
IEC 62899-201 AMD 1	Printed electronics - Part 201: Materials - Substrates; Amendment 1	2018-11-00	IEC/TC 119
IEC 62899-201-2	Printed electronics - Part 201-2: Materials - Substrates - Measurement methods for properties of stretchable substrates	2021-10-00	IEC/TC 119

³⁹ <https://www.electronics.org/>, last viewed on 05.09.2025

Document number	Document title	Publication date	Responsible TC
IEC 62899-202	Printed electronics - Part 202: Materials - Conductive ink	2023-05-00	IEC/TC 119
IEC 62899-202-5	Printed electronics - Part 202-5: Materials - Conductive ink - Mechanical bending test of a printed conductive layer on an insulating substrate	2018-09-00	IEC/TC 119
IEC 62899-202-7	Printed electronics - Part 202-7: Materials - Printed film - Measurement of peel strength for printed layer on flexible substrate by the 90° peel method	2021-03-00	IEC/TC 119
IEC 62899-202-9	Printed electronics - Part 202-9: Materials - Conductive ink - Printed patterns for mechanical test	2023-08-00	IEC/TC 119
IEC 62899-202-10	Printed electronics - Part 202-10: Materials - Resistance measurement method for thermoformable conducting layer	2023-08-00	IEC/TC 119
IEC 62899-203	Printed electronics - Part 203: Materials - Semiconductor ink	2024-05-00	IEC/TC 119
IEC 62899-203-2	Printed electronics - Part 203-2: Materials - Space charge limited mobility measurement in printed organic semiconductive layers	2025-06-00	IEC/TC 119
IEC 62899-204	Printed electronics - Part 204: Materials - Insulator ink - Measurement methods of properties of insulator inks and printed insulating layers	2019-05-00	IEC/TC 119
IEC 62899-301-3	Printed Electronics - Part 301-3: Equipment - Contact printing - Rigid master - Method to measure the shape errors of printing plate rollers	2024-09-00	IEC/TC 119
IEC/TR 62899-303-2	Printed electronics - Part 303-2: Equipment - Sheet to sheet printing - Mechanical dimension	2024-10-00	IEC/TC 119
IEC 62899-401	Printed electronics - Part 401: Printability - Overview	2017-03-00	IEC/TC 119
IEC 62899-402-1	Printed electronics - Part 402-1: Printability - Measurement of qualities - Line pattern widths	2017-03-00	IEC/TC 119
IEC/TR 62899-402-4	Printed electronics - Part 402-4: Printability - Measurement of qualities - Classification and measurement methods for morphology	2021-09-00	IEC/TC 119
IEC 62899-501-1	Printed electronics - Part 501-1: Quality assessment - Failure modes and mechanical testing - Flexible or bendable primary or secondary cells	2019-01-00	IEC/TC 119
IEC 62899-502-1	Printed electronics - Part 502-1: Quality assessment - Organic light emitting diode (OLED) elements - Mechanical stress testing of OLED elements formed on flexible substrates	2017-03-00	IEC/TC 119
IEC 62899-505	Printed electronics - Part 505: Quality assessment - Flexible gas sensor - Mechanical and thermal testing	2020-06-00	IEC/TC 119
IEC/TR 62899-550-1	Printed electronics - Part 550-1: Quality assessment - Framework document on durability testing - Mechanical and thermal testing	2022-10-00	IEC/TC 119

5.5.2. Area “Circular Economy” (updated)

The area “circular economy” is the largest field in terms of relevant standards related to the project CIRC-UIITS. As the project is part of the call “CLIMATE NEUTRAL, CIRCULAR AND DIGITISED PRODUCTION 2022” and the topic “Digital tools to support the engineering of a Circular Economy” within the Horizon Europe Framework Program, part of the CIRC-UIITS standardization landscape should address circular economy. 180 standards addressing the topic circular economy, especially about environmental aspects, life cycle assessment, design, equipment, and recycling. The following Table 21 shows the most relevant standards related to CIRC-UIITS in the area “circular economy”.

Table 21: List of top standards relevant in the area of “Circular Economy”, cells marked in blue represent standards under development.

Document number	Document title	Publication date	Responsible TC
ITU-T L. 1022	Circular economy: Definitions and concepts for material efficiency for information and communication technology	2019-10-00	ITU
ITU-T L.1410	Methodology for environmental life cycle assessments of information and communication technology goods, networks and services	2014-12-00	ITU
VDI 2343 volume 3	Recycling of electrical and electronical equipment - Disassembly	2009-04-00	VDI Society Energy and Environment
VDI 4800 volume 2	Resource efficiency - Evaluation of raw material demand	2018-03-00	VDI Society Energy and Environment
VDI 4800 volume 2 correction	Resource efficiency - Evaluation of raw material demand - Corrigendum concerning standard VDI 4800 Part 2:2018-03	2018-05-00	VDI Society Energy and Environment
VDI 4082	Recycling of cars - Draining and preparation of vehicles for the disassembly	2015-01-00	VDI Society Energy and Environment
EN ISO 14040	Environmental management - Life cycle assessment - Principles and framework (ISO 14040:2006)	2006-07-00	CEN
EN ISO 14040/A1	Environmental management - Life cycle assessment - Principles and framework - Amendment 1 (ISO 14040:2006/Amd 1:2020)	2020-10-00	CEN
EN ISO 14044	Environmental management - Life cycle assessment - Requirements and guidelines (ISO 14044:2006)	2006-07-00	CEN
EN ISO 14044/A1	Environmental management - Life cycle assessment - Requirements and guidelines - Amendment 1 (ISO 14044:2006/Amd 1:2017)	2018-02-00	CEN
EN ISO 14044/A2	Environmental management - Life cycle assessment - Requirements and guidelines - Amendment 2 (ISO 14044:2006/Amd 2:2020)	2020-10-00	CEN
ISO/TR 14047	Environmental management - Life cycle assessment - Illustrative examples on how to apply ISO 14044 to impact assessment situations	2012-06-00	ISO/TC 207
ISO/TS 14048	Environmental management - Life cycle assessment - Data documentation format	2002-04-00	ISO/TC 207
ISO/TR 14049	Environmental management - Life cycle assessment - Illustrative examples on how to apply ISO 14044 to goal	2012-06-00	ISO/TC 207

Document number	Document title	Publication date	Responsible TC
	and scope definition and inventory analysis		
EN ISO 14071	Environmental management - Life cycle assessment - Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006 (ISO/DIS 14071:2023)	2024-10-00	CEN
CEN ISO/TS 14071	Environmental management - Life cycle assessment - Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006 (ISO/TS 14071:2014)	2016-02-00	CEN
ISO/TS 14072	Environmental management - Life cycle assessment - Requirements and guidelines for organizational life cycle assessment	2014-12-00	ISO/TC 207
ISO/TS 14074	Environmental management - Life cycle assessment - Principles, requirements and guidelines for normalization, weighting and interpretation	2022-11-00	ISO/TC 207
ISO 14075	Environmental management - Principles and framework for social life cycle assessment	2024-10-00	ISO/TC 207
EN 50598-3	Ecodesign for power drive systems, motor starters, power electronics and their driven applications - Part 3: Quantitative eco design approach through life cycle assessment including product category rules and the content of environmental declarations	2015-03-00	CLC/TC 22X
ISO 59014	Environmental management and circular economy - Sustainability and traceability of secondary materials recovery - Principles and requirements	2024-10-00	ISO/TC 207
IEC/TR 62824	Guidance on material efficiency considerations in environmentally conscious design of electrical and electronic products	2016-04-00	IEC/TC 111
IEC/TS 63428	Guidance on material circularity considerations in environmentally conscious design	2024-08-00	IEC/TC 111
ETSI TR 104080 V 1.1.1	Environmental Engineering (EE) - Example of a Life Cycle Assessment (LCA) of a mobile phone	2024-07-00	ETSI/EE Mobile ICT devices
EN 303808 V 1.1.1	Environmental Engineering (EE) - Applicability of EN 45552 to EN 45559 methods for assessment of material efficiency aspects of ICT network infrastructure goods in the context of circular economy	2023-01-00	ETSI/EE Eco-Environmental Product Standards

5.5.3. Area “Quality management” (updated)

Quality management is a topic that should always be addressed especially in the context of industry. 134 standards are addressing the topic quality management, especially in the field of quality, testing, supply chain, management systems, safety and cybersecurity. The following Table 22 shows the most relevant standards related to CIRC-UIITS in the area “quality management”.

Table 22: List of top standards relevant in the area of “Quality management”.

Document number	Document title	Publication date	Responsible TC
VDA risk minimization supply chain	Joint Quality Management in the Supply Chain - Product creation, product manufacture and product delivery - Minimizing risks in the supply chain	2011-10-00	VDA QMC
VDA VDA Maturity Level Assurance, Specification Standard Structure, Robust Production Process, Product Integrity	Joint Quality Management in the Supply chain - Product development, Maturity level assurance for new parts - Automotive VDA component requirement, Specification standard structure - Guideline for the specification of systems, modules, components and individual parts	2007-11-00	VDA QMC
VDA volume 3 part 1	Quality Management in the Automotive Industry - Reliability Assurance of Car Manufacturers and Suppliers - Reliability Management	2019-07-00	VDA QMC
VDA volume 3 part 2	Quality Management in the Automotive Industry - Reliability Assurance of Car Manufacturers and Suppliers - Reliability methods and tools	2016-05-00	VDA QMC
VDA volume 4 section 2	Quality Management in the Automotive Industry - Quality Assurance in the Process Landscape - Section 2: Risk Analyses - Fault Tree Analysis (FTA), Failure Mode and Effects Analysis (FMEA), SWOT-Analysis (Strengths, Weaknesses, Opportunities, Threats)	2020-08-00	VDA QMC
VDA volume 4 section 3	Quality Management in the Automotive Industry - Quality Assurance in the Process Landscape - Section 3: Methods - Design for Manufacturing and Assembly (DFMA), Digital Mock-Up (DMU), Design of Experiments (DoE) – Trial Methodology, Manufacturing Feasibility Analysis, POKA YOKE, Quality Function Deployment (QFD), TRIZ, Economical Process Design and Process Control, 8D Method, 5 Why Method, Selection of Preventive Quality Management Methods	2020-08-00	VDA QMC
ITU-T L.1060	General principles for the green supply chain management of information and communication technology manufacturing industry	2021-07-00	ITU
EN ISO 9001	Quality management systems - Requirements (ISO 9001:2015)	2015-09-00	CEN
EN ISO 14006	Environmental management systems - Guidelines for incorporating ecodesign (ISO 14006:2020)	2020-02-00	CEN
ISO 14009	Environmental management systems - Guidelines for incorporating material circulation in design and development	2020-12-00	ISO/TC 207
ISO/TR 14049	Environmental management - Life cycle assessment - Illustrative examples on how to apply ISO 14044 to goal and scope definition and inventory analysis	2012-06-00	ISO/TC 207
EN ISO 14052	Environmental management - Material flow cost accounting - Guidance for practical implementation in a supply chain (ISO 14052:2017)	2018-10-00	CEN

Document number	Document title	Publication date	Responsible TC
ISO/IEC TS 17021-13	Conformity assessment - Requirements for bodies providing audit and certification of management systems - Part 13: Competence requirements for auditing and certification of compliance management systems	2021-12-00	ISO/CASCO
ISO/TR 17370	Application Guideline on Data Carriers for Supply Chain Management	2013-06-00	ISO/TC 122
ISO/TS 22318	Security and resilience - Business continuity management systems - Guidelines for supply chain continuity management	2021-12-00	ISO/TC 292
ISO 28001	Security management systems for the supply chain - Best practices for implementing supply chain security, assessments and plans - Requirements and guidance	2007-10-00	ISO/TC 8
ISO 28004-1 Technical Corrigendum 1	Security management systems for the supply chain - Guidelines for the implementation of ISO 28000 - Part 1: General principles; Technical Corrigendum 1	2012-08-00	ISO/TC 8
ISO 28004-1	Security management systems for the supply chain - Guidelines for the implementation of ISO 28000	2007-10-00	ISO/TC 8
ISO 28004-3	Security management systems for the supply chain - Guidelines for the implementation of ISO 28000 - Part 3: Additional specific guidance for adopting ISO 28000 for use by medium and small businesses (other than marine ports)	2014-02-00	ISO/TC 8
ISO 28004-4	Security management systems for the supply chain - Guidelines for the implementation of ISO 28000 - Part 4: Additional specific guidance on implementing ISO 28000 if compliance with ISO 28001 is a management objective	2014-02-00	ISO/TC 8
ETSI TR 103937 V 1.1.1	Cyber Security (CYBER) - Cyber Resiliency and Supply Chain Management	2024-08-00	ETSI/CYBER

5.5.4. Area “Digitalization” (updated)

In the area of “digitalization”, 58 standards were evaluated as relevant for CIRC-UIITS. Especially standards related to communication and data are included in CIRC-UIITS standardization landscape. The following Table 23 shows the most relevant standards related to CIRC-UIITS in the area “digitalization”.

Table 23: List of top standards relevant in the area of “Digitalization”.

Document number	Document title	Publication date	Responsible TC
ASAM MDX	Meta Data Exchange Format for Software Module Sharing; Version 1.3.0	2015-06-25	ASAM
ITU-T X.1209	Capabilities and their context scenarios for cybersecurity information sharing and exchange	2010-12-00	ITU
ITU-T L.1060	General principles for the green supply chain management of information and communication technology manufacturing industry	2021-07-00	ITU

Document number	Document title	Publication date	Responsible TC
ITU-T X.1410	Security architecture of data sharing management based on the distributed ledger technology	2023-03-00	ITU
ITU-T Y.4703	Internet of things service management application programming interface Representational State Transfer specification	2024-03-00	ITU
ITU-T Y.4704	Internet of things device management application programming interface Representational State Transfer specification	2024-03-00	ITU
ETSI GS CDM 002 V 1.1.1	Common information sharing environment service and Data Model (CDM) - System Requirements definition	2021-03-00	ETSI/ISG CDM
ISO/TS 14048	Environmental management - Life cycle assessment - Data documentation format	2002-04-00	ISO/TC 207
ISO/TR 17370	Application Guideline on Data Carriers for Supply Chain Management	2013-06-00	ISO/TC 122
ISO/TS 18876-1	Industrial automation systems and integration - Integration of industrial data for exchange, access and sharing - Part 1: Architecture overview and description	2003-11-00	ISO/TC 184
ISO/TS 18876-2	Industrial automation systems and integration - Integration of industrial data for exchange, access and sharing - Part 2: Integration and mapping methodology	2003-11-00	ISO/TC 184
ISO/IEC 23751	Information technology - Cloud computing and distributed platforms - Data sharing agreement (DSA) framework	2022-02-00	ISO/IEC JTC 1/SC 38
ISO/IEC 27400	Cybersecurity - IoT security and privacy - Guidelines	2022-06-00	ISO/IEC JTC 1
ISO/IEC 27402	Cybersecurity - IoT security and privacy - Device baseline requirements	2023-11-00	ISO/IEC JTC 1
ISO/IEC 27403	Cybersecurity - IoT security and privacy - Guidelines for IoT-domotics	2024-06-00	ISO/IEC JTC 1
ISO/IEC 30141	Internet of Things (IoT) - Reference architecture	2024-08-00	ISO/IEC JTC 1
ISO/IEC TS 30149	Internet of Things (IoT) - Trustworthiness principles	2024-05-00	ISO/IEC JTC 1
CLC/TS 50600-5-1	Information technology - Data centre facilities and infrastructures - Part 5-1: Maturity Model for Energy Management and Environmental Sustainability	2023-09-00	CLC/TC 215
EN 60300-3-2	Dependability management - Part 3-2: Application guide - Collection of dependability data from the field (IEC 60300-3-2:2004)	2005-03-00	CENELEC
IEC 63372	Quantification and communication of Carbon FootPRINT and GHG emission reductions/avoided emissions from electric and electronic products and systems - Principles, methodologies, requirements and guidance	Draft	IEC/TC 111
ETSI TS 103486 V 1.1.1	CYBER - Identity Management and Discovery for IoT	2024-03-00	ETSI/CYBER

5.5.5. Standards in use within CIRC-UIITS (updated)

The following subchapter shows examples of standards that are used within CIRC-UIITS to bring project developments in line with the state of the art presented in the standards (see Table 24). The most standards are used within WP 3 - *Circularity & eco-design assessment*, WP 4 - *Technological implementation, validation & demonstration* and WP 6 - *Dissemination, Communication & Education*.

Table 24: List of standards in use within CIRC-UIITS, what they are used for and by which partner.

WP	Document number and title	Use within CIRC-UIITS and by whom
WP 3	ISO 14044 :2006, Environmental management - Life cycle assessment - Requirements and guidelines	This standard was adopted as the methodological basis for LCA. It provided the overarching framework in Task 3.1 (Sustainability & Circularity assessment methodology definition) and was subsequently applied in Task 3.2 (Implementation of assessment and advisory services) for the LCA assessments carried out in the Bosch, Continental, and TNO pilots. (SUPSI)
	ISO 14025 :2006, Environmental labels and declarations — Type III environmental declarations — Principles and procedures	It is the standard on which environmental product declarations, such as Product Category Rules (PCRs), are based. This standard allows meaningful comparisons to be made between products with the same function, ensuring that these comparisons are based on the same Product environmental footprint category rules (PEFCR) criteria. This standard was considered in Task 3.1 as part of the methodological framework. However, it was not ultimately applied, since the products analysed in the project did not fall under any existing PEFCRs, and therefore no standardized product comparisons could be performed. (SUPSI)
	EN 15804 :2022, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products	The EN 15804 standard is used for the Environmental Product Declaration (EPD) in the context of environmental life cycle assessments of products, specifically to allocate the environmental impacts associated with recycled materials in a product's life cycle. This methodology considers net secondary material flows and calculates the environmental loads and benefits associated with recycling processes and virgin material substitution, providing a standardized approach for declaring these impacts across system boundaries. This standard was employed both at methodological level in Task 3.1 and operationally in Task 3.2 for the allocation of End-of-Life impacts in LCA. It provided the reference rules for declaring the environmental impacts associated with secondary material flows and recycling processes. (SUPSI)
	ISO 15686-5 :2017, Buildings and constructed assets - Service life planning - Part 5: Life-cycle costing	In the CIRC-UIITS project, the Life Cycle Costing (LCC) approach is exploited for economic impact assessment. While this standard is primarily designed for applications in the building sector, its principles and methodologies are transferable and adaptable to various sectors beyond construction. The robust framework provided by ISO 15686-5 2017 ensures thorough economic evaluations across the life cycle of assets, making it suitable for application in diverse contexts, including the objectives of the CIRC-UIITS project. This standard was applied both as a methodological framework (T3.1), and in the implementation phase (T3.2), for Life Cycle Costing (LCC) analyses. In particular, it was used in the Bosch and Continental pilots to assess the economic impacts across the product life cycle. (SUPSI)
	EN 45554 :2020, General methods for the assessment of the ability to repair, reuse and upgrade energy-related products	The EN 45554 standard outlines the steps for conducting a Repairability Assessment and was used for this purpose with the pilots. (SUPSI, BOSCH, OFFIS), Performance of dismounting (CONTI)
	ISO 59004 :2024, Circular economy — Vocabulary, principles and guidance for implementation	Used for terminology alignment in Circularity Assessment Methodology (SUPSI)

WP	Document number and title	Use within CIRC-UIITS and by whom
	ISO 59020:2024 , Circular economy — Measuring and assessing circularity performance	Reference framework for GRETA's circular indicators, such as the MCI. The MCI is not expressly cited in ISO 59020, yet it reflects the core indicators recommended by ISO 59020. (SUPSI)
WP 4	VDA 232-101:2015 , Global Automotive Declarable Substance List (GADSL)	The standard is used for compliance with the REACH - Regulation (EC) 1907/2006 and in a second step for compliance with the standards of International Material Data System in the automotive industry. (Conti)
	VDA 900-100:2022 , Guidance for Conducting Life Cycle Assessment Studies of Passenger Cars	Within CIRC-UIITS, the VDA 900-100 will be used for conducting a LCA in circular economy context. (Conti)
	EN ISO 9001:2015 , Quality management systems - Requirements	The EN ISO 9001 is used as a general quality management standard in the whole project especially related to the use cases. (TNO)
	ISO 21750:2006 , Road vehicles - Safety enhancement in conjunction with tyre inflation pressure monitoring	Within CIRC-UIITS, a new generation of "products" as a platform will be developed. Due to that, the requirements listed in ISO 21750 will be applied. (Conti)
	ISO 23664:2021 , Traceability of rare earths in the supply chain from mine to separated products	Within CIRC-UIITS, standard flooded batteries are used. The ISO 23664 serves as a link to traceability on supply chain and potentially on the KPIs, which will be used to evaluate the product within the project. (Conti)
	IEC 62321-3-4:2023 , Determination of certain substances in electrotechnical products - Part 3-4: Screening - Phthalates in polymers of electrotechnical products by high performance liquid chromatography with ultraviolet detector (HPLC-UV), thin layer chromatography (TLC) and thermal desorption mass spectrometry (TD-MS)	The IEC 62321-3-4 describes the determination of certain substances in an electronic engineering product. Within CIRC-UIITS, critical materials are used, the bill of materials of raw materials/ components used will be determined with this standard. The standard is used for compliance with the REACH - Regulation (EC) 1907/2006, which is the European Chemicals Regulation for the Registration, Evaluation, Authorization and Restriction of Chemicals. (Conti)
	ECSS-Q-ST-70-12C, ECSS-Q-ST-70-12C Annex A, ECSS-Q-ST-70-12C Annex B:2014 , Design rules for printed circuit boards	Within CIRC-UIITS, the PCB definition should be based on the same type of requirements for sustainable PCB at supplier level. For this purpose, the standard is used. In a second step, a gap or deviation related to this standard should be addressed. (Conti)
	CWA 17806:2021 , Design Circular Framework Setting - Composite recovery design solutions in the automotive industry	(Conti)
	CWA 17807:2021 , Dismantling methods and protocols in a Circular Economy - Framework - Composite recovery in the automotive industry	(Conti)
ISO 59004:2024 , Circular economy — Vocabulary, principles and guidance for implementation	(Conti)	
WP 6	VDI 4800 volume 1:2016 , Resource efficiency - Methodological principles and strategies; VDI 4800 volume 2:2018 , Resource efficiency - Evaluation of raw material demand, VDI 4800 volume 2 correction	The incorporation of VDI Guideline 4800, particularly Sheets 1/2, into serious games is highly beneficial. It offers transparent frameworks and illustrative examples for evaluating resource efficiency. Moreover, the guideline furnishes specific guidance for identifying and interpreting pertinent key figures. This provides players/learners with a practical guide to implementing resource efficiency measures that they can use in their working environment. (BESU)
	EN ISO 14040:2006 , Environmental management - Life cycle assessment - Principles and framework, EN ISO 14040/A1:2020 , Environmental management - Life cycle assessment -	The integration of the EN ISO 14040 (14040/A1) standard on the principles and framework conditions of life cycle assessment is of central importance for serious games that aim to convey didactic content in a playful way. In order to assess processes and workflows in the context of the circular economy, a comprehensive investigation framework is

WP	Document number and title	Use within CIRC-UIITS and by whom
	Principles and framework - Amendment 1	required. This includes analyzing the environmental characteristics of products along their life cycle and identifying potential for improvement. The target groups, which include decision-makers in industry, governmental and non-governmental organizations, are also considered. (BESU)
	EN ISO 14044 :2006, Environmental management - Life cycle assessment - Requirements and guidelines	The integration of the EN ISO 14044 standard into the development of serious games offers a significant added value. The application of this standard establishes a clearly defined process for life cycle assessment, which is of crucial importance for developers of serious games in the context of a circular economy. The standard defines standardized phases and activities that enable a uniform assessment of processes and workflows in the circular economy. This provides players/learners with a clear overview of what a life cycle assessment provides, how the data obtained is to be interpreted and how specific recommendations for action can be derived from it. This facilitates a more profound comprehension of environmental concerns and empowers players to apply the insights they have acquired directly to their everyday decision-making. (BESU)

6. Standardization strategy (updated)

After providing the consortium with an overview of currently existing standards within the fields of interest, the next step was to develop a standardization strategy for the project. This strategy defines how the project could become active in standardization to ensure a sufficient transfer of project results into standardization.

Figure 10 in subclause 4.5 shows the options that are possible and common for a research project like CIRC-UIITS to participate in standardization. Figure 1 shows the specific standardization strategy for CIRC-UIITS and the following Figure 15 shows the activities in more detail including an overview of the standardization activities that have been carried out.

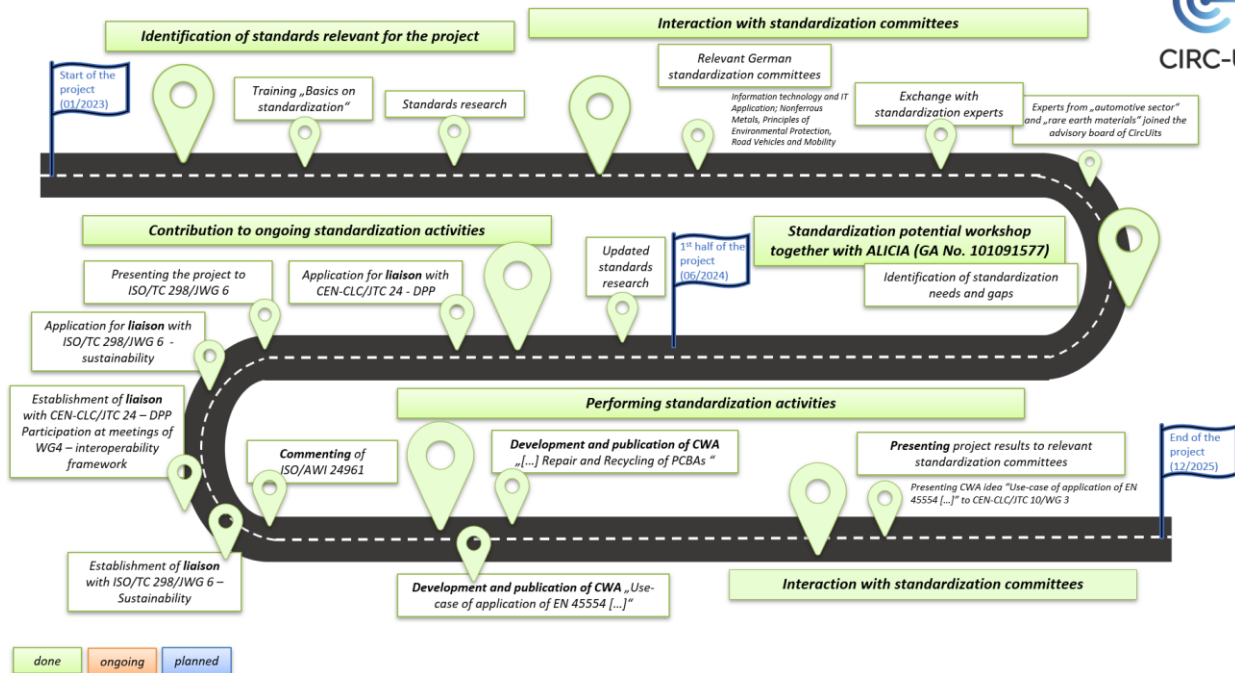


Figure 15: standardization roadmap and standardization activities that have been carried out within CIRC-UIITS

The standardization strategy and its activities are further described in subchapter 6.1, 6.2, 6.3 and 6.4.

6.1. Interaction with standardization community

The interaction with standardization committees is crucial to inform each other about the activities that are currently going on, both on standardization level and in the research field. Exchanges are needed to ensure that the work within the project aligns with planned and ongoing standardization work within standardization committees. Further, the committees will be informed about current work within the research field so they get an idea about what could become important in terms of standardization. Experts, which are active in standardization and have a lot of knowledge in specific fields, e.g., automotive, critical raw materials, etc., could also provide constructive feedback on the work of the project.

Further, the interaction with standardization committees allows direct participation in standardization, leading to an easier transfer of project results into standardization.

There are different ways to interact with standardization committees:

- Exchanges with TCs:** where the project can be introduced, results can be presented, also with regard to potential standardization needs, and possible ways for the project’s contribution to standardization can be discussed.
- Liaison:** allows the project to make a technical contribution to drafting standards in the working group that is developing the standard, and to attend the committee meetings if expressly invited by the committee, but only as observer. Liaisons are possible on European level or international level.
- Exchanges within DIN:** The project is introduced to colleagues, managing German standardization committees or to the German standardization committees themselves. Also, the projects' standardization ideas can be discussed within this frame. DIN’s project manager can access the documents and current developments can be reported to the project. Forwarding documents to the consortium is not possible.

DIN informed the following DIN standardization committees (see Table 25), which are partially mirroring the standardization work at European and international level, about CIRC-UIITS and the role of standardization in the project:

Table 25: List of German standardization committees, which have been contacted to inform about the project CIRC-UIITS.

German standardization committee	Working groups
Information Technology and IT Applications (NA 043)	<ul style="list-style-type: none"> Internet of Things (IoT) and Digital Twin (NA 043-01-41) DIN/DKE Joint working committee Digital product passport (NA 043-02-06 GA)
Nonferrous Metals (NA 066)	<ul style="list-style-type: none"> Section Further Nonferrous Metals (NA 066-03) Rare Earth (NA 066-03-11 AA)
Principles of Environmental Protection (NA 172)	<ul style="list-style-type: none"> Monetary valuation in environmental management (NA 172-00-02-01 AK) Life cycle assessment and environmental labelling (NA 172-00-03 AA) Joint working group NAGUS/NAM: Ecodesign methodology for mechanical products (NA 172-00-03-03 GAK) Circular Economy (NA 172-00-20-01 AK) Joint working group NAGUS/DKE: Ecodesign, in particular Material Efficiency of Energy-related products (NA 172-00-20-01 GAK)
Road Vehicles and Mobility (NA 052)	
Digital platforms (DIG)	

6.1.1. Presenting CIRC-UIITS in DIN Standards Committee Nonferrous Metals (DIN NA 066-03-11 AA Rare Earth)

In May 2023, DIN presented the project CIRC-UIITS to the DIN Standards Committee *Rare Earth* during one of their standardization meetings. Two experts from industry working in the field of semiconductors were very interested in the project. Therefore, DIN organized a meeting with these two experts and experts from the project (see 6.1.2).

6.1.2. Exchange with experts from DIN Standards Committee *Rare Earth*

In November 2023, four people from four partner organizations (POLIMI, BOSCH, CONTI, SAT) participated in an exchange with two experts from the DIN Standards Committee *Rare Earth*. After a short introduction, the project coordinator POLIMI presented the project objectives and use-cases. The standardization experts were very interested and asked about the focus of the project (e.g., whether the project is covering recycling topics, social assessment, and traceability in the automotive sector). In the context of traceability, one of the standardization experts mentioned the ISO/PC 348 *sustainable raw materials*, founded in 2023, in his role as the chairperson of this standardization committee. The project coordinator showed great interest in the ISO/PC 348. In addition, during this exchange the idea came up to include the two German experts from standardization in the advisory board of the project. So far, in May 2024 one expert has been included in the project advisory board.

6.1.3. Interaction with ISO/PC 348 sustainable raw materials

The ISO/PC 348 is a project committee, which means that they are established by a technical management board to prepare individual standards not falling within the scope of an existing technical committee.⁴⁰ The ISO/PC 348 was established in order to prepare a document that should specify criteria for sustainable raw materials along industry best practices. The document should be applicable for the full value chain of all materials.⁴¹

The committee and its scope were introduced to the entire consortium of CIRC-UIITS at the general assembly meeting in Turin in January 2024, and CRF also expressed great interest. They asked how CRF could get involved and DIN connected them with their national standardization body – UNI, the Italian standardization body. Since there was a great interest from the project for the ISO/PC 348, DIN contacted the committee manager of this committee, who is also from DIN, to get more information about the time plan of the PC, the scope, and how CIRC-UIITS could collaborate with the committee. The kick-off meeting for the committee took place in July, 2024. It became clear that the committee is not sure about the focus of the document and the next steps. Due to that, it was decided to not focus on this interaction with ISO/TC 348, but rather on more promising standardization activities.

6.1.4. Presenting CIRC-UIITS to organizations from industry and their experts from standardization

After informing different German standardization committees about CIRC-UIITS, different companies got in contact with DIN and ask for exchange meetings.

In April 2024, there was an exchange with experts from **Volkswagen** (VW). Five project partners (POLIMI, SAT, SUPSI, OFFIS, CONTI) have participated in this meeting together with the director of the department of Research & Innovation Policy at VW and two more experts from VW. Additionally, an exchange with the company **Vitesco Technologies** was conducted in April 2024. Four project partners (POLIMI, TXT, SUPSI, OFFIS, CONTI) participated in this meeting.

After an introduction round, DIN presented the standardization role in research projects and the standardization status in CIRC-UIITS, and the project coordinator presented the project in general. The companies were very interested in the project and also showed great interest in the upcoming standardization activities. They asked for involvement in the planned decisions regarding standardization within CIRC-UIITS. In addition, the companies were asked to become members of the advisory board of the project. For this purpose, contact was established with the relevant contact persons and the necessary documents for signing were passed on.

6.2. Standardization potentials

Within the conducted standardization potential workshop (see 4.5), these five standardization potentials were identified:

- Activities related to **digital product passport**
- common way to store all information about reparability of a product in a **data format**
- **CO₂ calculation** for materials, products, and technologies to ensure there is no green washing
- additional **KPI's for sustainability** (must be defined and how to calculate)
- **Reparability** and a possibility to disassemble parts

⁴⁰ ISO/IEC 2023, ISO/IEC Directives, Part 1, https://www.iso.org/sites/directives/current/consolidated/index.html#_Toc134090797, last viewed on 08.04.2024

⁴¹ <https://www.iso.org/committee/9983866.html>, last viewed in 08.04.2024

For each specific idea, separate meetings took place to discuss the ideas in more detail and further develop the ideas. The standardization potentials are evaluated and prioritized based on their impact and degree of implementation, which results in the standardization strategy for the CIRC-UIITS project. The status and a strategy for the individual potential are described below.

6.2.1. digital product passport (updated)

Within CIRC-UIITS a data structure was defined to store relevant information about PCBs throughout their life-cycle. The current state of the work for the DPP was discussed DIN-internally with the person who manages the work of CEN/CLC/JTC 24 *digital product passport*. While the scope of the CEN/CLC/JTC 24 includes the technical aspects of the DPP, the content of the data fields which needs to be stored in the DPP is excluded from the scope. These data fields can be predefined in the respective upcoming regulations, as it is the case in the current battery regulation. Possible data fields for other products could be based on the predefined data fields of the battery regulation. Therefore, suggestions about the required data fields cannot be placed at the CEN/CLC/JTC 24.

To keep CIRC-UIITS aligned with the latest developments regarding the backbone of the DPP system, CIRC-UIITS applied for a liaison with CEN/CLC/JTC 24 in April 2024 (see subclause 6.3.2).

A possible further option was the elaboration of a CWA with the suggested data structure for PCBs in a process which enables participation of the public. The results regarding this option are shown in subclause 6.4.1.

6.2.2. common way to store all information about reparability of a product in a data format (updated)

On May 16, 2024, OFFIS and Bosch discussed the standardization potential regarding the under section 4.5 described questions in order to potentially develop a CWA. In order to increase the quality of data and to ensure compatibility of interfaces the need for a standardized way to store data about reparability of a product was identified. The first idea from the partners was to create a methodology or guideline including a template in order to describe a data format to ensure the same data is available for each component. The content of a possible CWA could be based on *EN 45554 - General methods for the assessment of the ability to repair, reuse and upgrade energy-related products* – in which general methods to assess the reparability of an energy-related product and reusability of a product or parts thereof are provided. The partner's idea focused on providing a methodology to structure the dataset for each product component and therefore facilitate the assessment of reparability of a product. Within CIRC-UIITS project partners carried out an assessment of reparability for an automotive product by applying the EN 45554 standard. Based on this work, a CWA was initiated and developed. More information on that in subclause 6.4.2.

6.2.3. CO₂ calculation for materials, products and technologies to ensure there is no green washing

Green Claims are a currently highly discussed topic at the European level and in March 2023 the European Commission put forward a proposal for a directive against green claims. The directive is primarily intended to protect consumers from greenwashing. The proposed directive would require companies to substantiate the voluntary green claims they make in business-to-consumer commercial practices by complying with a number of requirements regarding their assessment (e.g., taking a life-cycle perspective).⁴² No further content-wise information on the proposed green claim directive was published by the European Commission during the project period.

⁴² [https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI\(2023\)753958](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2023)753958), last viewed on 30.04.2024

A specific standards research regarding CO₂ calculation leads to the following seven relevant standards and four standards under development (see Table 26). The list of standards was distributed to the project partners who had expressed their interest in this topic during the workshop on standardization potential.

No further actions in regard to this standardization potential were pursued within CIRC-UIITS.

Table 26: relevant standards regarding the topic CO₂ calculation, cells marked in blue represent standards under development, status June 2024

Document number	Document title	Publication date	Responsible TC
ISO 14064-1	Greenhouse gases - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals	2018-12-00	ISO/TC 207
ISO 14064-1:2018/DAMd1	Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals - Amendment 1	Under development, Stage code [40.20]	ISO/TC 207
ISO 14064-2	Greenhouse gases - Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements	2019-04-00	ISO/TC 207
ISO 14064-3	Greenhouse gases - Part 3: Specification with guidance for the verification and validation of greenhouse gas statements	2019-04-00	ISO/TC 207
ISO/CD TS 14064-4	Greenhouse gases — Part 4: Quantification and reporting of greenhouse gas emissions for organizations — Guidance for the application of ISO 14064-1	Under development, Stage code [30.60]	ISO/TC 207
ISO/WD 14064-5.2	Greenhouse gas management — Part 5: Guidelines for the use of remote methods in conducting verification and validation greenhouse gas statements	Under development, Stage code [20.60]	ISO/TC 207
ISO 14067	Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification	2018-08-00	ISO/TC 207
ISO/TR 14069 → will be replaced by ISO/CD TS 14064-4 [30.60]	Greenhouse gases – Quantification and reporting of greenhouse gas emissions for organizations - Guidance for the application of ISO 14064-1	2013-05-00	ISO/TC 207
ISO 14083	Greenhouse gases — Quantification and reporting of greenhouse gas emissions arising from transport chain operations	2023-03-00	ISO/TC 207
EN 19694 series	Stationary source emissions - Determination of greenhouse gas (GHG) emissions in energy-intensive industries part 1 - 6	2016-07-00	CEN/TC 264
IEC 63372 ED1	Quantification and communication of Carbon FootPRINT and GHG emission reductions/avoided emissions from electric and electronic products and systems – Principles, methodologies, requirements and guidance	Under development	IEC/TC 111
IWA 42	Net zero guidelines	2022-11-00	ISO/TMBG

6.2.4. Additional KPI's for sustainability (updated)

Another standardization idea which was identified during the standardization potential workshop, is the need for additional KPI's for sustainability, especially a definition of them and how to calculate them. On May 14, 2024, two experts from Bosch explained their first thoughts on missing standards in this field to DIN. Based on this exchange, a specific standards research was conducted. The standards listed in Table 27 could be relevant regarding the definition of additional KPIs for sustainability and circularity.

Table 27: relevant standards regarding the topic additional KPIs for sustainability, cells marked in blue represent standards under development.

Document number	Document title	Publication date	Responsible TC
ISO 59004	Circular Economy - Terminology, Principles and Guidance for Implementation	2024-05-00	ISO/TC 207
ISO/DIS 59040	Circular economy — Product circularity data sheet	Under development, Stage code [40.20]	ISO/TC 207
DIN EN 4555x series	<ul style="list-style-type: none"> DIN EN 45552 - General method for the assessment of the durability of energy-related products DIN EN 45553 - General method for the assessment of the ability to remanufacture energy-related products DIN EN 45554 - General methods for the assessment of the ability to repair, reuse and upgrade energy-related products DIN EN 45555 - General methods for assessing the recyclability and recoverability of energy-related products DIN EN 45556 - General method for assessing the proportion of reused components in energy-related products DIN EN 45557 - General method for assessing the proportion of recycled material content in energy-related products 	2020-00-00	CEN/CLC/JTC 10
DIN CLC/TR 45550	Definitions related to material efficiency	2021-00-00	CEN/CLC/JTC 10

On June 20, 2024, OFFIS and Bosch have discussed, which standards could be relevant and therefore should be made available. The documents ISO 59004 and ISO/DIS 59040 are of particular interest as they deal with terms and principles of the circular economy. The document DIN CLC/TR 45550 was already made available.

In addition, the Deliverable 3.1 *S&C assessment & advisory methodologies*, which was submitted in M18, could be interesting to close the gap in the currently existing standardization documents in the area of KPIs for sustainability and circular economy. Due to the large number of standardization activities running in parallel, it was decided to concentrate on the most promising activities. For this reason, this standardization idea was not pursued further during the project lifetime.

6.2.5. Repairability and a possibility to disassemble parts (updated)

In the context of the standardization need „repairability and possibility to disassemble parts“, there is currently a standardization activity ongoing, planning to initiate the development of a VDE SPEC with the title “[Circularity check](https://www.fixfirst.io/circularity-check)”. The planned standardization work aims to close the gap between the Right-to-Repair, Energy Labels, Repairability Scores, Ecodesign for Sustainable Products Regulation, Data Act, and Digital Product Passport⁴³. The VDE SPEC is managed by DKE, and DIN was in contact with the responsible project manager at DKE. Due to the large number of standardization activities running in parallel and the high engagement of the CIRC-UIITS partners, it was decided to concentrate on the most promising activities. For this reason, this standardization idea was not pursued further during the project lifetime.

If the publication of the VDE SPEC falls within the project period, DIN will inform the CIRC-UIITS partners.

6.3. Contribution to ongoing standardization activities

Since the interest to contribute to current standardization activities by the project was very high, DIN have checked together with interested partners and in close exchange with the responsible project manager at DIN, which documents are suitable for a contribution by CIRC-UIITS partners based on the current status of

⁴³ <https://www.fixfirst.io/circularity-check>, last viewed on 30.04.2024



the standardization projects and partners' expertise. This analysis resulted in the conduction of the following actions.

6.3.1. Liaison with ISO/TC 298/JWG 6 – Sustainability (updated)

As a result, one focus of a contribution to ongoing activities was on the active work item **ISO/AWI 24961 – Rare earths and lithium sustainability across the value chain: concentration, extraction, separation, conversion, recycling and reuse**. The project partners POLIMI, MADE, Conti and OFFIS have shown initial interest in participating. To be able to contribute, a type C liaison with ISO/TC 298/JWG 6 would have to be established.

On September 18, 2024, POLIMI and DIN participated in the 6th meeting of ISO/TC 298/JWG 6 – *sustainability*, which is responsible for the development of this draft standard. POLIMI and DIN presented the project and explained the interest and motivation in getting involved in the development of ISO/AWI 24961. After this exchange, CIRC-UIITS requested to establish a liaison with ISO/TC 298/JWG 6. The liaison got approved by the TC in May 2025.

For research projects, it is possible to establish a c-category at ISO level to make a technical contribution to drafting standards in a working group. POLIMI expressed its interest in acting as a liaison representative. Within this category, the following rights and obligations apply:

- Invitation to meetings
- Commenting drafting standards
- No voting rights
- Can not propose a new work item

In May 2025, POLIMI provided comments to ISO/AWI 24961. Those comments have been distributed within CIRC-UIITS and after no objections were received the comments have been submitted to ISO. All comments submitted have been considered by the JWG so far and CIRC-UIITS provided valuable input to the ISO draft in this way. At the time D5.4 was submitted, however, the ISO standard had not yet been finally adopted.

6.3.2. Liaison with CEN-CLC/JTC 24 – DPP (updated)

To keep CIRC-UIITS aligned with the latest developments regarding the backbone of the DPP system, CIRC-UIITS applied for a liaison with CEN/CLC/JTC 24 in April 2024. The liaison was approved by the TC in September 2024. Liaisons at European level have the following characteristics:

- to receive access to the working documents associated with these Technical Committee
- the possibility to propose technical documents with a view of their possible conversion into CEN deliverables
- the possibility to introduce preparatory work as a support to ongoing standardization activities
- the possibility to submit technical contributions to the body's meetings
- the possibility to formulate advice on current and future standards programmes
- no voting rights

POLIMI acted as the representatives within the overall JTC, and OFFIS acted as the representative for WG 4 - *Interoperability framework*. OFFIS participated at the meetings of WG 4 on a regular basis and the documents e.g., meeting agendas and minutes or decisions, were provided to the entire CIRC-UIITS consortium. OFFIS informed the project partners about ongoing activities in JTC 24 in the CIRC-UIITS general assembly meetings.

Through the liaison, especially OFFIS gained valuable insights into the standardization processes of WG 4 related to the DPP. The participation enabled passive attendance in discussion rounds focusing on the

development of the Interoperability Framework of the Digital Product Passport. The main topics addressed included the definition of the three interoperability layers and the underlying core and data model. The goal of the draft standard currently under approval in WG 4 is to enable interoperable, standardized, machine-readable, and multilingual product data exchange across sectors and systems. The liaison proved particularly valuable for the project, as it fostered considerations on how the interoperability of data within CIRC-UIITS could be achieved.

6.4. CWA developments (new)

6.4.1. CWA 18311 'Enabling Circular Economy Practices: Repair and Recycling of PCBAs'

The standardization potential of supporting the development of a digital product passport (see 6.2.1) led to the initiation of a CEN-CENELEC Workshop with the aim to develop a CWA. The initial idea was to develop a digital product passport for printed circuit board assemblies. The CWA and the corresponding workshop to develop the document were initiated under this name. There was high demand for the topic and the idea to develop a DPP CWA in industry. In addition to the 7 CIRC-UIITS partners, a lot of non-project stakeholders registered for the workshop, so that 30 people from 26 external organizations participated in the development of this CWA. The 7 CIRC-UIITS partners were: POLIMI (workshop chair), Continental, MARAS, SAT, OFFIS, SUPSI, and ERION. During the first four meetings, the workshop consortium discussed a lot about DPP content, responsibilities, structure etc. It turned out that the topic still has many unresolved issues and should involve a much larger group of stakeholders. It became clear that the scope of the workshop and the CWA is too broad and that it is not possible to develop a document for a comprehensive DPP within the timeframe of a CWA in the CIRC-UIITS project. Due to that, the workshop decided to narrow down the scope and to adapt the title to 'Enabling Circular Economy Practices: Repair and Recycling of PCBAs'.

CWA Scope:

'This CWA defines requirements and recommendations for recycling and repair aspects for printed board assemblies (PBAs) and could provide the basis for the repair and recycling related section in a future digital product passport for PCBAs. The document excludes the definition of an IT infrastructure and is orientated on the current developments of CEN/CLC-JTC 24 – DPP.'

The document was developed within eight workshop meetings, and the public had the opportunity to provide feedback on the draft document. After the open commenting phase, the final meeting took place to approve the final CWA (10.10.2025). Annex 5 shows the table of content of this CWA.

The CWA deals with aspects of repair and recycling for PCBs. It provides definitions for different PCB statuses and specifies recommendations and requirements for design aspects for repair and recycle. The CWA also includes the aspect of a full material declaration. In summary, the content of this CWA provides a basis for further consideration in the future standardization about a digital product passport. Besides the CIRC-UIITS project partners, different industry stakeholders showed great engagement during the development of the CWA.

Before the initiation and during the development, exchanges took place with the committee manager of the related European joint technical committee 24 – DPP to ensure that the work is in line with current ongoing standardization developments and did not contradict them.

6.4.2. CWA 18313 'Use-case for the application of EN 45554 in the automotive industry'

During the CIRC-UIITS project EN 45554 was applied for the pilots. One pilot assessed the reparability of an automotive product. In this context, several aspects emerged that should be considered when applying the more general EN 45554. The EN 45554 was developed by the European technical committee CEN/CLC/JTC 10 - *energy-related products - material efficiency aspects for ecodesign*. The idea of developing a CWA based on this use-case was presented to the responsible technical committee CEN/CLC/JTC 10, and the German mirror committee (NA 172-00-20-01 GAK) was contacted. The idea was presented by DIN, OFFIS and BOSCH. Positive feedback was received from the technical experts active in the standardization committees.

CWA scope:

'This CWA will describe a use-case for the assessment of the reparability of a product in the automotive industry based on the application of EN 45554. Challenges and lessons learned will be described and recommendations for the assessment of the reparability of a product from the manufacturer's perspective are given. These findings can be helpful also outside the automotive industry.'

The table of content can be found in Annex 6.

The content of the CWA was almost finished at the stage of initiation, so that together with the project plan of the workshop to develop the CWA, a preliminary draft CWA was published. In this way, the public could provide direct feedback and input to the use-case and a lot of time was saved. This was only possible, because the use-case was based directly on CIRC-UIITS results and therefore mainly independent from external industry content. However, during the consultation phase, the company Valeo expressed its interest in providing a second use-case. From CIRC-UIITS, the project partner OFFIS, BOSCH, POLIMI, MARAS and SUPSI were involved in the development of the CWA. In addition, 12 people from eight external organizations participated in the CEN-CENELEC Workshop.

The document was developed within four workshop meetings, and the public had the opportunity to provide feedback on the draft document. After the open commenting phase, the final meeting took place to approve the final CWA (06.10.2025). Annex 6 shows the table of content of this CWA.

In addition to the CWA document, an Excel template was developed and published together with the CWA. The Excel template provides users of EN 45554 with a table in which own data can be entered, and the assessment calculations are performed automatically. This ensures a standardized method of data usage and collection.

In context of the recently published 'Ecodesign for Sustainable Products Regulation' by the European Commission⁴⁴, it will probably be necessary to adapt the initial guidance in the form of the standard series EN 455xx to sector-specific standards, and the CWA developed within CIRC-UIITS pays tribute to the latest efforts. It will also be checked after the project lifetime whether the CWA could be integrated into possible future standards or a revision of EN 45554, e.g. as an annex to show a possible example of the norm application.

⁴⁴ https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:L_202401781, last viewed on 2025-08-19

7. Conclusion

The project achieved significant progress in the area of standardization related to CIRC-UIITS.

Within CIRC-UIITS an overview of the standardization landscape related to the project was given, which provides the knowledge about the current state of the art in the areas addressed within CIRC-UIITS and facilitating the collaborations with technical committees.

The project focused on specific areas such as semiconductor devices, printed electronics, and sustainable practices to address relevant standards and identified potential gaps.

Another milestone involved developing and implementing a standardization strategy. A workshop was held to assess the need for standardization, identifying five key potentials that formed the basis for further strategic actions. Additionally, the project successfully established links with important standardization bodies, including collaboration with European technical committees and contributing comments to an ISO draft concerning sustainability in rare earths and lithium.

Two new standardization documents (CWAs) were initiated, developed and published, addressing key topics under the ESPR regulation. These documents were developed through open workshops that encouraged collaboration and innovative approaches. Both CWAs are publicly available and can be downloaded for free from the CWA download area.

Overall, the project significantly influenced the standardization landscape, providing valuable insights that support future work towards sustainability and efficiency.

Once the CWAs have been published, they will be presented to the relevant standardization committees to discuss the next steps for adopting the results. Possible next steps could be the integration of the CWAs into existing standards during planned revisions or the initiation of a new standard based on the content of the CWAs. These activities will take place after completion of the CIRC-UIITS project.

Annexes

ANNEX 1: List of all standards relevant for CIRC-UIITS, updated November 2024

document number	Titel (Englisch)	publication date
IEC 111/695/FDIS*CEI 111/695/FDIS*IEC 62321-3-4*CEI 62321-3-4	Determination of certain substances in electrotechnical products - Part 3-4: Screening - Phthalates in polymers of electrotechnical products by high performance liquid chromatography with ultraviolet detector (HPLC-UV), thin layer chromatography (TLC) and thermal desorption mass spectrometry (TD-MS)	2023-02-00
VDI 4009	Reliability tests	2022-10-00
VDI 4800 Blatt 1	Resource efficiency - Methodological principles and strategies	2016-02-00
VDI 4800 Blatt 2	Resource efficiency - Evaluation of raw material demand	2018-03-00
VDI 4800 Blatt 2 Berichtigung	Resource efficiency - Evaluation of raw material demand - Corrigendum concerning standard VDI 4800 Part 2:2018-03	2018-05-00
EN ISO 9001	Quality management systems - Requirements (ISO 9001:2015)	2015-09-00
EN ISO 14040	Environmental management - Life cycle assessment - Principles and framework (ISO 14040:2006)	2006-07-00
EN ISO 14040/A1	Environmental management - Life cycle assessment - Principles and framework - Amendment 1 (ISO 14040:2006/Amd 1:2020)	2020-10-00
EN ISO 14044	Environmental management - Life cycle assessment - Requirements and guidelines (ISO 14044:2006)	2006-07-00
EN ISO 14051	Environmental management - Material flow cost accounting - General framework (ISO 14051:2011)	2011-09-00
ISO 21750	Road vehicles - Safety enhancement in conjunction with tyre inflation pressure monitoring	2006-03-00
ISO 23664	Traceability of rare earths in the supply chain from mine to separated products	2021-10-00
IEC/TR 63357*CEI/TR 63357	Semiconductor devices - Standardization roadmap of fault test method for automotive vehicles	2022-10-00
ISO 16750-1	Road vehicles - Environmental conditions and testing for electrical and electronic equipment - Part 1: General	2023-07-00
ISO 16750-2	Road vehicles - Environmental conditions and testing for electrical and electronic equipment - Part 2: Electrical loads	2023-07-00
VDA 232-101	Global Automotive Declarable Substance List	2015-02-00
ECSS-Q-ST-70-12C	Design rules for printed circuit boards	2014-07-14
ECSS-Q-ST-70-12C Annex A	PCB definition dossier	2014-07-14
ECSS-Q-ST-70-12C Annex B	PCB manufacturing dossier	2014-07-14
VDA 900-100	Guidance for Conducting Life Cycle Assessment Studies of Passenger Cars	2022-08-00
IEC 119/412/CDV*CEI 119/412/CDV*IEC 62899-203*CEI 62899-203	Printed electronics - Part 203: Materials - Semiconductor ink	2023-01-00
IEC 119/416/CD*CEI 119/416/CD*IEC/TR 62899-303-2*CEI/TR 62899-303-2	Printed electronics - Part 303-2: Equipment - Sheet to sheet printing - Mechanical dimension	2023-01-00
IEC 119/417/CD*CEI 119/417/CD*IEC 62899-401*CEI 62899-401	Printed electronics - Part 401: Printability - Overview	2023-01-00
IEC 119/419/CD*CEI 119/419/CD*IEC 62899-203-2*CEI 62899-203-2	Printed electronics - Part 203-2: Materials - Space charge limited mobility measurement in printed organic semiconductive layers	2023-01-00
IEC 119/420/CD*CEI 119/420/CD*IEC/TR 62899-402-4*CEI/TR 62899-402-4	Printed electronics - Part 402-4: Printability - Measurement of qualities - Classification and measurement methods for morphology	2023-01-00
IEC 119/440/CD*CEI 119/440/CD*IEC 62899-402-1*CEI 62899-402-1	Printed electronics - Part 402-1: Printability - Measurement of qualities - Line pattern widths	2023-05-00
IEC 119/441/CDV*CEI 119/441/CDV*IEC 62899-301-3*CEI 62899-301-3	Printed Electronics - Part 301-3: Equipment - Contact printing - Rigid master - Method to measure the shape errors of printing plate rollers	2023-07-00
IEC 101/658/CD*CEI 101/658/CD*IEC/TS 61340-5-4*CEI/TS 61340-5-4	Electrostatics - Part 5-4: Protection of electronic devices from electrostatic phenomena - Compliance verification	2022-03-00
IEC 111/691/CDV*CEI 111/691/CDV*IEC 63366*CEI 63366	Product category rules for life cycle assessment of electrical and electronic products and systems.	2023-03-00
IEC 111/692/CD*CEI 111/692/CD*IEC 62321-8*CEI 62321-8	Determination of certain substances in electrotechnical products - Part 8: Phthalates in polymers by gas chromatography-mass spectrometry (GC-MS), gas chromatography-mass spectrometry using a pyrolyzer/thermal desorption accessory (Py-TD-GC-MS)	2023-01-00
IEC 111/697/CD*CEI 111/697/CD*IEC 62321-3-1*CEI 62321-3-1	Determination of certain substances in electrotechnical products - Part 3-1: Elemental Screening by X-ray fluorescence spectrometry	2023-03-00
IEC 111/702/CD*CEI 111/702/CD*IEC/TS 63428*CEI/TS 63428	Guidance on material circularity considerations in environmentally conscious design	2023-04-00
IEC 21A/805/CD*CEI 21A/805/CD*IEC 63369-1*CEI 63369-1	Methodology for the Carbon Footprint calculation applicable to Lithium-ion batteries	2022-08-00
IPC 1401	Corporate Social Responsibility and Sustainability Protocols for Electronic Manufacturing Industry	2017-03-01
IEC 91/1755/CDV*CEI 91/1755/CDV*IEC 61189-2-805*CEI 61189-2-805	Test methods for electrical materials, printed board and other interconnection structures and assemblies - Part 2-805: XY CTE Test for Thin Base Materials by TMA	2021-10-00
IEC 91/1832/CDV*CEI 91/1832/CDV*IEC 61189-2-720*CEI 61189-2-720	Test methods for electrical materials, printed board and other interconnection structures and assemblies - Part 2-720: Detection of defects in interconnection structures by measurement of capacitance	2023-02-00
IEC 91/1833/CDV*CEI 91/1833/CDV*IEC 61189-2-808*CEI 61189-2-808	Test methods for electrical materials, printed board and other interconnection structures and assemblies - Part 2-808: Thermal resistance of an assembly by thermal transient method	2023-02-00
IEC 56/1962/CD*CEI 56/1962/CD*IEC 60300-3-10*CEI 60300-3-10	Dependability management - Part 3-10: Application guide - Maintainability and maintenance	2022-07-00

IEC 56/2002/CDV*CEI 56/2002/CDV*IEC 62309*CEI 62309	Dependability of products containing reused parts - Requirements for functionality and tests	2023-09-00
VDI 2246 Blatt 1	Designing maintainable engineered products - Basic principles	2001-03-00
VDI 2246 Blatt 2	Designing maintainable engineered products - Requirements catalog	2001-03-00
VDI 2343 Blatt 1	Recycling of electrical and electronic products - Principles and terminology	2001-05-00
VDI 2343 Blatt 1	Recycling of electrical and electronic equipment - Fundamentals, terms, and definitions	2023-10-00
VDI 2343 Blatt 2	Recycling of electrical and electronic equipment - Logistics	2010-02-00
VDI 2343 Blatt 3	Recycling of electrical and electronic equipment - Disassembly	2009-04-00
VDI 2343 Blatt 4	Recycling of electrical and electronic equipment - Preparation techniques	2012-01-00
VDI 2343 Blatt 5	Recycling of electrical and electronic equipment - Material and thermal recycling and removal	2014-11-00
VDI 2343 Blatt 6	Recycling of electrical and electronic equipment - Marketing	2020-09-00
VDI 2343 Blatt 7	Recycling of electrical and electronic equipment - Re-use	2014-12-00
VDI 2871 Blatt 1	Lean production systems - Lean leadership	2017-01-00
VDI-MT 2871 Blatt 2	Lean production systems - Lean leadership - List of methods	2021-06-00
VDI 2882	Obsolescence management from the perspective of users and operators	2018-05-00
IETF RFC 3986	Uniform Resource Identifier (URI): Generic Syntax	2005-01-00
VDI 4003	Reliability management	2007-03-00
VDI 4080	Recycling of cars - Quality of recycled car parts	2009-07-00
VDI 4082	Recycling of cars - Draining and preparation of vehicles for the disassembly	2015-01-00
VDI 4085	Planning, construction and managing of scrapyards - Facilities and equipment for the handling, storage and treatment of scraps and other materials	2017-04-00
VDI 4085 Blatt 2	Scrap yards - Baseline report	2015-12-00
VDI 4413	Logistic of waste disposal in producing enterprises	2016-03-00
VDI 4431	Life-cycle management in the manufacturing industry	2001-07-00
VDI 4605	Evaluation of sustainability	2017-10-00
VDI 4663 Blatt 1	Evaluation of energy and material efficiency - Methodical application of the physical optimum	2021-12-00
VDA 9003	Standardized service level measurement in automotive aftermarket business	2013-06-00
EN ISO 9004	Quality management - Quality of an organization - Guidance to achieve sustained success (ISO 9004:2018)	2018-04-00
ISO 10010	Quality management - Guidance to understand, evaluate and improve organizational quality culture	2022-08-00
EN ISO 11469	Plastics - Generic identification and marking of plastics products (ISO 11469:2016)	2016-10-00
EN 13018	Non-destructive testing - Visual testing - General principles	2016-02-00
EN ISO 14001	Environmental management systems - Requirements with guidance for use (ISO 14001:2015)	2015-09-00
EN ISO 14006	Environmental management systems - Guidelines for incorporating ecodesign (ISO 14006:2020)	2020-02-00
EN ISO 14008	Monetary valuation of environmental impacts and related environmental aspects (ISO 14008:2019)	2020-08-00
ISO 14009	Environmental management systems - Guidelines for incorporating material circulation in design and development	2020-12-00
EN ISO 14015	Environmental management - Guidelines for environmental due diligence assessment (ISO 14015:2022)	2022-06-00
EN ISO 14021	Environmental labels and declarations - Self-declared environmental claims (Type II environmental labelling) (ISO 14021:2016)	2016-04-00
EN ISO 14044/A1	Environmental management - Life cycle assessment - Requirements and guidelines - Amendment 1 (ISO 14044:2006/Amd 1:2017)	2018-02-00
EN ISO 14044/A2	Environmental management - Life cycle assessment - Requirements and guidelines - Amendment 2 (ISO 14044:2006/Amd 2:2020)	2020-10-00
EN ISO 14045	Environmental management - Eco-efficiency assessment of product systems - Principles, requirements and guidelines (ISO 14045:2012)	2012-05-00
ISO/TR 14047	Environmental management - Life cycle assessment - Illustrative examples on how to apply ISO 14044 to impact assessment situations	2012-06-00
ISO/TS 14048	Environmental management - Life cycle assessment - Data documentation format	2002-04-00
ISO/TR 14049	Environmental management - Life cycle assessment - Illustrative examples on how to apply ISO 14044 to goal and scope definition and inventory analysis	2012-06-00
EN ISO 14050	Environmental management - Vocabulary (ISO 14050:2020)	2020-08-00
EN ISO 14052	Environmental management - Material flow cost accounting - Guidance for practical implementation in a supply chain (ISO 14052:2017)	2018-10-00
EN ISO 14067	Greenhouse gases - Carbon footprint of products - Requirements and guidelines for quantification (ISO 14067:2018)	2018-09-00
CEN ISO/TS 14071	Environmental management - Life cycle assessment - Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006 (ISO/TS 14071:2014)	2016-02-00
prEN ISO 14071	Environmental management - Life cycle assessment - Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006 (ISO/DIS 14071:2023)	2023-11-00
ISO/TS 14072	Environmental management - Life cycle assessment - Requirements and guidelines for organizational life cycle assessment	2014-12-00
ISO/TS 14074	Environmental management - Life cycle assessment - Principles, requirements and guidelines for normalization, weighting and interpretation	2022-11-00
ISO 15226	Technical product documentation - Life cycle model and allocation of documents	1999-04-00
EN 15342	Plastics - Recycled Plastics - Characterization of polystyrene (PS) recyclates	2007-12-00
EN 15343	Plastics - Recycled Plastics - Plastics recycling traceability and assessment of conformity and recycled content	2007-12-00
EN 15347	Plastics - Recycled Plastics - Characterisation of plastics wastes	2007-12-00

EN 15348	Plastics - Recycled plastics - Characterization of poly(ethylene terephthalate) (PET) recyclates	2014-11-00
prEN 15348	Plastics - Recycled plastics - Characterization of poly(ethylene terephthalate) (PET) recyclates	2022-03-00
CEN/TS 16010	Plastics - Recycled plastics - Sampling procedures for testing plastics waste and recyclates	2020-12-00
EN 16449	Wood and wood-based products – Calculation of the biogenic carbon content of wood and conversion to carbon dioxide	2014-03-00
EN 16524	Mechanical products - Methodology for reduction of environmental impacts in product design and development	2020-11-00
CWA 17354	Industrial Symbiosis: Core Elements and Implementation Approaches	2018-12-00
ISO/TR 17370	Application Guideline on Data Carriers for Supply Chain Management	2013-06-00
EN ISO 17422	Plastics - Environmental aspects - General guidelines for their inclusion in standards (ISO 17422:2018)	2019-06-00
EN 17615	Plastics - Environmental Aspects - Vocabulary	2022-06-00
CWA 17675	Mapping of the mandatory and voluntary carbon management framework in the EU	2021-03-00
CWA 17796	Responsibility-by-design - Guidelines to develop long-term strategies (roadmaps) to innovate responsibly	2021-09-00
CWA 17806	Design Circular Framework Setting - Composite recovery design solutions in the automotive industry	2021-10-00
CWA 17807	Dismantling methods and protocols in a Circular Economy Framework - Composite recovery in the automotive industry	2021-10-00
FprEN 17948	Maintenance function and management	2023-04-00
ISO/IEC 19395	Information technology - Sustainability for and by information technology - Smart data centre resource monitoring and control	2015-01-00
ISO 20400	Sustainable procurement - Guidance	2017-04-00
ISO 22095	Chain of custody - General terminology and models	2020-10-00
ISO/TS 22318	Security and resilience - Business continuity management systems - Guidelines for supply chain continuity management	2021-12-00
ISO 22450	Recycling of rare earth elements - Requirements for providing information on industrial waste and end-of-life products	2020-10-00
ISO/TS 22451	Recycling of rare earth elements - Methods for the measurement of rare earth elements in industrial waste and end-of-life products	2021-05-00
ISO 22453	Exchange of information on rare earth elements in industrial wastes and end-of-life cycled products	2021-06-00
ISO/IEC 23751	Information technology - Cloud computing and distributed platforms - Data sharing agreement (DSA) framework	2022-02-00
EN ISO 26000	Guidance on social responsibility (ISO 26000:2010)	2020-10-00
ISO 28001	Security management systems for the supply chain - Best practices for implementing supply chain security, assessments and plans - Requirements and guidance	2007-10-00
ISO 28002	Security management systems for the supply chain - Development of resilience in the supply chain - Requirements with guidance for use	2011-08-00
ETSI GS CDM002 V 1. 2.1	Common information sharing environment service and Data Model (CDM) - System Requirements definition	2024-07-00
ETSI GS OEU 018 V 1.1.1	Operational energy Efficiency for Users (OEU) - Waste management of ICT equipment	2016-01-00
IECQ 03-3*CEIQ 03-3	IEC Quality Assessment System for Electronic Components (IECQ System) - Rules of Procedure - Part 3: IECQ Approved Component Products, Related Materials & Assemblies Scheme; Edition 2.2	2018-05-00
CLC/TR 45550	Definitions related to material efficiency	2020-12-00
EN 45552	General method for the assessment of the durability of energy-related products	2020-03-00
EN 45553	General method for the assessment of the ability to remanufacture energy-related products	2020-07-00
EN 45554	General methods for the assessment of the ability to repair, reuse and upgrade energy-related products	2020-02-00
EN 45555	General methods for assessing the recyclability and recoverability of energy-related products	2019-11-00
EN 45556	General method for assessing the proportion of reused components in energy-related products	2019-06-00
EN 45557	General method for assessing the proportion of recycled material content in energy-related products	2020-04-00
EN 45558	General method to declare the use of critical raw materials in energy-related products	2019-03-00
EN 45559	Methods for providing information relating to material efficiency aspects of energy-related products	2019-03-00
EN 50419	Marking of electrical and electronic equipment (EEE) in respect to separate collection of waste EEE (WEEE)	2022-07-00
CLC/TR 50584	Information technology - CENELEC/ETSI Glossary of terms and definitions for broadband deployment including sustainability aspects	2014-09-00
EN 50614	Requirements for the preparing for re-use of waste electrical and electronic equipment	2020-02-00
EN 50672	Ecodesign requirements for computers and computer servers	2017-11-00
EN 50678	General procedure for verifying the effectiveness of the protective measures of electrical equipment after repair	2020-03-00
EN 50693	Product category rules for life cycle assessments of electronic and electrical products and systems	2019-08-00
CLC/TR 50727	Material efficiency - Household and similar electrical appliances - Assessment of applicability of EN 4555X	2022-04-00
ISO 59004	Circular Economy - Terminology, Principles and Guidance for Implementation	2023-04-00
ISO 59010	Circular Economy — Guidance on the transition of business models and value networks	2023-04-00
ISO/FDIS 59014	Environmental management and circular economy - Sustainability and traceability of secondary materials recovery - Principles and requirements	2023-10-00
ISO 59020	Circular economy - Measuring and assessing circularity	2023-04-00

EN IEC 61123	Reliability testing - Compliance test plans for success ratio (IEC 61123:2019)	2020-02-00
IEC/TS 61945	Integrated circuits - Manufacturing line approval - Methodology for technology and failure analysis	2000-03-00
prEN IEC 62309	Dependability of products containing reused parts - Requirements for functionality and tests	2023-09-00
EN 62421	Electronics assembly technology - Electronic modules (IEC 62421:2007)	2007-10-00
EN IEC 62430	Environmentally conscious design (ECD) - Principles, requirements and guidance (IEC 62430:2019)	2019-12-00
IEC 62474*CEI 62474	Material declaration for products of and for the electrotechnical industry	2018-11-00
IEC/TR 62476	Guidance for evaluation of product with respect to substance-use restrictions in electrical and electronic products	2010-02-00
EN 62542	Environmental standardization for electrical and electronic products and systems - Standardization of environmental aspects - Glossary of terms (IEC 62542:2013)	2013-08-00
IEC/TR 62635	Guidelines for end of life information provided by manufacturers and recyclers and for recyclability rate calculation of electrical and electronic equipment	2012-10-00
IEC/TR 62824*CEI/TR 62824	Guidance on material efficiency considerations in environmentally conscious design of electrical and electronic products	2016-04-00
EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances (IEC 63000:2016)	2018-12-00
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IEC/TS 63058*CEI/TS 63058	Switchgear and controlgear and their assemblies for low voltage - Environmental aspects	2021-01-00
IEC/TR 63133*CEI/TR 63133	Semiconductor devices - Scan based ageing level estimation for semiconductor devices	2017-10-00
IEC/TR 63212*CEI/TR 63212	Harmonization of environmental performance criteria for electrical and electronic products - Feasibility study	2020-05-00
IEC 63333*CEI 63333	General method for assessing the proportion of reused components in products	2023-08-00
prEN IEC 63366	Product category rules for life cycle assessment of electrical and electronic products and systems.	2023-03-00
DIN SPEC 91436	Reference model for operational waste and recyclables management oriented towards a vision of "zero waste"	2021-05-00
DIN SPEC 91472	Remanufacturing (Reman) - Quality classification for circular processes	2023-06-00
ETSI TR 103476 V 1.1.2	Environmental Engineering (EE) - Circular Economy (CE) in Information and Communication Technology (ICT) - Definition of approaches, concepts and metrics	2018-02-00
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ASAM MDX	Meta Data Exchange Format for Software Module Sharing; Version 1.3.0	2015-06-25
CEN Guide 4	Guide for addressing environmental issues in products standards	2008-11-00
DIN-Fachbericht 108	Guide for the inclusion of environmental aspects in product standardization and development; German and English Version	2003-00-00
ITU-T L Supplement 13	ITU-T L.1410 - Case study: A hybrid approach-based comparative analysis of the environmental impact of a baseline data centre and an energy-efficient data centre	2015-10-00
ITU-T L Supplement 2	Methodology for the assessment of the environmental impact of information and communication technology goods, networks and services - Case studies	2013-12-00
ITU-T L Supplement 20	Green public ICT procurement	2015-10-00
ITU-T L Supplement 27	Supplement on success stories on e-waste management	2016-10-00
ITU-T L Supplement 28	Circular economy in information and communication technology; definition of approaches, concepts and metrics	2016-10-00
ITU-T L Supplement 34	Example of hybrid life cycle assessment of the aggregated second order effects of selected information and communication technology services	2016-10-00
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RAL-UZ 213	Basic Criteria for Award of the Environmental Label - Server and Data Storage Products	2020-01-00
RAL-UZ 215	Basic Criteria for Award of the Environmental Label - Resources and Energy-Efficient Software Products	2020-01-00
VDA284	Data quality of different plastic grades with recycled content for the automotive industry	2023-02-00
VDA volume 1	Quality management in the Automotive Industry - Documented Information and Retention - Guideline for control and retention of documentation within the framework of the product life cycle - particularly their classification	2018-08-00
VDA volume 19 part 2	Quality Management in the Automotive Industry - Technical cleanliness in assembly - Environment, logistics, personnel and assembly equipment	2010-10-00
VDA volume 2	Quality Management in the Automotive Industry - Securing the Quality of Supplies - Production process and product approval (PPA)	2020-04-00
VDA volume 3 part 1	Quality Management in the Automotive Industry - Reliability Assurance of Car Manufacturers and Suppliers - Reliability Management	2019-07-00
VDA volume 3 part 2	Quality Management in the Automotive Industry - Reliability Assurance of Car Manufacturers and Suppliers - Reliability methods and tools	2016-05-00
VDA volume 4 section 1	Quality Management in the Automotive Industry - Quality Assurance in the Process Landscape - Section 1: General - Methods Overview, Elementary Aids, Development Processes	2020-08-00
VDA volume 4 section 2	Quality Management in the Automotive Industry - Quality Assurance in the Process Landscape - Section 2: Risk Analyses - Fault Tree Analysis (FTA), Failure Mode and Effects Analysis (FMEA), SWOT-Analysis (Strengths, Weaknesses, Opportunities, Threats)	2020-08-00
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VDA volume 4 section 4	Quality Management in the Automotive Industry - Quality Assurance in the Process Landscape - Section 4: Process Models - Six Sigma, Design for Six Sigma (DFSS), Industrial Tolerance Process	2020-08-00
VDA volume 5	Quality Management in the Automotive Industry - Measurement and Inspection Processes - Capability, Planning and Management	2021-07-00
VDA Maturity Level Assurance	Joint Quality Management in the Supply Chain - Product development - Maturity level assurance for new Parts - Methods, measurement criteria, documentation	2022-06-00
ITU-T.L.1020	Circular economy: Guide for operators and suppliers on approaches to migrate towards circular ICT goods and networks	2018-01-00
ITU-T.L.1021	Extended producer responsibility - Guidelines for sustainable e-waste management	2018-04-00
ITU-T.L.1022	Circular economy: Definitions and concepts for material efficiency for information and communication technology	2019-10-00
ITU-T.L.1023	Assessment method for circularity performance scoring	2023-08-00
ITU-T.L.1024	The potential impact of selling services instead of equipment on waste creation and the environment - Effects on global information and communication technology	2021-01-00
ITU-T.L.1030	E-waste management framework for countries	2018-06-00
ITU-T.L.1033	Guidance for institutions of higher learning to contribute in the effective life cycle management of e-equipment and e-waste	2021-10-00
ITU-T.L.1060	General principles for the green supply chain management of information and communication technology manufacturing industry	2021-07-00
ITU-T.L.1100	Procedure for recycling rare metals in information and communication technology goods	2012-02-00
ITU-T.L.1101	Measurement methods to characterize rare metals in information and communication technology goods	2014-03-00
ITU-T.X.1209	Capabilities and their context scenarios for cybersecurity information sharing and exchange	2010-12-00
ITU-T.L.1410	Methodology for environmental life cycle assessments of information and communication technology goods, networks and services	2014-12-00
ITU-T.X.1410	Security architecture of data sharing management based on the distributed ledger technology	2023-03-00
ITU-T.L.1471	Guidance and criteria for information and communication technology organizations on setting Net Zero targets and strategies	2023-08-00
ETSI TS 105174-8 V 1.2.1	Access, Terminals, Transmission and Multiplexing (ATM) - Broadband Deployment and Lifecycle Resource Management - Part 8: Implementation of WEEE practices for ICT equipment during maintenance and at end-of-life	2019-12-00
ISO 11748-1	Road vehicles - Technical documentation of electrical and electronic systems - Part 1: Content of exchanged documents	2001-06-00
ISO 14002-1	Environmental management systems - Guidelines for using ISO 14001 to address environmental aspects and conditions within an environmental topic area - Part 1: General	2019-11-00
IEEE 1680.1	IEEE Standard for Environmental and Social Responsibility Assessment of Computers and Displays	2018-00-00
IEEE 1680.1a	IEEE Standard for Environmental and Social Responsibility Assessment of Computers and Displays - Amendment 1: Editorial and Technical Corrections and Clarifications	2020-00-00
EN ISO 18541-1	Road vehicles - Standardized access to automotive repair and maintenance information (RMI) - Part 1: General information and use case definition (ISO 18541-1:2021)	2021-06-00
EN ISO 18541-2	Road vehicles - Standardized access to automotive repair and maintenance information (RMI) - Part 2: Technical requirements (ISO 18541-2:2021)	2021-06-00
EN ISO 18541-3	Road vehicles - Standardized access to automotive repair and maintenance information (RMI) - Part 3: Functional user interface requirements (ISO 18541-3:2021)	2021-06-00
EN ISO 18541-4	Road vehicles - Standardized access to automotive repair and maintenance information (RMI) - Part 4: Conformance test (ISO 18541-4:2021)	2021-06-00
EN ISO 18542-1	Road vehicles - Standardized repair and maintenance information (RMI) terminology - Part 1: General information and use case definition (ISO 18542-1:2012)	2012-12-00
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ISO/TS 18876-1	Industrial automation systems and integration - Integration of industrial data for exchange, access and sharing - Part 1: Architecture overview and description	2003-11-00
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ISO/IEC 19592-1	Information technology - Security techniques - Secret sharing - Part 1: General	2016-11-00
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ISO/TR 20218-2	Robotics - Safety design for industrial robot systems - Part 2: Manual load/unload stations	2017-12-00
ISO/DIS 22040-2	Life cycle management of concrete structures - Part 2: Structural planning and design stage	2023-07-00
ISO 26262-5	Road vehicles - Functional safety - Part 5: Product development at the hardware level	2018-12-00
ISO 28004-1 Technical Corrigendum 1	Security management systems for the supply chain - Guidelines for the implementation of ISO 28000 - Part 1: General principles; Technical Corrigendum 1	2012-08-00
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ISO 28004-3	Security management systems for the supply chain - Guidelines for the implementation of ISO 28000 - Part 3: Additional specific guidance for adopting ISO 28000 for use by medium and small businesses (other than marine ports)	2014-02-00
ISO 28004-4	Security management systems for the supply chain - Guidelines for the implementation of ISO 28000 - Part 4: Additional specific guidance on implementing ISO 28000 if compliance with ISO 28001 is a management objective	2014-02-00
ISO/IEC TR 30132-1	Information technology - Information technology sustainability - Energy efficient computing models - Part 1: Guidelines for energy effectiveness evaluation	2016-09-00
ISO/IEC 30134-3	Information technology - Data centres - Key performance indicators - Part 3: Renewable energy factor (REF)	2016-04-00
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ISO/IEC 30134-6	Information technology - Data centres key performance indicators - Part 6: Energy Reuse Factor (ERF)	2021-08-00

ISO/IEC 30134-8	Information technology - Data centres key performance indicators - Part 8: Carbon usage effectiveness (CUE)	2022-03-00
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VDA4998-1	Automotive Supply Chain REST API; Version 1.0	2021-06-00
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EN 50598-3	Ecodesign for power drive systems, motor starters, power electronics and their driven applications - Part 3: Quantitative eco design approach through life cycle assessment including product category rules and the content of environmental declarations	2015-03-00
CLC/TS 50600-5-1	Information technology - Data centre facilities and infrastructures - Part 5-1: Maturity Model for Energy Management and Environmental Sustainability	2023-09-00
EN 50625-1	Collection, logistics & treatment requirements for WEEE - Part 1: General treatment requirements	2014-03-00
EN 50625-2-2	Collection, logistics & Treatment requirements for WEEE - Part 2-2: Treatment requirements for WEEE containing CRTs and flat panel displays	2015-05-00
CLC/TS 50625-3-1	Collection, logistics & treatment requirements for WEEE - Part 3-1: Specification for de-pollution - General	2015-01-00
CLC/TS 50625-3-3	Collection, logistics & treatment requirements for WEEE - Part 3-3: Specification for de-pollution - WEEE containing CRTs and flat panel displays	2017-08-00
CLC/TS 50625-4	Collection, logistics & treatment requirements for WEEE - Part 4: Specification for the collection and logistics associated with WEEE	2017-06-00
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IEC 60050-904*CEI 60050-904	International Electrotechnical Vocabulary - Part 904: Environmental standardization for electrical and electronic products and systems	2014-11-00
IEC 60194-1*CEI 60194-1	Printed boards design, manufacture and assembly - Vocabulary - Part 1: Common usage in printed board and electronic assembly technologies	2021-02-00
IEC 60194-2*CEI 60194-2	Printed boards design, manufacture and assembly - Vocabulary - Part 2: Common usage in electronic technologies as well as printed board and electronic assembly technologies	2017-12-00
IEC 60300-3-10	Dependability management - Part 3-10: Application guide; Maintainability	2001-01-00
EN 60300-3-2	Dependability management - Part 3-2: Application guide - Collection of dependability data from the field (IEC 60300-3-2:2004)	2005-03-00
IEC 60747-14-1	Semiconductor devices - Part 14-1: Semiconductor sensors - Generic specification for sensors	2010-01-00
IEC 60748-11-1	Semiconductor devices; integrated circuits; part 11; section 1: internal visual examination for semiconductor integrated circuits excluding hybrid circuits	1992-04-00
IEC 60748-20-1	Semiconductor devices; integrated circuits; part 20: generic specification for film integrated circuits and hybrid film integrated circuits; section 1: requirements for internal visual examination	1994-02-00
IEC 60748-23-1	Semiconductor devices - Integrated circuits - Part 23-1: Hybrid integrated circuits and film structures; Manufacturing line certification; Generic specification	2002-05-00
IEC 60748-23-2	Semiconductor devices - Integrated circuits - Part 23-2: Hybrid integrated circuits and film structures; Manufacturing line certification; Internal visual inspection and special tests	2002-05-00
IEC 60748-23-4	Semiconductor devices - Integrated circuits - Part 23-4: Hybrid integrated circuits and film structures; Manufacturing line certification; Blank detail specification	2002-05-00
EN 60749-1	Semiconductor devices - Mechanical and climatic test methods - Part 1: General (IEC 60749-1:2002)	2003-06-00
EN 60749-14	Semiconductor devices - Mechanical and climatic test methods - Part 14: Robustness of terminations (lead integrity) (IEC 60749-14:2003)	2003-10-00
EN 60749-3	Semiconductor devices - Mechanical and climatic test methods - Part 3: External visual examination (IEC 60749-3:2017)	2017-06-00
IEC 61182-1	Printed boards - Electronic data description and transfer - Part 1: Printed board description in digital form	1994-08-00
IEC 61182-2	Printed board assembly products - Manufacturing description data and transfer methodology - Part 2: Generic requirements	2006-09-00
IEC 61188-5-1	Printed boards and printed board assemblies - Design and use - Part 5-1: Attachment (land/joint) considerations; Generic requirements	2002-07-00
EN 61188-5-2	Printed boards and printed board assemblies - Design and use - Part 5-2: Attachment (land/joint) considerations; Discrete components (IEC 61188-5-2:2003)	2003-09-00
EN 61188-5-5	Printed boards and printed board assemblies - Design and use - Part 5-5: Attachment (land/joint) considerations - Components with gull-wing leads on four sides (IEC 61188-5-5:2007)	2007-11-00
EN 61188-5-8	Printed boards and printed board assemblies - Design and use - Part 5-8: Attachment (land/joint) considerations - Area array components (BGA, FBGA, CGA, LGA) (IEC 61188-5-8:2007)	2008-03-00
EN 61193-1	Quality assessment systems - Part 1: Registration and analysis of defects on printed board assemblies (IEC 61193-1:2001)	2002-02-00
EN 62326-1	Printed boards - Part 1: Generic specification (IEC 62326-1:2002)	2002-06-00
FprEN 62899-1	IEC 62899-1, Ed. 1: Printed electronics - Materials - Part 1: Substrates	2015-01-00
IEC 62899-101*CEI 62899-101	Printed electronics - Part 101: Terminology - Vocabulary	2019-10-00
IEC 62899-202*CEI 62899-202	Printed electronics - Part 202: Materials - Conductive ink	2023-05-00
IEC 91/1878/CDV*CEI 91/1878/CDV*IEC 61188-6-3*CEI 61188-6-3	Circuit boards and circuit board assemblies - Design and use - Part 6-3: Land pattern design - Description of land pattern for through hole components (THT)	2023-08-00

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EN 15344	Plastics - Recycled plastics - Characterization of Polyethylene (PE) recyclates	2021-05-00
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EN 15346	Plastics - Recycled plastics - Characterization of poly(vinyl chloride) (PVC) recyclates	2014-11-00
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CEN/TS 16861	Plastics - Recycled plastics - Determination of selected marker compounds in food grade recycled polyethylene terephthalate (PET)	2015-06-00
ISO 17088	Plastics - Organic recycling - Specifications for compostable plastics	2021-04-00
ISO/TR 23891	Plastics - Recycling and recovery - Necessity of standards	2020-09-00
ISO/IEC 27400	Cybersecurity - IoT security and privacy - Guidelines	2022-06-00
ISO/IEC 27402	Cybersecurity - IoT security and privacy - Device baseline requirements	2023-11-00
ISO/IEC 27403	Cybersecurity - IoT security and privacy - Guidelines for IoT-domotics	2024-06-00
ISO 31000	Risk management - Guidelines	2018-02-00
IEC 31010*CEI 31010	Risk management - Risk assessment techniques	2019-06-00
IEC 62309	Dependability of products containing reused parts - Requirements for functionality and tests	2004-07-00
EN IEC 62402	Obsolescence management (IEC 62402:2019)	2019-07-00
EN 62550	Spare parts provisioning (IEC 62550:2017)	2017-03-00
EN 62551	Analysis techniques for dependability - Petri net techniques (IEC 62551:2012)	2012-11-00
EN IEC 62960	Dependability reviews during the life cycle (IEC 62960:2020)	2020-05-00
VDA 320	Electric and Electronic Components in Motor Vehicles 48 V On-Board Power Supply - Requirements and Tests	2014-08-00
VDA 605	Phase out management of electronic components in the automotive aftermarket	2012-03-00
VDA EOS	Quality Management in the Automotive Industry - EOS - Electrical Overstress in the Automotive Industry - Dealing with semiconductor devices showing a signature of electrical overstress - Contents, documentations and explanations	2020-01-00
VDA Product Integrity	Quality Management in the Automotive Industry - Product Integrity - Recommended action for organizations regarding product safety and conformity - Recall Management Using Over-the-Air-Updates	2021-03-00
VDA Specification Standard Structure	Joint Quality Management in the Supply chain - Product development, Maturity level assurance for new parts - Automotive VDA component requirement, Specification standard structure - Guideline for the specification of systems, modules, components and individual parts	2007-11-00
VDA risk minimization supply chain	Joint Quality Management in the Supply Chain - Product creation, product manufacture and product delivery - Minimizing risks in the supply chain	2011-10-00
VDA Robust Production Process	Joint Quality Management in the supply chain - Product manufacturing and delivery - Robust production process - Pre-requisites, Standards, Controlling, Examples	2007-11-00
EN ISO 10218-1	Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots (ISO 10218-1:2011)	2011-07-00
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ISO 26262-3	Road vehicles - Functional safety - Part 3: Concept phase	2018-12-00
ISO 26262-7	Road vehicles - Functional safety - Part 7: Production, operation, service and decommissioning	2018-12-00
ISO 26262-9	Road vehicles - Functional safety - Part 9: Automotive safety integrity level (ASIL)-oriented and safety-oriented analyses	2018-12-00
EN 50625-2-1	Collection, logistics and treatment requirements for WEEE - Part 2-1: Treatment requirements for lamps	2014-12-00
CLC/TS 50625-3-2	Collection, logistics & Treatment requirements for WEEE - Part 3-2: Technical specification for de-pollution - Lamps	2016-05-00
CLC/TS 50625-3-4	Collection, logistics & treatment requirements for WEEE - Part 3-4: Specification for de-pollution - temperature exchange equipment	2017-07-00
CLC/TS 50625-3-5	Collection, logistics & Treatment requirements for WEEE - Part 3-5: Technical specification for de-pollution - Photovoltaic panels	2017-11-00
IEC 60050-541*CEI 60050-541	International electrotechnical vocabulary, chapter 541: printed circuits	1990-10-00
IEC 60068-2-58 Edition 4.1*CEI 60068-2-58 Edition 4.1	Environmental testing - Part 2-58: Tests - Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)	2017-07-00
EN IEC 60749-10	Semiconductor devices - Mechanical and climatic test methods - Part 10: Mechanical shock - Device and subassembly (IEC 60749-10:2022)	2022-06-00
EN IEC 60749-15	Semiconductor devices - Mechanical and climatic test methods - Part 15: Resistance to soldering temperature for through-hole mounted devices (IEC 60749-15:2020)	2020-09-00
EN 60749-19	Semiconductor devices - Mechanical and climatic test methods - Part 19: Die shear strength (IEC 60749-19:2003)	2003-04-00
EN IEC 60749-20	Semiconductor devices - Mechanical and climatic test methods - Part 20: Resistance of plastic encapsulated SMDs to the combined effect of moisture and soldering heat (IEC 60749-20:2020)	2020-10-00
EN 60749-20-1	Semiconductor devices - Mechanical and climatic test methods - Part 20-1: Handling, packing, labelling and shipping of surface-mount devices sensitive to the combined effect of moisture and soldering heat (IEC 60749-20-1:2009)	2009-06-00



EN 60749-21	Semiconductor devices - Mechanical and climatic test methods - Part 21: Solderability (IEC 60749-21:2011)	2011-08-00
EN 60749-27	Semiconductor devices - Mechanical and climatic test methods - Part 27: Electrostatic discharge (ESD) sensitivity testing - Machine model (MM) (IEC 60749-27:2006)	2006-08-00
EN 60749-27/A1	Semiconductor devices - Mechanical and climatic test methods - Part 27: Electrostatic discharge (ESD) sensitivity testing - Machine model (MM) (IEC 60749-27:2006/A1:2012)	2012-11-00
EN IEC 60749-37	Semiconductor devices - Mechanical and climatic test methods - Part 37: Board level drop test method using an accelerometer (IEC 60749-37:2022)	2022-11-00
EN IEC 60749-39	Semiconductor devices - Mechanical and climatic test methods - Part 39: Measurement of moisture diffusivity and water solubility in organic materials used for semiconductor components (IEC 60749-39:2021)	2022-01-00
EN 60749-40	Semiconductor devices - Mechanical and climatic test methods - Part 40: Board level drop test method using a strain gauge (IEC 60749-40:2011)	2011-09-00
EN IEC 60749-41	Semiconductor devices - Mechanical and climatic test methods - Part 41: Standard reliability testing methods of non-volatile memory devices (IEC 60749-41:2020)	2020-09-00
EN 60749-42	Semiconductor devices - Mechanical and climatic test methods - Part 42: Temperature and humidity storage (IEC 60749-42:2014)	2014-10-00
EN 61188-7	Printed boards and printed board assemblies - Design and use - Part 7: Electronic component zero orientation for CAD library construction (IEC 61188-7:2017)	2017-06-00
EN 61189-11	Test methods for electrical materials, printed boards and other interconnection structures and assemblies - Part 11: Measurement of melting temperature or melting temperature ranges of solder alloys (IEC 61189-11:2013)	2013-06-00
EN IEC 61189-2-804	Test methods for electrical materials, printed board and other interconnection structures and assemblies - Part 2-804: Test methods for time to delamination - T260, T288, T300 (IEC 61189-2-804:2023)	2023-10-00
FprEN 61189-3-913	IEC 61189-3-719, Ed. 1: Test methods for electrical materials, printed boards and other interconnection structures and assemblies - Part 3-913: Test method for thermal conductivity of printed circuit boards for high-brightness LEDs	2015-09-00
IEC 61189-3-913*CEI 61189-3-913	Test methods for electrical materials, printed boards and other interconnection structures and assemblies - Part 3-913: Test method for thermal conductivity of printed circuit boards for high-brightness LEDs	2016-01-00
IEC/TR 61189-3-914*CEI/TR 61189-3-914	Test methods for electrical materials, printed boards and other interconnection structures and assemblies - Part 3-914: Test method for thermal conductivity of printed circuit boards for high-brightness LEDs - Guidelines	2017-03-00
EN 61189-5	Test methods for electrical materials, interconnection structures and assemblies - Part 5: Test methods for printed board assemblies (IEC 61189-5:2006)	2006-09-00
EN 61189-5-1	Test methods for electrical materials, printed boards and other interconnection structures and assemblies - Part 5-1: General test methods for materials and assemblies - Guidance for printed board assemblies (IEC 61189-5-1:2016)	2016-09-00
EN 61189-5-2	Test methods for electrical materials, printed boards and other interconnection structures and assemblies - Part 5-2: General test methods for materials and assemblies - Soldering flux for printed board assemblies (IEC 61189-5-2:2015)	2015-03-00
EN 61189-5-3	Test methods for electrical materials, printed boards and other interconnection structures and assemblies - Part 5-3: General test methods for materials and assemblies - Soldering paste for printed board assemblies (IEC 61189-5-3:2015)	2015-03-00
EN IEC 61189-5-301	Test methods for electrical materials, printed boards and other interconnection structures and assemblies - Part 5-301: General test methods for materials and assemblies - Soldering paste using fine solder particles (IEC 61189-5-301:2021)	2021-04-00
EN 61189-5-4	Test methods for electrical materials, printed boards and other interconnection structures and assemblies - Part 5-4: General test methods for materials and assemblies - Solder alloys and fluxed and non-fluxed solid wire for printed board assemblies (IEC 61189-5-4:2015)	2015-03-00
EN IEC 61189-5-501	Test methods for electrical materials, printed boards and other interconnection structures and assemblies - Part 5-501: General test methods for materials and assemblies - Surface insulation resistance (SIR) testing of solder fluxes (IEC 61189-5-501:2021)	2021-03-00
EN IEC 61189-5-502	Test methods for electrical materials, printed board and other interconnection structures and assemblies - Part 5-502: General test methods for materials and assemblies - Surface insulation resistance (SIR) testing of assemblies (IEC 61189-5-502:2021)	2021-03-00
EN 61189-5-503	Test methods for electrical materials, printed board and other interconnection structures and assemblies - Part 5-503: General test method for materials and assemblies - Conductive anodic filaments (CAF) testing of circuit boards (IEC 61189-5-503:2017)	2017-08-00
EN IEC 61189-5-504	Test methods for electrical materials, printed board and other interconnection structures and assemblies - Part 5-504: General test methods for materials and assemblies - Process ionic contamination testing (PICT) (IEC 61189-5-504:2020)	2020-06-00
EN IEC 61189-5-601	Test methods for electrical materials, printed boards and other interconnection structures and assemblies - Part 5-601: General test methods for materials and assemblies - Reflow soldering ability test for solder joint, and reflow heat resistance test for printed boards (IEC 61189-5-601:2021)	2021-03-00
EN IEC 61191-1	Printed board assemblies - Part 1: Generic specification - Requirements for soldered electrical and electronic assemblies using surface mount and related assembly technologies (IEC 61191-1:2018)	2018-11-00
EN 61191-2	Printed board assemblies - Part 2: Sectional specification - Requirements for surface mount soldered assemblies (IEC 61191-2:2017)	2017-10-00
EN 61191-6	Printed board assemblies - Part 6: Evaluation criteria for voids in soldered joints of BGA and LGA and measurement method (IEC 61191-6:2010)	2010-04-00
IEC/TR 61191-7*CEI/TR 61191-7	Printed board assemblies - Part 7: Technical cleanliness of components and printed board assemblies	2020-03-00
IEC/TR 61191-8*CEI/TR 61191-8	Printed board assemblies - Part 8: Voiding in solder joints of printed board assemblies for use in automotive electronic control units - Best practices	2021-03-00
IEC/TR 61191-9*CEI/TR 61191-9	Printed board assemblies - Part 9: Electrochemical reliability and ionic contamination on printed-circuit board assemblies for use in automotive applications - Best practices	2023-06-00
EN 61193-3	Quality assessment systems - Part 3: Selection and use of sampling plans for printed board and laminate end-product and in-process auditing (IEC 61193-3:2013)	2013-04-00
IEC/TS 61340-5-4*CEI/TS 61340-5-4	Electrostatics - Part 5-4: Protection of electronic devices from electrostatic phenomena - Compliance verification	2021-08-00
IEC 61969-3*CEI 61969-3	Mechanical structures for electrical and electronic equipment - Outdoor enclosures - Part 3: Environmental requirements, tests and safety aspects	2020-06-00
EN 62047-13	Semiconductor devices - Micro-electromechanical devices - Part 13: Bend- and shear-type test methods of measuring adhesive strength for MEMS structures (IEC 62047-13:2012)	2012-04-00
EN 62047-7	Semiconductor devices - Micro-electromechanical devices - Part 7: MEMS BAW filter and duplexer for radio frequency control and selection (IEC 62047-7:2011)	2011-08-00
EN 62258-2	Semiconductor die products - Part 2: Exchange data formats (IEC 62258-2:2011)	2011-07-00



CLC/TR 62258-7	Semiconductor die products - Part 7: XML schema for data exchange (IEC/TR 62258-7:2007)	2007-10-00
CLC/TR 62258-8	Semiconductor die products - Part 8: EXPRESS model schema for data exchange (IEC/TR 62258-8:2008)	2008-08-00
IEC 62321-10	Determination of certain substances in electrotechnical products - Part 10: Polycyclic aromatic hydrocarbons (PAHs) in polymers and electronics by gas chromatography-mass spectrometry (GC-MS)	2020-06-00
prEN IEC 62321-10	Determination of certain substances in electrotechnical products - Part 10: Polycyclic aromatic hydrocarbons (PAHs) in polymers and electronics by gas chromatography-mass spectrometry (GC-MS) (IEC 62321-10:2020)	2020-10-00
IEC 62321-2	Determination of certain substances in electrotechnical products - Part 2: Disassembly, disjointment and mechanical sample preparation	2021-08-00
IEC 62321-3-1*CEI 62321-3-1	Determination of certain substances in electrotechnical products - Part 3-1: Screening test methods - Screening of electrotechnical products for lead, mercury, cadmium, total chromium and total bromine using X-ray fluorescence spectrometry	2013-06-00
IEC 62321-3-2*CEI 62321-3-2	Determination of certain substances in electrotechnical products - Part 3-2: Screening - Fluorine, chlorine and bromine in polymers and electronics by combustion-ion chromatography (C-IC)	2020-06-00
prEN IEC 62321-3-2	Determination of certain substances in electrotechnical products - Part 3-2: Screening - Fluorine, chlorine and bromine in polymers and electronics by combustion-ion chromatography (C-IC) (IEC 62321-3-2:2020)	2020-10-00
IEC 62321-3-3*CEI 62321-3-3	Determination of certain substances in electrotechnical products - Part 3-3: Screening - Polybrominated biphenyls, polybrominated diphenyl ethers and phthalates in polymers by gas chromatography-mass spectrometry using a pyrolyser/thermal desorption accessory (Py/TDGCMS)	2021-09-00
IEC 62321-4 AMD 1	Determination of certain substances in electrotechnical products - Part 4: Mercury in polymers, metals and electronics by CV-AAS, CV-AFS, ICP-OES and ICP-MS; Amendment 1	2017-07-00
IEC 62321-4 Edition 1.1	Determination of certain substances in electrotechnical products - Part 4: Mercury in polymers, metals and electronics by CV-AAS, CV-AFS, ICP-OES and ICP-MS	2017-07-00
IEC 62321-4	Determination of certain substances in electrotechnical products - Part 4: Determination of mercury in polymers, metals and electronics by CV-AAS, CV-AFS, ICP-OES and ICP-MS	2013-06-00
EN 62321-5	Determination of certain substances in electrotechnical products - Part 5: Mercury in polymers, metals and electronics by CV-AAS, CV-AFS, ICP-OES and ICP-MS (IEC 62321-5:2013)	2014-04-00
IEC 62321-6	Determination of certain substances in electrotechnical products - Part 6: Polybrominated biphenyls and polybrominated diphenyl ethers in polymers by gas chromatography-mass spectrometry (GC-MS)	2015-06-00
IEC 62321-7-1	Determination of certain substances in electrotechnical products - Part 7-1: Hexavalent chromium - Presence of hexavalent chromium (Cr(VI)) in colourless and coloured corrosion-protected coatings on metals by the colorimetric method	2015-09-00
IEC 62321-7-2	Determination of certain substances in electrotechnical products - Part 7-2: Hexavalent chromium - Determination of hexavalent chromium (Cr(VI)) in polymers and electronics by the colorimetric method	2017-03-00
IEC 62321-8*CEI 62321-8	Determination of certain substances in electrotechnical products - Part 8: Phthalates in polymers by gas chromatography-mass spectrometry (GC-MS), gas chromatography-mass spectrometry using a pyrolyzer/thermal desorption accessory (Py/TD-GC-MS)	2017-03-00
EN IEC 62435-3	Electronic components - Long-term storage of electronic semiconductor devices - Part 3: Data (IEC 62435-3:2020)	2020-04-00
IEC 62435-8	Electronic components - Long-term storage of electronic semiconductor devices - Part 8: Passive electronic devices	2020-07-00
IEC 62435-9	Electronic components - Long-term storage of electronic semiconductor devices - Part 9: Special cases	2021-08-00
IEC/TS 62474-1*CEI/ITS 62474-1	Material declaration for products of and for the electrotechnical industry - Part 1: Guidance on the implementation of IEC 62474	2022-11-00
FprEN 62830-1	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 1: Vibration based piezoelectric energy harvesting	2016-12-00
FprEN 62830-3	IEC 62830-3, Ed. 1: Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 3: Vibration based electromagnetic energy harvesting	2015-06-00
IEC 62830-8	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 8: Test and evaluation methods of flexible and stretchable supercapacitors for use in low power electronics	2021-10-00
IEC/TR 62878-2-7	Device embedding assembly technology Part 2-7: Guidelines - Accelerated stress testing of passive embedded circuit boards	2019-03-00
IEC 62899-201 AMD 1	Printed electronics - Part 201: Materials - Substrates; Amendment 1	2018-11-00
IEC 62899-201*CEI 62899-201	Printed electronics - Part 201: Materials - Substrates	2016-02-00
IEC 62899-201-2*CEI 62899-201-2	Printed electronics - Part 201-2: Materials - Substrates - Measurement methods for properties of stretchable substrates	2021-10-00
IEC 62899-202-10*CEI 62899-202-10	Printed electronics - Part 202-10: Materials - Resistance measurement method for thermoformable conducting layer	2023-08-00
IEC 62899-202-5*CEI 62899-202-5	Printed electronics - Part 202-5: Materials - Conductive ink - Mechanical bending test of a printed conductive layer on an insulating substrate	2018-09-00
IEC 62899-202-7*CEI 62899-202-7	Printed electronics - Part 202-7: Materials - Printed film - Measurement of peel strength for printed layer on flexible substrate by the 90° peel method	2021-03-00
IEC 62899-202-9*CEI 62899-202-9	Printed electronics - Part 202-9: Materials - Conductive ink - Printed patterns for mechanical test	2023-08-00
IEC 62899-204*CEI 62899-204	Printed electronics - Part 204: Materials - Insulator ink - Measurement methods of properties of insulator inks and printed insulating layers	2019-05-00
IEC 62899-501-1*CEI 62899-501-1	Printed electronics - Part 501-1: Quality assessment - Failure modes and mechanical testing - Flexible or bendable primary or secondary cells	2019-01-00
IEC 62899-502-1*CEI 62899-502-1	Printed electronics - Part 502-1: Quality assessment - Organic light emitting diode (OLED) elements - Mechanical stress testing of OLED elements formed on flexible substrates	2017-03-00
IEC 62899-505*CEI 62899-505	Printed electronics - Part 505: Quality assessment - Flexible gas sensor - Mechanical and thermal testing	2020-06-00

IEC/TR 62899-550-1*CEI/TR 62899-550-1	Printed electronics - Part 550-1: Quality assessment - Framework document on durability testing - Mechanical and thermal testing	2022-10-00
EN IEC 62969-1	Semiconductor devices - Semiconductor interface for automotive vehicles - Part 1: General requirements of power interface for automotive vehicle sensors (IEC 62969-1:2017)	2018-02-00
EN IEC 62969-2	Semiconductor devices - Semiconductor interface for automotive vehicles - Part 2: Efficiency evaluation methods of wireless power transmission using resonance for automotive vehicles sensors (IEC 62969-2:2018)	2018-04-00
EN IEC 62969-3	Semiconductor devices - Semiconductor interface for automotive vehicles - Part 3: Shock driven piezoelectric energy harvesting for automotive vehicle sensors (IEC 62969-3:2018)	2018-06-00
EN IEC 62969-4	Semiconductor devices - Semiconductor interface for automotive vehicles - Part 4: Evaluation method of data interface for automotive vehicle sensors (IEC 62969-4:2018)	2018-08-00
ECSS-Q-ST-70-60C + Corrigendum 1	Qualification and procurement of printed circuit boards	2019-03-01
IEC/DIS 82474-1	Material declaration - Part 1: General requirements	2023-07-00
DIN EN IEC 63395*VDE 0042-3395	Sustainable management of waste electrical and electronic equipment (e-waste) (IEC 111/750/CDV:2024); German and English version prEN IEC 63395:2024	2024-12-00
DIN EN ISO 14019-1	Sustainability information - Part 1: General principles and requirements for validation and verification (ISO/DIS 14019-1:2024); German and English version prEN ISO 14019-1:2024	2024-12-00
DIN EN ISO 14019-2	Sustainability information - Part 2: Principles and requirements for verification processes (ISO/DIS 14019-2:2024); German and English version prEN ISO 14019-2:2024	2024-12-00
DIN EN ISO 14019-4	Sustainability information - Part 4: Principles and requirements for bodies validating and verifying sustainability information (ISO/DIS 14019-4:2024); German and English version prEN ISO 14019-4:2024	2024-12-00
DIN SPEC 91482	Guideline for the standardization of an End-of-Life Bill of Materials	2024-07-00
VDMA 35111	Method for calculating the product carbon footprint (PCF) for precision tools	2024-11-00
ETSI TS 103486 V 1.1.1	CYBER - Identity Management and Discovery for IoT	2024-03-00
ETSI TS 103881 V 1.1.1	Environmental Engineering (EE) - Global digital sustainable product passport opportunities to achieve a circular economy	2024-01-00
ETSI TR 103937 V 1.1.1	Cyber Security (CYBER) - Cyber Resiliency and Supply Chain Management	2024-08-00
ETSI TR 104080 V 1.1.1	Environmental Engineering (EE) - Example of a Life Cycle Assessment (LCA) of a mobile phone	2024-07-00
FprEN 18037	Guidelines on a sectoral cybersecurity assessment	2024-09-00
CEN/TR 18047	Mechanical products - Order of magnitude of key environmental data	2024-03-00
CWA 18059-1	Definition of parameters required for modelling of the material, cell and manufacturing process behaviour for battery cells for the automotive market - Part 1: Data required for modelling the material, cell and manufacturing process for cells for the automotive market	2023-12-00
CWA 18059-2	Definition of parameters required for modelling of the material, cell and manufacturing process behaviour for battery cells for the automotive market - Part 2: Experiments and characterisation techniques for data required for modelling cells	2023-12-00
prEN 18061	Road vehicles - Rechargeable batteries with internal energy storage - Steps, conditions and protocols for the safe repair and reuse of modules and batteries designed for EV applications	2024-03-00
FprCEN/TS 18084	Road vehicles - Post Shredder Technology recycling - Design recommendations for plastic products	2024-05-00
CWA 18106	Circularity Protocols for extending the useful Life of Large Industrial Equipment	2024-04-00
CWA 18119	A methodology to improve the recyclability rate of Strategic/Critical Metals from car electronics	2024-05-00
FprEN IEC 60747-15	Semiconductor devices - Part 15: Discrete devices - Isolated power semiconductor devices	2024-05-00
IEC 21A/867/CDV*CEI 21A/867/CDV*IEC 63369-1*CEI 63369-1	Methodology for the Carbon Footprint calculation applicable to industrial Lithium-ion batteries	2023-12-00
IEC 47E/837/CDV*CEI 47E/837/CDV*IEC 60747-2*CEI 60747-2	Semiconductor devices - Part 2: Discrete devices - Rectifier diodes	2024-08-00
IEC 47E/838/CDV*CEI 47E/838/CDV*IEC 60747-6*CEI 60747-6	Semiconductor devices - Part 6: Discrete devices - Thyristors	2024-08-00
IEC 47F/478/CDV*CEI 47F/478/CDV*IEC 62047-49*CEI 62047-49	Semiconductor devices - Micro-electromechanical devices - Part 49: Temperature and humidity test methods for piezoelectric MEMS cantilevers	2024-08-00
IEC 56/2043/DTR*CEI 56/2043/DTR*IEC/TR 63162*CEI/TR 63162	Electric components - Reliability - Failure rates at reference conditions	2024-02-00
IEC 61/7091/CD*CEI 61/7091/CD*IEC 60335-2-123*CEI 60335-2-123	Household and similar electrical appliances - Safety - Part 2-123: Particular requirements for robots	2023-12-00
IEC 69/964/CDV*CEI 69/964/CDV*IEC 63584*CEI 63584	Open Charge Point Protocol (OCPP)	2024-07-00
IEC 91/1941/CD*CEI 91/1941/CD*IEC 61189-3-302*CEI 61189-3-302	Test methods for electrical materials, printed board and other interconnection structures and assemblies - Part 3-302: Detection of plating defects in unpopulated circuit boards by computed tomography (CT)	2024-03-00
IEC 91/1956/CD*CEI 91/1956/CD*IEC 61249-3-6*CEI 61249-3-6	Materials for printed boards and other interconnecting structures - Part 3-6: Sectional specification set for unreinforced base materials, clad and unclad - PTFE unfilled laminate sheets of defined flammability (vertical burning test), copper-clad	2024-04-00
IEC 91/1981/CD*CEI 91/1981/CD*IEC 63516*CEI 63516	Fixed folding durability test method for flexible opto-electric circuit boards	2024-08-00
IEC 111/757/CDV*CEI 111/757/CDV*IEC 63372*CEI 63372	Quantification and communication of Carbon FootPRINT and GHG emission reductions/avoided emissions from electric and electronic products and systems - Principles, methodologies, requirements and guidance	2024-05-00
IEC 119/477/CD*CEI 119/477/CD*IEC 62899-402-8*CEI 62899-402-8	Printed electronics - Part 402-8: Printability - Measurement of qualities - Shape pattern dimension	2024-01-00
IEC 119/488/CD*CEI 119/488/CD*IEC 62899-402-2*CEI 62899-402-2	Printed electronics - Part 402-2: Printability - Measurement of qualities - Edge waviness of printed pattern using a two-dimensional optical image	2024-04-00
IEC 119/508/CD*CEI 119/508/CD*IEC 60050-543*CEI 60050-543	International Electrotechnical Vocabulary (IEV) - Part 543: Printed and Flexible Electronics	2024-08-00
IEC 62933-4-4*CEI 62933-4-4	Electrical energy storage (EES) systems - Part 4-4: Environmental requirements for battery-based energy storage systems (BESS) with reused batteries	2023-11-00
IEC 63338*CEI 63338	General guidance on reuse and repurposing of secondary cells and batteries	2024-08-00
IWA 45	Sustainable critical mineral supply chains	2024-08-00
ISO/TS 5474-5	Electrically propelled road vehicles - Functional and safety requirements for power transfer between vehicle and external electric circuit - Part 5: Automatic conductive power transfer	2024-01-00



ISO/FDIS 14075	Environmental management - Principles and framework for social life cycle assessment	2024-07-00
ISO 14404-1	Calculation method of carbon dioxide emission intensity from iron and steel production - Part 1: Steel plant with blast furnace	2024-09-00
ISO 14404-2	Calculation method of carbon dioxide emission intensity from iron and steel production - Part 2: Steel plant with electric arc furnace (EAF)	2024-09-00
ISO 14404-3	Calculation method of carbon dioxide emission intensity from iron and steel production - Part 3: Steel plant with electric arc furnace (EAF) and coal-based or gas-based direct reduction iron (DRI) facility	2024-09-00
ISO/IEC 30141	Internet of Things (IoT) - Reference architecture	2024-08-00
ISO/IEC TS 30149	Internet of Things (IoT) - Trustworthiness principles	2024-05-00
ISO 59004	Circular economy - Vocabulary, principles and guidance for implementation	2024-05-00
ISO 59010	Circular economy - Guidance on the transition of business models and value networks	2024-05-00
ISO 59020	Circular economy - Measuring and assessing circularity performance	2024-05-00
ISO/TR 59032	Circular economy - Review of existing value networks	2024-05-00
ITU-T Y.4703	Internet of things service management application programming interface Representational State Transfer specification	2024-03-00
ITU-T Y.4704	Internet of things device management application programming interface Representational State Transfer specification	2024-03-00

ANNEX 2: Standards provided to the CIRC-UIITS Consortium

Document number	title
IEC DIS 82474-1:2023 (draft)	Material declaration — Part 1: General requirements
ISO 59004:2024	Circular economy — Vocabulary, principles and guidance for implementation
ISO 59010:2024	Circular economy — Guidance on the transition of business models and value networks
ISO 59020:2024	Circular economy — Measuring and assessing circularity performance
ISO 59032:2024	Circular economy — Review of existing value networks
ISO 59040:2024	Circular economy — Product circularity data sheet
Recommendation ITU-T L.1022:2019	Circular economy: Definitions and concepts for material efficiency for information and communication technology
Recommendation ITU-T L.1023:2023	Assessment method for circularity performance scoring
CWA 17354:2018	Industrial Symbiosis: Core Elements and Implementation Approaches
CWA 17806:2021	Design Circular Framework Setting - Composite recovery design solutions in the automotive industry
CWA 17807:2021	Dismantling methods and protocols in a Circular Economy - Framework - Composite recovery in the automotive industry
DIN CLC/TR 45550:2021	Definitions related to material efficiency
VDI 4800 volume 2:2018 + correction:2018	Resource efficiency - Evaluation of raw material demand + Corrigendum concerning standard VDI 4800 Part 2
DIN EN 45554:2020	General methods for the assessment of the ability to repair, reuse and upgrade energy-related products; English version EN 45554:2020, English translation of DIN EN 45554:2020-10
DIN SPEC 91436:2021	Reference model for operational waste and recyclables management oriented towards a vision of "zero waste"
DIN SPEC 91472:2023	Remanufacturing (Reman) - Qualitätsklassifizierung für zirkuläre Prozesse
BS EN IEC 63000:2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances



What is “Standardization“?

Standardisation...

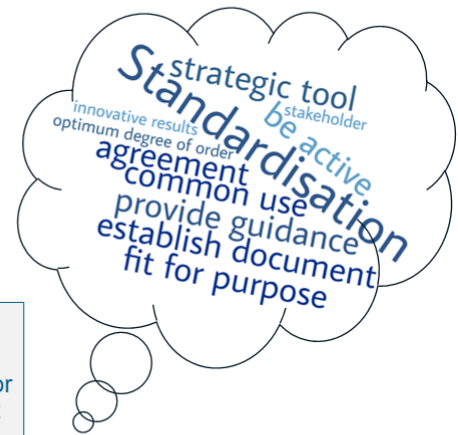
activity of establishing, with regards to actual or potential problems, **provisions for common and repeatable use**, aimed at the achievement of the optimum degree of order in a given context

(Source: EN 45020:2006 Standardization and related activities - General vocabulary (ISO/IEC Guide 2:2004))

Standard...

document, established by consensus and approved by a recognized body that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context

(Source: EN 45020:2006 Standardization and related activities - General vocabulary (ISO/IEC Guide 2:2004))



Why are standards important for R&I projects?



Standards development on national, European and international level

International Standardisation Organisations



International Organisation for Standardisation



International Electrotechnical Commission



International Telecommunication Union

European Standardisation Organisations



European Committee for Standardization



European Committee for Electrotechnical Standardization

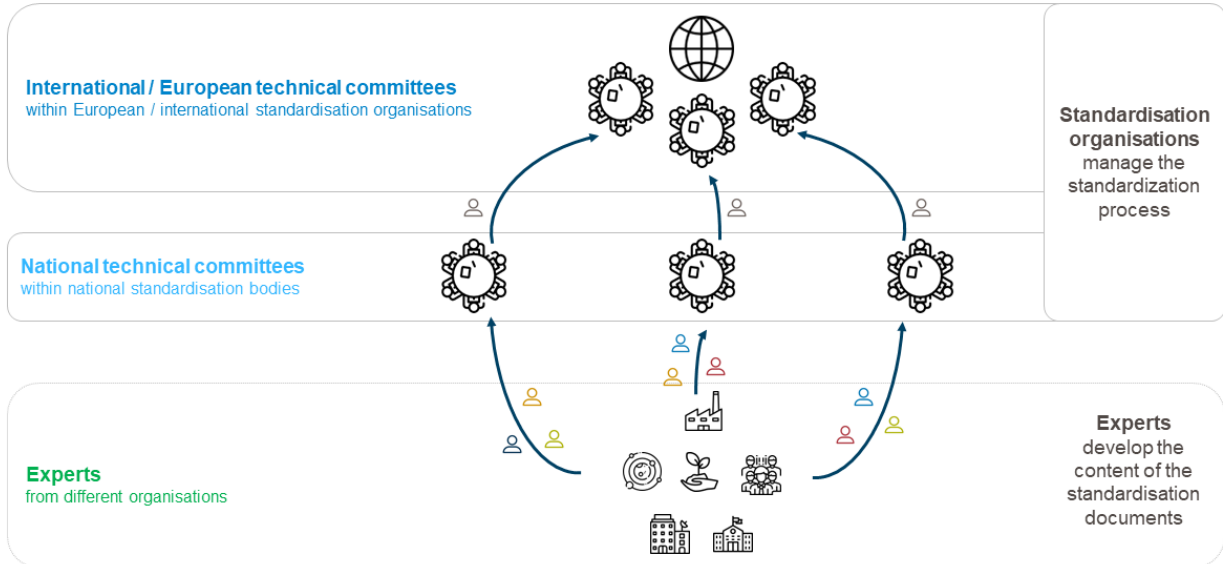


European Telecommunications Standards Institute

National Standardisation Bodies



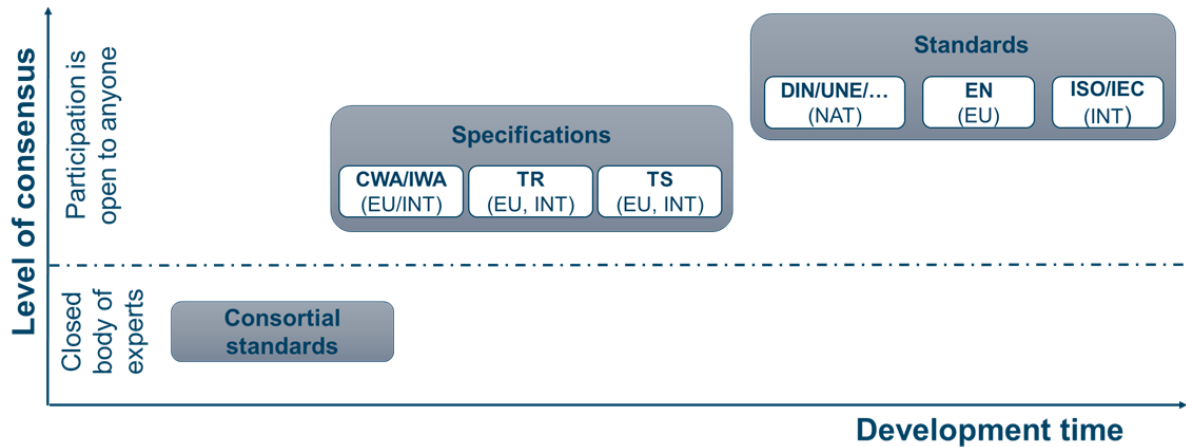
Development of standardization documents in technical committees



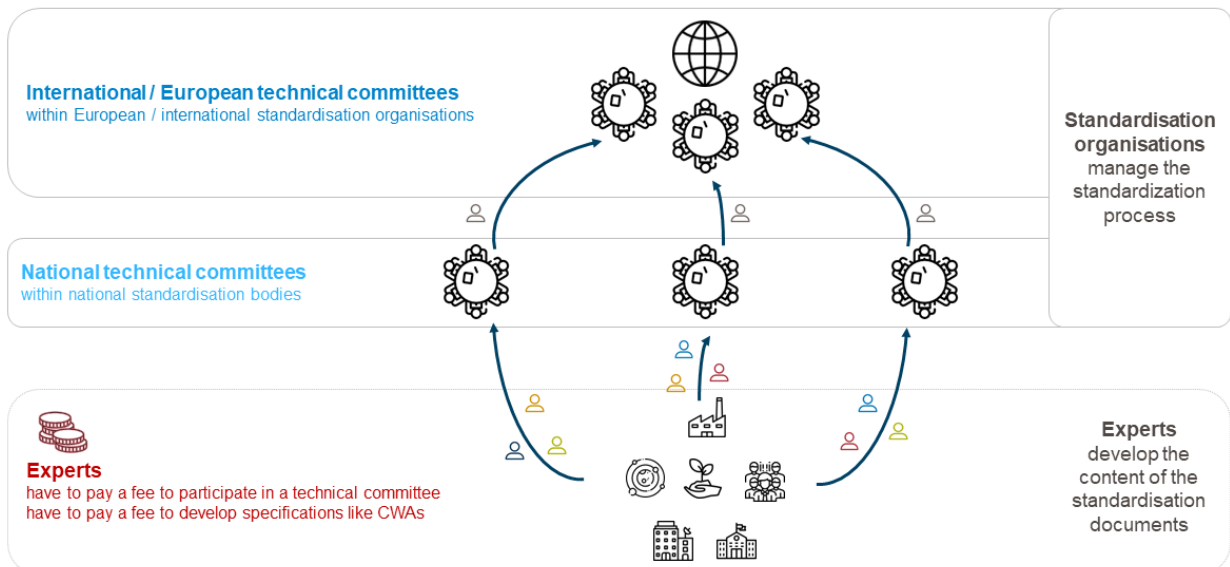
Types of standards

Basic standard	Terminology standard	Testing standard	Product standard	Process standard	Service standard	Interface standard	Standard on data to be provided
<ul style="list-style-type: none"> standard that has a wide-ranging coverage or contains general provisions for one particular field 	<ul style="list-style-type: none"> that is concerned with terms, usually accompanied by their definitions, and sometimes by explanatory notes, illustrations, examples, etc. 	<ul style="list-style-type: none"> that is concerned with test methods, sometimes supplemented with other provisions related to testing, such as sampling, use of statistical methods, sequence of tests 	<ul style="list-style-type: none"> that specifies requirements to be fulfilled by a product or a group of products, to establish its fitness for purpose 	<ul style="list-style-type: none"> that specifies requirements to be fulfilled by a process, to establish its fitness for purpose 	<ul style="list-style-type: none"> that specifies requirements to be fulfilled by a service, to establish its fitness for purpose 	<ul style="list-style-type: none"> that specifies requirements concerned with the compatibility of products or systems at their points of inter-connection 	<ul style="list-style-type: none"> that contains a list of characteristics for which values or other data are to be stated for specifying the product, process or service

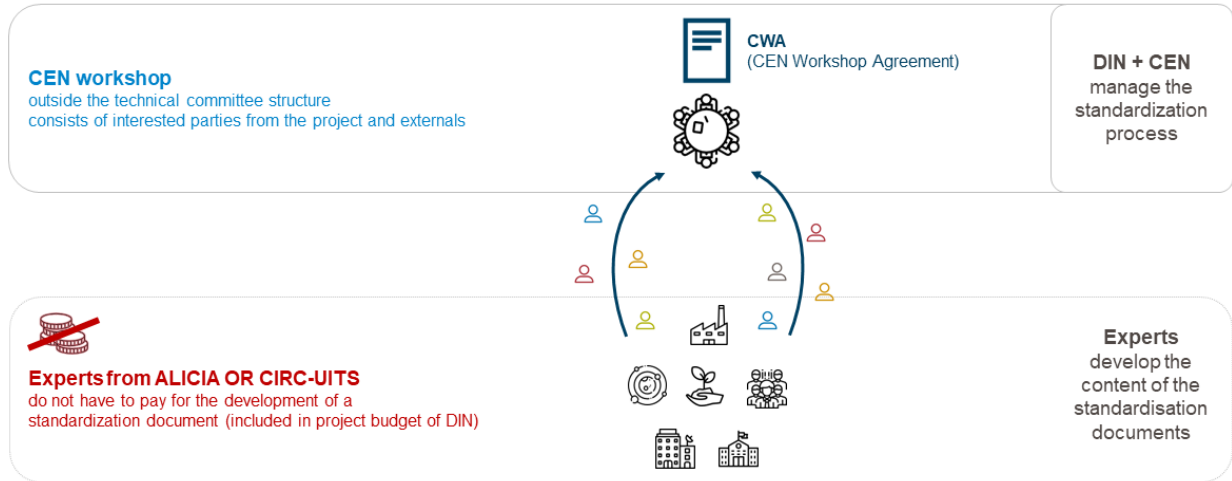
Types of standardisation deliverables



Development of standardization documents in technical committees



Development of standardization documents within a research project



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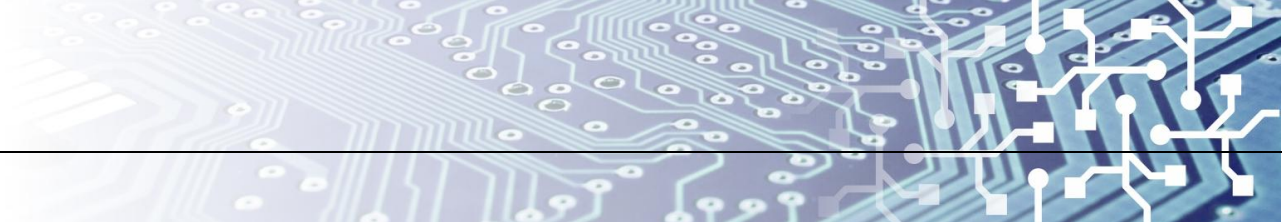


ANNEX 4: Stage Codes⁴⁵

Stage	Substage			90 Decision			
	00 Registration	20 Start of main action	60 Completion of main action	92 Repeat an earlier phase	93 Repeat current phase	98 Abandon	99 Proceed
00 Preliminary stage	00.00 Proposal for new project received	00.20 Proposal for new project under review	00.60 Close of review			00.98 Proposal for new project abandoned	00.99 Approval to ballot proposal for new project
10 Proposal stage	10.00 Proposal for new project registered	10.20 New project ballot initiated	10.60 Close of voting	10.92 Proposal returned to submitter for further definition		10.98 New project rejected	10.99 Approval to new project approved
20 Preparatory stage	20.00 New project registered in TC/SC work programme	20.20 Working draft (WD) study initiated	20.60 Close of comment period			20.98 Project deleted	20.99 WD approved for registration as CD
30 Committee stage	30.00 Committee draft (CD) registered	30.20 CD Study initiated	30.60 Close of comment period	30.92 CD referred back to Working Group		30.98 Project deleted	30.99 CD approved for registration as DIS
40 Enquiry stage	40.00 DIS registered	40.20 DIS ballot initiated: 12 weeks	40.60 Close of voting	40.92 Full report circulated: DIS referred back to TC or SC	40.93 Full report circulated: decision for new DIS ballot	40.98 Project deleted	40.99 Full report circulated: DIS approved for registration as FDIS
50 Approval stage	50.00 Final text received or FDIS registered for formal approval	50.20 Proof sent to secretariat or FDIS ballot initiated: 8 weeks	50.60 Close of voting. Proof returned by secretariat	50.92 FDIS or proof referred back to TC or SC		50.98 Project deleted	50.99 FDIS or proof approved for publication

⁴⁵ https://www.iso.org/files/live/sites/isoorg/files/developing_standards/docs/en/stage_codes.pdf, last viewed on 16.10.2023





Stage	Substage						
	00 Registration	20 Start of main action	60 Completion of main action	90 Decision			
				92 Repeat an earlier phase	93 Repeat current phase	98 Abandon	99 Proceed
60 Publication stage	60.00 International Standard under publication		60.60 International Standard published				
90 Review stage		90.20 International Standard under periodical review	90.60 Close of review	90.92 International Standard to be revised	90.93 International Standard confirmed		90.99 Withdrawal of International Standard proposed by TC or SC
95 Withdrawal stage		95.20 Withdrawal ballot initiated	95.60 Close of voting	95.92 Decision not to withdraw International Standard			95.99 Withdrawal of International Standard



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