



AIRPOXY

Thermoformable, repairable and bondable smart
epoxy- based composites for aero structures

Deliverable 7.3

Report on the standardization landscape and applicable standards

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Glossary

Abbreviation / acronym	Description
AMGA	Horizon 2020 Annotated Model Grant Agreement
CA	Consortium Agreement
DOA	Description of action
EC	European Commission
GA	Grant Agreement
WP	Work Package
UNE	Spanish Association for Standardization
CEN	European Committee for Standardization
CENELEC (CLC)	European Committee for Standardization in the Electrical field
ISO	International Organization for Standardization; International Standard
IEC	International Electrotechnical Commission; International Standard
ASTM	American Society for Testing and Materials
TC	Technical Committee
SC	Subcommittee
WG	Working Group
EN	European Standard
TR	Technical Report
TS	Technical Specification
CWA	CEN Workshop Agreement
prEN	Project of European Standard
FprEN	Final Project of European Standard
WD	Working Draft
CD	International Committee Draft
DIS	Draft International Standard
FDIS	Final Draft International Standard



1. Executive Summary

UNE, the Spanish Association for Standardization, as a European Standardization Body, is providing support regarding the standardization tasks included in the project. This document includes some of the outcomes of Task 7.6 Standardization and certifications activities, and it specifically reports the results of SubTask T7.6.1, Analysis of the applicable standardization landscape.. In order to fulfil this commitment, deliverable D7.3 ‘Report on the standardization landscape and applicable standards’ 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 objectives of D7.3 are:

- facilitate the acceptance and utilization by the market of the developed solution proposed by AIRPOXY project,
- ensure compatibility and interoperability with what already exists in the market, and
- identify the relevant standardization technical committees with potential interest in order to complement the dissemination plan of the AIRPOXY project.



2. 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 subclauses, more detailed information is provided.

2.1. 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 are able to 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 subclause 2.2, 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.

2.2. 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, in order 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	<p>CEN is a non-profit association whose members are the national standards bodies of 33 European countries. It develops standards in fields not related to electrotechnology nor telecommunications. It is the counterpart at European level of ISO.</p>
 European Committee for Electrotechnical Standardization	<p>CENELEC is a non-profit association whose members are the national standards bodies of 33 European countries. It develops standards in fields related to electrotechnology. It is the counterpart at European level of IEC.</p>
 European Telecommunications Standards Institute	<p>ETSI is a non-profit organization with more than 800 member organizations worldwide. It develops standards for Information and Communications Technologies (ICT).</p>

2.3. 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

 <p>International Standardization Organization</p>	<p>ISO is an independent, non-governmental international organization with a membership of 163 national standards bodies. ISO develops standards mainly in fields not related to electrotechnology nor telecommunications.</p>
 <p>International Electrotechnical Commission</p>	<p>IEC is a not-for-profit, non-governmental organization with a membership of 84 national standards bodies. IEC develops standards in fields related to electrotechnology.</p>

2.4. 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.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • Elaboration: free timeframe • Internal approval in TC • European: optional national adoption • No revision required
Workshop Agreement	IWA	CWA	Variable	<ul style="list-style-type: none"> • 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.

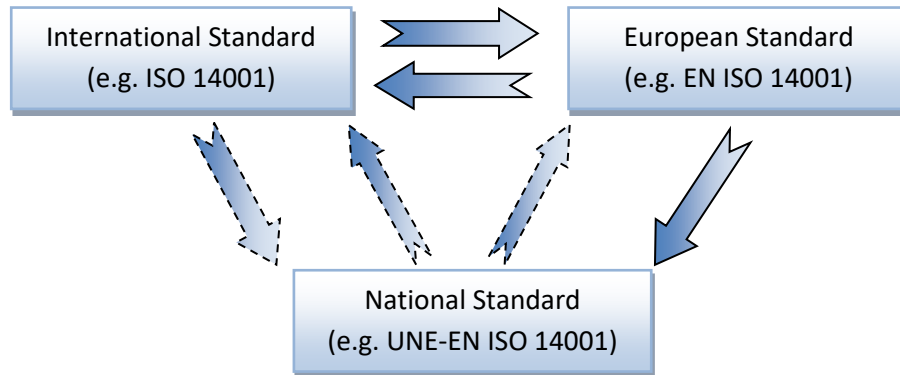


Figure 1. Possible tracks of standards adoption

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

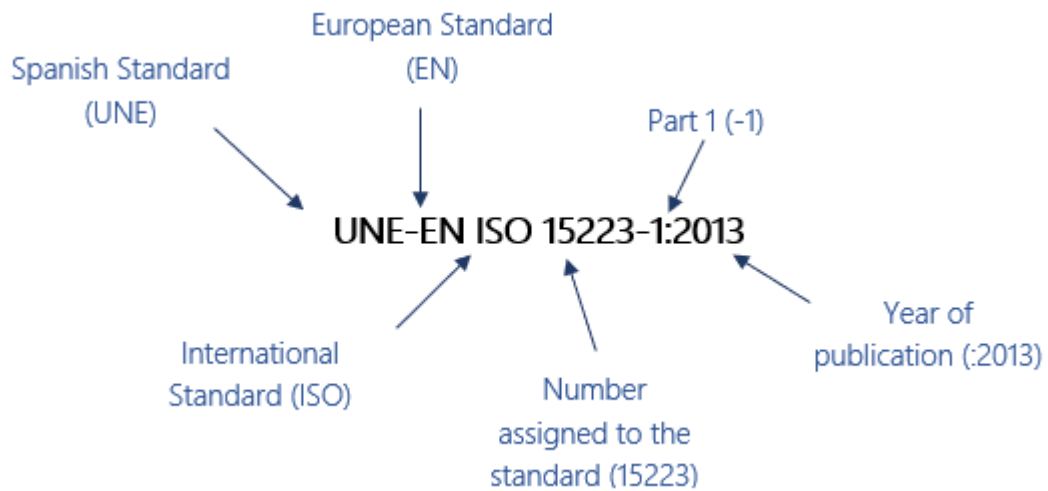


Figure 2. Example of identification of elements in the code of a standard

3. Methodology used to prepare the report

This document presents the standardization activity found relevant for the AIRPOXY project. In order to structure the search, two kinds of searches have been made: key-words and International Classification of Standards (ICS).

3.1. Product description

As defined in the AIRPOXY objectives, an innovative new generation of 3R epoxy composites with smart properties (Re-processability, reparability and recyclability) for aircraft applications, from proof of concept (TRL3) to validation in industrial environment (TRL5), will be implemented.

AIRPOXY materials will enable:

- new innovative 3R-Thermoforming processes,
- a more robust and cheaper chemical 3R-Bonding technology,
- easy cost-efficient 3R-Repair method for rejected or damaged parts.

Moreover, recycling of manufacturing or end of life waste will be possible through matrix dissolution or grinding of 3R composites achieving true sustainability and closing the loop.

3.2. Key-words

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

Table 4. List of key-words acting as starting point for the identification of standardization areas

Key-word
Resin
Epoxy
Carbon fibre/ Carbon fibre reinforced/ Fibre-reinforced
Reinforcement
Preimpregnated/ Prepreg
Laminates
Composites
Thermoset

Thermoplastic
Adhesive
Structural adhesive
Welding for thermoplastics
Bonding
Thermoforming
Environmental label and declarations
Life cycle
Workplace exposure
Workplace air/atmosphere
Protective clothing/chemical
Respiratory protective devices

3.3. International Classification for Standards (ICS)

The second search has been made looking for documents with defined ICS (International Classification for Standards) which 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. It may also be used for classifying standards and normative documents in databases, libraries, etc.”

Therefore, the relation between the ICS and the respective keywords has helped on the searching of the standards that could be references for the overall scope of the project.

The ICS is a hierarchical classification which consists of three levels. Level 1 covers 40 fields of activity in standardization, e.g. rubber and plastic industries, IT applications in health care technology, agriculture, metallurgy. Each field has a two-digit notation, e.g.

01 GENERALITIES. TERMINOLOGY. STANDARDIZATION. DOCUMENTATION

The fields are subdivided into 392 groups (level 2). The notation of a group consists of the field notation and a three-digit group number, separated by a point, e.g.

01.040 Vocabularies

144 of the 392 groups are further divided into 909 sub-groups (level 3). The notation of a sub-group consists of the group notation and a two-digit number, separated by a point, e.g.

01.040.35 Information technologies

The searching of ICS is based in the relevant key-words given in Table 5.

Table 5. List of ICS acting as starting point for the identification of standardization areas

ICS	Description
13.020.60	Product life-cycles
13.040.30	Workplace atmospheres
13.340.10	Protective clothing
13.340.30	Respiratory protective devices
13.340.40	Hand and arm protection
49.025.40	Aircraft. Rubber and plastics
49.025.50	Aircraft. Adhesives
59.100.01	Materials for the reinforcement of composites in general
59.100.10	Carbon materials
59.100.20	Textile glass materials
83.080.10	Thermosetting materials
83.080.20	Thermoplastic materials
83.120	Reinforced plastics

4. Standardization related to AIRPOXY project

4.1. 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 AIRPOXY project.

Table 6. List of European and international committees related to AIRPOXY project

European TC	Title
ASD-STAN	Aerospace
CEN/TC 79	Respiratory protective devices
CEN/TC 137	Assesment 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 193	Adhesives
CEN/TC 249	Plastics
CEN/TC 262	Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys
International TC	Title
ISO/TC 35	Paints and varnishes
ISO/TC 61	Plastics
ISO/TC 94	Personal safety -- Personal protective equipment
ISO/TC 146	Air quality
ISO/TC 156	Corrosion of metals and alloys
ISO/TC 207	Environmental management

4.2. Identified Standards sorted by Technical Committee

Subsequent to the application of the previous methodology explained in 3.2 and 3.3, a list of relevant standards 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.

ASD-STAN Aerospace

Scope:

Promote the harmonization of aerospace standards in Europe, and pay attention to these areas where improved standardization can result in reduced costs to manufacturers.

Table 7. List of ASD-STAN standards and standards under development

Standard reference	Title	Status
EN 2243-1:2005	Aerospace series - Non-metallic materials - Structural adhesives - Test method - Part 1: Single lap shear	
EN 2243-5:2005	Aerospace series - Non-metallic materials - Structural adhesives - Test method - Part 5: Ageing tests	
EN 2243-6:2005	Aerospace series - Non-metallic materials - Structural adhesives - Test method - Part 6: Determination of shear stress and shear strain	
EN 2329:1993	Aerospace series - Textile glass fibre preimpregnates - Test method for the determination of mass per unit area	
EN 2331:1993	Aerospace series - Textile glass fibre preimpregnates - Test methods for the determination of the resin and fibre content and mass of fibre per unit area	
EN 2332:1993	Aerospace series - Textile glass fibre preimpregnates - Test method for the determination of the resin flow	
EN 2375:1992	Aerospace series - Resin preimpregnated materials - Production batch sampling procedure	
EN 2557:1997	Aerospace series - Carbon fibre preimpregnates - Determination of mass per unit area	
EN 2558:1997	Aerospace series - Carbon fibre preimpregnates - Determination of the volatile content	
EN 2559:1997	Aerospace series - Carbon fibre preimpregnates - Determination of the resin and fibre content and the mass of fibre per unit area	
EN 2560:1998	Aerospace series - Carbon fibre preimpregnates - Determination of the resin flow	
EN 2561:1995	Aerospace series - Carbon fibre reinforced plastics - Unidirectional laminates - Tensile test parallel to the fibre direction	

EN 2562:1997	Aerospace series - Carbon fibre reinforced plastics - Unidirectional laminates - Flexural test parallel to the fibre direction	
EN 2563:1997	Aerospace series - Carbon fibre reinforced plastics - Unidirectional laminates - Flexural test parallel to the fibre direction	
EN 2564:2018	Aerospace series - Carbon fibre laminates - Determination of the fibre, resin and void contents	Revision under development: prEN 2564 rev
EN 2565:2013	Aerospace series - Preparation of carbon fibre reinforced resin panels for test purposes	
EN 2597:1998	Aerospace series - Carbon fibre reinforced plastics - Unidirectional laminates - Tensile test perpendicular to the fibre direction	
EN 2743:2001	Aerospace series - Fibre reinforced plastics - Standard procedures for conditioning prior to testing unaged materials	
EN 2823:2017	Aerospace series - Fibre reinforced plastics - Determination of the effect of exposure to humid atmosphere on physical and mechanical characteristics	
EN 2825:2011	Aerospace series - Burning behaviour of non metallic materials under the influence of radiating heat and flames - Determination of smoke density	
EN 2826:2011	Aerospace series - Burning behaviour of non metallic materials under the influence of radiating heat and flames - Determination of gas components in the smoke	
EN 2850:2017	Aerospace series - Carbon fibre thermosetting resin - Unidirectional laminates - Compression test parallel to fibre direction	
EN 3783:2013	Aerospace series - Fibre composite materials - Normalisation of fibre dominated mechanical properties	
EN 6031:2015	Aerospace series - Fibre reinforced plastics - Test method - Determination of in-plane shear properties ($\pm 45^\circ$ tensile test)	
EN 6032:2015	Aerospace series - Fibre reinforced plastics - Test method - Determination of the glass transition temperatures	

EN 6033:2015	Aerospace series - Carbon fibre reinforced plastics - Test method - Determination of interlaminar fracture toughness energy - Mode I - GIC	
EN 6034:2015	Aerospace series - Carbon fibre reinforced plastics - Test method - Determination of interlaminar fracture toughness energy - Mode II - GIIC	
EN 6035:2015	Aerospace series - Fibre reinforced plastics - Test method - Determination of notched and unnotched tensile strength	
EN 6036:2015	Aerospace series - Fibre reinforced plastics - Test method - Determination of notched, unnotched and filled hole compression strength	
EN 6037:2015	Aerospace series - Fibre reinforced plastics - Test method - Determination of bearing strength	
EN 6038:2015	Aerospace series - Fibre reinforced plastics - Test method - Determination of the compression strength after impact	
EN 6041:2018	Aerospace series - Non-metallic materials - Test method - Analysis of non-metallic materials (uncured) by Differential Scanning Calorimetry (DSC)	
EN 6064:2017	Aerospace series - Analysis of non-metallic materials (cured) for the determination of the extent of cure by Differential Scanning Calorimetry (DSC)	
EN 9278:2018	Aerospace series - General Principles of Obsolescence Management of chemicals, materials and processes	

CEN/TC 79 Respiratory protective devices

Scope:

To prepare European Standards for respiratory protective devices for use in the work place and for fire fighting and for rescue purposes, where there exists a risk to health from inhaling dusts, fumes, gases, vapours or from oxygen deficiency, as well as European Standards for underwater breathing apparatus.

Table 8. List of CEN/TC 79 standards and standards under development

Standard reference	Title	Status
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EN 136:1998 + Corrigendum AC:2003	Respiratory protective devices - Full face masks - Requirements, testing, marking	
EN 140:1998 + Corrigendum AC:1999	Respiratory protective devices - Half masks and quarter masks - Requirements, testing, marking	
EN 143:2000 + Corrigendum AC:2005 + Amendment A1:2006	Respiratory protective devices - Particle filters - Requirements, testing, marking	Revision under development: FprEN 143
EN 149:2001+A1:2009	Respiratory protective devices - Filtering half masks to protect against particles - Requirements, testing, marking	
EN 405:2001+A1:2009	Respiratory protective devices - Valved filtering half masks to protect against gases or gases and particles - Requirements, testing, marking	
EN 529:2005	Respiratory protective devices - Recommendations for selection, use, care and maintenance - Guidance document	
EN 1827:1999+A1:2009	Respiratory protective devices - Half masks without inhalation valves and with separable filters to protect against gases or gases and particles or particles only - Requirements, testing, marking	
EN 12083:1998 + Corrigendum AC:2000	Respiratory protective devices - Filters with breathing hoses, (Non-mask mounted filters) - Particle filters, gas filters, and combined filters - Requirements, testing, marking	
EN 13274-6:2001	Respiratory protective devices - Methods of test - Part 6: Determination of carbon dioxide content of the inhalation air	
EN 13274-7:2008	Respiratory protective devices - Methods of test - Part 7: Determination of particle filter penetration	
EN 14387:2004+A1:2008	Respiratory protective devices - Gas filter(s) and combined filter(s) - Requirements, testing, marking	Revision under development: FprEN 14387

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 9. List of CEN/TC 137 standards and standards under development

Standard reference	Title	Status
CEN ISO/TS 21623:2018	Workplace exposure - Assessment of dermal exposure to nano-objects and their aggregates and agglomerates (NOAA) (ISO/TS 21623:2017)	
CEN/TR 15278:2006	Workplace exposure - Strategy for the evaluation of dermal exposure	
CEN/TS 15279:2006	Workplace exposure - Measurement of dermal exposure - Principles and methods	
EN 481:1993	Workplace atmospheres - Size fraction definitions for measurement of airborne particles	
EN 482:2012+A1:2015	Workplace exposure - General requirements for the performance of procedures for the measurement of chemical agents	
EN 689:2018	Workplace exposure - Measurement of exposure by inhalation to chemical agents - Strategy for testing compliance with occupational exposure limit values	Corrigendum under drafting: EN 689:2018+AC
EN 1076:2009	Workplace exposure - Procedures for measuring gases and vapours using pumped samplers - Requirements and test methods	
EN 13205-1:2014	Workplace exposure - Assessment of sampler performance for measurement of airborne particle concentrations - Part 1: General requirements	
EN 13890:2009	Workplace exposure - Procedures for measuring metals and metalloids in airborne particles - Requirements and test methods	
EN 13936:2014	Workplace exposure - Procedures for measuring a chemical agent present as a mixture of airborne particles and vapour - Requirements and test methods	
EN 14031:2003	Workplace atmospheres - Determination of airborne endotoxins	
EN 15051-1:2013	Workplace exposure - Measurement of the dustiness of bulk materials - Part 1: Requirements and choice of test methods	

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	
EN ISO 13138:2012	Air quality - Sampling conventions for airborne particle deposition in the human respiratory system (ISO 13138:2012)	
FprEN 17199-1	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA and other respirable particles - Part 1: Requirements and choice of test methods	Under development
prEN 17289-1	Characterization of bulk materials - Determination of a sizeweighted fine fraction and crystalline silica content - Part 1: General information and choice of test methods	Under development
prEN ISO 22065	Workplace air - Procedures for measuring gases and vapours using pumped samplers - Requirements and test methods (ISO/DIS 22065:2018)	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 10. List of CEN/TC 139 standards and standards under development

Standard reference	Title	Status
EN ISO 1518-1:2011	Paints and varnishes - Determination of scratch resistance - Part 1: Constant-loading method (ISO 1518-1:2011)	Revision under development: prEN ISO 1518-1
EN ISO 1518-2:2011	Paints and varnishes - Determination of scratch resistance - Part 2: Variable-loading method (ISO 1518-2:2011)	Revision under development: prEN ISO 1518-2

EN ISO 2409:2013	Paints and varnishes - Cross-cut test (ISO 2409:2013)	Revision under development: prEN 2409 rev
EN ISO 2812-1:2017	Paints and varnishes - Determination of resistance to liquids - Part 1: Immersion in liquids other than water (ISO 2812-1:2017)	
EN ISO 3219:1994	Plastics - Polymers/resins in the liquid state or as emulsions or dispersions - Determination of viscosity using a rotational viscometer with defined shear rate (ISO 3219:1993)	
EN ISO 11997-1:2017	Paints and varnishes - Determination of resistance to cyclic corrosion conditions - Part 1: Wet (salt fog)/dry/humid (ISO 11997-1:2017)	
EN ISO 11997-2:2013	Paints and varnishes - Determination of resistance to cyclic corrosion conditions - Part 2: Wet (salt fog)/dry/humidity/UV light (ISO 11997-2:2013)	
EN ISO 20567-1:2017	Paints and varnishes - Determination of stone-chip resistance of coatings - Part 1: Multi-impact testing (ISO 20567-1:2017)	

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 11. List of CEN/TC 162 standards and standards under development

Standard reference	Title	Status
CEN/TR 15419:2017	Protective clothing - Guidelines for selection, use, care and maintenance of chemical protective clothing	
EN 13034:2005+A1:2009	Protective clothing against liquid chemicals - Performance requirements for chemical protective clothing offering limited protective performance against liquid chemicals (Type 6 and Type PB [6] equipment)	
EN 14325:2018	Protective clothing against chemicals - Test methods and performance classification of chemical protective clothing materials, seams, joins and assemblages	

EN 14605:2005+A1:2009	Protective clothing against liquid chemicals - performance requirements for clothing with liquid-tight (Type 3) or spray-tight (Type 4) connections, including items providing protection to parts of the body only (Types PB [3] and PB [4])	
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CEN/TC 193 Adhesives

Scope:

Standardization in the field of all adhesives to produce: - standards for vocabulary and classification; - general standards for characterization (physico-chemical and mechanical test methods); - standards for methods of test for adhesives and performance standards for specific applications including standards with requirements useful for certification purposes. With the exception, for the time being of those dealt with by CEN/TC 67.

Table 12. List of CEN/TC 193 standards and standards under development

Standard reference	Title	Status
EN 1465:2009	Adhesives - Determination of tensile lap-shear strength of bonded assemblies	
EN 13887:2003	Structural Adhesives - Guidelines for surface preparation of metals and plastics prior to adhesive bonding	

CEN/TC 249 Plastics

Scope:

Standardization of 1) terminology, 2) test methods, 3) specifications, classifications and designation systems, 4) environmental aspects, 5) joining systems and techniques, of plastics, plastic-based materials, semi-finished products and products (thermoplastics, thermosets, degradable plastics, bio-based polymers, thermoplastic elastomers, composites, reinforcement products for plastics, recyclates). Rubber is excluded. Specific end-product related items are also excluded if they are covered by the scope of an existing product TC.

Table 13. List of CEN/TC 249 standards and standards under development

Standard reference	Title	Status
CEN/TS 16892:2015	Plastics - Welding of thermoplastics - Specification of welding procedures	
EN 12814-1:1999 + Corrigendum	Testing of welded joints of thermoplastics semi-finished products - Part 1: Bend test	

AC:2003		
EN 12814-2:2000	Testing of welded joints of thermoplastics semi-finished products - Part 2: Tensile test	Revision under development: prEN 12814-2 rev
EN 12814-4:2018 + Corrigendum AC:2018	Testing of welded joints of thermoplastics semi-finished products - Part 4: Peel test	
EN 12814-5:2000	Testing of welded joints of thermoplastics semi-finished products - Part 5: Macroscopic examination	
EN 12814-8:2001 + Corrigendum AC:2003	Testing of welded joints of thermoplastics semi-finished products - Part 8: Requirements	Revision under development: prEN 12814-8 rev
EN 13100-1:2017	Non destructive testing of welded joints of thermoplastics semi-finished products - Part 1: Visual examination	
EN 13100-2:2004	Non-destructive testing of welded joints in thermoplastics semi-finished products - Part 2: X-ray radiographic testing	Revision under development: prEN 13100-2
EN 13100-3:2004	Non destructive testing of welded joints in thermoplastics semi-finished products - Part 3: Ultrasonic testing	
EN 13677-3:200	Reinforced thermoplastic moulding compounds - Specification for GMT - Part 3: Specific requirements	
EN 16245-2:2013	Fibre-reinforced plastic composites - Declaration of raw material characteristics - Part 2: Specific requirements for resin, curing systems, additives and modifiers	
EN 16245-3:2013	Fibre-reinforced plastic composites - Declaration of raw material characteristics - Part 3: Specific requirements for fibre	
EN 16245-4:2013	Fibre-reinforced plastic composites - Declaration of raw material characteristics - Part 4: Specific requirements for fabrics	
prEN 16296	Imperfections in thermoplastics welded joints - Quality levels	Under development
EN ISO 178:2010	Plastics - Determination of flexural properties (ISO 178:2010)	

EN ISO 295:2004	Plastics - Compression moulding of test specimens of thermosetting materials (ISO 295:2004)	
EN ISO 527-1:2012	Plastics - Determination of tensile properties - Part 1: General principles (ISO 527-1:2012)	Revision under development: prEN ISO 527-1
EN ISO 527-4:1997	Plastics - Determination of tensile properties - Part 4: Test conditions for isotropic and orthotopic fibre-reinforced plastic composites (ISO 527-4:1997)	
EN ISO 527-5:2009	Plastics - Determination of tensile properties - Part 5: Test conditions for unidirectional fibre-reinforced plastic composites (ISO 527-5:2009)	
EN ISO 604:2003	Plastics - Determination of compressive properties (ISO 604:2002)	
EN ISO 10352:2010	Fibre-reinforced plastics - Moulding compounds and prepregs - Determination of mass per unit area (ISO 10352:2010)	Revision under development: prEN ISO 10352 rev
EN ISO 11357-1:2016	Plastics - Differential scanning calorimetry (DSC) - Part 1: General principles (ISO 11357-1:2016)	
EN ISO 11667:1999	Fibre-reinforced plastics - Moulding compounds and prepregs - Determination of resin, reinforced-fibre and mineral-filler content - Dissolution methods (ISO 11667:1997)	
EN ISO 12114:1997	Fibre-reinforced plastics - Thermosetting moulding compounds and prepregs - Determination of cure characteristics (ISO 12114:1997)	
EN ISO 12115:1997	Fibre-reinforced plastics - Thermosetting moulding compounds and prepregs - Determination of flowability, maturation and shelf life (ISO 12115:1997)	
EN ISO 14125:1998 + Corrigendum AC:2002 + Amendment A1:2011	Fibre-reinforced plastic composites - Determination of flexural properties (ISO 14125:1998) + ISO 14125:1998/Cor.1:2001 + ISO 14125:1998/Amd 1:2011	
EN ISO 14126:1999 + Corrigendum AC:2002	Fibre-reinforced plastic composites - Determination of compressive properties in the in-plane direction (ISO 14126:1999) + ISO 14126:1999/Cor.1:2001	

EN ISO 14129:1997	Fibre-reinforced plastic composites - Determination of the in-plane shear stress/shear strain response, including the in-plane shear modulus and strength, by the +/- 45° tension test method (ISO 14129:1997)	
EN ISO 14130:1997	Fibre-reinforced plastic composites - Determination of apparent interlaminar shear strength by short-beam method (ISO 14130:1997)	
EN ISO 15252-1:1999	Plastics - Epoxy powder moulding compounds (EP-PMCs) - Part 1: Designation system and basis for specifications (ISO 15252-1:1999)	
EN ISO 15252-2:1999	Plastics - Epoxy powder moulding compounds (EP-PMCs) - Part 2: Preparation of test specimens and determination of properties (ISO 15252-2:1999)	
EN ISO 15252-3:1999	Plastics - Epoxy powder moulding compounds (EP-PMCs) - Part 3: Requirements for selected moulding compounds (ISO 15252-3:1999)	
EN ISO 20753:2018	Plastics - Test specimens (ISO 20753:2018)	

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 14. List of CEN/TC 262 standards and standards under development

Standard reference	Title	Status
EN ISO 9227:2017	Corrosion tests in artificial atmospheres - Salt spray tests (ISO 9227:2017)	

ISO/TC 35 Paints and varnishes

Scope:

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

There isn't any list of ISO/TC 35 standards because all the identified ISO standards have been adopted as EN ISO standards by the CEN/TC 139 Paints and varnishes, so they are already included in the list of CEN/TC 139 standards.

ISO/TC 61 Plastics

Scope:

Standardization of nomenclature, methods of test, and specifications applicable to materials and products in the field of plastics including processing (of products) by assembly in particular, but not limited to, polymeric adhesives, sealing, joining, welding.

Excluded: rubber, lacquers.

Note 1: By agreement, standards in relation to thermoplastic elastomers are developed and maintained by ISO/TC 45 and by ISO/TC 61.

Note 2: Jointing technology (including equipment and training) between plastic pipes (including all types of reinforced plastics), and/or fittings, valves and auxiliary equipment, and the assessment of the properties of the resulting joints are developed and maintained by ISO/TC 138.

Table 15. List of ISO/TC 61 standards and standards under development

Standard reference	Title	Status
ISO 1268-1:2001	Fibre-reinforced plastics -- Methods of producing test plates -- Part 1: General conditions	
ISO 1268-4:2005	Fibre-reinforced plastics -- Methods of producing test plates -- Part 4: Moulding of prepregs	
ISO 1268-7:2001	Fibre-reinforced plastics -- Methods of producing test plates -- Part 7: Resin transfer moulding	
ISO 2113:1996 + Corrigendum Cor 1:2003	Reinforcement fibres -- Woven fabrics -- Basis for a specification	
ISO 2577:2007	Plastics -- Thermosetting moulding materials -- Determination of shrinkage	
ISO 3374:2000	Reinforcement products -- Mats and fabrics -- Determination of mass per unit area	
ISO 3597-1:2003	Textile-glass-reinforced plastics -- Determination of mechanical properties on rods made of roving-reinforced resin -- Part 1: General considerations and preparation of rods	
ISO 4587:2003	Adhesives -- Determination of tensile lap-shear strength of rigid-to-rigid bonded assemblies	

ISO 4602:2010	Reinforcements -- Woven fabrics -- Determination of number of yarns per unit length of warp and weft	
ISO 5025:2017	Reinforcement products -- Woven fabrics -- Determination of width and length	
ISO 12815:2013	Fibre-reinforced plastic composites -- Determination of plain-pin bearing strength	
ISO 12817:2013	Fibre-reinforced plastic composites -- Determination of open-hole compression strength	
ISO 13003:2003	Fibre-reinforced plastics -- Determination of fatigue properties under cyclic loading conditions	
ISO 14127:2008	Carbon-fibre-reinforced composites -- Determination of the resin, fibre and void contents	
ISO 14322:2018	Plastics -- Epoxy resins -- Determination of degree of crosslinking of crosslinked epoxy resins by differential scanning calorimetry (DSC)	
ISO 15024:2001	Fibre-reinforced plastic composites -- Determination of mode I interlaminar fracture toughness, GIC, for unidirectionally reinforced materials	
ISO 15034:1999	Composites -- Prepregs -- Determination of resin flow	
ISO 15040:1999	Composites -- Prepregs -- Determination of gel time	
ISO 17212:2012	Structural adhesives -- Guidelines for the surface preparation of metals and plastics prior to adhesive bonding	
ISO 18280:2010	Plastics -- Epoxy resins -- Test methods	
ISO 18352:2009	Carbon-fibre-reinforced plastics -- Determination of compression-after-impact properties at a specified impact-energy level	
ISO 19927:2018	Fibre-reinforced plastic composites -- Determination of interlaminar strength and modulus by double beam shear test	
ISO 20368:2017	Plastics -- Epoxy resins -- Determination of degree of crosslinking of crosslinked epoxy resins by Fourier Transform Infrared (FTIR) Spectroscopy	

ISO/CD 22836	Carbon fibre-reinforced composites -- Method for accelerated moisture absorption and supersaturated conditioning by moisture using sealed pressure vessel	Under development
ISO/CD 22838	Composites and reinforcements fibres—Determination of the fracture toughness of bonded plates of carbon fibre reinforced plastics (CFRPs) and metal using double cantilever beam specimens	Under development
ISO/CD 22841	Composites and reinforcements fibres—Carbon fibre reinforced plastics(CFRPs) and metal assemblies—Determination of the tensile lap-shear strength	Under development

The identified ISO standards adopted as EN ISO standards by the CEN/TC 249 Plastics haven't been included in the list above, as they are already included in the list of CEN/TC 249 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 16. List of ISO/TC 94 standards and standards under development

Standard reference	Title	Status
ISO 6529:2013	Protective clothing -- Protection against chemicals -- Determination of resistance of protective clothing materials to permeation by liquids and gases	
ISO 16602:2007	Protective clothing for protection against chemicals -- Classification, labelling and performance requirements	
ISO/TS 16973:2016	Respiratory protective devices -- Classification for respiratory protective device (RPD), excluding RPD for underwater application	
ISO/TS 16975-1:2016	Respiratory protective devices -- Selection, use and maintenance -- Part 1: Establishing and implementing a respiratory protective device programme	
ISO/TS 16975-2:2016	Respiratory protective devices -- Selection, use and maintenance -- Part 2: Condensed guidance to establishing and implementing a respiratory protective device programme	
ISO/CD 17420-1	Respiratory protective devices -- Performance requirements -- Part 1: General	Under development

ISO/CD 17420-2	Respiratory protective devices -- Performance requirements -- Part 2: Requirements for filtering RPD	Under development
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ISO/TC 146 Air quality

Scope:

Standardization of tools for air quality characterisation of emissions, workspace air, ambient air, indoor air, in particular measurement methods for air pollutants (particles, gases, odours, micro-organisms) and for meteorological parameters, measurement planning, procedures for Quality Assurance/Quality Control (QA/QC) and methods for the evaluation of results including the determination of uncertainty.

Excluded:

- the establishment of limit values for air pollutants;
- the air quality in clean rooms;
- radioactive substances.

Table 17. List of ISO/TC 146 standards and standards under development

Standard reference	Title	Status
ISO 7708:1995	Air quality -- Particle size fraction definitions for health-related sampling	
ISO/TR 14294:2011	Workplace atmospheres -- Measurement of dermal exposure -- Principles and methods	
ISO 18158:2016	Workplace air -- Terminology	
ISO 20581:2016	Workplace air -- General requirements for the performance of procedures for the measurement of chemical agents	
ISO 21832:2018	Workplace air -- Metals and metalloids in airborne particles -- Requirements for evaluation of measuring procedures	
ISO 24095:2009	Workplace air -- Guidance for the measurement of respirable crystalline silica	
ISO/TR 27628:2007	Workplace atmospheres -- Ultrafine, nanoparticle and nano-structured aerosols -- Inhalation exposure characterization and assessment	

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.

There isn't any list of ISO/TC 156 standards because all the identified ISO standards have been adopted as EN ISO standards by the CEN/TC 262 Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys, so they are already included in the list of CEN/TC 262 standards.

ISO/TC 207 Environmental management

Scope:

Standardization in the field of environmental management systems and tools in support of sustainable development.

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

Note: The TC for environmental management will have close cooperation with ISO / TC 176 in the field of environmental systems and audits.

Table 18. List of ISO/TC 207 standards and standards under development

Standard reference	Title	Status
ISO 14020:2000	Environmental labels and declarations -- General principles	
ISO 14025:2006	Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures	
ISO 14026:2017	Environmental labels and declarations -- Principles, requirements and guidelines for communication of footprint information	
ISO/TS 14027:2017	Environmental labels and declarations -- Development of product category rules	
ISO 14040:2006	Environmental management -- Life cycle assessment -- Principles and framework	
ISO 14044:2006 + Amendment A1:2017	Environmental management -- Life cycle assessment -- Requirements and guidelines	



ISO 14045:2012	Environmental management -- Eco-efficiency assessment of product systems -- 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/TS 14048:2002	Environmental management -- Life cycle assessment -- Data documentation format	
ISO/TS 14071:2014	Environmental management -- Life cycle assessment -- Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006	
ISO/TS 14072:2014	Environmental management -- Life cycle assessment -- Requirements and guidelines for organizational life cycle assessment	

All these ISO standards are adopted as EN ISO standards directly by CEN through the Subsector CEN/SS S 26 Environmental management.

5. Other involved organizations and relevant documents

5.1. American Society for Testing and Materials (ASTM)

ASTM International, formerly known as the American Society for Testing and Materials (ASTM), is a globally recognized leader in the development and delivery of international voluntary consensus standards. Today, some 12,000 ASTM standards are used around the world to improve product quality, enhance safety, facilitate market access and trade, and build consumer confidence.

ASTM’s leadership in international standards development is driven by the contributions of its members: more than 30,000 of the world’s top technical experts and business professionals representing 150 countries. Working in an open and transparent process and using ASTM’s advanced electronic infrastructure, ASTM members deliver the test methods, specifications, guides, and practices that support industries and governments worldwide.

Table 19. List of ASTM standards

Standard reference	Title
ASTM B117 - 18	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM D638 - 14	Standard Test Method for Tensile Properties of Plastics
ASTM D695 - 15	Standard Test Method for Compressive Properties of Rigid Plastics
ASTM D790 - 17	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D792 - 13	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D1002 - 10	Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)
ASTM D2344 / D2344M - 16	Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates
ASTM D3039 / D3039M - 17	Standard Test Method for Tensile Properties of Polymer Matrix Composite Materials
ASTM D3170 / D3170M - 14	Standard Test Method for Chipping Resistance of Coatings
ASTM D3171 - 15	Standard Test Methods for Constituent Content of Composite Materials
ASTM D3410 / D3410M - 16	Standard Test Method for Compressive Properties of Polymer Matrix Composite Materials with Unsupported Gage Section by Shear Loading
ASTM D3418 - 15	Standard Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry

ASTM D3479 / D3479M - 12	Standard Test Method for Tension-Tension Fatigue of Polymer Matrix Composite Materials
ASTM D3518 / D3518M - 18	Standard Test Method for In-Plane Shear Response of Polymer Matrix Composite Materials by Tensile Test of a $\pm 45^\circ$ Laminate
ASTM D5379 / D5379M - 12	Standard Test Method for Shear Properties of Composite Materials by the V-Notched Beam Method
ASTM D5528 - 13	Standard Test Method for Mode I Interlaminar Fracture Toughness of Unidirectional Fiber-Reinforced Polymer Matrix Composites
ASTM D5766 / D5766M - 11(2018)	Standard Test Method for Open-Hole Tensile Strength of Polymer Matrix Composite Laminates
ASTM D5868 - 01(2014)	Standard Test Method for Lap Shear Adhesion for Fiber Reinforced Plastic (FRP) Bonding
ASTM D5961 / D5961M - 17	Standard Test Method for Bearing Response of Polymer Matrix Composite Laminates
ASTM D6415 / D6415M - 06a(2013)	Standard Test Method for Measuring the Curved Beam Strength of a Fiber-Reinforced Polymer-Matrix Composite
ASTM D6484 / D6484M - 14	Standard Test Method for Open-Hole Compressive Strength of Polymer Matrix Composite Laminates
ASTM D6641 / D6641M - 16e1	Standard Test Method for Compressive Properties of Polymer Matrix Composite Materials Using a Combined Loading Compression (CLC) Test Fixture
ASTM D6742 / D6742M - 17	Standard Practice for Filled-Hole Tension and Compression Testing of Polymer Matrix Composite Laminates
ASTM D7028 - 07(2015)	Standard Test Method for Glass Transition Temperature (DMA Tg) of Polymer Matrix Composites by Dynamic Mechanical Analysis (DMA)
ASTM D7078 / D7078M - 12	Standard Test Method for Shear Properties of Composite Materials by V-Notched Rail Shear Method
ASTM D7136 / D7136M - 15	Standard Test Method for Measuring the Damage Resistance of a Fiber-Reinforced Polymer Matrix Composite to a Drop-Weight Impact Event
ASTM D7137 / D7137M - 17	Standard Test Method for Compressive Residual Strength Properties of Damaged Polymer Matrix Composite Plates
ASTM D7332 / D7332M - 16	Standard Test Method for Measuring the Fastener Pull-Through Resistance of a Fiber-Reinforced Polymer Matrix Composite

5.2. European Commission-Joint Research Centre - Institute for Environment and Sustainability

The mission of the JRC-IES is to provide scientific-technical support to the European Union’s Policies for the protection and sustainable development of the European and global environment. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process,



it serves the common interest of the Member States, while being independent of special interests, whether private or national.

The following guidance document is relevant for the environmental assessment task of this project:

- International Reference Life Cycle Data System - ILCD handbook - Recommendations for Life Cycle Impact Assessment in the European context - based on existing environmental impact assessment models and factors.

5.3. Product Category Rules (PCR)

Product Category Rules (PCR) are documents that provide rules, requirements, and guidelines for developing an Environmental Product Declarations (EPD)* for a specific product category. They are used as complements to the programme instructions, e.g. in terms of calculation rules, scenarios, and EPD contents. A PCR should enable different practitioners using the PCR to generate consistent results when assessing products of the same product category.

** An Environmental Product Declaration (EPD) is an independently verified and registered document that communicates transparent and comparable information about the life-cycle environmental impact of products.*

The following PCR is relevant for the environmental assessment task of this project:

- PCR 2018:10 Boards, blocks, panels, sheets of plastics, or in composite system, for structural application.

6. Conclusion

After the analysis of the current standardization context at European and International levels, the following conclusions may be drawn:

1. There is a large number of European and international technical committees, as well as of standards and project standards related to AIRPOXY project that may be useful for its development and also for its future dissemination. Despite of not having found only a specific standardization technical committee whose activity impacts directly on AIRPOXY project, specific tasks to be addressed in the project are related to standardization works, and several technical committees have been identified as possibly most relevant. Depending on the assessment by AIRPOXY 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 Deliverable D7.8 (Report on the contribution to the standardization), several actions can be performed, for example:

- the follow up of the standardization activity through updates reported by UNE;
- the follow up through the joining of one or more AIRPOXY representatives to these standardization committees. Standardization is an open activity and all interested parties may participate in a CEN/CENELEC/ISO/IEC technical committee through its National Mirror Committee and National Standardization Body;
- the dissemination of the AIRPOXY project progress by delivering reports to the relevant TCs Secretaries or by attending relevant technical committees meetings.

2. Once decided the target TCs, initial planning of activities (direct participation, meeting attendances, workshop organization-invitation-dissemination activities to TCs) should be determined for each relevant TC and for the development of future Deliverable D7.8, Report on the interaction with the standardization.

As previously said, with respect to the dissemination activities, despite all the technical committees of this report have some relation to AIRPOXY project, probably the most relevant are those summarized in the following table:

Table 20. List of most relevant technical committees for dissemination activities

European TC	Title
ASD-STAN	Aerospace
CEN/TC 139	Paints and varnishes
CEN/TC 193	Adhesives
CEN/TC 249	Plastics
International TC	Title
ISO/TC 35	Paints and varnishes
ISO/TC 61	Plastics



7. References

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

- CEN Website (www.cen.eu)
- CEN/CENELEC Projex Online database (projex.cen.eu) (restricted to authorized users)
- ISO Website (www.iso.org)
- ISO Project Portal (isotc.iso.org) (restricted to authorized users)
- EUR-Lex (eur-lex.europa.eu)
- European Commission Energy website (ec.europa.eu/energy/en/topics/energy-efficiency)
- ASTM International Website (www.astm.org)