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Ships and marine technology — Test procedures for liquid hydrogen storage tank of hydrogen ships

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Foreword

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This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 3, *Piping and machinery*.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Hydrogen offers a reliable way to decarbonise a variety of sectors including the maritime industry, where it has been historically difficult to meaningfully reduce CO_2 emissions despite the commitments by governments and the implementation of regulatory measures.

There are technologies available that enable hydrogen to be produced, stored, transported and used as energy in different ways. Various materials can be produced by hydrogen, including renewable energy, natural gas, coal and oil. Hydrogen can be transported as a gas by pipelines or in liquid form by ship, much like liquid natural gas (LNG), and transformed into electric energy to provide homes or industry with power and also into fuels for cars, trucks, ships and planes.

However, the safe and wide use of hydrogen in marine industry faces several challenges, in particular the absence of applicable international standards on the safety testing of hydrogen systems. All system components should be designed and tested for the safety and reliability in handling liquid hydrogen and thereby the facilitation of decarbonisation with the transition into hydrogen-based clean energy.

In this regard, this document sets up a general test requirement for the liquid hydrogen cargo tank of hydrogen carrier ships. It is expected that useful information can be provided to the marine industry stakeholders including ship owners, classification societies and shipyards. Finally, this document aims to contribute to the growth of relevant industries and benefit all related stakeholders.

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Ships and marine technology — Test procedures for liquid hydrogen storage tank of hydrogen ships

1 Scope

This document specifies general inspection and test requirements for liquid hydrogen cargo tanks on board hydrogen carrier ships. In the cases of liquefied hydrogen containment systems, the testing activity depends strictly on the type of storage containment technology identified by the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code).[1] This document is applicable to Type C independent metallic double wall type tanks with vacuum insulation having a capacity of not more than 1 000 cubic metres (m^3). It is also applicable to liquid hydrogen cargo tanks which are designed to transport pure para-hydrogen (not less than 95 % content).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

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

ISO 17636-1, *Non-destructive testing of welds — Radiographic testing — Part 1: X- and gamma-ray techniques with film*

ISO 17636-2, *Non-destructive testing of welds — Radiographic testing — Part 2: X- and gamma-ray techniques with digital detectors*

ISO 3452-1, *Non-destructive testing — Penetrant testing — Part 1: General principles*

ISO 9934-1, *Non-destructive testing — Magnetic particle testing — Part 1: General principles*

ISO 23208, *Cryogenic vessels — Cleanliness for cryogenic service*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
design pressure
pressure used to determine minimum scantlings of the *liquefied hydrogen (LH_2)* (3.3) storage tank

3.2
maximum allowable working pressure
MAWP
maximum pressure of a storage tank determined by the tank design code

Note 1 to entry: MAWP should not be less than the *design pressure* (3.1).

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