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Gaseous hydrogen — Pressure vessels for stationary storage —

Part 3: Pressure cycle test data to demonstrate partial pressure cycle estimation methods

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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A list of all parts in the ISO 19884 series can be found on the ISO website.

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Introduction

A much higher level of long-term reliability is required for a pressure vessel in stationary use compared to on-board use, as the risk of a serious incident in the event of a vessel rupture is significantly higher. Reliability is ensured through full-pressure cycle testing in accordance with the performance-based standard, ISO 19884-1 [1] . One of the primary objectives of utilizing stationary vessels is to accumulate hydrogen pressure quickly prior to refuelling vehicles. That is why the pressure of a stationary vessel never decreases to zero in actual use. The expected pressurizing time-history is between the design pressure and 70% of the design pressure, that is, a partial pressure cycle, for which a longer cycle life is expected than the full pressure cycle life. The cycle life extension by the partial pressure cycle seems applicable to other high-pressure hydrogen equipment, such as tubes. Cycle life extension is rather a matter of maintenance for reliable performance. The authority with jurisdiction needs to be convinced that the vessel can be relied upon for a period longer than the nameplate life. This document presents candidate methods for estimating cycle life extension through partial pressure cycling for authorities and users, enabling hydrogen stations to be operated and managed efficiently and safely. This document presents the currently available methods and the test data to support them. However, this document is not intended to inhibit the advancement of new technologies that are presently being developed or used in the market, or those yet to emerge. As these new technologies mature, they will be added in future revisions of this document.

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Gaseous hydrogen — Pressure vessels for stationary storage —

Part 3: Pressure cycle test data to demonstrate partial pressure cycle estimation methods

1 Scope

This document describes detailed methods for evaluating cycle life extension by partial pressure cycles with necessary conditions and example data of their application.

Two methods for evaluating cycle life extension by partial pressure cycles based on the Goodman diagram and exponential formula are presented in ISO 19884-1 [1]. These methods do not rely on fracture mechanical methodology but on pressurizing cycle test data, since the framework of ISO 19884-1 [1] is constructed on performance demonstrated by pressurizing cycle test data in hydrogen.

2 Normative references

There are no normative references in this document.

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
Class A material
material known to have no significant or unanticipated changes in its performance or mechanical properties when exposed to gaseous hydrogen under the listed service conditions

3.2
design pressure
pressure used in the design of the vessel for the purposes of establishing the minimum thickness of the pressure shell for the stated cycle life and service conditions

3.3
full pressure cycle
cycle of pressure amplitude greater than 100% of the *design pressure* (3.2) to less than 10% of the *design pressure* (3.2)

3.4
full pressure cycle life
maximum number of full pressure cycles in hydrogen service that the pressure vessel is designed to withstand in service

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