



CSA/ANSI HGV 4.5:23
National Standard of Canada
American National Standard



Priority and sequencing equipment for hydrogen fuelling stations



scc  ccn

Legal Notice for Standards

Canadian Standards Association and CSA America Standards Inc. (operating as "CSA Group") develop standards through a consensus standards development process approved by the Standards Council of Canada and the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus and develop a standard. Although CSA Group administers the process and establishes rules to promote fairness in achieving consensus, it does not independently test, evaluate, or verify the content of standards.

Disclaimer and exclusion of liability

This document is provided without any representations, warranties, or conditions of any kind, express or implied, including, without limitation, implied warranties or conditions concerning this document's fitness for a particular purpose or use, its merchantability, or its non-infringement of any third party's intellectual property rights. CSA Group does not warrant the accuracy, completeness, or currency of any of the information published in this document. CSA Group makes no representations or warranties regarding this document's compliance with any applicable statute, rule, or regulation.

IN NO EVENT SHALL CSA GROUP, ITS VOLUNTEERS, MEMBERS, SUBSIDIARIES, OR AFFILIATED COMPANIES, OR THEIR EMPLOYEES, DIRECTORS, OR OFFICERS, BE LIABLE FOR ANY DIRECT, INDIRECT, OR INCIDENTAL DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES, HOWSOEVER CAUSED, INCLUDING BUT NOT LIMITED TO SPECIAL OR CONSEQUENTIAL DAMAGES, LOST REVENUE, BUSINESS INTERRUPTION, LOST OR DAMAGED DATA, OR ANY OTHER COMMERCIAL OR ECONOMIC LOSS, WHETHER BASED IN CONTRACT, TORT (INCLUDING NEGLIGENCE), OR ANY OTHER THEORY OF LIABILITY, ARISING OUT OF OR RESULTING FROM ACCESS TO OR POSSESSION OR USE OF THIS DOCUMENT, EVEN IF CSA GROUP HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES.

In publishing and making this document available, CSA Group is not undertaking to render professional or other services for or on behalf of any person or entity or to perform any duty owed by any person or entity to another person or entity. The information in this document is directed to those who have the appropriate degree of experience to use and apply its contents, and CSA Group accepts no responsibility whatsoever arising in any way from any and all use of or reliance on the information contained in this document.

CSA Group is a private not-for-profit company that publishes voluntary standards and related documents. CSA Group has no power, nor does it undertake, to enforce compliance with the contents of the standards or other documents it publishes.

Intellectual property rights and ownership

As between CSA Group and the users of this document (whether it be in printed or electronic form), CSA Group is the owner, or the authorized licensee, of all works contained herein that are protected by copyright, all trade-marks (except as otherwise noted to the contrary), and all inventions and trade secrets that may be contained in this document, whether or not such inventions and trade secrets are protected by patents and applications for patents. Without limitation, the unauthorized use, modification, copying, or disclosure of this document may violate laws that protect CSA Group's and/or others' intellectual property and may give rise to a right in CSA Group and/or others to seek legal redress for such use, modification, copying, or disclosure. To the extent permitted by licence or by law, CSA Group reserves all intellectual property rights in this document.

Patent rights

Attention is drawn to the possibility that some of the elements of this standard may be the subject of patent rights. CSA Group shall not be held responsible for identifying any or all such patent rights. Users of this standard are expressly advised that determination of the validity of any such patent rights is entirely their own responsibility.

Authorized use of this document

This document is being provided by CSA Group for informational and non-commercial use only. The user of this document is authorized to do only the following:

If this document is in electronic form:

- load this document onto a computer for the sole purpose of reviewing it;
- search and browse this document; and
- print this document if it is in PDF format.

Limited copies of this document in printed or paper form may be distributed only to persons who are authorized by CSA Group to have such copies, and only if this Legal Notice appears on each such copy.

In addition, users may not and must not permit others to

- alter this document in any way or remove this Legal Notice from the attached standard;
- sell this document without authorization from CSA Group; or
- make an electronic copy of this document.

If you do not agree with any of the terms and conditions contained in this Legal Notice, you may not load or use this document or make any copies of the contents hereof, and if you do make such copies, you are required to destroy them immediately. Use of this document constitutes your acceptance of the terms and conditions of this Legal Notice.



Standards Update Service

CSA/ANSI HGV 4.5:23

September 2023

Title: *Priority and sequencing equipment for hydrogen fuelling stations*

To register for e-mail notification about any updates to this publication

- go to www.csagroup.org/store/
- click on **Product Updates**

The **List ID** that you will need to register for updates to this publication is **243116**.

If you require assistance, please e-mail techsupport@csagroup.org or call 416-747-2233.

Visit CSA Group's policy on privacy at www.csagroup.org/legal to find out how we protect your personal information.

Canadian Standards Association (operating as “CSA Group”), under whose auspices this National Standard has been produced, was chartered in 1919 and accredited by the Standards Council of Canada to the National Standards system in 1973. It is a not-for-profit, nonstatutory, voluntary membership association engaged in standards development and certification activities.

CSA Group standards reflect a national consensus of producers and users — including manufacturers, consumers, retailers, unions and professional organizations, and governmental agencies. The standards are used widely by industry and commerce and often adopted by municipal, provincial, and federal governments in their regulations, particularly in the fields of health, safety, building and construction, and the environment.

More than 10 000 members indicate their support for CSA Group’s standards development by volunteering their time and skills to Committee work.

CSA Group offers certification and testing services in support of and as an extension to its standards development activities. To ensure the integrity of its certification process, CSA Group regularly and continually audits and inspects products that bear the CSA Group Mark.

In addition to its head office and laboratory complex in Toronto, CSA Group has regional branch offices in major centres across Canada and inspection and testing agencies in fourteen countries. Since 1919, CSA Group has developed the necessary expertise to meet its corporate mission: CSA Group is an independent service organization whose mission is to provide an open and effective forum for activities facilitating the exchange of goods and services through the use of standards, certification and related services to meet national and international needs.

For further information on CSA Group services, write to
CSA Group
178 Rexdale Boulevard
Toronto, Ontario, M9W 1R3
Canada

A National Standard of Canada is a standard developed by a Standards Council of Canada (SCC) accredited Standards Development Organization, in compliance with requirements and guidance set out by SCC. More information on National Standards of Canada can be found at www.scc.ca.

SCC is a Crown corporation within the portfolio of Innovation, Science and Economic Development (ISED) Canada. With the goal of enhancing Canada’s economic competitiveness and social wellbeing, SCC leads and facilitates the development and use of national and international standards. SCC also coordinates Canadian participation in standards development, and identifies strategies to advance Canadian standardization efforts.

Accreditation services are provided by SCC to various customers, including product certifiers, testing laboratories, and standards development organizations. A list of SCC programs and accredited bodies is publicly available at www.scc.ca.

Standards Council of Canada
600-55 Metcalfe Street
Ottawa, Ontario, K1P 6L5
Canada



Cette Norme Nationale du Canada n’est disponible qu’en anglais.

Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users to judge its suitability for their particular purpose.

®A trademark of the Canadian Standards Association, operating as “CSA Group”

CSA Group

The Canadian Standards Association (operating as “CSA Group”), under whose auspices this National Standard has been produced, was chartered in 1919 and accredited by the Standards Council of Canada to the National Standards system in 1973. It is a not-for-profit, nonstatutory, voluntary membership association engaged in standards development and certification activities.

CSA Group standards reflect a national consensus of producers and users including manufacturers, consumers, retailers, unions and professional organizations, and governmental agencies. The standards are used widely by industry and commerce and often adopted by municipal, provincial, and federal governments in their regulations, particularly in the fields of health, safety, building and construction, and the environment.

More than 10 000 members indicate their support for CSA Group’s standards development by volunteering their time and skills to Committee work.

CSA Group offers certification and testing services in support of and as an extension to its standards development activities. To ensure the integrity of its certification process, CSA Group regularly and continually audits and inspects products that bear the CSA Group Mark.

In addition to its head office and laboratory complex in Toronto, CSA Group has regional branch offices in major centres across Canada and inspection and testing agencies in fourteen countries. Since 1919, CSA Group has developed the necessary expertise to meet its corporate mission: CSA Group is an independent service organization whose mission is to provide an open and effective forum for activities facilitating the exchange of goods and services through the use of standards, certification and related services to meet national and international needs.

For further information on CSA Group services, write to:
CSA Group
178 Rexdale Boulevard, Toronto, Ontario, M1W 1P7
Canada

American National Standards Institute

The American National Standards Institute (ANSI), Inc. is the nationally recognized coordinator of voluntary standards development in the United States through which voluntary organizations, representing virtually every technical discipline and every facet of trade and commerce, organized labor and consumer interests, establish and improve the some 10 000 national consensus standards currently approved as American National Standards.

ANSI provides that the interests of the public may have appropriate participation and representation in standardization activity, and cooperates with departments and agencies of U.S. Federal, state and local governments in achieving compatibility between government codes and standards and the voluntary standards of industry and commerce.

ANSI represents the interests of the United States in international nontreaty organizations such as the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). The Institute maintains close ties with regional organizations such as the Pacific Area Standards Congress (PASC) and the Pan American Standards Commission (COPANT). As such, ANSI coordinates the activities involved in the U.S. participation in the above groups.

ANSI approval of standards is intended to verify that the principles of openness and due process have been followed in the approval procedure and that a consensus of those directly and materially affected by the standards has been achieved. ANSI coordination is intended to assist the voluntary system to ensure that national standards needs are identified and met with a set of standards that are without conflict or unnecessary duplication in their requirements.

Responsibility of approving American standards rests with the
American National Standards Institute, Inc.
25 West 43rd Street, Fourth floor
New York, NY 10036

*National Standard of Canada
American National Standard*

CSA/ANSI HGV 4.5:23

***Priority and sequencing equipment
for hydrogen fuelling stations***



*A trademark of the Canadian Standards Association, and
CSA American Standards Inc., operating as "CSA Group"



American National Standards Institute, Inc.



*Approved on August 14, 2023 by ANSI
Published in September 2023 by CSA Group
A not-for-profit private sector organization
178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3*

*To purchase standards and related publications, visit our Online Store at
www.csagroup.org/store/ or call toll-free 1-800-463-6727 or 416-747-4044.*

ICS 75.200
ISBN 978-1-4883-4847-1

© 2023 Canadian Standards Association
All rights reserved. No part of this publication may be reproduced in any form whatsoever
without the prior permission of the publisher.

Contents

Technical Committee on Hydrogen Transportation 4

Subcommittee on Hydrogen Dispensing Systems 8

Preface 11

SDG Foreword 13

1 Scope 14

- 1.1 Inclusions 14
- 1.2 Exclusions 14
- 1.3 Terminology 14
- 1.4 Units of measure 14

2 Reference publications 14

3 Definitions 17

4 General 17

- 4.1 Safety, durability, and maintainability 17
- 4.2 Alternative components 17
 - 4.2.1 Innovation 17
 - 4.2.2 Testing of alternative components and equipment 17
- 4.3 Risk analysis 18
 - 4.3.1 General 18
 - 4.3.2 Additional guidance 18

5 Materials 18

- 5.1 Suitability 18
- 5.2 Evaluation 18
- 5.3 Wetted materials 18
- 5.4 Hydrogen contamination 18
- 5.5 Environmental conditions 18
- 5.6 Non-ignitability 19
- 5.7 Seals 19
- 5.8 Material acceptability waiver 19

6 Construction and assembly requirements 19

- 6.1 Operating temperatures 19
- 6.2 Gaskets 19
- 6.3 Piping, tubing, and fittings 19
 - 6.3.1 General 19
 - 6.3.2 Design, fabrication, and testing 19
 - 6.3.3 Bends 19
 - 6.3.4 Close pipe nipples 19
 - 6.3.5 Fittings and end connections 19
- 6.4 Electrical equipment and wiring 20

6.4.1	Compliance	20
6.4.2	Electrical continuity	20
6.4.3	Hazardous (classified) locations	20
6.5	Enclosures	20
6.5.1	General	20
6.5.2	Vent openings	20
6.5.3	Gas detection systems	20
6.5.4	Hazardous components	21
6.6	Instrumentation	21
6.7	Fasteners	21
6.7.1	Threads	21
6.7.2	Corrosion resistance	21
6.7.3	Tapered threads	21
6.7.4	Threaded joints	21
6.8	Access	21
6.9	Sharp projections or edges	21
6.10	Assembly	21
7	Test procedures	21
7.1	General	21
7.1.1	Testing temperatures	21
7.1.2	Hydrogen test media	22
7.2	Pressure test	22
7.3	Electrical tests	22
7.3.1	General	22
7.3.2	Ground continuity	22
7.4	Leakage test	22
7.4.1	General	22
7.4.2	Test specimen	22
7.4.3	Test pressures	22
7.4.4	Test media	22
7.4.5	Component isolation	23
7.4.6	Test procedure	23
7.4.7	Pass/fail criteria	23
7.5	Strength test	23
7.5.1	General	23
7.5.2	Test specimen	24
7.5.3	Test pressures	24
7.5.4	Test media	24
7.5.5	Pneumatic strength test	24
7.5.6	Hydrostatic strength test	25
7.5.7	Pass/fail criteria	25
8	Markings and instructions	25
8.1	Markings	25
8.2	Markings characteristics	26
8.3	Marking plates	26
8.4	Installation instructions	26

Annex A (normative) — Manufacturing and production tests 27

Currently in preview, click buy full version

Technical Committee on Hydrogen Transportation

J. Hamilton	California Hydrogen Business Council, Sacramento, California, USA <i>Category: User Interest</i>	<i>Chair</i>
C. Hayes	Swagelok Company, Solon, Ohio, USA <i>Category: Producer Interest</i>	<i>Vice-Chair</i>
A. I. Murra	Abraham Murra Consulting, Santa Margarita, California, USA <i>Category: Gas Supplier</i>	<i>Vice-Chair</i>
K. Beaulieu	Transport Canada, Ottawa, Ontario, Canada	<i>Non-voting</i>
M. Blieske	LIFTE H2 Inc., Boston, Massachusetts, USA	<i>Non-voting</i>
R. S. Bommenahalli	Nikola Motor Corp., Phoenix, Arizona, USA	<i>Non-voting</i>
R. Boyd	Boyd Hydrogen LLC, Spring Lake Heights, New Jersey, USA <i>Category: General Interest</i>	
J. P. Cohen	Chemical Products and Chemicals Inc., Pottsville, Pennsylvania, USA <i>Category: Gas Supplier</i>	
M. Conrad	Ford Motor Company, Dearborn, Michigan, USA	<i>Alternate</i>
W. L. Cooper	Plug Power, Newport Beach, California, USA <i>Category: Gas Supplier</i>	
Early	Compressed Gas Association Inc., Chantilly, Virginia, USA	<i>Non-voting</i>

J. E. Eihusen	Hexagon Lincoln Inc., Lincoln, Nebraska, USA	<i>Non-voting</i>
L. Gambone	Nikola Motor Corp., Phoenix, Arizona, USA <i>Category: User Interest</i>	
E. Girouard	Emcara Gas Development Inc., Guelph, Ontario, Canada <i>Category: Producer Interest</i>	
B. R. Gordon	Ivys Energy Solutions Inc., Somerville, Massachusetts, USA <i>Category: Producer Interest</i>	
K. Harris	John Cockerill, Los Angeles, California, USA	<i>Non-voting</i>
P. Horacek	Powertech Labs Inc., Surrey, British Columbia, Canada <i>Category: General Interest</i>	
J. F. Jordan	Hexagon Agility, Cook, Minnesota, USA <i>Category: User Interest</i>	
S. Katz	S. Katz and Associates Inc., North Vancouver, British Columbia, Canada <i>Category: General Interest</i>	
S. Mathison	FirstElement Fuel Inc., Irvine, California, USA <i>Category: Gas Supplier</i>	
C. McWhinney	Millennium Reign Energy LLC, Dayton, Ohio, USA <i>Category: Producer Interest</i>	
G. Meadows	Westport Fuel Systems Canada Inc., Cambridge, Ontario, Canada	<i>Non-voting</i>
B. Mezher	Luxfer Canada Ltd., Calgary, Alberta, Canada	<i>Non-voting</i>

N. L. Newhouse	Hexagon Lincoln Inc., Lincoln, Nebraska, USA <i>Category: Producer Interest</i>	
D. Patel	ANGI Energy Systems, Janesville, Wisconsin, USA <i>Category: Producer Interest</i>	
K. Quackenbush	Fuel Cell and Hydrogen Energy Association, Washington, DC, USA <i>Category: General Interest</i>	
S. Quong	Quong and Associates Inc., San Francisco, California, USA <i>Category: General Interest</i>	
A. Ryan	Toyota Motor Engineering and Manufacturing North America, Gardena, California, USA	<i>Alternate</i>
A. Sadiku	Energy and Transportation Division at Environment and Climate Change Canada (ECCC), Ottawa, Ontario, Canada	<i>Non-voting</i>
G. Stottler	Stottler Development LLC, Honeoye Falls, New York, USA <i>Category: General Interest</i>	
A. Tchouvelev	A.V. Tchouvelev and Associates Inc., Mississauga, Ontario, Canada <i>Category: General Interest</i>	
M. Tuttle	Hexagon Purus, Westminster, Maryland, USA	<i>Non-voting</i>
M. Veenstra	Ford Motor Company, Dearborn, Michigan, USA <i>Category: User Interest</i>	
C. Webster	TesTneT Canada Inc., Langley, British Columbia, Canada <i>Category: General Interest</i>	
S. Wheaton	Choshu Industry Corporation of America Inc., Calgary, Alberta, Canada <i>Category: Producer Interest</i>	

L. Yang

Toyota Motor Engineering and Manufacturing
North America,
Gardena, California, USA
Category: User Interest

I. Monner

CSA Group,
Calgary, Alberta, Canada

Project Manager

Subcommittee on Hydrogen Dispensing Systems

R. Boyd	Boyd Hydrogen LLC, Spring Lake Heights, New Jersey, USA	<i>Chair</i>
D. Patel	ANGI Energy Systems, Janesville, Wisconsin, USA	<i>Vice-Chair</i>
M. Blieske	LIFTE H2 Inc., Boston, Massachusetts, USA	
R. S. Bommenahalli	Nikola Motor Corp., Phoenix, Arizona, USA	
S. Chigusa	CHOSHU Industry Corporation of America Inc., Rancho Palos Verdes, California, USA	
J. P. Cohen	Air Products and Chemicals Inc., Allentown, Pennsylvania, USA	
W. Collins	WPCSOL LLC, East Windsor, Connecticut, USA	
J. E. Eihusen	Hexagon Lincoln Inc., Lincoln, Nebraska, USA	
N. Farahani	QPS Evaluation Services Inc., Toronto, Ontario, Canada	
B. R. Gordon	Ivys Energy Solutions Inc., Somerville, Massachusetts, USA	
J. Hamilton	California Hydrogen Business Council, Sacramento, California, USA	
A. Harris	Air Liquide, Redwood City, California, USA	
S. Katz	S. Katz and Associates Inc., North Vancouver, British Columbia, Canada	

E. Klett	TotalEnergies Gas Mobility, Nieuwegein, Netherlands
K. Loewenthal	Nikola Motor Corp., Phoenix, Arizona, USA
S. Mathison	FirstElement Fuel, Inc., Irvine, California, USA
K. McKeown	Electric Hydrogen, San Francisco, California, USA
C. McWhinney	Millennium Reign Energy LLC, Dayton, Ohio, USA
A. I. Murra	Abraham Murra Consulting, Santa Margarita, California, USA
C. Nickell	Air Liquide, Houston, Texas, USA
E. Nupoort	Nel Hydrogen A/S, Herning, Denmark
C. Paffhausen	Bennett Pump Co., Spring Lake, Michigan, USA
M. Pirraglia	HYGEN Group, Mississauga, Ontario, Canada
G. Punia	Change Energy Services, Oakville, Ontario, Canada
S. Quong	Quong & Associates Inc., San Francisco, California, USA
P. Sanquini	CRP Industries Inc., South Brunswick Township, New Jersey, USA
Z. Seaver	Plug Power, Latham, New York, USA
J. Stinn	Plug Power, Latham, New York, USA

K. Sumba	ANGI Energy Systems/Gilbarco-Veeder Root, Janesville, Wisconsin, USA	
J. Taylor	Aveum Inc., Winnipeg, Manitoba, Canada	
S. Wheaton	Choshu Industry Corporation of America Inc., Calgary, Alberta, Canada	
A. Willfort	WEH Technologies Inc., Katy, Texas, USA	
E. Wolff-Klammer	UL LLC, Northbrook, Illinois, USA	
L. Yang	Toyota Motor Engineering & Manufacturing North America, Gardena, California, USA	
S. Marxen	CSA Group, Cleveland, Ohio, USA	<i>Project Manager</i>

Preface

This is the second edition of CSA/ANSI HGV 4.5, *Priority and sequencing equipment for hydrogen fuelling stations*. It supersedes the previous edition published in 2013.

The following are the major changes to this edition:

- a) reorganization of content to ensure consistency with current CSA editorial practices; and
- b) harmonization with other hydrogen fuelling documents.

This Standard is considered suitable for use for conformity assessment within the stated scope of the Standard.

CSA Group acknowledges that the development of this Standard was made possible, in part, by the financial support of Natural Resources Canada.

This Standard was prepared by the Subcommittee on Hydrogen Dispensing Systems, under the jurisdiction of the Technical Committee on Hydrogen Transportation and the Strategic Steering Committee on Transportation, and has been formally approved by the Technical Committee.

This Standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

This Standard has been approved by the American National Standards Institute (ANSI) as an American National Standard.

Interpretations: The Strategic Steering Committee on Transportation has provided the following direction for the interpretation of standards under its jurisdiction: “The literal text shall be used in judging compliance of products with the safety requirements of this Standard. When the literal text cannot be applied to the product, such as for new materials or construction, and when a relevant CSA committee interpretation has not already been published, CSA Group’s procedures for interpretation shall be followed to determine the intended safety principle.”

Notes:

- 1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*
- 2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*
- 3) *This Standard was developed by consensus, which is defined by CSA Policy governing standardization — Code of good practice for standardization as “substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity”. It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this Standard.*
- 4) *To submit a request for interpretation of this Standard, please send the following information to inquiries@csagroup.org and include “Request for interpretation” in the subject line:*
 - a) *define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;*
 - b) *provide an explanation of circumstances surrounding the actual field condition; and*
 - c) *where possible, phrase the request in such a way that a specific “yes” or “no” answer will address the issue.*

Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization and are available on the Current Standards Activities page at standardsactivities.csagroup.org.