



**International
Standard**

ISO 19887-1

**Gaseous Hydrogen — Fuel system
components for hydrogen-fuelled
vehicles —**

**Part 1:
Land vehicles**

**First edition
2024-10**

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[ISO 19887-1:2024](https://standards.itih.ai/catalog/standards/iso/fc82688d-71eb-4754-b6bd-4ecc75dfbf8b/iso-19887-1-2024)

<https://standards.itih.ai/catalog/standards/iso/fc82688d-71eb-4754-b6bd-4ecc75dfbf8b/iso-19887-1-2024>

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[ISO 19887-1:2024](https://standards.itih.ai/catalog/standards/iso/fc82688d-71eb-4754-b6bd-4ecc75dfbf8b/iso-19887-1-2024)

<https://standards.itih.ai/catalog/standards/iso/fc82688d-71eb-4754-b6bd-4ecc75dfbf8b/iso-19887-1-2024>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

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

Published in Switzerland

Contents

	Page
Foreword	viii
Introduction	ix
1 Scope	1
1.1 Inclusions.....	1
1.2 Applicability.....	2
1.3 Exclusions.....	2
2 Normative references	2
3 Terms and definitions	3
4 General requirements	7
4.1 General construction and assembly.....	7
4.1.1 Intended use.....	7
4.1.2 Material requirements.....	8
4.1.3 Threaded openings.....	9
4.1.4 Service temperatures.....	10
4.1.5 Design service life.....	10
4.2 Failure modes and effects analysis (FMEA).....	10
4.3 Electrical equipment and wiring.....	10
4.3.1 Openings.....	10
4.3.2 Equipment.....	10
4.3.3 Materials.....	10
4.3.4 Connectors.....	10
4.4 Component literature.....	11
4.4.1 General.....	11
4.4.2 Instructions – General.....	11
4.4.3 Instructions – Additional considerations.....	11
4.4.4 Installation instructions.....	11
4.5 Marking.....	11
4.5.1 General marking information.....	11
4.5.2 Marking methods.....	12
4.5.3 Exclusion of markings.....	12
5 General test methods	12
5.1 General test requirements.....	12
5.1.1 Testing samples.....	12
5.1.2 References to other standards.....	12
5.1.3 Pressure and temperature requirements.....	13
5.1.4 Test gases.....	13
5.1.5 Material acceptance.....	14
5.1.6 Multi-functional components.....	14
5.1.7 Pre-cooling effects.....	14
5.1.8 Electrically operated components.....	14
5.2 Hydrostatic strength.....	14
5.2.1 General.....	14
5.2.2 Test method.....	14
5.3 Leakage.....	15
5.3.1 General.....	15
5.3.2 External leakage.....	15
5.3.3 Internal leakage.....	15
5.3.4 Test conditions.....	15
5.4 Excess torque resistance.....	16
5.5 Bending moment.....	16
5.6 Continuous operation.....	17
5.6.1 General.....	17
5.6.2 Test method.....	17

ISO 19887-1:2024(en)

5.7	Corrosion resistance	18
5.7.1	General	18
5.7.2	Salt spray exposure	19
5.7.3	Accelerated cyclic corrosion	19
5.8	Ultraviolet resistance of external surfaces	21
5.8.1	General	21
5.8.2	Ultraviolet resistance test	21
5.8.3	Pass criteria	22
5.9	Automotive fluid exposure	22
5.9.1	General	22
5.9.2	Test method	22
5.9.3	Fluids	22
5.9.4	Pass criteria	22
5.10	Atmospheric exposure	22
5.10.1	Oxygen aging	23
5.10.2	Ozone	23
5.11	Abnormal electrical voltages	23
5.11.1	Overvoltage testing	23
5.11.2	Minimum opening voltage	24
5.12	Non-metallic material hydrogen compatibility	24
5.12.1	General	24
5.12.2	Hydrogen gas exposure	24
5.13	Vibration resistance	24
5.13.1	Test method	24
5.13.2	Pass criteria	25
5.14	Stress corrosion cracking resistance	25
5.14.1	General	25
5.14.2	Test method	25
5.14.3	Pass criteria	25
5.15	Insulation resistance	25
5.16	Pre-cooled hydrogen exposure	26
6	Quality assurance	26
7	Production inspection and acceptance testing	26
7.1	Inspection and acceptance testing plan	26
7.2	Inspection of system critical components	26
7.3	External leak testing	26
8	Check valves	26
8.1	Marking	26
8.2	Construction and assembly	27
8.3	Tests	27
8.3.1	General	27
8.3.2	Continuous operation	28
8.3.3	Pass criteria	28
9	Manual valves	28
9.1	Marking	29
9.2	Construction and assembly	29
9.2.1	General	29
9.2.2	Handles	29
9.2.3	Emergency manual shut-off valves	29
9.2.4	Quarter-turn valves	29
9.2.5	Multi-turn valves	29
9.3	Tests	29
9.3.1	General	29
9.3.2	Continuous operation	30
9.3.3	Operating torque	31
9.3.4	Valve stem torque	32

10	Manual container valves	32
10.1	Marking	32
10.2	Construction and assembly	32
10.2.1	General	32
10.2.2	Handle	32
10.2.3	Quarter-turn valves	33
10.2.4	Multi-turn valves	33
10.2.5	Internal excess flow valve	33
10.3	Tests	33
10.3.1	General	33
10.3.2	Continuous operation	33
10.3.3	Operating torque	34
10.3.4	Valve stem torque	34
11	Automatic valves and automatic container valves	35
11.1	Marking	35
11.2	Construction and assembly	35
11.2.1	General	35
11.2.2	De-energized position	35
11.2.3	Shut-off valve failure position	35
11.2.4	Internal excess flow valve	35
11.3	Tests	35
11.3.1	General	35
11.3.2	Continuous operation	36
11.3.3	Automatic valve manual override torque	37
12	Hydrogen injectors	37
12.1	Marking	37
12.2	Construction and assembly	38
12.2.1	General	38
12.2.2	De-energized position	38
12.3	Tests	38
12.3.1	General	38
12.3.2	Continuous operation	38
12.3.3	Insulation resistance	39
12.3.4	Pneumatic strength	39
12.3.5	Extreme temperature cycling	39
13	Pressure sensors, temperature sensors, and pressure gauges	40
13.1	Marking	40
13.2	Construction and assembly	41
13.2.1	General	41
13.2.2	Pressure gauge lens	41
13.3	Tests	41
13.3.1	General	41
13.3.2	Continuous operation	41
13.3.3	Abnormal electrical voltages	42
13.3.4	Insulation resistance	43
14	Pressure regulators	43
14.1	Marking	43
14.2	Construction and assembly	43
14.2.1	General	43
14.2.2	Nominal outlet pressure	43
14.2.3	Pressure regulator PRV	43
14.3	Tests	43
14.3.1	General	43
14.3.2	Hydrostatic strength	44
14.3.3	Leakage	45
14.3.4	Continuous operation	45
14.3.5	Pressure impulse	45

ISO 19887-1:2024(en)

14.3.6	Pressure chamber – PRV operation.....	46
15	Pressure relief valves.....	46
15.1	Marking.....	46
15.2	Construction and assembly.....	46
15.2.1	General.....	46
15.2.2	Venting.....	46
15.2.3	Inspection and acceptance testing.....	46
15.3	Tests.....	46
15.3.1	General.....	46
15.3.2	Hydrostatic strength.....	47
15.3.3	Leakage.....	47
15.3.4	Continuous operation.....	47
15.3.5	Opening and reseating characteristics.....	48
16	Pressure relief devices.....	48
17	Excess flow valves.....	48
17.1	Marking.....	48
17.2	Construction and assembly.....	49
17.3	Tests.....	49
17.3.1	General.....	49
17.3.2	Continuous operation.....	49
17.3.3	Bypass flow.....	49
18	Gastight housing and leakage capture passages.....	50
18.1	Marking.....	50
18.2	Construction and assembly.....	50
18.2.1	General.....	50
18.2.2	Inspection and acceptance testing.....	50
18.3	Tests.....	50
18.3.1	General.....	50
18.3.2	Leakage.....	51
18.3.3	Venting ability and pressure retention.....	51
18.3.4	Pull-off.....	52
19	Rigid fuel lines.....	52
19.1	Marking.....	52
19.2	Construction and assembly.....	52
19.3	Tests.....	52
19.3.1	General.....	52
19.3.2	Continuous operation.....	53
19.3.3	Bending.....	53
20	Flexible fuel lines, hoses, and hose assemblies.....	53
20.1	Markings.....	54
20.1.1	General.....	54
20.1.2	Bulk hoses.....	54
20.1.3	Hose assemblies.....	54
20.1.4	Marking surfaces.....	55
20.1.5	Date code.....	55
20.2	Construction, assembly, and installation instructions.....	55
20.2.1	General.....	55
20.2.2	Linings.....	55
20.2.3	Hose cover.....	55
20.2.4	Protection from permeation or leakage.....	55
20.2.5	Static electricity dissipation.....	56
20.2.6	End connections.....	56
20.2.7	Component literature.....	56
20.3	Tests.....	56
20.3.1	General.....	56
20.3.2	Hydrostatic strength.....	57

ISO 19887-1:2024(en)

20.3.3	Leakage.....	58
20.3.4	Corrosion resistance.....	58
20.3.5	Automotive fluid exposure.....	59
20.3.6	Vibration resistance.....	60
20.3.7	Pressure cycle.....	61
20.3.8	Electrical conductivity.....	63
20.3.9	Hose permeation.....	64
20.3.10	Ultraviolet light and water exposure.....	65
20.3.11	Hydrogen impulse.....	65
20.3.12	Ozone exposure resistance.....	67
20.4	Manufacturing plan.....	67
20.4.1	Documentation.....	67
20.4.2	Production processes.....	67
20.4.3	Leakage test conducted as production test.....	67
21	Filter assemblies.....	68
21.1	Marking.....	68
21.2	Construction and assembly.....	69
21.2.1	General.....	69
21.2.2	Electrical conductivity.....	69
21.3	Tests.....	69
21.3.1	General.....	69
21.3.2	Continuous operation.....	69
22	Fittings.....	70
22.1	Marking.....	70
22.2	Construction and assembly.....	70
22.3	Tests.....	70
22.3.1	General.....	70
22.3.2	Continuous operation.....	71
22.3.3	Repeated assembly.....	71
23	Non-metallic low-pressure rigid fuel lines.....	71
23.1	General.....	71
23.2	Marking.....	71
23.3	Construction and assembly.....	72
23.4	Tests.....	72
23.4.1	General.....	72
23.4.2	Hydrostatic strength.....	72
23.4.3	Continuous operation.....	72
23.4.4	Chloride resistance.....	73
24	Discharge line closures.....	73
24.1	Markings.....	73
24.2	Construction and assembly.....	74
24.2.1	General.....	74
24.2.2	Inspection and acceptance testing.....	74
24.3	Tests.....	74
24.3.1	General.....	74
24.3.2	Continuous operation.....	75
24.3.3	Water jet protection.....	75
24.3.4	Leakage venting.....	75
Annex A (Informative) Extreme thermal cycling test.....		76
Bibliography.....		78

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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, *Specific 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.

ISO 19887-1:2024

<https://standards.iteh.ai/catalog/standards/iso/fc82688d-71eb-4754-b6bd-4ecc75dfbf8b/iso-19887-1-2024>

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 CSA/ANSI HGV 3.1:22.

iTeh Standards (<https://standards.iteh.ai>) Document Preview

[ISO 19887-1:2024](https://standards.iteh.ai/catalog/standards/iso/fc82688d-71eb-4754-b6bd-4ecc75dfbf8b/iso-19887-1-2024)

<https://standards.iteh.ai/catalog/standards/iso/fc82688d-71eb-4754-b6bd-4ecc75dfbf8b/iso-19887-1-2024>

Gaseous Hydrogen — Fuel system components for hydrogen-fuelled vehicles —

Part 1: Land 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 19887-1 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*

ISO 19887-1:2024(en)

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

Ncm³

quantity of the specified gas that occupies a volume of 1 cm³ at a temperature of 293,15 K (20 °C) and an absolute pressure of 101,325 kPa (1 atm)