



BUSINESS PLAN
CEN/TC 268
CRYOGENIC VESSELS AND SPECIFIC HYDROGEN TECHNOLOGIES APPLICATIONS

EXECUTIVE SUMMARY

Business environment

Regarding the cryogenic vessels, the main manufacturers and users of insulated (vacuum or non-vacuum) vessels for the transport or the storage of refrigerated gases are located in Europe and they represent more than 35 % of the world market. The rest of the market is covered by Australia, Asia and United-States.

The parties involved are:

- Manufacturers of cryogenic vessels, actuators and safety devices against excessive pressure
- Users and gas industries.

Four European directives were adopted in 1990s which have changed the business environment of cryogenic vessels market.

Concerning hydrogen technologies, Europe consumed 14 % of hydrogen produced in the world. Hydrogen is used mainly in chemical industry, electronics, and aerospace industry and in energy applications.

Benefits

CEN/TC 268 was created in 1990 to elaborate a package of European standards describing the design, fabrication and inspection of static or transportable insulated vessels (vacuum or non-vacuum), the operational requirements relevant to these vessels and the specifications on their equipment. The safety was the main objective of this CEN/TC 268 and consequently standards on compatibility of gases with materials, cleanliness and safety accessories were drafted.

Since its inception more than 28 standards were published in the frame of European Directives ("Pressure Equipment Directive", "Transportable Pressure Equipment Directive") and RID/ADR. 14 standards are harmonized with PED and 9 are referenced in RID/ADR. The aim of these directives is to replace specific national rules with European rules, to put an end to any barrier to trade and to improve safety within the European Union.

The key words of CEN/TC 268 are since the beginning: safety, efficiency, low temperature and technical harmonization.

CEN/TC 268, by producing standards on hydrogen technologies, in particular and selectively on alternative fuel infrastructure, would contribute to break the oil dependence of transport.

Priorities

The priorities have been:

- To develop European product standards to meet the requirements of Directive 2014/68/EU (Pressure Equipment Directive)
- To develop standardized methods for the cryogenic vessels design, the operational requirements and the specifications on their equipment;
- To take into account environmental aspects in European standards;
- To develop European standards to meet the requirements of Directive 2014/94/EU on the deployment of alternative fuels infrastructure;
- To develop a standard on liquid helium cryostat.

1 BUSINESS ENVIRONMENT OF THE CEN/TC 268

1.1 Description of the Business Environment

The following political, economic, technical, regulatory, legal, societal and/or international dynamics describe the business environment of the industry sector, products, materials, disciplines or practices related to the scope of this CEN/TC, and they may significantly influence how the relevant standards development processes are conducted and the content of the resulting standards:

The scope of CEN/TC 268 is the standardization in the field of insulated vessels (vacuum or non-vacuum) for the storage and the transport of refrigerated liquefied gases, as defined in Class 2 of "Recommendations on the Transport of dangerous goods – Model regulation", in particular concerning the design of the vessels and their safety accessories, gas/materials compatibility, insulation performance, the operational requirements of the equipment and accessories.

The one-off preparation of standards for hydrogen technologies strictly meet the European mandate on the draft Directive for the deployment of alternative fuels infrastructure.

CEN/TC 268 works in close cooperation with EIGA, the European Industrial Gases Association. The work is generally prepared at the professional level with EIGA and transferred to CEN/TC 268.

For cryogenic vessels, thanks to this preliminary work the publication of the standards is easier and the state of art in Europe in this field is well advanced since the European manufacturers use the method of "cold stretching" or "use of cold properties" which has the aim to reduce considerably the wall thickness of the stationary cryogenic vessels. Consequently, the quantity of expensive materials (such as stainless steels) used is limited and that has an influence on the costs. This technology is in agreement with the European Directive on the Pressure Equipment. It is hoped that the European technology be approved by the other countries.

At the European level, cross-border transport of dangerous goods has been subject to the RID/ADR agreements for many years. Cryogenic vessels are also involved with Pressure Equipment Directive 2014/68/EU which has been mandatory in the European Union since 2002-05-09. This Directive had a direct influence on CEN/TC 268 works as the European Commission has mandated CEN to prepare standards to address the essential requirement specified in this Directive.

On the European market, the users of cryogenic vessels are divided into different sectors, such as medical, industrial, chemical industry, food industry. Due to the large application of these vessels, CEN/TC 268 established the following structure:

- WG 1 Design
- WG 2 Compatibility, insulation, accessories
- WG 3 Operational requirements
- WG 5 Specific hydrogen technologies applications
- WG 6 Specific helium technology applications

The European manufacturers have been facing the competition from emerging countries and from non-European countries: cryogenic vessels are not only covered by European standards, but also by International standards. Therefore, CEN/TC 268 has developed close links with the following committee under ISO management: ISO/TC 220 "Cryogenic vessels".

The European Commission adopted a Directive on the deployment of alternative fuels infrastructure. This Directive is in keeping with the Europe 2020 strategy that aims at tackling the social challenges like climate change, energy and resources scarcity, at enhancing competitiveness and meeting the energy security. The main alternative fuel options are electricity, hydrogen, biofuels, and natural gas. This Directive aims to ensuring the build-up of alternative fuel infrastructure and the implementation of common technical specifications for this infrastructure in

European Union. International standards were available and referenced in the Directive 2014/98/EU as an intermediate solution. CEN/TC 268 was in charge of the development of European standards supporting this Directive for hydrogen technologies.

1.2 Quantitative Indicators of the Business Environment

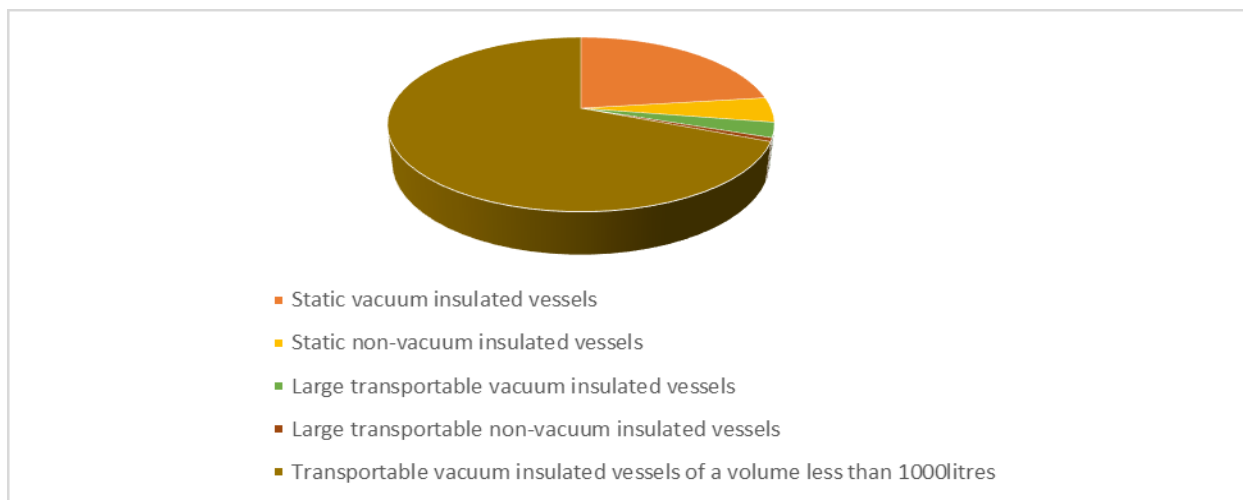
The following list of quantitative indicators describes the business environment in order to provide adequate information to support actions of the CEN /TC 268 for the cryogenic vessels:

Data were provided by EIGA (European Industrial Gas Association)

There are approximately 15 manufacturers of cryogenic vessels in Europe.

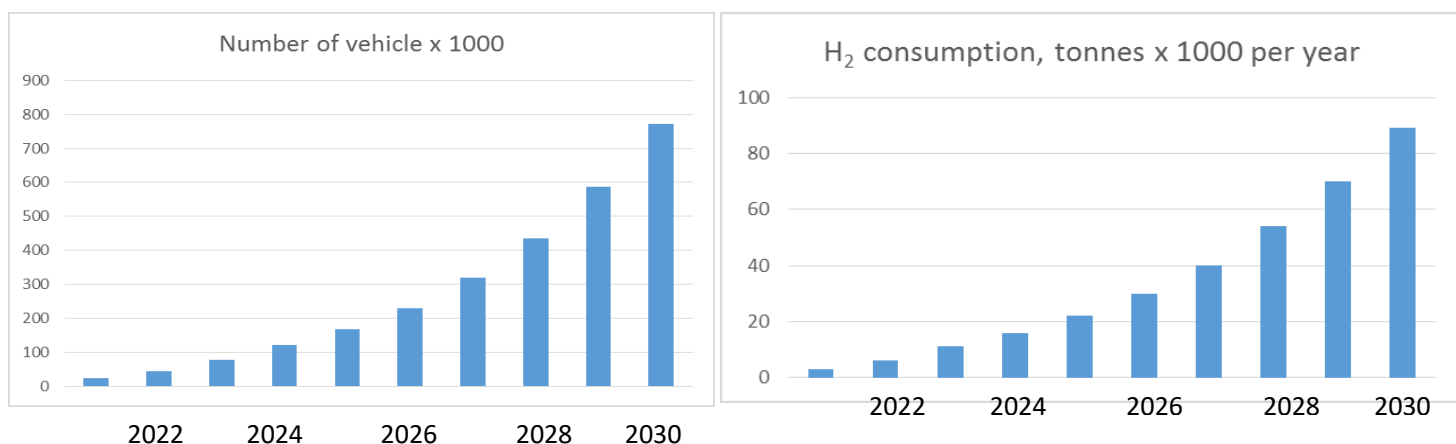
The number of vessels in Europe is presented in the table below:

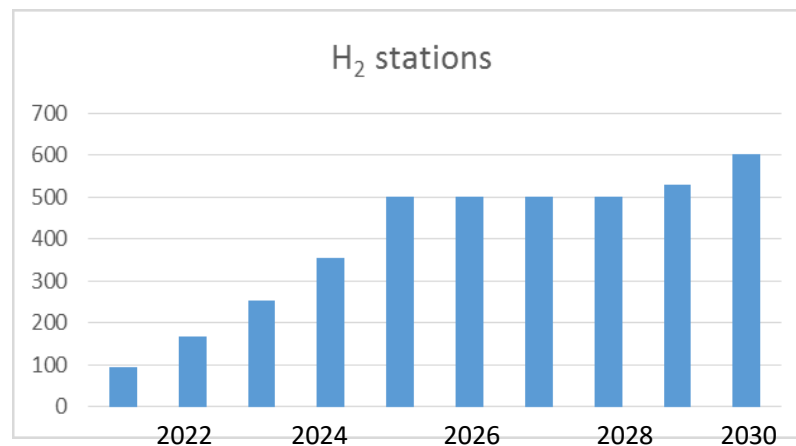
Type of vessels	Number of vessels
Static vacuum insulated vessels	50000
Static non-vacuum insulated vessels	10000
Large transportable vacuum insulated vessels	6000
Large transportable non-vacuum insulated vessels	1500
Transportable vacuum insulated vessels of a volume less than 1000litres	150000



The indicators presented below show the business environment for hydrogen technologies in cars applications.

In Europe, the hydrogen vehicle market could represent in 2030





2 BENEFITS EXPECTED FROM THE WORK OF THE CEN/TC 268

- The first benefit of European standardization within CEN/TC 268 is to allow cryogenic vessels manufacturers and users to meet in a well-known structure, to write together standards which are used by all.
- The second benefit is that EN standards removed the technical barriers, decrease the cost of designing, manufacturing, inspecting and testing the cryogenic vessels and their accessories. It also emphasizes the production in series with "type vessels" for small cryogenic vessels. 41 standards have been published. CEN/TC 268 would like to establish Vienna Agreement with ISO/TC 220 standards under development. The third benefit is that EN standards allow maintaining a high level of quality, reliability and functional safety. On the European market, cryogenic vessels in compliance with EN standards respect a high level of performance.
- The third and very important benefit of CEN/TC 268 is to prepare harmonized standards which support European directives on transportable vessels and PED. Effectively, 18 standards published of CEN/TC 268 have already been cited in the Official Journal of the European Union under Directives 2014/68/EU (Pressure Equipment Directive). The development of standards as part of mandate M533 supporting the Directive on deployment of alternative fuels infrastructure.

3 PARTICIPATION IN THE CEN/TC 268

All the CEN national members are entitled to nominate delegates to CEN Technical Committees and experts to Working Groups, ensuring a balance of all interested parties. Participation as observers of recognized European or international organizations is also possible under certain conditions. To participate in the activities of this CEN/TC, please contact the national standards organization in your country.

4 OBJECTIVES OF THE CEN/TC 268 AND STRATEGIES FOR THEIR ACHIEVEMENT

4.1 Defined objectives of the CEN/TC

The objectives of CEN/TC 268 have been the preparation on standards on:

- Design,
- Compatibility, insulation and accessories,
- Operational requirements,
- Fundamental requirements,
- Outdoor hydrogen refueling points,
- Hydrogen purity,
- Connectors for vehicles for the refueling of gaseous hydrogen,
- Protection against overpressure for liquid helium cryostat.

The present purpose of CEN/TC 268 is to maintain and to update the standards to take into account the benefit of the evolution of the technology, the evolution of the directives and of the International standardization (ISO/TC 220).

Following CEN consultant assessment on PED and the systematic review, CEN/TC 268 decided to create Vienna Agreement with active drafting standards in ISO/TC 220.

For example, once the harmonized standards are published and are cited in the Official Journal of the European Union, they can be used by manufacturers and suppliers to claim "presumption of conformity".

The one-off preparation of standards for hydrogen technologies strictly meet the European mandate on the Directive for the deployment of alternative fuels infrastructure under the mandate M533.

4.2 Identified strategies to achieve the CEN/TC.s defined objectives.

To reach its objectives, CEN/TC 268 has WGs to deal with the specific aspects defined under clause 4.1

The priority for CEN/TC 268 is now to avoid duplication of standards between ISO and CEN and to update standards under PED. That's the reason why CEN/TC 268 requests to ISO/TC 220 to consider the revision of some published standards.

To improve the work in CEN/TC 268, liaisons are established with the following committees:

- CEN/TC 54 "Unfired pressure vessels"
- CEN/TC 69 "Industrial valves";
- CEN/TC 282 "Installations and equipment for LNG";
- CEN/TC 342 "Metal hoses, hose assemblies, bellows and expansion joints";
- ISO/TC 220 "Cryogenic vessels";
- ISO/TC 197 "Hydrogen technologies"
- CEN/CENELEC/JTC 6 "Hydrogen in energy service"
- EIGA "European Industrial Gas Association".

CEN/TC 268 decided in 2017 to establish a Task Group under the responsibility of the committee leadership. This Task Group will prepare the orientation of work of CEN/TC 268 and it will study to open the work to new subject.

4.3 Environmental aspects

All CEN/TC 268 standards are published. CEN/TC 268 will consider the environmental aspects during review of existing standards. The committee will take into account these aspects in design standards, end of life standards.

Regarding the construction the life cycle of cryogenic vessels, environmental aspects identified are:

- Raw materials: aspect relating to the choice of materials, components, and fluids used in the product composition
- Manufacture: aspect regarding the processes
- Recyclability at end of life
- Transportation.

To help in this way, the use of CEN checklist is recommended. EIGA (External organization in liaison) worked on environmental aspects of standardization and developed a matrix to complete the CEN checklist. The use of this matrix is also recommended.

CEN/TC 268, by producing standards, would contribute to break the oil dependence of transport to substitute oil with alternative fuel option as hydrogen used via fuel cells on vehicles.

5 FACTORS AFFECTING COMPLETION AND IMPLEMENTATION OF THE CEN/TC 268 WORK PROGRAMME

The first factor that could affect the periodical revision of the standard would be not sufficiently available expert resources.

The second one relates to the establishment of Vienna Agreement with existing standards in ISO/TC 220. If ISO/TC 220 doesn't decide to revise the concerned standards, CEN/TC 268 will study the possibility to revise its own standards (in this case, it will not possible to reduce the number of standards between these 2 structures).