European Sealing Association e.V.

Hydrogen Legislation, Standards and Regulations

Ralf Vogel,
ESA Technical Director

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EU Legislation

Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources

Industry must procure at least 42% of its hydrogen from renewable fuels of non-biological origin (RFNBOS) by 2030, though countries that can achieve a fossil-free hydrogen mix of at least 77% by 2030 can see that target reduced by 20%

Regulation (EC) No 79/2009 of 14January2009 on type-approval of hydrogen-powered motor vehicles, and amending Directive2007/46/EC

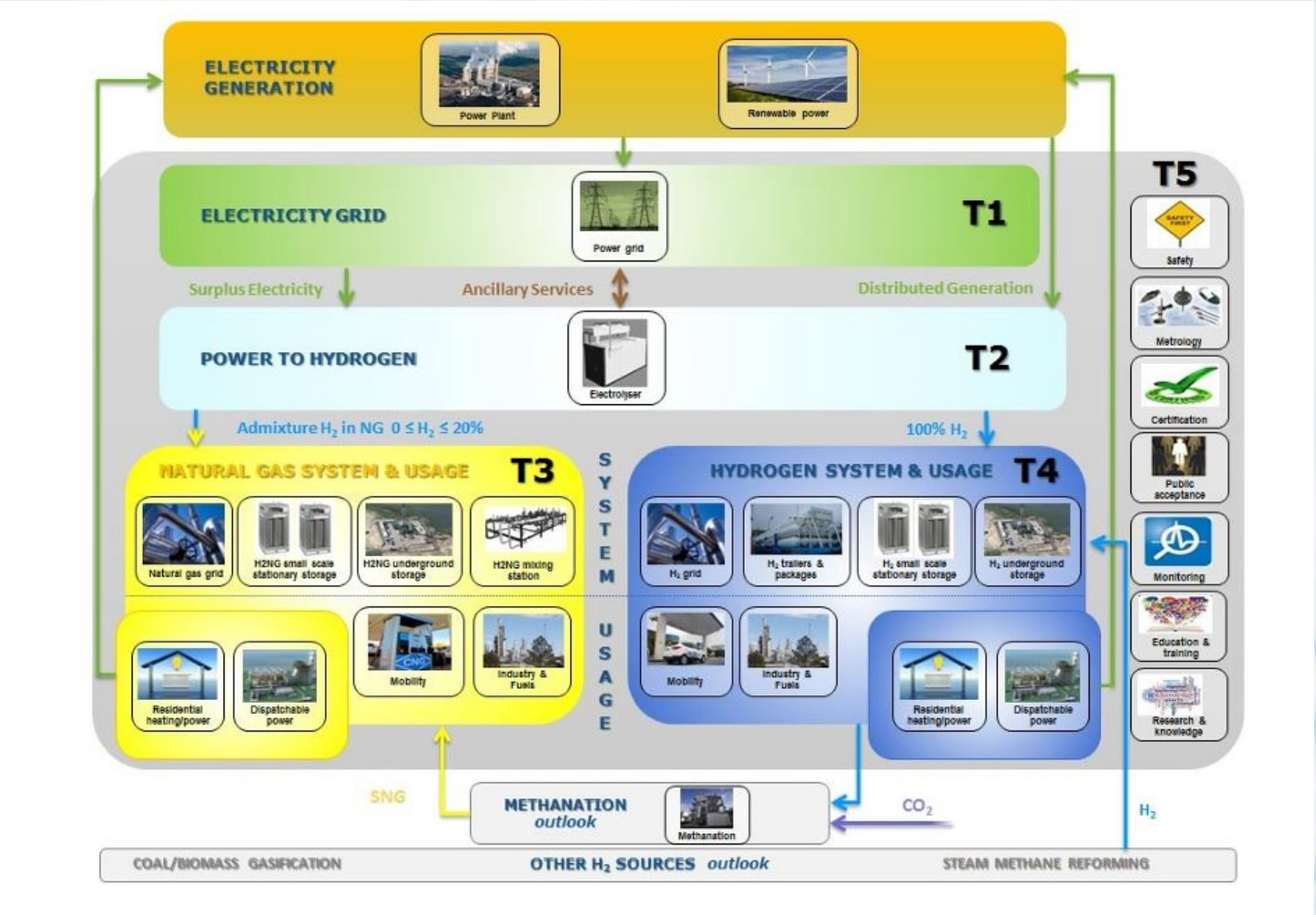
EU Standards

The European Commission has recognised the need to support the rapid development of the new hydrogen industry in Europe and they have requested both CEN and CENELEC to draft new European standards to reduce the technical barriers associated with the rapid, safe adoption of the technology

This has resulted in a high level of activity in developing new and adapted standards addressing areas such as electrolysers and storage and use of hydrogen in the gas infrastructure

The CEN technical committees, TC 234 and TC 235, are responsible for both developing new standards and revising existing ones for gas infrastructure, pressure regulators and safety devices. This work will cover the introduction of H2 into the existing gas grid at various quantities and also the requirements for the transmission and use of 100% hydrogen

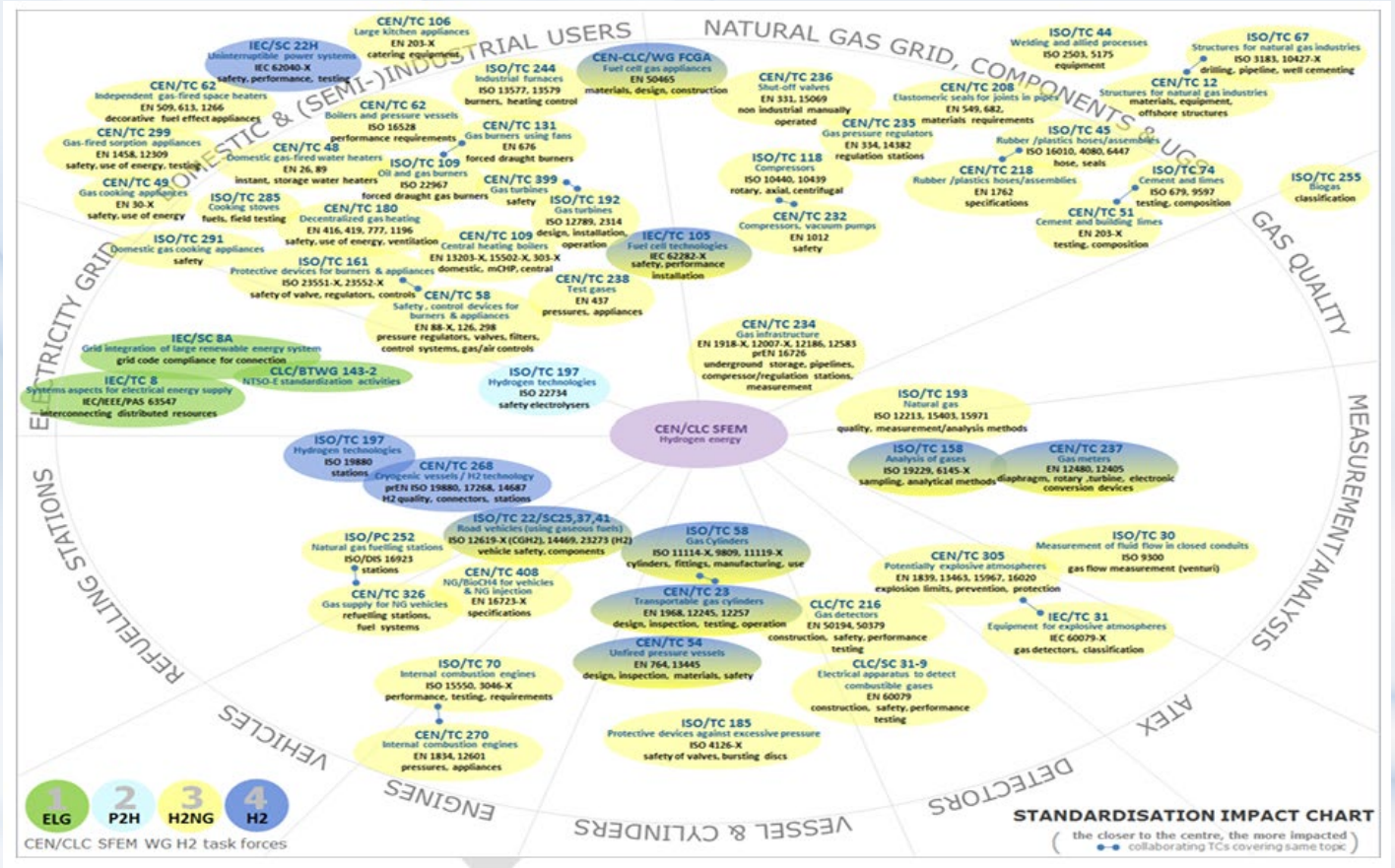
CEN Standard Development



CEN/ISO Working Groups

- o CEN/TC 58 on Safety and Control Devices of Burners and Appliances
- o CEN/TC 234 on Gas Infrastructure
- o CEN/TC 235 on Gas Pressure Regulators and associated safety devices
- o CEN/TC 238 on Test Gases
- o CEN/TC 268 on Cryogenic Vessels and Hydrogen Technologies
- o CEN/TC 408 on Biomethane and CNG
- o ISO/TC 22 on Road Vehicles
- o ISO/TC 158 on Analysis of Gases
- o ISO/TC 192 on Gas Turbines
- o ISO/TC 193 on Natural Gas
- o IEC/TC 105 on Fuel Cell Technologies
- o ISO/PC 252 on Natural Gas Fuelling Stations

Standardisation Activities



Mapping of international and European standardization activities in the area of hydrogen and H2NG

ISO Standards (1)

ISO19880:3-2018 defines the requirements for valves in hydrogen fuel stations. According to ISO 19880-3:2018, tests at room temperature will be conducted at 20 °C (± 5) °C and other specified tests will be conducted at −40 °C (+0 °C, −3 °C) and at 85 °C (+3 °C, −0 °C) when the valves are used in a dispenser. In addition, in cases where a manufacturer specifies a specific temperature range for use, then the valves need to be tested for the minimum and maximum temperatures in that range. Valves need to be able to withstand 102,000 hydrogen gas pressure cycles without damage or leakage, and the replacement of valve seals is acceptable at intervals of 16,000 cycles

ISO 16111: This standard provides general principles and requirements for the design, manufacture, testing, and documentation of hydrogen gas seals for rotating machinery. It covers various aspects, including material selection, testing methods, and safety considerations

ISO Standards (2)

ISO 14687:2019 Hydrogen fuel quality - This standard provides specifications for hydrogen fuel quality, including maximum allowable impurity levels. While not focused on sealing, it indirectly impacts the quality and integrity of hydrogen containment systems

ISO 12619-1:2014 Road vehicles - Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components - Part 1: General requirements and definitions
It specifies general requirements and definitions of compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components, intended for use on the types of motor vehicles defined in ISO 3833. There are 16 parts of this standards for specific components like regulators and valves

ISO 15916:2015 Basic considerations for the safety of hydrogen systems

ISO Standards (3)

ISO/AWI 21341 Ships and marine technology
Test procedures for liquid hydrogen valve of hydrogen ships

ISO 23555-1:2022 Gas pressure safety and control devices for use in gas transmission, distribution and installations for inlet pressures up to and including 10 MPa — Part 1: General requirements
This document specifies generic safety, constructional, performance, testing and documentation requirements for high pressure controls for use in gas transmission, distribution and installations (hereafter referred to as controls)

ISO 23555-2:2022 Gas pressure safety and control devices for use in gas transmission, distribution and installations for inlet pressures up to and including 10 MPa — Part 2: Gas pressure regulator
This document specifies safety, constructional, performance, testing and documentation requirements for gas pressure regulators for use in gas transmission and distribution installations. This document is applicable to regulators with operating pressures greater than 500 kPa

German Legislation

On 24 July 2021 the German Parliament passed an amendment to the Energy Act which contains new provisions for the regulation of hydrogen networks

As in other jurisdictions, the legal and regulatory framework for hydrogen is not yet comprehensive

The German Parliament passed an amendment to the Energy Act which contains new provisions for the regulation of hydrogen networks. These new rules are, however, only of a transitional nature

It is to be expected that hydrogen network regulation will evolve further alongside the development of European law. A framework for carbon capture and storage necessary for the market launch of “blue” hydrogen is lacking completely

Technical rules e.g. for the increased blending of hydrogen into the natural gas grid are still under consideration

German Standards

Standardization, norming, certification and approval procedures for hydrogen systems must be included as a further field of action

In this context, the scientific findings must be translated into the corresponding binding regulations in a timely manner through close cooperation with the responsible institutions.

In particular, test centres for the examination of hydrogen system components must be established for certification purposes. Further prerequisites, such as the certification of hydrogen based on its CO2 footprint or its purity by means of special hydrogen labels, should also be drawn up or existing ones expanded accordingly. This will result early in standards for components or systems that will guide development

In addition, the benchmarks that determine the safe and sustainable handling of all forms of largely climate-neutral hydrogen are derived from this on an international level

DVGW Germany

DVGW Research Center at Engler-Bunte-Institut of Karlsruhe Institute of Technology (KIT)

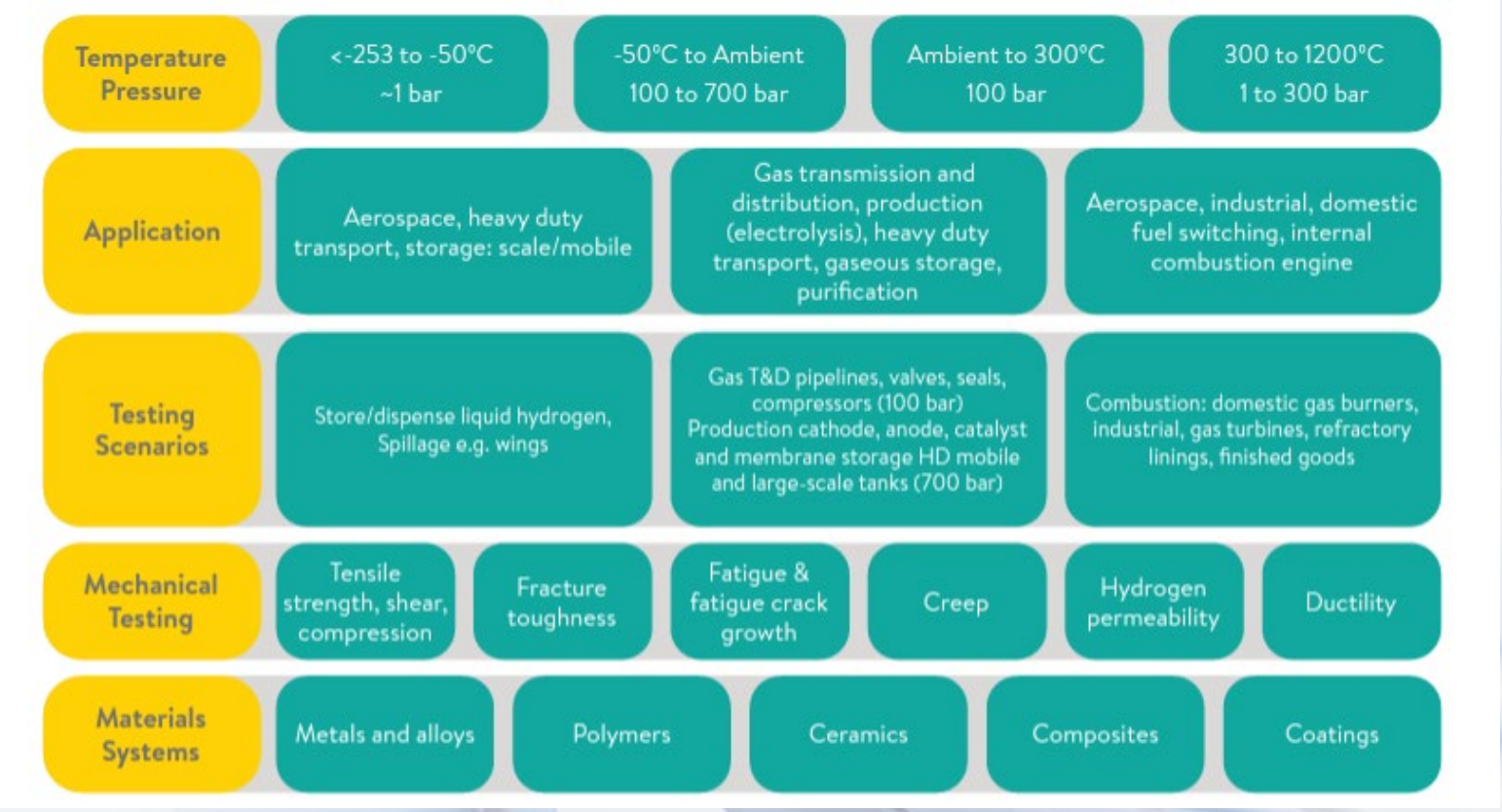
Fittings and components for gas installation, gas distribution and gas transport up to a size of DN 500 can be tested in the laboratories at the Test Laboratory Gas. The focus here is on the national and European standards as well as the Pressure Equipment Directive (2014/68/EU). Approval tests for 100% hydrogen up to 50 bar partial pressure have already been carried out within the scope of the Pressure Equipment Directive

Certification program ZP 5101: “Compatibility and permeation properties of elastomer materials for seals and membranes in gas appliances and installations in relation to hydrogen for a content of up to 100 Vol% H2”. The certification program entered into force on 19/11/2021. It supplements the existing testing for elastomer materials for natural gas so that they can also be tested and certified for H2 blending and 100 Vol% hydrogen as part of the conformity assessment

UK Standards and Regulations

- There is very little legislation that specifically relates to hydrogen. Instead, hydrogen projects must navigate the existing legislative landscape that applies to gasses more generally. Hydrogen is captured under the definition of “gas” in the Gas Act 1986 (the “Gas Act”) and is therefore regulated as part of the gas network
- BSI also offers its Kitemark scheme for gas fittings in use with hydrogen (a combination of GAR and PAS 4444)

UK Testing Needs Analysis



Ref. UK Hydrogen: Testing Gap Analysis and next steps, Henry Royce Institute, 05/2022

US/ Canada Standards (1)

API have started work on a new document API 6Z Standard for Valves in Hydrogen Gas (H2) Service at Normal Temperature

ASME Boiler and Pressure Vessel Code (BPVC): The ASME BPVC includes specific sections (e.g., Section VIII, Division 3) that address the design, construction, and inspection of pressure vessels and components used for hydrogen storage and containment

ASME B31.12 Hydrogen Piping and Pipeline Code Design Rules

NFPA (National Fire Protection Association) 2: Hydrogen Technologies Code: This NFPA code addresses the safe design, installation, and operation of hydrogen-generating systems, storage systems, and equipment. It includes guidelines for hydrogen sealing to prevent leaks and ensure safety

US/ Canada Standards (2)

Standards such as NACE MR-0175 for upstream exploration and production, and NACE MR-0103 for refinery environments, can help define and specify control valve requirements for hydrogen gases

CSA B51: Boiler, Pressure Vessel, and Pressure Piping Code: In Canada, CSA B51 outlines requirements for the design and construction of pressure vessels and components used in hydrogen service

Asian Standards

China has 94 standards related to hydrogen but mainly for automotive use

STANDARD FOR HYDROGEN PIPING SYSTEMS AT USER LOCATIONS
AIGA (Asia Industrial Gases Association) 087/14
Based on CGA G-5.4–2012 Fifth Edition

Indian Standard IS 1090:2002 – Compressed Hydrogen - Specification

Indian Standard IS 16749 : 2018 - Basic considerations for the safety of hydrogen systems