ANSI/CSA HGV 4.5-2013

CSA Group

Standard for priority and sequencing equipment for hydrogen vehicle fueling

Legal Notice for Standards

Canadian Standards Association and CSA America, Inc. (operating as "CSA Group") develop standards through a consensus standards development process approved by the Standards Council of Canada. 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 print 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 may 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.

CSA Group

Standards Update Service

ANSI/CSA HGV 4.5-2013
March 2013

Title: *Standard for priority and sequencing equipment for hydrogen vehicle fueling*
Pagination: 15 pages, each dated **March 2013**

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

- go to **shop.csa.ca**
- click on **CSA Update Service**

The **List ID** that you will need to register for updates to this publication is **2422626**.

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

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

AMERICAN NATIONAL STANDARD
ANSI/CSA HGV 4.5-2013

First Edition - 2013

APPROVED

March 14, 2013
American National Standards Institute, Inc.

Standard Developer

CSA AMERICA INC.,
Operating as "CSA Group"
8501 East Pleasant Valley Road
Cleveland, Ohio 44131

CANADIAN STANDARDS ASSOCIATION,
Operating as "CSA Group"
5060 Spectrum Way, Suite 100
Mississauga, Ontario, Canada L4W 5N6

Published in March 2013 by CSA Group

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 these 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 National Standards rests with the

American National Standards Institute, Inc.
25 West 43rd Street, Fourth Floor
New York, NY
10036

Preface

This publication represents a standard for requirements for priority and sequencing equipment, which is part of a hydrogen gas vehicle fueling system.

This standard is based on engineering principles, research and the combined expertise of manufacturers, users, and others having specialized experience.

Nothing in this standard is to be considered in any way as indicating a measure of quality beyond compliance with the provisions it contains. It is designed to allow compliance of products which may exceed that specified in the provisions herein. In its preparation, full recognition has been given to possibilities of improvement through ingenuity of design. This standard is subject to revision as further experience and investigation may show it is necessary and desirable.

CSA, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. CSA shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of or reliance upon this standard.

Users of this American National Standard are advised that the devices/products/activities within its scope may be subject to regulation at the federal, state, or local levels. Users are strongly urged to investigate this possibility through appropriate channels. In the event of a conflict with this standard, the federal, state, or local regulations should be followed.

CAUTIONARY NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute, Inc., require that action be taken to reaffirm, revise or withdraw this standard no later than five (5) years from the date of approval. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute, Inc., 25 West 43rd Street, Fourth Floor, New York, N.Y. 10036, (212) 642-4900.

EFFECTIVE DATE: An organization using this standard for product evaluation as a part of its certification program will normally establish the date by which all products certified by that organization should comply with this standard.

History Of The Development Of ANSI HGV 4.5

(This History is informative and is not part of the standard.)

In September 2002, CSA met with the U.S. Department of Energy, Renewable Fuels Group in Washington, D.C. to discuss standards development opportunities in the hydrogen technology area. During this meeting, DOE requested that CSA provide a proposal relating to the development of hydrogen technology standards and codes in the United States.

Industry recognized that an important consideration in the successful commercialization of hydrogen gas as a vehicle fuel was the issue of codes and standards, pertaining to both fueling stations and vehicle fuel system components. CSA undertook the goal of establishing a program for the development of an organized family of coordinated standards that addresses hydrogen gas vehicles and fueling stations.

Industry and CSA recognized there was no standard that addressed requirements for priority and sequencing equipment, which is part of a hydrogen gas vehicle fueling system. The development of such a standard was necessary based on industry needs and feedback:

(1) There were no standards available for priority and sequencing equipment, which is part of a hydrogen gas vehicle fueling system.

(2) Automotive OEMs driving the application of hydrogen as a fuel for vehicles expressed concern over solutions in demonstration projects in the field.

The focus of the priority and sequencing equipment standard established requirements for the performance of priority and sequencing equipment, which is part of a hydrogen gas vehicle fueling system.

CSA has positioned itself as a leader in the fuel cell, hydrogen and natural gas sectors as a Standards Developing Organization (SDO). CSA is aggressively updating and developing national standards, and is playing a major role in the promulgation of US technologies nationally. As US TAG Administrator to IEC TC 105 for Fuel Cell Technologies and as US TAG members of ISO TC 197 and ISO TC 22 / SC 25, CSA is facilitating US technology internationally. CSA organized committees to address technical issues in the development of standards which would affect future expansion of the hydrogen industry.

The HGV 4.5 priority and sequencing equipment standard was processed as an American National Standard in accordance with procedures of the American National Standards Institute (ANSI).

This is the first edition of the HGV 4.5 priority and sequencing equipment standard, and was approved by the American National Standards Institute, Inc. on March 14, 2013.

Previous editions of this standard are as follows:

CSA America HGV 4.5-2009 TIR.

Automotive Technical Committee

Livio Gambone	Powertech Labs Inc.	*Chairman*
Joe Cohen	Air Products and Chemicals Inc.	
Douglas Horne	Clean Vehicle Education Foundation	
John Jordan	Agility Fuel Systems	
Susana Katz	S. Katz and Associates Inc.	
Norman Newhouse	Lincoln Composites, Inc.	
Gini Sage	General Motors of Canada Limited	
Stan Sinclair	Southern California Gas Company	
Neel Sirosh	Quantum Fuel Systems Technologies Worldwide, Inc.	
Mike Spears	SSP Fittings Corporation	
Rhoads Stephenson	Motor Vehicle Fire Research Institute	

NGV/HGV 4.5 Technical Advisory Committee

Dev Patel	Kraus Global Inc.	*(Chairman)*
Robert Boyd	Boyd Hydrogen LLC	
Joe Cohen	Air Products and Chemicals Inc.	
Ron Czischke	Underwriters Laboratories	
John Dimmick	Clean Vehicle Education Foundation	
Hajime Fukumoto	Japan Automobile Research Institute (JARI)	
Aaron Harris	Nuvera Fuel Cells, Inc.	
Douglas Horne	Clean Vehicle Education Foundation	*(Alternate)*
Samuel Lam	BC Ministry of Transportation	
Steven Mathison	Honda R&D Americas, Inc.	
Mark McDougall	Powertech Labs Inc.	*(Alternate)*
Tim McGuire	Mercedes-Benz Research and Development North America Inc.	
Angela Nanalal	Powertech Labs Inc.	
Knut Nerheim	Linde North America, Inc.	
Brian Nowicki	Nuvera Fuel Cell Inc	*(Alternate)*
Spencer Quong	Quong & Associates, Inc.	
Volker Rothe	Adam Opel A	*(Alternate)*
Gini Sage	General Motors of Canada Limited	
Eugene Steele	General Motors Corp	*(Alternate)*
Mike Veenstra	Ford Motor Company	
Perry Wager	Alberta Municipal Affairs Safety	
David Wenger	Wenger Engineering GmbH	

ANSI/CSA HGV 4.5-2013

Priority and sequencing equipment for hydrogen vehicle fueling

Published in March 2013 by CSA Group
A not-for-profit private sector organization
5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6
1-800-463-6727 • 416-747-4044

*To purchase standards and related publications, visit our Online Store at **shop.csa.ca** or call toll-free 1-800-463-6727 or 416-747-4044.*

ISBN 978-1-77139-007-1

Contents

Page

Part I Construction

1.1 Scope 1
1.2 General Construction and Assembly 1
1.3 Equipment and Data to be Furnished by the Manufacturer 2
1.4 Failure Modes and Effects Analysis 3
1.5 Enclosure 3
1.6 Accessibility 3
1.7 Valves 3
1.8 Piping, Tubing and Fittings 3
1.9 Electrical Equipment and Wiring 4
1.10 Installation Instructions 4
1.11 Marking 5

Part II Performance

2.1 General 7
2.2 Leakage 7
2.3 Electrical Tests 8
2.4 Marking Material Adhesion and Legibility 9

Part III Manufacturing and Production Tests 11

Part IV Definitions 13

EXHIBIT A List Of Reference Standards 15

EXHIBIT B Reference List Of All CSA America HGV Series Of Documents 17

APPENDIX A Wire Color Designations 19

This standard contains America equivalents to the SI (Metric) quantities, the purpose being to allow the standard to be used both units. (Standard for use of the International System of Units (SI): The Modern Metric System, IEEE/ASTM SI I0 or Metric Practice Guide, CAN/CSA Z234.1 are used as a guide in making conversions.) If a value for a measurement and an equivalent value in other units, the first stated is to be regarded as the requirement. The given equivalent value may be approximate. If a value for a measurement and an equivalent value in other units, are both specified as a quoted marking requirement, the first stated unit, or both shall be provided.

ANSI/CSA HGV 4.5-2013
Priority and sequencing equipment for hydrogen vehicle fueling

Part I: Construction

1.1 Scope

1.1.1
These requirements apply to priority and sequencing equipment (see Part IV - Definitions) which is part of a hydrogen gas vehicle fueling system, hereinafter referred to as equipment.

1.1.2
Priority and sequencing equipment of a type not specifically addressed in these requirements may be subjected to such examinations and tests as deemed necessary by the testing agency to determine compliance with the intent of these requirements.

1.1.3
If a value for measurement, as given in these requirements, is followed by an equivalent value in other units, the first stated value is to be regarded as the specification.

1.2 General Construction and Assembly

1.2.1
Construction of equipment, whether specifically covered by provisions of these requirements or not, shall be in accordance with reasonable concepts of safety, substantiality and durability.

All specifications as to construction, set forth herein, may be satisfied by the construction actually prescribed or such other construction as will provide at least equivalent performance.

1.2.2
Equipment shall be suitable as a minimum for operation at ambient temperatures of -40°C (-40°F) to 60°C (140°F). Also see section 1.2.8.

1.2.3
All parts that may be contacted during normal adjustment or servicing shall be free from sharp projections or edges and projecting screw ends.

1.2.4
All parts shall be of such construction or installation so the equipment is secure against displacement, distortion, warping, or other damage and shall be supported to maintain a fixed relationship with each other.