SLOVENSKI STANDARD
oSIST prEN ISO 19884:2018

01-april-2018

Plinasti vodik - Jeklenke in velike jeklenke za skladiščenje (ISO/DIS 19884:2018)

Gaseous hydrogen - Cylinders and tubes for stationary storage (ISO/DIS 19884:2018)

Gasförmiger Wasserstoff - Flaschen und Großflaschen zur ortsfesten Lagerung (ISO/DIS 19884:2018)

Hydrogène gazeux - Bouteilles et tubes pour stockage stationnaire (ISO/DIS 19884:2018)

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ICS:

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71.100.20	Industrijski plini	Gases for industrial application

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Gaseous hydrogen — Cylinders and tubes for stationary storage

Hydrogène gazeux — Bouteilles et tubes pour stockage stationnaire

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

In any case, national regulation, if applicable, prevails on standard.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

ISO 19884 was prepared by Technical Committee ISO/TC 197, *Hydrogen technologies*.

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Introduction

As the use of gaseous hydrogen evolves from the chemical industry into various emerging applications, such as fuel for fuel cells and internal combustion engines, and other specialty hydrogen applications, new requirements and usages are foreseen for seamless and composite pressure vessels, including higher number of pressure cycles, and use of transportable storages as stationary vessels.

Requirements covering pressure vessels for stationary storage of compressed gaseous hydrogen are listed in this standard and are mainly intended to maintain or improve the level of safety of this application.

It is to be noted that vessels qualified to ISO 19884 will also need to meet regulations of countries where installed, such as the European PED and building codes that reference ASME. It is a goal of ISO 19884 that qualified vessels will be acceptable to regulators in countries where installed.

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Gaseous hydrogen — Cylinders and tubes for stationary storage

1 Scope

This International Standard specifies the requirements for design, manufacture and testing of standalone or manifolded (for some specific tests such as bonfire) cylinders, tubes, and other pressure vessels of steel, stainless steel, aluminium alloys or of non-metallic construction material. These are intended for the stationary storage of gaseous hydrogen of up to a maximum water capacity of 10 000 l and a maximum allowable working pressure not exceeding 110 MPa, of seamless metallic construction (Type 1) or of composite construction (Types 2, 3 and 4), hereafter referred to as pressure vessels. Type 2 and 3 vessels with welded liners are excluded.

For an existing design already qualified for other applications (e.g. transportable applications) follow the requirements of Annex B.

This International Standard is not intended as a specification for pressure vessels used for solid, liquid hydrogen or hybrid cryogenic-high pressure hydrogen storage applications.

This International Standard does not include external piping which can be designed according to a recognized standard (e.g. ISO 15649).

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2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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ANSI/CSA CHMC 1-2014 - *Test methods for evaluating material compatibility in compressed hydrogen applications - Metals*

ASME Boiler and Pressure Vessel Code,

ASTM D3170 / D3170M - 14 *Standard Test Method for Chipping Resistance of Coatings*

ASTM E647, *Standard Test Method for Measurement of Fatigue Crack Growth Rates*

CSA PRD 1-2013 - *Pressure relief devices for natural gas vehicle (NGV) fuel containers*

EN 12245, *Transportable gas cylinders. Fully wrapped composite cylinders*

ISO 306, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature (VST)*

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 1519, *Paints and varnishes -- Bend test (cylindrical mandrel)*

ISO 2808, *Paints and varnishes — Determination of film thickness*

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ISO 2812-1 *Paints and varnishes -- Determination of resistance to liquids -- Part 1: Immersion in liquids other than water*

ISO 4624, *Paints and varnishes — Pull-off test for adhesion*

ISO 6272-2 *Paints and varnishes -- Rapid-deformation (impact resistance) tests -- Part 2: Falling-weight test, small-area indenter*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 7225, *Gas cylinders — Precautionary labels*

ISO 7866, *Gas cylinders — Refillable seamless aluminium alloy gas cylinders — Design, construction and testing*

ISO 9227, *Corrosion tests in artificial atmospheres -- Salt spray tests*

ISO 9809-1, *Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100* MPa

ISO 9809-3, *Gas cylinders -- Refillable seamless steel gas cylinders -- Design, construction and testing -- Part 3: Normalized steel cylinders*

ISO 9809-4, *Gas cylinders -- Refillable seamless steel gas cylinders -- Design, construction and testing -- Part 4: Stainless steel cylinders with an Rm value of less than 1 100 MPa*

ISO 11114-1 *Gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 1: Metallic materials*

ISO 11114-2, *Gas cylinders -- Compatibility of cylinder and valve materials with gas contents -- Part 2: Non-metallic materials*

ISO 11114-4, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 4: Test methods for selecting metallic materials resistant to hydrogen embrittlement*

ISO11119-1, *Gas cylinders -- Refillable composite gas cylinders and tubes -- Design, construction and testing -- Part 1: Hoop wrapped fibre reinforced composite gas cylinders and tubes up to 450 l*

ISO11119-2, *Gas cylinders -- Refillable composite gas cylinders and tubes -- Design, construction and testing -- Part 2: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 l with load-sharing metal liners*

ISO 11120, *Gas cylinders — Refillable seamless steel tubes for compressed gas transport, of water capacity between 150 l and 3000 l — Design construction and testing*

ISO 11357-2, *Plastics -- Differential scanning calorimetry (DSC) -- Part 2: Determination of glass transition temperature*

ISO 11439, *Gas cylinders -- High pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles*

ISO 11507, *Paints and varnishes -- Exposure of coatings to artificial weathering -- Exposure to fluorescent UV lamps and water*

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ISO 11623, *Transportable gas cylinders -- Periodic inspection and testing of composite gas cylinders*

ISO 12108, *Metallic materials -- Fatigue testing -- Fatigue crack growth method*

ISO 14130, *Fibre-reinforced plastic composites -- Determination of apparent interlaminar shear strength by short-beam method*

ISO 15500-13, *Road vehicles -- Compressed natural gas (CNG) fuel system components -- Part 13: Pressure relief device (PRD)*

EN 13322-2, *Transportable gas cylinders — Refillable welded steel gas cylinders — Design and construction — Part 2: Stainless steel*

3 Terms, definitions and symbols

3.1 Terms and definitions

3.1.1.
autofrettage
pressure application procedure which strains the metal liner past its yield point sufficient to cause permanent plastic deformation, and results in the liner having compressive stresses and the fibres having tensile stresses when at zero internal gauge pressure

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3.1.2.
autofrettage pressure
pressure within the overwrapped composite pressure vessel at which the required distribution of stresses between the liner and the composite overwrap is established

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3.1.3. https://standards.iteh.ai/catalog/standards/sist/9b48c4b3-3ad2-436e-96bc-4e11f1e798/sist-en-17533-2020
batch of pressure vessels/liners
set of manufactured finished pressure vessels/liners subject to a manufacturing quality pass / fail criteria based on the results of specified tests performed on a specified number of units from that set

3.1.4.
boss
dome shaped metallic component mounted on one end or on the two ends of a non-metallic liner with a neck providing an opening and/or an external element of mechanical support

3.1.5.
burst pressure
highest pressure reached in a cylinder during a burst test

3.1.6.
composite overwrap
combination of fibres (including steel wire) and matrix

3.1.7.
controlled tension winding
process used in manufacturing composite pressure vessels with metal liners by which compressive stresses in the liner and tensile stresses in the composite overwrap at zero internal pressure are obtained by winding the reinforcing fibres under controlled tension

3.1.8.
cycle amplitude
ratio of pressure increase to maximum pressure in a pressure cycle, expressed in %

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3.1.9.
design change
change in the selection of structural materials or dimensional changes exceeding the tolerances as on the design drawings

3.1.10.
exterior coating
layers of material applied to the cylinder (eg for protection)

NOTE The coating may be clear or pigmented.

3.1.11.
finished pressure vessels
pressure vessels, which are ready for use, typical of normal production, complete with identification marks and external coating including integral insulation specified by the manufacturer, but free from non-integral insulation or protection

NOTE In the framework of this standard, a tube or a cylinder is a finished pressure vessel.

3.1.12.
full cycle
cycle of pressure amplitude between not less than MAWP (see 3.1.19) and not more than 10% of the MAWP

3.1.13.
fully wrapped composite pressure vessel
pressure vessel with a composite overwrap taking both circumferential and longitudinal stress

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3.1.14.
leakage
release of hydrogen through a crack, pore, or similar defect

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NOTE Permeation through the wall of a Type 4 pressure vessel that is less than the rates described in A.14 is not considered leakage.

3.1.15.
liner
inner portion of the composite cylinder, comprising a metallic or non-metallic vessel, whose purpose is both to contain the gas and transmit the gas pressure to the fibres

3.1.16.
load sharing liner
liner that has a burst pressure of at least 5 % of the minimum burst pressure of the finished composite cylinder

3.1.17.
matrix
material that is used to bind and hold the fibres in place

3.1.18.
maximum allowable temperature
maximum temperature of any part of the pressure vessel for which it is designed (or intended to be used if Annex B is followed)

NOTE Different limits may apply for maintenance.

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3.1.19.
maximum allowable working pressure (MAWP)
maximum pressure to which the component is designed to be subjected to and which is the basis for determining the strength of the component under consideration (also known as design pressure)

3.1.20.
maximum energy content
maximum energy content is the product of the pressure vessel's water capacity in litres and the MAWP in MPa.

3.1.21.
minimum allowable temperature

minimum temperature of any part of the pressure vessel for which it is designed (or intended to be used if Annex B is followed)

3.1.22.
operator
Entity legally responsible for the use and maintenance of the vessel

3.1.23.
Pressure-activated pressure relief device (PRD)
device designed to release pressure in order to prevent a rise in pressure above a specified value due to emergency or abnormal conditions

NOTE Pressure-activated PRDs may be either re-closing devices (such as valves) or non-re-closing devices (such as rupture disks).

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3.1.24.
pressure cycle
pressure variation composed of one period of monotonic pressure increase up to a peak pressure followed by one period of monotonic pressure decrease

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3.1.25.
pressure cycle life
maximum number of pressure cycles in hydrogen service that the pressure vessel is designed to withstand in service

3.1.26.
pre-stress
process of applying autofrettage or controlled tension winding

3.1.27.
service life
maximum period (expressed in years) for which the pressure vessel is designed to be in service (based on fatigue life and stress rupture characteristics of composite cylinders)

NOTE service life usually depends on the pressure cycle or other service conditions and requirements from applicable standards. For composite cylinders, life in years is a requirement to address reliability under stress rupture conditions, which is also an underlying basis for the required stress ratios.

3.1.28.
Shallow pressure cycle
Pressure cycle from MAWP to not less than 70 % of MAWP

3.1.29.
shallow pressure cycle life
maximum number of shallow pressure cycles, that the pressure vessel is designed to withstand in hydrogen service

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