FINAL DRAFT International Standard

ISO/FDIS 19887

Gaseous Hydrogen — Fuel system components for hydrogen fuelled vehicles

ISO/TC **197**

Secretariat: **SCC**

Voting begins on:
2024-07-10

Voting terminates on:
2024-09-04

Reference number
ISO/FDIS 19887:2024(en)

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Published in Switzerland

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Foreword

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This document was prepared by Technical Committee ISO/TC 197, *Hydrogen Technologies,* in collaboration with Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 41, S*pecific aspects for gaseous fuels*.

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.

Introduction

The purpose of this document is to promote the implementation of hydrogen powered land vehicles through the creation of performance-based testing requirements for components on hydrogen-fuelled vehicles. The successful commercialization of hydrogen land vehicle technologies requires standards pertaining to vehicle fuel system components and the global homologation of standards requirements for technologies with the same end use. This will allow manufacturers to achieve economies of scale in production through the ability to manufacture one product for global use.

This document is based on the CSA Standard ANSI/CSA HGV 3.1:22.

Gaseous Hydrogen — Fuel system components for hydrogen fuelled vehicles

1 Scope

1.1 Inclusions

This document establishes requirements for newly produced compressed hydrogen gas fuel system components, as listed below, that are intended for use on hydrogen gas powered land vehicles:

a) check valves (see Clause 8);

b) manual valves (see Clause 9);

c) manual container valves (see Clause 10);

d) automatic valves and automatic container valves (see Clause 11);

e) hydrogen injectors (see Clause 12);

f) pressure sensors, temperature sensors, and pressure gauges (see Clause 13);

g) pressure regulators (see Clause 14);

h) pressure relief valves (PRV) (see Clause 15);

i) pressure relief devices (PRD) (see Clause 16, and refer to ISO 19882);

j) excess flow valves (see Clause 17);

k) gastight housing and leakage capture passages (see Clause 18);

l) rigid fuel lines (see Clause 19);

m) flexible fuel lines, hoses, and hose assemblies (see Clause 20);

n) filter assemblies (see Clause 21);

o) fittings (see Clause 22);

p) non-metallic, low-pressure rigid fuel lines (see Clause 23);

q) discharge line closures (see Clause 24).

NOTE Other components not specifically identified here can be examined to meet the criteria of ISO 19887 and tested according to the appropriate functional needs.

1.2 Applicability

This document applies to components that have a nominal working pressure, as specified by the manufacturer, of 25 MPa, 35 MPa, 50 MPa, or 70 MPa at 15 °C, referred to in this document as the following pressure classes:

a) “H25” – 25 MPa;

b) “H35” – 35 MPa;

c) “H50” – 50 MPa; and

d) “H70” – 70 MPa.

Other nominal working pressures for hydrogen gas besides those defined can be used if the qualification test requirements of this document are met.

This document also applies to components downstream of the first stage of pressure reduction with a maximum operating pressure designated by the manufacturer in MPa or kPa.

1.3 Exclusions

This document does not apply to the following:

a) hydrogen gas fuel system components incorporated during the manufacture of motor vehicles originally manufactured in compliance with the international regulations on hydrogen and fuel cell vehicles, such as UN GTR No. 13, UN Regulation No. 134, UN Regulation No. 146, or IEC 62282-4-101;

b) fuel containers;

c) stationary power generation applications;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles; or

g) components intended for liquid hydrogen.

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 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 1431-1, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static and dynamic strain testing*

ISO 6270-2, *Paints and varnishes — Determination of resistance to humidity — Part 2: Condensation (in-cabinet exposure with heated water reservoir)*

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

ISO/TR 11340, *Rubber and rubber products — Hydraulic hose assemblies — External leakage classification for hydraulic systems*

ISO 14687, *Hydrogen fuel quality — Product specification*

ISO 19882, *Gaseous hydrogen — Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers*

ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*

ASTM D572, *Standard Test Method for Rubber—Deterioration by Heat and Oxygen*

ASTM D1149, *Standard Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment*

ASTM D1193-06, *Standard Specification for Reagent Water*

ASTM G154, *Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials*

SAE J343, *Test and Test Procedures for SAE 100R Series Hydraulic Hose and Hose Assemblies*

SAE J2719, *Hydrogen Fuel Quality for Fuel Cell Vehicles*

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
bypass flow
intentional flow through or around an excess flow valve, or similar valve, in its activated position

3.2
compressed hydrogen gas
hydrogen gas that has been compressed

Note 1 to entry: For more information on compressed hydrogen gas composition, see 5.1.4.3.

3.3
discharge line
components attached to the exhaust port of pressure relief devices or pressure relief valves or other devices releasing gas

3.4
discharge line closure
device used to keep contamination out of a discharge line while still permitting escape of gas from the line to atmosphere

3.4.1
repeated-use discharge line closure
discharge line closure (3.4) intended to relieve multiple gas release events

3.4.2
single-use discharge line closure
discharge line closure (3.4) intended to relieve a single gas release event

3.5
duty cycle
one complete operation of the component such as pressurization and depressurization or on and off, as applicable

3.5.1
injector duty cycle
operating frequency of an injector as specified by the manufacturer

3.6
external leakage
leakage from any pressure-retaining chamber to atmosphere, or to any chamber venting to atmosphere

3.7
filling cycle
pressure increase representing a vehicle fuelling for components subjected to container pressure

3.8
filter assembly
assembly that contains a filter media intended to remove contaminants from the gas stream

3.9
fitting
connector used to join sections of pipe, tube, hose, or components

3.10
flexible fuel line
non-rigid tubing or hose through which hydrogen gas flows

3.11
gastight housing
enclosure meant to capture leakage from pressure-retaining components

3.12
hydrogen injector
solenoid operating valve used to control hydrogen flow into an engine or associated intake

Note 1 to entry: Hydrogen injectors are primarily used for internal combustion engine applications but can also be used to control hydrogen flow into a fuel cell.

3.13
internal leakage
leakage from one pressure-retaining chamber to another, where both are intended to contain pressure during normal operation

3.14
leakage capture line
line or hose meant to capture or deliver hydrogen leakage from gastight housings to outside the vehicle

3.15
leakage capture passages
portions of pressure-retaining components meant to capture and direct gas leakage from the pressure-retaining seals of that component

3.16
lock-up pressure
stabilized pressure at the outlet of a pressure regulator at zero flow

3.17
non-metallic, low-pressure rigid fuel line
tubing constructed from non-metallic materials that has been designed not to flex in normal operation and through which fuel flows on the downstream side of pressure regulation

3.18
normal cubic centimetre
Ncm^3
quantity of the specified gas that occupies a volume of 1 cm^3 at a temperature of 293,15 K (20 °C) and an absolute pressure of 101,325 kPa (1 atm)

3.19
pressure
gauge pressure against atmospheric pressure, unless otherwise stated