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Gaseous hydrogen — Fuelling stations —

Part 5: Dispenser hoses and hose assemblies

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Contents

Page

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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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 ISO/TC 197, *Hydrogen technologies*.

A list of all parts in the ISO 19880 series can be found on the ISO website.

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

This document promotes the implementation of performance-based testing for components of dispensing systems and fuelling stations that are based on proven engineering principles, research and the combined expertise of gas utilities, fuel providers, manufacturers, users, and others having specialized experience.

The successful commercialization of hydrogen vehicle technologies requires codes and standards pertaining to fuelling stations, vehicle fuel system components, and the global homologation of standards requirements for technologies with the same end use. Essentially this will allow manufacturers to achieve economies of scale by producing one product for use globally.

International harmonization contributes to reducing technical barriers and stimulates related markets. A series of documents that address hydrogen-fuelled vehicles and fuelling stations is being developed. These documents will provide internationally homologized minimum safety performance criteria at the component level, thus providing a foundation to build a safe “fuelling system”.

This document was developed using the standard ANSI/CSA HGV 4.2-2013.

This document was developed based on five pressure classes of wire or textile reinforced hoses and hose assemblies suitable for use with gaseous hydrogen for hydrogen dispensing. This is based on technologies in use at the time of the development of the requirements.

In the future, other types and classes of hoses and hose assemblies will need to be evaluated to determine the suitability of requirements in this document.

This document applies to newly manufactured hoses and hose assemblies for connecting a dispenser to a high pressure fuelling nozzle.

A nozzle vent hose is included in this document; however the pressure rating may be lower than the nozzle rating, based on the nozzle and dispenser design.

For general hydrogen safety information, see ISO/TR 15916.

Gaseous hydrogen — Fuelling stations —

Part 5: Dispenser hoses and hose assemblies

1 Scope

This document specifies the requirements for wire or textile reinforced hoses and hose assemblies suitable for dispensing hydrogen up to 70 MPa nominal working pressure, in the operating temperature range of −40 °C to 65 °C.

This document contains safety requirements for material, design, manufacture and testing of gaseous hydrogen hose and hose assemblies for hydrogen fuelling stations.

Hoses and hose assemblies excluded from the scope of this document are the following:

1) those used as part of a vehicle high pressure on-board fuel storage system,

2) those used as part of a vehicle low pressure fuel delivery system, and

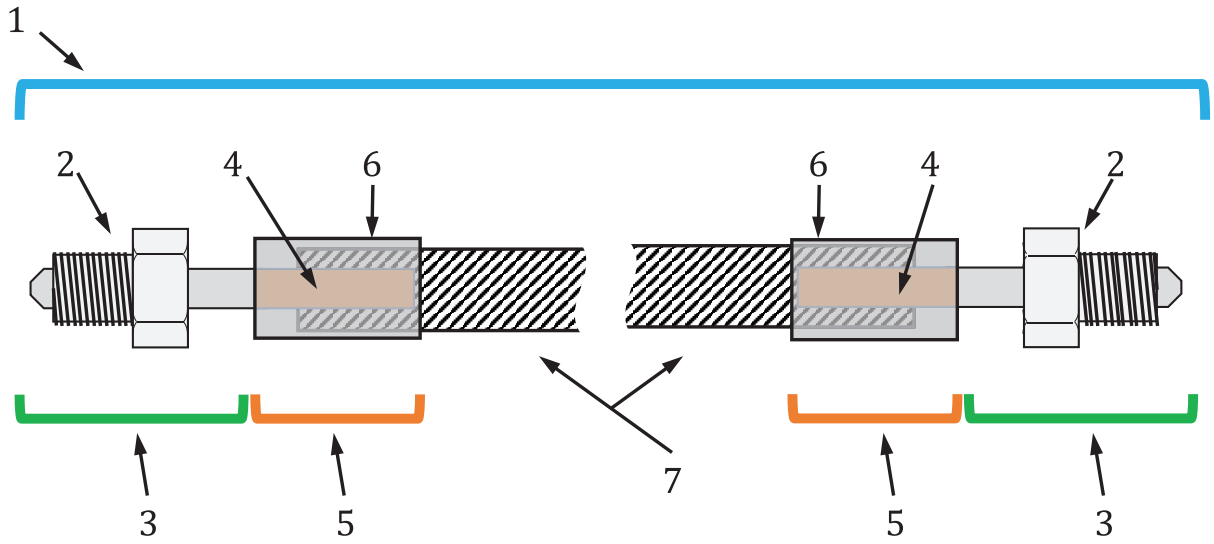
3) flexible metal hoses.

NOTE 1 This document was developed primarily for hoses and hose assemblies for dispensing high pressure hydrogen from refuelling dispensers to hydrogen vehicles. Requirements for hoses used to deliver hydrogen from a transportable vessel (e.g. trailer) into a buffer storage of a station are addressed in ISO 16964.

NOTE 2 Hose assemblies include the hose with connectors on each end (see Figure 1). Each connector has two basic functional elements that are addressed as described below:

1) Coupling to hose. This function is defined by requirements and verified (along with the hose itself) by performance-based tests in this document.

2) Fitting for transition and connection to the piping system or equipment. This function is addressed by reference to appropriate hydrogen equipment standards and piping codes.



Key

1 hose assembly
2 mechanical joint
3 fitting
4 nipple
5 coupling
6 crimped socket
7 hose

Figure 1 — Hose assembly and fitting

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 1402, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing*

ISO 4671, *Rubber and plastics hoses and hose assemblies — Methods of measurement of the dimensions of hoses and the lengths of hose assemblies*

ISO 4080:2009, *Rubber and plastics hoses and hose assemblies — Determination of permeability to gas*

ISO 6802, *Rubber or plastics hoses and hose assemblies — Hydraulic impulse test with flexing*

ISO 6803:2017, *Rubber or plastics hoses and hose assemblies — Hydraulic-pressure impulse test without flexing*

ISO 7326:2016, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

ISO 8031:2009, *Rubber and plastics hoses and hose assemblies — Determination of electrical resistance and conductivity*

ISO 8330, *Rubber and plastics hoses and hose assemblies — Vocabulary*

ISO 8331, *Rubber and plastics hoses and hose assemblies — Guidelines for selection, storage, use and maintenance*

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

ISO 15649, *Petroleum and natural gas industries — Piping*

ISO 16964, *Gas cylinders — Flexible hoses assemblies — Specification and testing*

ISO 17268, *Gaseous hydrogen land vehicle refuelling connection devices*

ISO 19880-1[1)], *Gaseous hydrogen — Fuelling stations — Part 1: General requirements*

ISO 30013, *Rubber and plastics hoses — Methods of exposure to laboratory light sources — Determination of changes in colour, appearance and other physical properties*

IEC 60243-1, *Electric strength of insulating materials — Test methods — Part 1: Tests at power frequencies*

IEC 62631-3-1, *Dielectric and resistive properties of solid insulating materials — Part 3-1: Determination of resistive properties (DC methods) — Volume resistance and volume resistivity — General method*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 8330, ISO 19880-1 and the following apply.

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

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

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

3.1
connector
matching parts (such as male and female parts) that can be put together to form a "connection" which permits the transfer of fluids, electric power, or control signals

Note 1 to entry: *Fittings* (3.4) are a type of connector used in piping systems.

Note 2 to entry: Examples of connectors commonly used in hydrogen systems are as follows:

a) The fuelling nozzle “connector” mates with the receptacle “connector” on the vehicle to form the connection for transfer of compressed hydrogen between the dispenser and the vehicle, as defined in ISO 17268 for this specific application.

b) The hose assemblies have connectors on each end that allow *coupling* (3.2) to the hoses and connection to the piping system (e.g. hose breakaway device or fuelling nozzle).

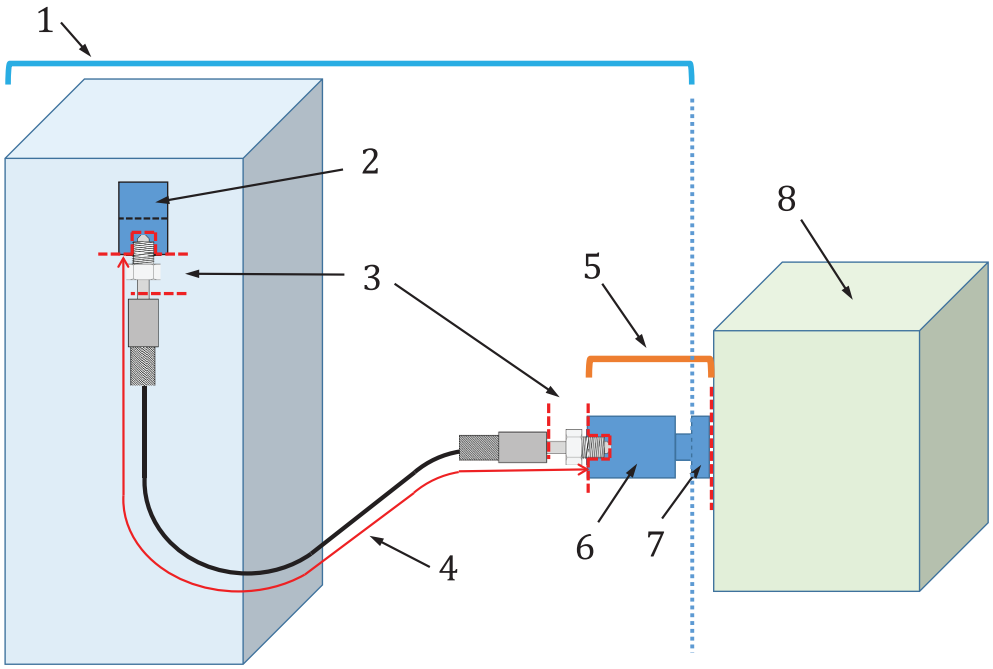
c) Control systems often use electrical connectors to allow rapid and secure assembly or replacement.

3.2
coupling
integrated structure of nipple and socket with end portion of a hose crimped together as shown in Figure 1

3.3
dispenser hose
fuelling hose
hose assembly (3.5) used for dispensing gaseous hydrogen to vehicles through a nozzle

Note 1 to entry: See Figure 2.

1) Under preparation.



Key

1 dispenser
2 hose breakaway device (ISO 19880-3)
3 *fitting* (3.4)
4 *hose assembly* (3.5)
5 *connector* (3.1)
6 nozzle (ISO 17268)
7 receptacle on vehicle (ISO 17268)
8 vehicle

Figure 2 — Components connecting a dispenser to a vehicle

3.4
fitting
connector (3.1) used to join any pressure retaining components in the system, and in the case of the *hose assembly* (3.5), device, usually made of metal, attached to the end of a hose to facilitate connection to equipment or other hose shown in Figure 1

Note 1 to entry: Fittings can be used in a finished hose assembly; however requirements for fittings are out of scope of this document.

3.5
hose assembly
assembly which includes the hose and end connections, including any necessary *fittings* (3.4), bend restrictors, and appropriate markings

3.6
nozzle vent hose
hose used to depressurize the fuelling nozzle and vent the hydrogen to an approved location

3.7
minimum bend radius
smallest specified radius to which a hose may be bent in service

Note 1 to entry: The minimum bend radius is shown in Table 3.

3.8
pressure rating
maximum pressure at which it is permissible to operate a component as specified by the manufacturer at the maximum temperature expected during service

3.9
proof pressure
pressure applied during a non-destructive test and held for a specified period of time to prove the integrity of the construction

4 Classification

This clause applies to newly manufactured hoses and hose assemblies for dispenser hoses connecting the dispenser to the fuelling nozzle supply port.

Hoses and couplings shall meet the requirements in this document with end fittings selected by the manufacturer, customer, or testing agency as required to connect to the test equipment. Fittings shall be consistent with the requirements of the appropriate documents in the ISO 19880-series, ISO 17268, or ISO 15649.

The end fitting of the hose assembly may be changed to another type that meets requirements defined above without the need to repeat the performance tests for verification of the hose assembly and its coupling as long as the hose coupling remains unchanged.

Some newly manufactured hoses and hose assemblies include vent lines required by some fuelling nozzles. Nozzle vent hose assemblies shall meet the requirements of ISO 16964 or the requirements in this document and be appropriately rated for operation in the vent system that has been defined based on the nozzle manufacturer instructions and the dispenser design.

Table 1 converts Hydrogen Service Levels (HSL), as defined in ISO 19880-1, to pressure levels.

When using ISO 16964, the hose rating is 125 % of the working pressure which is 10 % lower than the pressure ratings in Table 1.

A hose assembly shall be designated according to the pressure classes defined in Table 1 or by the manufacturer's stated pressure rating. The information in Table 1 is taken from ISO 19880-1 (and pressure class H11 is added). The pressure rating of the hose assembly shall be equal to or above the dispenser pressure ratings. For further information regarding the relationships between pressure terms, see ISO 19880-1.

Table 1 — Hose assembly pressure levels and minimum pressure ratings

Pressure level (HSL) (MPa)	Pressure class	Maximum allowable working pressure (MAWP) (Minimum component pressure rating for dispenser components) (MPa)
11	H11	15,13
25	H25	34,38
35	H35	48,13
50	H50	68,75
70	H70	96,25

The hoses and hose assemblies shall be designed to operate at temperatures ranging from −40 °C to 65 °C.

5 Materials and construction

5.1 General

The hose and liner shall be constructed with materials that are resistant to corrosion and exposure to hydrogen.

5.2 Lining

The lining shall be of uniform thickness and free from defects. Defects are defined as but are not limited to bubbles, thinning, gouging, or discoloration.

The lining may also consist of multiple material layers.

5.3 Reinforcement

The reinforcement consists of one or more layers of suitable wire or textile material applied by any suitable technique.

5.4 Cover

The cover shall be resistant to abrasion, cracking, crazing, the effects of exposure to ultraviolet light and ozone, be of uniform thickness, and free from defects. Defects may include but are not limited to bubbles, thinning, gouging, or discoloration. All outer covering shall either be of a permeable material or sufficiently perforated to avoid diffused gas build up.

5.5 Static electricity dissipation

5.5.1 General

Static electricity can be generated on the external and interior surface of a hose assembly.

5.5.2 External surface

The hose assembly shall be constructed so as to provide an external, electrically conductive, bonding path between the end couplings to dissipate external static electric charges.

5.5.3 Internal surface

The hose assembly shall be constructed so that the liner provides an adequate internal layer of prevention to avoid dielectric breakdown by static electricity in the fluid during normal use.