NICKEFFECT

D7.3

Report on standardization landscape and contribution to standards

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Abstract:	The document presents an analysis of the relevant standardization landscape based on the requirements from the technical work packages of NICKEFFECT project. Various standardization bodies are described as well as a selection of the most appropriate standards is made to provide the partners with the information about the relevant "state-of-the-art" in the process. Furthermore, the selection assists the project´s results contribution to the global standardization activities. The roadmap for standardization strategy is developed to outline the necessary steps towards increasing the project's impact.

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NICKEFFECT Consortium			
#	Participant Organisation Name	Short Name	Country
1	FUNDACION CIDETEC	CID	ES
2	UNIVERSIDAD AUTONOMA DE BARCELONA	UAB	ES
3	VRIJE UNIVERSITEIT BRUSSEL	VUB	BE
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12	ASOCIACION ESPANOLA DE NORMALIZACION	UNE	ES

NICKEFFECT

Ni-based ferromagnetic coatings with enhanced efficiency to replace Pt in energy and digital storage applications

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List of Abbreviations and Acronyms	
AMD	Amendment
AWI	Approved Work Item
CD	International Committee Draft
CEN	European Committee for Standardization
CENELEC (CLC)	European Committee for Standardization in the Electrical field
CWA	CEN Workshop Agreement
DIS	Draft International Standard
EN	European Standard
EU	European Union
FDIS	Final Draft International Standard
FprEN	Final Project of European Standard
IEC	International Electrotechnical Commission; International Standard
ISO	International Organization for Standardization; International Standard
prEN	Project of European Standard
PWI	Preliminary Work Item
SC	Subcommittee
TC	Technical Committee
TR	Technical Report
TS	Technical Specification
UNE	Spanish Association for Standardization
WG	Working Group
WP	Work Package

1 Executive summary

UNE, the Spanish Association for Standardization, as a European Standardization Body, is providing support regarding the standardization task included in the NICKEFFECT project (WP7 "Dissemination, Exploitation and Guiding & Standardization activities"). This document includes the outcomes of *Task 7.4 Creation of guidelines for standardization for Industry*. In order to fulfil this commitment, deliverable D7.3 'Report on the standardization landscape and contribution to standards' includes the information related to the following activities:

1. Analysis of the applicable standardization landscape starting from needs of other WPs about existing standards and standardization committees and organisations involved.

2. Contribution to the ongoing and future standards with project results that can be easily used by the European or international Industry, thus increasing the project's impact.

The main objectives of D7.3 are:

- facilitate the acceptance and utilization by the market of the developed solution proposed by NICKEFFECT project,
- ensure compatibility and interoperability with what already exists in the market through standards, and
- use the standardization system as a tool for dissemination of the project results and interaction with the market stakeholders.

2 Standardization landscape and applicable standards

2.1 Introduction

Standards are voluntary technical documents that set out requirements for a specific item, material, component, system or service, or describes in detail a particular method, procedure or best practice. Standards are developed and defined through a process of sharing knowledge and building consensus among technical experts nominated by interested parties and other stakeholders - including businesses, consumers and environmental groups, among others. These experts are organized in Technical Committees (TCs), which are subdivided in Subcommittees (SCs) and/or Working Groups (WGs). These TCs are included in the structure of the Standardization Organizations (National, European and International, with the respective mirror committees) and work following their internal regulations.

The standardization bodies operate at National (UNE, AFNOR, BSI, DIN, etc.), Regional (CEN, CENELEC, ETSI) or International (ISO, IEC) level. Sometimes there are different standardization bodies at the same level but covering different fields. This is the case of ISO (general) and IEC (electrical) at international level, or CEN, CENELEC and ETSI at European level in the same way.

In the next sections, more detailed information is provided.

2.1.1 National Standardization Organizations

The National Standardization Organizations (UNE, AFNOR, BSI, DIN, etc.) are the organizations officially recognized at national level as being able to represent all standardization interests in their country. They are responsible for developing national standards in their countries and they are

members of ISO, IEC, CEN and CENELEC (note that ITU and ETSI have a different membership policy). National stakeholders interested in standardization activities can take part in the process at European or International level through their national standardization organization.

The legal status of National Standardization Organizations varies from one country to another. The most typical status is a private non-profit organization whose members are national business associations and companies, but sometimes the National Standardization Organization is a part of the Public Administration.

As stated in section 2.1.2, the European Standardization System guarantees that European Standards are identically adopted by all the National Standardization Organizations and any national conflicting standard is withdrawn, through the commitment of the Standstill Agreement. This means the national catalogues of standards have a big level of coherence across Europe and that the European Standardization System helps to achieve the goal of the single market objective.

2.1.2 European Standardization Organizations

The European Standardization system plays a major role in the EU Single Market, enabling the free circulation of goods among 34 countries. The European standardization system relies on a single standard model. European standards are identically adopted by all the National Members and any national conflicting standard is withdrawn. European standards facilitate compliance with EU harmonization legislation, hence the entry and free circulation of goods in the EU Single Market, based on a set of requirements equally applicable in all Member States of the European Union.

European Standardization Organizations work closely with their international level counterparts to avoid duplication of efforts and promote global relevance of standards. As a result of this, 31% of CEN standards are identical to ISO standards and 72% of CENELEC standards are identical to IEC standards.

CEN, CENELEC and ETSI have been officially recognized by the European Union (EU) and by the European Free Trade Association (EFTA) as European Standardization Bodies responsible for developing standards at European level (see Table 1).

Table 1: European Standardization Organizations

European Committee for Standardization	CEN is a non-profit association whose members are the national standards bodies of 34 European countries. It develops standards in fields not related to electrotechnology nor telecommunications. It is the counterpart at European level of ISO.
European Committee for Electrotechnical Standardization	CENELEC is a non-profit association whose members are the national standards bodies of 34 European countries. It develops standards in fields related to electrotechnology. It is the counterpart at European level of IEC.

European Telecommunications Standards Institute	ETSI is a non-profit organization with more than 800 member organizations worldwide. It develops standards for Information and Communications Technologies (ICT).

2.1.3 International Standardization Organizations

International Standardization Organizations develop worldwide applicable, market-driven standards, in a multi-stakeholder environment which ensures that a wide range of technical views are represented, including those relating to social and economic interests. While not subjected to a specific jurisdiction, International Standards have an important contribution to facilitating international trade. This contribution has been recognized by the World Trade Organization (WTO) and the organizations cited below follow the Code of Good Practice for the Preparation, Adoption and Application of Standards of the WTO Agreement on Technical Barriers to Trade. International Standards are based in the Global Relevance principle, the standards are useful through all the world.

Table 2 shows the International Standardization Organizations.

Table 2: International Standardization Organizations

International Standardization Organization	ISO is an independent, non-governmental international organization with a membership of 167 national standards bodies. ISO develops standards mainly in fields not related to electrotechnology nor telecommunications.
International Electrotechnical Commission	IEC is a not-for-profit, non-governmental organization with a membership of 89 national standards bodies. IEC develops standards in fields related to electrotechnology.

2.1.4 Standardization documents

The formal definition of a Standard is a “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”. These include requirements and/or recommendations in relation to products, systems, processes or services.

- European Standards are documents that have been ratified by one of the three European Standardization Organizations, CEN, CENELEC or ETSI; recognized as competent in the area of voluntary technical standardization as for the EU Regulation 1025/2012. As mentioned, the principle is one standard for all Europe. Their application is voluntary, but the adoption at national level as standard is mandatory.

- International Standards are documents that have been ratified by one of the two International Standardization Organizations, ISO or IEC. Their application is voluntary, and the adoption at national level is also voluntary.

All the standards, independently of their origin (national, European or international) are developed under the basis of consensus and approved by the members of the organization according to strict, defined procedures and strict drafting timeframes. Other types of documents are Technical Specifications (TS), Technical Reports (TR) and Workshop Agreements (WA), which have lower level of consensus and a faster drafting timeframe.

A summary of the characteristics of the different standardization documents can be found in Table 3.

Table 3: Characteristics of the different standardization documents

Type	International code	European code	National code	Main characteristics
Standard	ISO IEC	EN	UNE, NF, BS, DIN, etc. When adopting: UNE-EN, NF-EN, UNE-ISO, NF-ISO, etc.	• Elaboration: 3 years • 2 steps of member approval • European: compulsory national adoption • Revision: every 5 years
Technical Specification	ISO/TS IEC/TS	CEN/TS CLC/TS	When adopting: UNE-CEN/TS, NF-CEN/TS, UNE-ISO/TS, NF-ISO/TS, etc.	• Elaboration: 21 months • 1 step of member approval or internal approval in TC • European: optional national adoption • Revision: at 3 years (upgrading to EN or deletion)
Technical Report	ISO/TR IEC/TR	CEN/TR CLC/TR	When adopting: UNE-CEN/TR, NF-CEN/TR, UNE-ISO/TR, NF-ISO/TR, etc.	• Elaboration: free timeframe • Internal approval in TC • European: optional national adoption • No revision required

Workshop Agreement	IWA	CWA	Variable	• Elaboration: free timeframe (usually few months) • Internal approval in the Workshop • European: optional national adoption • Revision: at 3 years (upgrading to EN or deletion)

There are also agreements established between European and International Organizations in order to avoid duplication of efforts and promote global relevance of standards, which allows to adopt or develop in parallel each other's standards with the same content and code. National standards could also be proposed as a base for new European or International standards. The following Figure 1 shows the possible tracks of the standards.

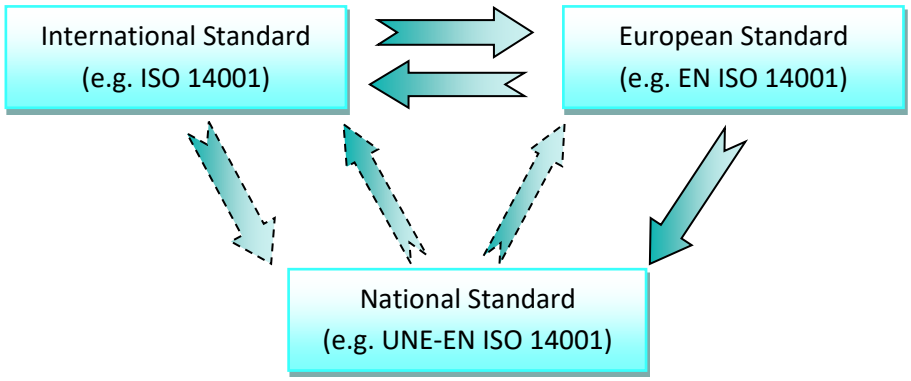

Figure 1: Possible tracks of standards adoption

Therefore, the code of any standard is the combination of the above-mentioned issues and could be explained as shown in Figure 2.

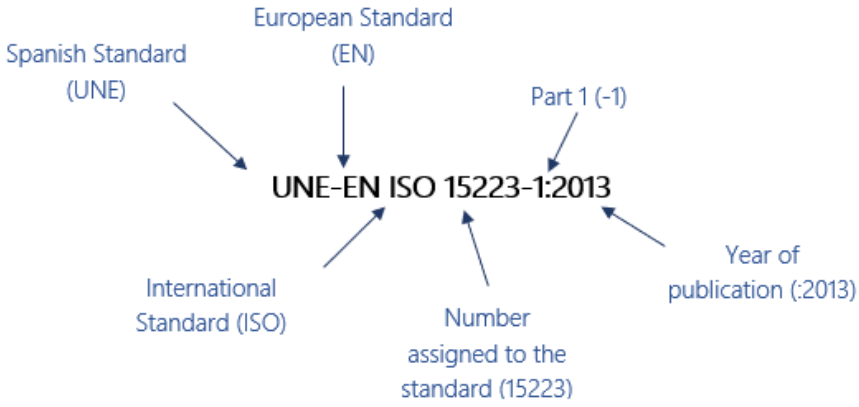

Figure 2: Example of identification of elements in the code of a standard

2.2 Methodology used for the searching of standards

This part of the deliverable presents the standardization activity found relevant for the NICKEFFECT project. It has been prepared to provide the partners with information about the relevant state-of-the-art in standardization, including related standardization technical committees, published standards and standards under development, which can be of interest for the project objectives and development.

The first search has been made looking for keywords in the title and scope of the standards. In Table 4 the list of concepts prepared by UNE and CIDETEC to act as a starting point for the identification of standardization areas can be found.

Table 4: List of keywords acting as a starting point for the identification of standardization areas

Keywords
Water electrolysis
Fuel cell: stack, single cell
Proton Exchange membrane
Polymer electrolyte
Electrodeposition, plating, electroplated
Electroless
Sputtering, sputtered
Nickel alloy, Nickel
Metallic coating
Magnetic storage
Ferromagnetic
Coating: porosity (porous), wettability, corrosion, robustness, degradation

Electrochemical corrosion
Surface roughness
Environmental label and declarations
Life cycle
Chemical risk assessment: Workplace exposure, Workplace air/atmosphere
Protective clothing/chemical
Respiratory protective devices

2.3 Standardization related to NICKEFFECT project

2.3.1 Technical Committees identification

The following is a list of the European and international committees which have been identified as technical bodies working on subjects related to NICKEFFECT project.

Table 5: List of European and international committees related to NICKEFFECT project

European TC	Title
CEN/TC 137	Assessment of workplace exposure to chemical and biological agents
CEN/TC 139	Paints and varnishes
CEN/TC 162	Protective clothing including hand and arm protection and lifejackets
CEN/TC 185	Fasteners
CEN/TC 262	Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys
CEN/TC 271	Surface treatment equipment - Safety
CLC/TC 111 X	Environment
International TC	**Title**
ISO/TC 35	Paints and varnishes
ISO/TC 94	Personal safety -- Personal protective equipment
ISO/TC 107	Metallic and other inorganic coatings
ISO/TC 155	Nickel and nickel alloys
ISO/TC 158	Analysis of gases
ISO/TC 156	Corrosion of metals and alloys
ISO/TC 197	Hydrogen technologies
ISO/TC 201	Surface chemical analysis
ISO/TC 207	Environmental management
IEC/TC 68	Magnetic alloys and steels
IEC/TC 105	Fuel cell technologies

2.3.2 Identified Standards sorted by Technical Committee

Subsequent to the application of the previous methodology explained in 2.2, a list of relevant published standards and standards under development has been obtained.

In order to present the list in a coherent and understandable way, the list of relevant standards has been grouped by the responsible Technical Committee (TC).

There are other standards not relevant for the project but identified as being of possible interest. They are included in the list also grouped by TC and in colour grey.

CEN/TC 137 Assessment of workplace exposure to chemical and biological agents

Scope:

Standardization in the field of assessment of exposure to agents at the workplace including the planning and performing of measurement but excluding the establishment of limit values.

Table 6: List of CEN/TC 137 published standards and standards under development

Standard reference	Title
EN 16897:2017	Workplace exposure - Characterization of ultrafine aerosols/nanoaerosols - Determination of number concentration using condensation particle counters
EN 16966:2018	Workplace exposure - Measurement of exposure by inhalation of nano-objects and their aggregates and agglomerates - Metrics to be used such as number concentration, surface area concentration and mass concentration
EN 17058:2018	Workplace exposure - Assessment of exposure by inhalation of nano-objects and their aggregates and agglomerates
CEN/TR 15278:2006	Workplace exposure - Strategy for the evaluation of dermal exposure
CEN/TR 17055:2017	Workplace exposure - Measurement of chemical agents complying with the requirements given in EN 482 and either one of EN 838, EN 1076, EN 13205, EN 13890 and EN 13936 - Choice of procedures
CEN/TS 15279:2006	Workplace exposure - Measurement of dermal exposure - Principles and methods
prEN ISO 13977	Workplace exposure — Measurement of dermal exposure — Principles and methods UNDER DEVELOPMENT
EN 482:2021	Workplace exposure - Procedures for the determination of the concentration of chemical agents - Basic performance requirements
EN 689:2018+AC:2019	Workplace exposure - Measurement of exposure by inhalation to chemical agents - Strategy for testing compliance with occupational exposure limit values
EN ISO 21832:2020	Workplace air - Metals and metalloids in airborne particles - Requirements for evaluation of measuring procedures (ISO 21832:2018)

EN ISO 22065:2020	Workplace air - Gases and vapours - Requirements for evaluation of measuring procedures using pumped samplers (ISO 22065:2020)
EN ISO 23320:2022	Workplace air - Gases and vapours - Requirements for evaluation of measuring procedures using diffusive samplers (ISO 23320:2022)
	Workplace exposure - Counting rules for the characterization of airborne nano-objects and their agglomerates and aggregates for scanning electron microscopy UNDER DEVELOPMENT
	Workplace exposure - Application of direct-reading low-cost sensors for measuring NOAA in the workplace UNDER DEVELOPMENT

CEN/TC 139 Paints and varnishes

Scope:

Standardization in the field of paints, varnishes and related products. Establishment of methods of test and requirements for coating materials and coatings. Definition of terms.

Table 7: List of CEN/TC 139 published standards and standards under development

Standard reference	Title
CEN ISO/TR 5602:2022	Sources of error in the use of electrochemical impedance spectroscopy for the investigation of coatings and other materials (ISO/TR 5602:2021)
EN ISO 16773-1:2016	Electrochemical impedance spectroscopy (EIS) on coated and uncoated metallic specimens - Part 1: Terms and definitions (ISO 16773-1:2016)
EN ISO 16773-2:2016	Electrochemical impedance spectroscopy (EIS) on coated and uncoated metallic specimens - Part 2: Collection of data (ISO 16773-2:2016)
EN ISO 16773-3:2016	Electrochemical impedance spectroscopy (EIS) on coated and uncoated metallic specimens - Part 3: Processing and analysis of data from dummy cells (ISO 16773-3:2016)
EN ISO 19403-2:2020	Paints and varnishes - Wettability - Part 2: Determination of the surface free energy of solid surfaces by measuring the contact angle (ISO 19403-2:2017)

CEN/TC 162 Protective clothing including hand and arm protection and lifejackets

Scope:

To prepare European Standards (requirements and testing) in the field of clothing to protect against physical and chemical hazards. Hand and arm protectors are included as well as high visibility clothing and clothing against drowning (e.g. lifejackets).

Table 8: List of CEN/TC 162 published standards and standards under development

Standard reference	Title
EN ISO 4042:2022	Fasteners - Electroplated coating systems (ISO 4042:2022)

EN ISO 374-1:2016	Protective gloves against dangerous chemicals and micro-organisms - Part 1: Terminology and performance requirements for chemical risks (ISO 374-1:2016) UNDER DEVELOPMENT: prEN ISO 374-1
EN ISO 374-1:2016/A1:2018	Protective gloves against dangerous chemicals and micro-organisms - Part 1: Terminology and performance requirements for chemical risks - Amendment 1 (ISO 374-1:2016/Amd 1:2018)
CEN/TR 15419:2017	Protective clothing - Guidelines for selection, use, care and maintenance of chemical protective clothing
EN 1149-1:2006	Protective clothing - Electrostatic properties - Part 1: Test method for measurement of surface resistivity
EN 1149-2:1997	Protective clothing - Electrostatic properties - Part 2: Test method for measurement of the electrical resistance through a material (vertical resistance)
EN 1149-3:2004	Protective clothing - Electrostatic properties - Part 3: Test methods for measurement of charge decay
EN 1149-5:2018	Protective clothing - Electrostatic properties - Part 5: Material performance and design requirements
EN 464:1994	Protective clothing - Protection against liquid and gaseous chemicals, including aerosols and solid particles - Test method: Determination of leak-tightness of gas-tight suits (Internal pressure test)
EN ISO 13688:2013	Protective clothing - General requirements (ISO 13688:2013)
EN ISO 13688:2013/A1:2021	Protective clothing - General requirements - Amendment 1 (ISO 13688:2013/Amd 1:2021)
prEN ISO 16602-1	Protective clothing for protection against chemicals — Classification, labelling and performance UNDER DEVELOPMENT
prEN ISO 16602-3	Protective clothing for protection against chemicals – classification, labelling and performance requirements — Part 3: Chemical test methods, classification and requirements UNDER DEVELOPMENT

CEN/TC 185 Fasteners

Scope:

Standardization in the field of mechanical fasteners, taking cognizance of the ISO standards prepared by ISO/TC 2. Note: The term "Mechanical fastener" covers all types of products designed to connect mechanically two or more structural parts to form a solid or movable joint or to contribute essentially to establish this function, such as screws, nuts, washers, pins and rivets.

Table 9: List of CEN/TC 185 published standards and standards under development

Standard reference	Title
EN 16523-1:2015+A1:2018	Determination of material resistance to permeation by chemicals - Part 1: Permeation by potentially hazardous liquid chemicals under conditions of continuous

CEN/TC 262 Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys

Scope:

Standardization in the field of metallic and other inorganic coatings, for corrosion protection of metals and for decorative and engineering purposes

Table 10: List of CEN/TC 262 published standards and standards under development

Standard reference	Title
EN ISO 2178:2016	Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method (ISO 2178:2016)
EN ISO 10308:2006	Metallic coatings - Review of porosity tests (ISO 10308:2006)
EN ISO 18332:2008	Metallic and other inorganic coatings - Definitions and conventions concerning porosity (ISO 18332:2007)
EN ISO 8044:2020	Corrosion of metals and alloys - Vocabulary (ISO 8044:2020) CURRENTLY UNDER REVISION: prEN ISO 8044 rev
EN ISO 2080:2022	Metallic and other inorganic coatings - Surface treatment, metallic and other inorganic coatings - Vocabulary (ISO 2080:2022)
EN ISO 2064:2000	Metallic and other inorganic coatings - Definitions and conventions concerning the measurement of thickness (ISO 2064:1996)
EN ISO 1463:2021	Metallic and oxide coatings - Measurement of coating thickness - Microscopical method (ISO 1463:2021)
EN ISO 3497:2000	Metallic coatings - Measurement of coating thickness - X-ray spectrometric methods (ISO 3497:2000)
EN ISO 3543:2000	Metallic and non-metallic coatings - Measurement of thickness - Beta backscatter method (ISO 3543:2000)
EN ISO 3543:2000/AC:2006	Metallic and non-metallic coatings - Measurement of thickness - Beta backscatter method (ISO 3543:2000)
EN ISO 3882:2003	Metallic and other inorganic coatings - Review of methods of measurement of thickness (ISO 3882:2003) CURRENTLY UNDER REVISION: prEN ISO 3882 rev
EN ISO 4518:2021	Metallic coatings - Measurement of coating thickness - Profilometric method (ISO 4518:2021)

EN ISO 9220:2022	Metallic coatings - Measurement of coating thickness - Scanning electron microscope method (ISO 9220:2022)
EN ISO 2361:1995	Electrodeposited nickel coatings on magnetic and non-magnetic substrates - Measurement of coating thickness - Magnetic method (ISO 2361:1982)
EN ISO 4527:2003	Metallic coatings - Autocatalytic (electroless) nickel-phosphorus alloy coatings - Specification and test methods (ISO 4527:2003)
EN ISO 4526:2004	Metallic coatings - Electroplated coatings of nickel for engineering purposes (ISO 4526:2004)
EN ISO 1456:2009	Metallic and other inorganic coatings - Electrodeposited coatings of nickel, nickel plus chromium, copper plus nickel and of copper plus nickel plus chromium (ISO 1456:2009)
EN ISO 9400:1995	Nickel-based alloys - Determination of resistance to intergranular corrosion (ISO 9400:1990)
EN ISO 17081:2014	Method of measurement of hydrogen permeation and determination of hydrogen uptake and transport in metals by an electrochemical technique (ISO 17081:2014)
EN ISO 10111:2019	Metallic and other inorganic coatings - Measurement of mass per unit area - Review of gravimetric and chemical analysis methods (ISO 10111:2019)
EN ISO 12687:1998	Metallic coatings - Porosity tests - Humid sulfur (flowers of sulfur) test (ISO 12687:1996)
EN ISO 17475:2008	Corrosion of metals and alloys - Electrochemical test methods - Guidelines for conducting potentiostatic and potentiodynamic polarization measurements (ISO 17475:2005/Cor 1:2006)
EN ISO 8407:2021	Corrosion of metals and alloys - Removal of corrosion products from corrosion test specimens (ISO 8407:2021)

CEN/TC 271 Surface treatment equipment - Safety

Scope:

Standardization in the field of safety for the design and construction of machinery and installations used for the application of organic coatings (paints, varnishes and similar products) including pre-treatment plants, coating equipment, compound feed equipment, coating plants and varnish dryers, but excluding equipment used e.g. in foundries, in thermoprocessing plants, etc. already covered by existing CEN/TC's.

Table 11: List of CEN/TC 271 published standards and standards under development

Standard reference	Title
EN 17059:2018	Plating and anodizing lines - Safety requirements

CLC/TC 111 X Environment

Scope:

To deal with environmental aspects for electrical and electronic products and systems. To promote activities in CENELEC relevant to reducing detrimental impacts of electrotechnical activities/products/systems on the natural environment (In this context "reducing" means a process of continual environment improvement aimed towards an optimum balance with social, economic, safety and performance requirements). To enhance CENELEC's environmental links with the European legal framework, particularly in the context of standardization aspects of EU environmental regulations and directives. To improve energy and resource efficiency of electrotechnical products and systems as important aspects in order to reduce impacts on the environment (for example climate changes and resource depletion) To prepare the necessary standards framework and, in co-operation with other CENELEC Technical Bodies, co-ordinate the development of, or when necessary, produce the needed standardization deliverables. Product TCs remain autonomous in dealing with environmental aspects relevant to the products included in their scope. To assist product committees in the elaboration of environmental requirements of product standards in order to foster common technical approaches and solutions for similar problems and thus promote consistency in CENELEC standards. To cooperate with recognized standardization bodies and other relevant organizations for matters of common environmental interest. To communicate with and to give advice to CENELEC BT and Technical Committees on questions related to work on environmental issues. EMC and EMF aspects are excluded, but relevant developments will be noted.

Table 12: List of CLC/TC 111X published standards and standards under development

Standard reference	Title
EN 50693:2019	Product category rules for life cycle assessments of electronic and electrical products and systems
prEN IEC 63366	Product category rules for life cycle assessment of electrical and electronic products and systems. UNDER DEVELOPMENT

ISO/TC 35 Paints and varnishes

Scope:

Standardization in the field of paints, varnishes and related products, including raw materials.

Table 13: List of ISO/TC 35 published standards and standards under development

Standard reference	Title
ISO/TR 5602:2021[1]	Sources of error in the use of electrochemical impedance spectroscopy for the investigation of coatings and other materials
ISO 16773-1:2016[1]	Electrochemical impedance spectroscopy (EIS) on coated and uncoated metallic specimens — Part 1: Terms and definitions
ISO 16773-2:2016[1]	Electrochemical impedance spectroscopy (EIS) on coated and uncoated metallic specimens — Part 2: Collection of data

ISO 16773-3:2016[1]	Electrochemical impedance spectroscopy (EIS) on coated and uncoated metallic specimens — Part 3: Processing and analysis of data from dummy cells
ISO 22553-1:2019	Paints and varnishes — Electro-deposition coatings — Part 1: Vocabulary
ISO 22553-2:2019	Paints and varnishes — Electro-deposition coatings — Part 2: Throwing power
ISO 22553-6:2019	Paints and varnishes — Electro-deposition coatings — Part 6: Entry marks
ISO 22553-8:2020	Paints and varnishes — Electro-deposition coatings — Part 8: Electric charge density
ISO 22553-11:2020	Paints and varnishes — Electro-deposition coatings — Part 11: Bath stability
ISO 22553-14:2021	Paints and varnishes — Electro-deposition coatings — Part 14: Deposition behaviour

[1] *This standard has been adopted as a European standard by the CEN/TC 139 Paints and varnishes, so it is already included in the list of CEN/TC 139 standards.*

ISO/TC 94 Personal safety -- Personal protective equipment

Scope:

Standardization of the performance of personal protective equipment designed to safeguard wearers against all known possible hazards.

Table 14: List of ISO/TC 94 published standards and standards under development

Standard reference	Title
ISO 374-1:2016[1]	Protective gloves against dangerous chemicals and micro-organisms — Part 1: Terminology and performance requirements for chemical risks UNDER DEVELOPMENT: ISO/DIS 374-1
ISO 374-1:2016/Amd 1:2018[1]	Protective gloves against dangerous chemicals and micro-organisms — Part 1: Terminology and performance requirements for chemical risks — Amendment 1
ISO/TS 16975-4:2022	Respiratory protective devices — Selection, use and maintenance — Part 4: Selection and usage guideline for respiratory protective devices under pandemic/epidemic/outbreak of infectious respiratory disease
ISO/TR 11610:2004	Protective clothing — Vocabulary UNDER DEVELOPMENT: ISO 11610
ISO 13688:2013	Protective clothing — General requirements
ISO 13688:2013/Amd 1:2021	Protective clothing — General requirements — Amendment 1

[1] *This standard has been adopted a European standard by the CEN/TC 162 Protective clothing including hand and arm protection and lifejackets, so it is already included in the list of CEN/TC 162 standards.*

ISO/TC 107 Metallic and other inorganic coatings

Scope:

- Standardization of the characteristics of protective and decorative metallic coating applied by electrolysis, fusion, vacuum or chemical means, mechanical deposition, ion plating.
- Standardization of the characteristics of protective and decorative non-metallic coatings (excluding paints and other organic coatings) on metal surface applied by electrolysis, fusion, vacuum or chemical means.
- Standardization of testing and inspection methods for such coatings.
- Standardization of the preparation of the substrates prior to the deposition of metallic and inorganic coatings.

Table 15: List of ISO/TC 107 published standards and standards under development

Standard reference	Title
ISO 1463:2021[1]	Metallic and oxide coatings — Measurement of coating thickness — Microscopical method
ISO 2064:1996[1]	Metallic and other inorganic coatings — Definitions and conventions concerning the measurement of thickness
ISO 2080:2022[1]	Metallic and other inorganic coatings — Surface treatment, metallic and other inorganic coatings — Vocabulary
ISO 2178:2016[1]	Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method
ISO 2361:1982[1]	Electrodeposited nickel coatings on magnetic and non-magnetic substrates — Measurement of coating thickness — Magnetic method
ISO 2819:2017	Metallic coatings on metallic substrates — Electrodeposited and chemically deposited coatings — Review of methods available for testing adhesion
ISO 3497:2000[1]	Metallic coatings — Measurement of coating thickness — X-ray spectrometric methods
ISO 3882:2003[1]	Metallic and other inorganic coatings — Review of methods of measurement of thickness UNDER DEVELOPMENT: ISO/CD 3882
ISO 4518:2021[1]	Metallic coatings — Measurement of coating thickness — Profilometric method
ISO 9220:2022[1]	Metallic coatings — Measurement of coating thickness — Scanning electron microscope method
ISO 4527:2003[1]	Metallic coatings — Autocatalytic (electroless) nickel-phosphorus alloy coatings — Specification and test methods
ISO 27831-1:2008	Metallic and other inorganic coatings — Cleaning and preparation of metal surfaces — Part 1: Ferrous metals and alloys

ISO 27831-2:2008	Metallic and other inorganic coatings — Cleaning and preparation of metal surfaces — Part 2: Non-ferrous metals and alloys
ISO 12687:1996	Metallic coatings — Porosity tests — Humid sulfur (flowers of sulfur) test
ISO 18332:2007[1]	Metallic and other inorganic coatings — Definitions and conventions concerning porosity
ISO/TR 26946:2011	Standard method for porosity measurement of thermally sprayed coatings
ISO 1456:2009[1]	Metallic and other inorganic coatings — Electrodeposited coatings of nickel, nickel plus chromium, copper plus nickel and of copper plus nickel plus chromium
ISO 4526:2004[1]	Metallic coatings — Electroplated coatings of nickel for engineering purposes
ISO 15726:2009	Metallic and other inorganic coatings — Electrodeposited zinc alloys with nickel, cobalt or iron
ISO 10289:1999	Methods for corrosion testing of metallic and other inorganic coatings on metallic substrates — Rating of test specimens and manufactured articles subjected to corrosion tests
ISO 2360:2017	Non-conductive coatings on non-magnetic electrically conductive base metals — Measurement of coating thickness — Amplitude-sensitive eddy-current method
ISO 10111:2019[1]	Metallic and other inorganic coatings — Measurement of mass per unit area — Review of gravimetric and chemical analysis methods
ISO 27830:2017	Metallic and other inorganic coatings — Requirements for the designation of metallic and inorganic coatings
ISO 10308:2006[1]	Metallic coatings — Review of porosity tests
ISO 3543:2000[1]	Metallic and non-metallic coatings — Measurement of thickness — Beta backscatter method
ISO 3543:2000/Cor 1:2003[1]	Metallic and non-metallic coatings — Measurement of thickness — Beta backscatter method — Technical Corrigendum 1
ISO 4519:1980	Electrodeposited metallic coatings and related finishes — Sampling procedures for inspection by attributes
ISO 14571:2020	Metallic coatings on non-metallic basis materials — Measurement of coating thickness — Micro-resistivity method

[1]*This standard has been adopted as a European standard by the CEN/TC 262 Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys, so it is already included in the list of CEN/TC 262 standards.*

ISO/TC 155 Nickel and nickel alloys

Scope:

Standardization in the field of nickel and nickel alloys including terminology, specifications and methods of sampling, testing and analysis.

Table 16: List of ISO/TC 155 published standards and standards under development

Standard reference	Title
ISO/TR 4644:2021	Nickels, ferronickels and nickel alloys — Standards for the determination of chemical composition
ISO 6372:2017	Nickel and nickel alloys — Terms and definitions
ISO 6352:1985[1]	Ferronickel — Determination of nickel content — Dimethylglyoxime gravimetric method

[1]*This standard has been adopted a European standard by the CEN/SS M14 Nickel, CEN Subsector that mirrors the work of ISO/TC 155 as there is no equivalent CEN/TC.*

ISO/TC 156 Corrosion of metals and alloys

Scope:

Standardization in the field of corrosion of metals and alloys including corrosion test methods, corrosion prevention methods and corrosion control engineering life cycle. General coordination of activities in these fields within ISO.

Table 17: List of ISO/TC 156 published standards and standards under development

Standard reference	Title
ISO 23222:2020	Corrosion control engineering life cycle — Risk assessment
ISO 23123:2020	Corrosion control engineering life cycle — General requirements
ISO/TR 16208:2014	Corrosion of metals and alloys — Test method for corrosion of materials by electrochemical impedance measurements
ISO 14802:2012	Corrosion of metals and alloys — Guidelines for applying statistics to analysis of corrosion data
ISO 11845:2020	Corrosion of metals and alloys — General principles for corrosion testing
ISO 8044:2020[1]	Corrosion of metals and alloys — Vocabulary UNDER DEVELOPMENT: ISO/AWI 8044
ISO 9400:1990[1]	Nickel-based alloys — Determination of resistance to intergranular corrosion
ISO 26146:2012	Corrosion of metals and alloys — Method for metallographic examination of samples after exposure to high-temperature corrosive environments
ISO 17475:2005	Corrosion of metals and alloys — Electrochemical test methods — Guidelines for conducting potentiostatic and potentiodynamic polarization measurements

ISO 17475:2005/Cor 1:2006[1]	Corrosion of metals and alloys — Electrochemical test methods — Guidelines for conducting potentiostatic and potentiodynamic polarization measurements — Technical Corrigendum 1
ISO 17474:2012	Corrosion of metals and alloys — Conventions applicable to electrochemical measurements in corrosion testing
ISO 8407:2021[1]	Corrosion of metals and alloys — Removal of corrosion products from corrosion test specimens

[1]*This standard has been adopted as a European standard by the CEN/TC 262 Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys, so it is already included in the list of CEN/TC 262 standards.*

ISO/TC 158 Analysis of gases

Scope:

Standardization in the field of analysis of gases, including:

- terminology;
- preparation of gas mixtures;
- sampling;
- transfer lines;
- analytical methods including evaluation of characteristics of the analysers.

Excluded:

- subjects falling within the scope of any other ISO technical committee (e.g. ISO/TC 28, ISO/TC 146 and ISO/TC 193) unless specifically requested.

Table 18: List of ISO/TC 158 published standards and standards under development

Standard reference	Title
ISO 21087:2019	Gas analysis — Analytical methods for hydrogen fuel — Proton exchange membrane (PEM) fuel cell applications for road vehicles

ISO/TC 197 Hydrogen technologies

Scope:

Standardization in the field of systems and devices for the production, storage, transport, measurement and use of hydrogen.

Table 19: List of ISO/TC 97 published standards and standards under development

Standard reference	Title
ISO 22734:2019	Hydrogen generators using water electrolysis — Industrial, commercial, and residential applications — Part 1: General requirements, test protocols and safety requirements UNDER DEVELOPMENT:

	ISO/AWI 22734-1 Hydrogen generators using water electrolysis — Industrial, commercial, and residential applications — Part 1: General requirements, test protocols and safety requirements ISO/PWI TS 22734-2 Hydrogen generators using water electrolysis — Part 2: Testing guidance for performing electricity grid service

ISO/TC 201 Surface chemical analysis

Scope:

Standardization in the field of surface chemical analysis. Surface chemical analysis includes analytical techniques in which beams of electrons, ions, neutral atoms or molecules, or photons are incident on the specimen material and scattered or emitted electrons, ions, neutral atoms or molecules, or photons are detected. It also includes techniques in which probes are scanned over the surface and surface-related signals are detected.

Excluded:

Scanning electron microscopy which is within the scope of ISO/TC 202.

Note:

With current techniques of surface chemical analysis, analytical information is obtained for regions close to a surface (generally within 20 nm) and analytical information-versus-depth data are obtained with surface analytical techniques over greater depths.

Table 20: List of ISO/TC 201 published standards and standards under development

Standard reference	Title
ISO 16243:2011	Surface chemical analysis — Recording and reporting data in X-ray photoelectron spectroscopy (XPS)
ISO 18116:2005	Surface chemical analysis — Guidelines for preparation and mounting of specimens for analysis
ISO 18117:2009	Surface chemical analysis — Handling of specimens prior to analysis
ISO 14975:2000	Surface chemical analysis — Information formats
ISO 14976:1998	Surface chemical analysis — Data transfer format
ISO 22581:2021	Surface chemical analysis — Near real-time information from the X-ray photoelectron spectroscopy survey scan — Rules for identification of, and correction for, surface contamination by carbon-containing compounds
ISO 19830:2015	Surface chemical analysis — Electron spectroscopies — Minimum reporting requirements for peak fitting in X-ray photoelectron spectroscopy
ISO 19668:2017	Surface chemical analysis — X-ray photoelectron spectroscopy — Estimating and reporting detection limits for elements in homogeneous materials

ISO/TR 18392:2005	Surface chemical analysis — X-ray photoelectron spectroscopy — Procedures for determining backgrounds UNDER DEVELOPMENT: ISO/CD TR 18392
ISO 13424:2013	Surface chemical analysis — X-ray photoelectron spectroscopy — Reporting of results of thin-film analysis
ISO 10810:2019	Surface chemical analysis — X-ray photoelectron spectroscopy — Guidelines for analysis
ISO/TR 15969:2021	Surface chemical analysis — Depth profiling — Measurement of sputtered depth
ISO/TR 23173:2021	Surface chemical analysis — Electron spectroscopies — Measurement of the thickness and composition of nanoparticle coatings
ISO 28600:2011	Surface chemical analysis — Data transfer format for scanning-probe microscopy
ISO 16531:2020	Surface chemical analysis — Depth profiling — Methods for ion beam alignment and the associated measurement of current or current density for depth profiling in AES and XPS
ISO 24237:2005	Surface chemical analysis — X-ray photoelectron spectroscopy — Repeatability and constancy of intensity scale
ISO 18554:2016	Surface chemical analysis — Electron spectroscopies — Procedures for identifying, estimating and correcting for unintended degradation by X-rays in a material undergoing analysis by X-ray photoelectron spectroscopy
ISO 15470:2017	Surface chemical analysis — X-ray photoelectron spectroscopy — Description of selected instrumental performance parameters
ISO/TR 14187:2020	Surface chemical analysis — Characterization of nanostructured materials
ISO/AWI 20579-1	Surface chemical analysis — Sample handling, preparation and mounting — Part 1: Documenting and reporting the handling of specimens prior to analysis
ISO/AWI 20579-2	Surface chemical analysis — Sample handling, preparation and mounting — Part 2: Documenting and reporting the preparation and mounting of specimens for analysis
ISO/AWI TR 13096	Guideline to describe AFM probe properties

ISO/TC 207 Environmental management

Scope:

Standardization in the field of environmental management to address environmental and climate impacts, including related social and economic aspects, in support of sustainable development.

Excluded:

- test methods of pollutants, setting limit values and levels of environmental performance, and standardization of products.

Note 1: TC 207 is focused on environmental management systems, auditing, verification/validation and related investigations, environmental labelling, environmental performance evaluation, life cycle assessment, climate change and its mitigation and adaptation, ecodesign, material efficiency, environmental economics and environmental and climate finance.

Note 2: Where appropriate, the ISO/TC 207 works in cooperation with existing committees on subjects that may support environmental management.

Table 21: List of ISO/TC 207 published standards and standards under development

Standard reference	Title
ISO 14020:2022[1]	Environmental statements and programmes for products - Principles and general requirements (ISO 14020:2022)
ISO/TS 14027:2017[1]	Environmental labels and declarations — Development of product category rules
ISO/TS 14029:2022	Environmental statements and programmes for products — Mutual recognition of environmental product declarations (EPDs) and footprint communication programmes
ISO 14040:2006[1]	Environmental management — Life cycle assessment — Principles and framework
ISO 14040:2006/Amd 1:2020[1]	Environmental management — Life cycle assessment — Principles and framework — Amendment 1
ISO 14044:2006[1]	Environmental management — Life cycle assessment — Requirements and guidelines
ISO 14044:2006/Amd 1:2017[1]	Environmental management — Life cycle assessment — Requirements and guidelines — Amendment 1
ISO 14044:2006/Amd 2:2020[1]	Environmental management — Life cycle assessment — Requirements and guidelines — Amendment 2
ISO 14045:2012[1]	Environmental management — Eco-efficiency assessment of product systems — Principles, requirements and guidelines
ISO 14046:2014[1]	Environmental management — Water footprint — Principles, requirements and guidelines
ISO/TR 14047:2012	Environmental management — Life cycle assessment — Illustrative examples on how to apply ISO 14044 to impact assessment situations
ISO/TR 14049:2012	Environmental management — Life cycle assessment — Illustrative examples on how to apply ISO 14044 to goal and scope definition and inventory analysis
ISO/TS 14071:2014[1]	Environmental management — Life cycle assessment — Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006
ISO/TR 14073:2017	Environmental management — Water footprint — Illustrative examples on how to apply ISO 14046

ISO/TS 14074:2022	Environmental management — Life cycle assessment — Principles, requirements and guidelines for normalization, weighting and interpretation
ISO/CD 14075	Principles and framework for social life cycle assessment
ISO/WD TS 14076	Eco-Technoeconomic Analyses: Principles, requirements and guidelines
ISO/AWI 59014	Secondary materials — Principles, sustainability and traceability requirements

[1]*This standard has been adopted a European standard by the CEN/SS S26 Environmental management, CEN Subsector that mirrors the work of ISO/TC 207 as there is no equivalent CEN/TC.*

IEC/TC 68 Magnetic alloys and steels

Scope:

To prepare international standards relating to the magnetic and other physical properties of alloys and steels which are relevant to their electrotechnical usage.

NOTE: The work of TC 68 should be at all times co-ordinated with the activities of IEC/TC 51 and ISO/TC 17.

Table 22: List of IEC/TC 68 published standards and standards under development

Standard reference	Title
IEC 60404-1:2016[1]	Magnetic materials - Part 1: Classification UNDER DEVELOPMENT: IEC 60404-1/AMD1 ED3
IEC 60404-8-6:2016[1]	Magnetic materials - Part 8-6: Specifications for individual materials - Soft magnetic metallic materials

[1]*This standard has been adopted a European standard by the CLC/SR 68 Magnetic alloys and steels, CEN Reporting Secretariat that mirrors the work of IEC/TC 68 as there is no equivalent CLC/TC.*

IEC/TC 105 Fuel cell technologies

Scope:

To prepare international standards regarding fuel cell (FC) technologies for all FC types and various associated applications such as stationary FC power systems for distributed power generators and combined heat and power systems, FCs for transportation such as propulsion systems (see note below), range extenders, auxiliary power units, portable FC power systems, micro FC power systems, reverse operating FC power systems, and general electrochemical flow systems and processes.

NOTE: Projects with applications in the field of road vehicles will be coordinated with ISO TC 22 and its relevant SCs using the cooperation modes defined in the ISO/IEC Directives.

Table 23: List of IEC/TC 105 published standards and standards under development

Standard reference	Title
IEC TS 62282-7-1:2017	Fuel cell technologies - Part 7-1: Test methods - Single cell performance tests for polymer electrolyte fuel cells (PEFC) UNDER DEVELOPMENT: IEC TS 62282-7-1 ED3
IEC 62282-8-102:2019	Fuel cell technologies - Part 8-102: Energy storage systems using fuel cell modules in reverse mode - Test procedures for the performance of single cells and stacks with proton exchange membrane, including reversible operation
IEC 62282-8-102:2019[1]	Fuel cell technologies - Part 8-102: Energy storage systems using fuel cell modules in reverse mode - Test procedures for the performance of single cells and stacks with proton exchange membrane, including reversible operation

[1]*This standard has been adopted a European standard by the CLC/SR 105 Fuel cell technologies, CEN Reporting Secretariat that mirrors the work of IEC/TC 105 as there is no equivalent CLC/TC.*

2.4 Other involved organizations and relevant documents

There are some European and American non-standardized protocols on fuel fells and electrolysers used for the testing of materials and membrane electrode assemblies (MEAs), and eventually stacks. They are developed in different organizations.

2.4.1 Joint Research Centre

The Joint Research Centre (JRC) is a department of the European Commission that plays a key role at multiple stages of the EU policy cycle. It contributes to the overall objective of Horizon Europe.

It works closely with research and policy organizations in the Member States, with the European institutions and agencies, and with scientific partners in Europe and internationally, including within the United Nations system.

The core strengths offered are anticipation, integration and impact.

In addition, the JRC offers scientific expertise and competences from a very wide range of disciplines in support of almost all EU policy areas.

The following protocols are relevant for this project:

- EU harmonised terminology for low-temperature water electrolysis for energy-storage applications – JRC technical report_European Commission
- EU harmonised protocols for testing of low temperature water electrolysers – JRC technical report_European Commission
- Development of reference hardware for harmonised testing of PEM single cell fuel cells – JRC technical report_European Commission
- EU harmonised terminology for hydrogen generated by electrolysis – JRC Validated methods, reference methods and measurements reports_European Commission
- EU harmonised polarisation curve test method for low-temperature water electrolysis – JRC Validated methods, reference methods and measurements reports_European Commission

- EU harmonised test procedure: electrochemical impedance spectroscopy for water electrolysis cells – JRC Validated methods, reference methods and measurements reports_European Commission
- EU harmonised test protocols for PEMFC MEA testing in single cell configuration for automotive applications – JRC Validated methods, reference methods and measurements reports_European Commission
- EU harmonised cyclic voltammetry test method for low-temperature water electrolysis single cells – JRC science for policy report_European Commission
- Fuel Cell Testing Protocols: An International Perspective Chemical – Joint ANL-JRC Scientific and Technical Report

2.4.2 Office of Energy Efficiency and Renewable Energy (EERE) - U.S. Department of Energy's (DOE's)

The U. S. Department of Energy's (DOE's or the Department's) hydrogen and fuel cell efforts are part of a broad portfolio of activities to build a competitive and sustainable clean energy economy to secure the nation's energy future.

DOE's efforts to enable the widespread commercialization of hydrogen and fuel cell technologies form an integrated program—the DOE Hydrogen and Fuel Cells Program (the Program). The Program is coordinated across the Department and includes activities in the offices of Energy Efficiency and Renewable Energy (EERE), Science, Nuclear Energy, and Fossil Energy.

The Fuel Cell Technologies Program (FCT Program), situated within EERE, addresses key technical challenges for fuel cells and hydrogen production, delivery, and storage and the institutional barriers, such as hydrogen codes and standards, training, and public awareness that inhibit the widespread commercialization of hydrogen and fuel cell technologies. Within the FCT Program it is developed the following document relevant for this project:

- The Fuel Cell Technologies Program Multi-Year Research, Development, and Demonstration Plan (MYRD&D Plan): a living document, which is revised periodically to reflect progress in the technologies, revisions to developmental timelines and targets, updates based on external reviews, and changes in the scope of the FCT Program.

  The following sections are especially remarkable: Fuel Cells and Hydrogen Production.

2.4.3 Other documents

- Looking Inside Polymer Electrolyte Membrane Fuel Cell Stack Using Tailored Electrochemical Methods – Journal of Electrochemical Energy Conversion and Storage – ASME (The American Society of Mechanical Engineers) and European Commission

2.5 Conclusion

After the analysis of the current standardization context at European and International levels, the main conclusion is that there are many European and international Technical Committees, as well as published and under development standards related to NICKEFFECT project that may be useful for its development and also for its future dissemination.

Despite that only the activity of several Technical Committees could impact directly in specific tasks to be addressed in the NICKEFFECT project.

Depending on the assessment by NICKEFFECT partners of the impact of the identified standardization committees on their tasks and the level of contribution that their results can represent for these committees and for the development of the activity of contribution to the standardization, several actions can be performed.

In the next section 3 a strategy for the contribution to standardization with detailed actions to be performed is explained in detailed.

3 Contribution to the standardization

3.1 Introduction

This part of D7.3 defines a strategy for the contribution to standardization from NICKEFFECT. It includes the steps towards a successful contribution to standardization, the actions for its implementation and a tentative schedule.

It will be updated with the progress of the different actions and its outcomes resulting in one or several versions of D7.3 that will be circulated internally to the Consortium.

The schedule of the actions described in this document is open to changes according to the progress of the project and the standardization landscape.

3.2 Definition of the strategy

The contribution to standardization of NICKEFFECT is based in the interaction with the relevant Standardization Technical Committees and in the initiation of a standardization process. The strategy comprises the following actions explained below:

3.2.1 First contact with the standardization technical committees

The objective of this first contact is to raise awareness about NICKEFFECT among the relevant standardization committees and to ease subsequent contacts. Different categories of stakeholders at European/international level are present in these committees, so the standardization system is used as a targeted dissemination channel. Feedback will be asked to gather any view, opinion or advise about the project and the standardization possibilities or needs. Additionally, these first contacts will be useful to determine the best path towards the initiation of a standardization process, moreover this first step will ease future contacts if this process is launched within a standardization technical committee.

3.2.2 Subsequent interaction with the standardization technical committees

Different relationships can be stablished with the relevant CEN/CENELEC and ISO/IEC technical committees. Two factors determine the more suitable interactions: the impact/relevance of the standardization works of the standardization committees and the feasibility of initiating a standardization process within a technical committee (versus initiating the standardization process within a standardization workshop, details are given below). The ways of interaction of the project with the standardization committees include:

1. Follow-up the activity of the relevant standardization technical committees. This allows to detect the initiation of standardization works that can be relevant for NICKEFFECT and the progress of significant existing under-development standards.

2. Further contact with the standardization committees to update the progress of NICKEFFECT. This is achievable by delivering reports, by attending relevant technical committees' meetings or by joint events. On the one hand, this action contributes to further dissemination of the project and can guide the initiation of the standardization process, on the other hand this further contact is mandatory towards the standardization committees directly covering (if it where the case) the subject that will be promoted by NICKEFFECT to undergo a standardization process.

3. The participation of one or more NICKEFFECT partners in the standardization technical committees. Standardization is an open activity, and all interested parties may participate in the technical committees through the designation of their National Standardization Body. This option allows for a deeper follow-up of the activity of a standardization committee and is valuable if the standardization process is going to be initiated within the standardization committee.

4. The establishment of a formal liaison of NICKEFFECT with the standardization committees. Under this figure, the consortium can participate in the TC works as an observer, without voting rights. This implies an economic cost, and it is recommended only when the work of the standardization committee is closely linked with the main goals of the project and a direct technical contribution from the project is expected. The figure of project liaison is recognized in CEN/CENELEC but it doesn't exist in ISO/IEC.

3.2.3 Standardization process

The main objective of the standardization activities in NICKEFFECT is to facilitate the market acceptance of the results by transferring these results and findings to standards that have a wide recognition in the market. With the collaboration of the relevant partners the feasible results to go through a standardization process will be identified. Different options to contribute to standardization shall be considered depending on the kind of the results and the standardization context (existence of closely related standards and reactions of the standardization committees):

1. Development of a new standard within a standardization workshop. A standardization workshop is a group of entities with a common interest in developing a standard about a specific issue. It is the equivalent figure to the standardization committee, but the number of participants is typically smaller and the working procedures faster and more flexible. A standardization workshop is created when there is a need of developing a precise standard in an innovative field that is not covered by the existing standardization committees or when these committees are not interested in developing such standard (e.g. it does not fit in their

work programme). If the subject is close to the field covered by a standardization committee it shall be informed and allow for the launching of the standardization workshop.

Considering that the standardization workshop option is interesting for NICKEFFECT mainly in the European environment, the standardization workshop will be named hereinafter as CEN Workshop. The standard produced by a CEN Workshop is called CEN Workshop Agreement, typically named as CWA. The nature and timeline for the development of CWAs is very suitable for the framework of the R&I projects.

After only 10-12 months, a 'CWA' can be put in place, which serves as the basis for new standards—based on NICKEFFECT research. A CWA is published globally and takes 4 simple steps to create:

2. Standardization within a standardization committee. It may be interesting or needed that the results of NICKEFFECT to go through the standardization process are standardized within a standardization committee. The possible scenarios are:

   a. Development of a new standard within a standardization committee. When there is a result of NICKEFFECT to be promoted to a standard in a field covered by a standardization committee and such committee decides to include this development in its work programme. The resulting standard would have the support of the standardization committee but the work shall be adapted to the internal timeline of such standardization committee and could go beyond the timeframe of the project.

   b. Contribute to an on-going standard. As a consequence of the monitoring of the standardization landscape it may be found that the results of NICKEFFECT are covered by an on-going standard but that these results do not fit in the current draft of the standard. Gaps in standards may be found in both, standards that are being developed from a new initiative and standards already published that are going under a review process towards a new version.

c. Request the modification of a standard that is not under development or review. The gap may be found also in published standards that are not under any work within the standardization committee. In this case, a fully justified modification request can be made to the standardization committee.

d. Outline of a future standard. Only when there is not a clear view on a full roadmap for the contribution to standardization (like lack of agreement within the Consortium or lack of the expected results).

3.3 Implementation

The actions and approach to be performed for the implementation of the each of the steps of the strategy described in section 3.2 are detailed next.

3.3.1 First contact with the standardization technical committees

Table 24 includes the standardization committees identified in the first part of this deliverable and those proposed for contacting with the objectives described in 3.2.1 as NICKEFFECT will innovate in topics related to their scope; the rest of them are just considered useful in terms of compatibility of the developments of NICKEFFECT.

Table 24: Identification of standardization committees to be contacted

European TC	Title	To be contacted
CEN/TC 137	Assessment of workplace exposure to chemical and biological agents	NO
CEN/TC 139	Paints and varnishes	YES
CEN/TC 162	Protective clothing including hand and arm protection and lifejackets	NO
CEN/TC 185	Fasteners	NO
CEN/TC 262	Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys	YES
CEN/TC 271	Surface treatment equipment - Safety	YES
CLC/TC 111 X	Environment	NO
International TC	**Title**	
ISO/TC 35	Paints and varnishes	YES
ISO/TC 94	Personal safety -- Personal protective equipment	NO
ISO/TC 107	Metallic and other inorganic coatings	YES
ISO/TC 155	Nickel and nickel alloys	YES
ISO/TC 156	Corrosion of metals and alloys	YES

ISO/TC 158	Analysis of gases	NO
ISO/TC 197	Hydrogen technologies	YES
ISO/TC 201	Surface chemical analysis	YES
ISO/TC 207	Environmental management	NO
IEC/TC 68	Magnetic alloys and steels	NO
IEC/TC 105	Fuel cell technologies	YES

UNE will contact the Secretary of each selected standardization committee. The support of the Coordinator/Partners of NICKEFFECT will be needed to summarize the relevant progress and validate the information to disseminate avoiding any confidential content.

These first contacts are foreseen at M18.

3.3.2 Subsequent interaction with the standardization technical committees

The implementation of the actions described in 3.2.2 starts with the monitoring of the work of the standardization committees identified in the first part of the deliverable. This surveillance will also include the analysis of European standardization workshops. The monitoring of the relevant standardization activity will be continuous during the duration of NICKEFFECT.

The standardization committees included in Table 24 will be updated with the relevant progress in NICKEFFECT. This will be done by updating the report/information provided in the first contacts and, at the same time, keeping open the possibility of having a face-to-face interaction (e.g. attending to a meeting of the standardization committee if feasible).

The programming of these updates depends on the reactions to the first contacts and on when the relevant outcomes of NICKEFFECT are delivered.

At the same time, if an opportunity for a face-to-face interaction arises, it would be done when feasible. The implication of the Coordinator/Partners will be needed to explain the technical details.

Further interaction with the standardization committees (participation of members of NICKEFFECT in these committees and the consideration of a project liaison) will be determined according to the outcomes of the described communications and the approach of the standardization process described in 3.2.3.

3.3.3 Standardization process

Based in the identification of standardizable results, in the standardization landscape at the moment (result of the interaction with the standardization committees and the monitoring of their standardization works) and the progress of the project, the most suitable roadmap among the options described in 3.2.3 will be selected and conducted.

A dedicated standardization session to work on the identification of the standardizable results and the election of the roadmap is foreseen in NICKEFFECT. This session could take place during a project meeting. A tentative date for this standardization session is M24.

The standardization process is considered very valuable for the market uptake of the results of NICKEFFECT and for the impact of the project beyond the financing period. The decisions taken, the actions performed and the results obtained will be properly registered in the final update to this deliverable, internally circulated to the Consortium.

3.4 Conclusion

Considering all the previously presented information, the summary of the tentative dates and the responsible for the actions are included in the following table:

Table 25: Summary of the actions in the strategy towards a contribution to standardization

Action	Responsible	Month
First contacts with the standardization committees in Table 24	UNE	M18
Updates on the standardization landscape	UNE	Continuous
Provision of updated report/information to the standardization committees identified in Table 24	UNE (content provided by the Coordinator)	Whenever it is demanded
Face-to-face interaction with the relevant standardization committees	UNE and Coordinator/Partners	When relevant
Dedicated standardization session	UNE	M24
Standardization process	UNE and Coordinator/Partners	M24-M48

The progress of the different actions and its outcomes will be properly updated in several versions of this deliverable at M24 and M48, as tentative dates. They will be internally circulated to the Consortium.

4 References

For the elaboration of this report, the following sources have been consulted:

- CEN/CENELEC Website (https://www.cencenelec.eu/)
- CEN/CENELEC Projex Online database (https://projex.cencenelec.eu/) (restricted to authorized users)
- ISO Website (www.iso.org)
- ISO Project Portal (https://sd.iso.org/projects) (restricted to authorized users)

- IEC Website (https://iec.ch/)
- Joint Research Centre – European Commission Website (https://commission.europa.eu/about-european-commission/departments-and-executive-agencies/joint-research-centre_en)
- Office of Energy Efficiency and Renewable Energy- U.S. Department of Energy's (https://www.energy.gov/eere/office-energy-efficiency-renewable-energy)