CSA/ANSI NGV 3.1:20

National Standard of Canada
American National Standard

Fuel system components for compressed natural gas powered vehicles

Approved American National Standard
ANSI

Standards Council of Canada
Conseil canadien des normes

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 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.

Standards Update Service

CSA/ANSI NGV 3.1:20
March 2020

Title: *Fuel system components for compressed natural gas powered vehicles*

To register for e-mail notification about any updates to this publication
- go to **store.csagroup.org**
- click on **Product Updates**

The **List ID** that you will need to register for updates to this publication is **24276**.

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.

Individuals, companies, and associations across Canada indicate their support for CSA Group's standards development by volunteering their time and skills to Committee work and supporting CSA Group's objectives through sustaining memberships. The more than 7000 committee volunteers and the 2000 sustaining memberships together form CSA Group's total membership from which its Directors are chosen. Sustaining memberships represent a major source of income for CSA Group's standards development activities.

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 eight 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 well-being, 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

Standards Council of Canada
Conseil canadien des normes

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.

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.

Individuals, companies, and associations across Canada indicate their support for CSA Group's standards development by volunteering their time and skills to Committee work and supporting CSA Groups objectives through sustaining memberships. The more than 7000 committee volunteers and the 2000 sustaining memberships together form CSA Group's total membership from which its Directors are chosen. Sustaining memberships represent a major source of income for CSA Groups standards development activities.

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 eight 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,
Canada M9W 1R3

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 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 NGV 3.1:20

Fuel system components for compressed natural gas powered vehicles

Interprovincial Gas Advisory Council

American National Standards Institute, Inc.

Approved on March 17, 2020 by ANSI
Approved on January 14, 2020 by IGAC
Published in March 2020 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 store.csagroup.org or call toll-free 1-800-463-6727 or 416-747-4044.

ICS 43.060.40
ISBN 978-1-4883-2607-3

Contents

Preface

This is the fourth edition of CSA/ANSI NGV 3.1, *Fuel system components for compressed natural gas powered vehicles*. It supersedes the previous editions published in 2014, 2012, and 1995 as ANSI NGV 3.1 • CSA 12.3.

The major changes to this edition include the following:

a) References have been updated.
b) Editorial/notation changes have been made to improve readability.
c) Notes have been added for guidance.
d) Technical changes have been made to the following Clauses: 5.3.3, 5.4, 5.5, 5.7.3.3, 5.11, 7.3, 7.4, 10.4.2, 14.4.4, 14.4.6, and 16.4.4.2.
e) The following new Clauses have been added: 5.16, 6.5, 9.4.3.1, 9.4.4, 10.4.4, 11.3, 11.4.4, 11.4.5, 15.4.4.3, 19.4.6, 19.4.8, and 21.4.2.

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

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

This Standard was prepared by the Subcommittee on Onboard Vehicle Components for Natural Gas Vehicles, under the jurisdiction of the Technical Committee on Natural Gas Transportation and the Strategic Steering Committee on Transportation, and has been formally approved by the Technical Committee and the Interprovincial Gas Advisory Council.

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.

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.csa.ca****.*

5) *This Standard is subject to review within five years from the date of publication. Suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to* ***inquiries@csagroup.org*** *and include "Proposal for change" in the subject line:*
   a) *Standard designation (number);*
   b) *relevant clause, table, and/or figure number;*
   c) *wording of the proposed change; and*
   d) *rationale for the change.*

CSA/ANSI NGV 3.1:20
Fuel system components for compressed natural gas powered vehicles

0 History of the development of CSA/ANSI NGV 3.1

Note: *This history is informative and is not part of the Standard.*

In 1984 there was a growing need in the U.S. natural gas vehicle industry for guidelines pertaining to the assembly of aftermarket equipment installed on motor vehicles in order to operate alternatively on either gasoline or natural gas. The American Gas Association Laboratories (AGAL), in response to this need, developed an A.G.A. Requirement for Natural Gas Vehicle (CNG) Conversion Kits, No. 1-85. This requirement was intended to help promote the safe development and installation of NGV conversion systems by manufacturers and installers. The first draft of A.G.A. Requirement No. 1-85 was developed during 1984 and 1985, with the final version dated August 20, 1985.

At the time of its issuance, A.G.A. No. 1-85 was in compliance with NGV equipment and fuelling stations specifications published by the National Fire Protection Association (NFPA) under its Standard for Compressed Natural Gas (CNG) Vehicular Fuel Systems, NFPA 52. The first edition of NFPA 52 was issued in 1984. A second edition was issued in 1988.

In 1988, a group of U.S. gas utilities formed the Natural Gas Vehicle (NGV) Coalition (the Coalition) to promote widespread use of compressed natural gas as a transport fuel. The Coalition organized committees to address technical, marketing, and legislative issues which would affect the future expansion of a U.S. transportation industry fuelled by natural gas.

The Coalition recognized that an important consideration in the successful commercialization of natural gas as a vehicle fuel was the issue of codes and standards (or the lack of codes and standards, or harmonized codes and standards) pertaining to both fuel stations and vehicle fuel systems. The Coalition's Technology Committee was established to achieve the goal of an organized family of coordinated codes, standards, and regulations addressing natural gas vehicles and fuelling stations. To help achieve this goal, the Technology Committee established the Standards and Standardization Subcommittee.

Subsequently, the third edition of NFPA 52 was published in 1992. This edition incorporated many changes developed and recommended by the NGV Coalition's task groups.

During August 1992, an NGV Conversion Equipment Task Group was established to coordinate with the AGAL for requirements for compressed NGV conversion kits. The task group agreed the phrase "NGV fuel system" should replace "NGV conversion kits". (An NGV fuel system is comprised of all major components required to supply, manage, and/or control fuel flow, enabling a vehicle to operate on natural gas.) The task group continued to meet during August, October, and December 1992 to promulgate the development of a standard to cover both dedicated and bi-fuel natural gas systems for light and medium duty vehicles.

A standard for NGV fuel system components existed in Canada, the National Standard of Canada CAN/CGA-12.3, *Fuel System Components for Natural Gas Powered Vehicles*. The genesis for this Canadian document was the Amendment to the 1982 CGA B149.1 *Natural Gas Installation Code* which added to the Code provisions for Natural Gas for Vehicles (NGV) fuel system components on highway

vehicles, as well as coverage of NGV refuelling stations. Subsequently, these NGV aspects evolved into stand-alone Canadian documents, one being the CAN/CGA-12.3 which was first published in February 1991.

In order to further common goals for North American harmonization, the task group and the Canadian Gas Association (CGA) NGV Steering Committee on Natural Gas Powered Vehicles initiated formation of a joint activity involving the CGA Steering Committee's Subcommittee on Fuel System Components for Natural Gas Powered Vehicles and the Coalition's NGV Conversion Equipment Task Group.

On February 17, 1993, the first joint meeting of the NGV Conversion Equipment Task Group and the CGA 12.3 Standards Subcommittee on *Fuel System Components for Natural Gas Powered Vehicles* was held. As a result, the U.S. Task Group and Canadian Subcommittee agreed to establish the Joint NGVC/CGA Subcommittee on Natural Gas Vehicle Conversion Equipment, to develop harmonized requirements for a North American Bi-National standard. The newly established subcommittee agreed to proceed with harmonization of the Canadian Standard for *Fuel System Components for Natural Gas Powered Vehicles*, CAN/CGA-12.3, which was first published in February 1991, and A.G.A. Requirement 1-85. In light of the different approaches in Canada and the U.S. (i.e., systems vs. components), the joint subcommittee agreed that separate harmonized standards be developed for both complete fuel systems and individual system components. Two joint working groups were established to draft the standards requirements for NGV conversion fuel system components and NGV conversion fuel systems, for consideration and final approval by the joint subcommittee.

A standard was prepared by the Joint U.S./Canadian Conversion Component Working Group during several meetings over a period of two years and involved four drafts.

At its July 1994 meeting, the Joint NGVC/CGA Conversion Equipment Subcommittee reviewed and modified the fourth draft of the proposed harmonized standard and voted affirmatively to initiate an ANSI Canvass Ballot and Canadian Public Review and Comment to initiate national recognition and approval of the standard.

During August 1994, the A.G.A. Laboratories and Canadian Gas Association initiated a 60 day ANSI Canvass Ballot and Canadian Public Review and Comment of proposed AGA NGV 3.1/CGA 12.3 — Draft 5. At its November 29, 1994 meeting, the joint subcommittee considered and resolved all comments and criticisms received during public review and accepted several minor editorial modifications of the draft.

The first edition of the harmonized U.S/Canadian Standard for *Fuel System Components for Natural Gas Powered Vehicles* was approved by the American National Standards Institute, Inc. on May 10, 1995, the CGA NGV Standards Steering Committee on Natural Gas Vehicles and Fuelling on April 17, 1995, and by the Canadian Interprovincial Gas Advisory Council (IGAC) on June 16, 1995.

In 2007, in response to industry requests, the standard was revised and rewritten in its entirety, and was published as the second edition of ANSI NGV 3.1 • CSA 12.3.

The second edition of the Standard for *Fuel System Components for Compressed Natural Gas Powered Vehicles* was approved by the American National Standards Institute, Inc. on February 14, 2012, and by the Harmonized Joint Automotive Technical Committee on March 25, 2010.

The third edition of the Standard for *Fuel system components for compressed natural gas powered vehicles* was approved by the American National Standards Institute, Inc. on February 25, 2014, the Joint Automotive Technical Committee on February 20, 2014, the Technical Committee on Natural Gas

Powered Vehicles and Fuelling on January 24, 2014, and by the Canadian Interprovincial Gas Advisory Council (IGAC) on February 27, 2014.

This, the fourth edition of this Standard, was prepared by the Subcommittee on Onboard Vehicle Components for Natural Gas Vehicles, under the jurisdiction of the Technical Committee on Natural Gas Transportation and the Strategic Steering Committee on Transportation, and has been formally approved by the Technical Committee on Natural Gas Transportation, the Interprovincial Gas Advisory Council, the Standards Council of Canada, and the American National Standards Institute.

Previous editions of this Standard are as follows:

ANSI/AGA NGV 3.1-1995/CGA 12.3-M95
ANSI NGV 3.1-2012 • CSA 12.3-2012
ANSI NGV 3.1-2014 • CSA 12.3-2014

The following identifies the designation and the year of the harmonized Standard:

CSA/ANSI NGV 3.1:20

1 Scope

1.1

This Standard establishes requirements for newly produced compressed natural gas fuel system components, intended for use on natural gas powered vehicles, as listed in Table 1.

Table 1
Fuel system components
(See Clauses 1.1 and 1.5.)

Check valves
Manual valves
Manual container valves
Automatic valves
Gas injectors
Pressure indicators
Pressure regulators
Gas flow adjusters
Gas/air mixers
Pressure relief valves
Pressure relief devices
Excess flow valves
Gas-tight housing and ventilation hoses
Rigid fuel lines
Flexible fuel line, hoses, and assemblies
Filters
Fittings
Discharge line closures

1.2

This Standard applies to devices that have a service pressure (SP) of either 16 500 kPa (2400 psi), 20 700 kPa (3000 psi), or 24 800 kPa (3600 psi), hereinafter referred to in this Standard as the following:

a) "P24" – 16 547 kPa (2400 psi);
b) "P30" – 20 684 kPa (3000 psi); or
c) "P36" – 24 821 kPa (3600 psi).

The Standard also applies to components downstream of the first stage of pressure reduction.

1.3

The construction of the noted components, whether specifically covered by the various provisions of this Standard or not, should be in accordance with reasonable concepts of safety, performance, and durability.

1.4

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

1.5

This Standard emphasizes the pressure containment, performance, and safety characteristics of components listed in Table 1.

1.6

It is recognized that other components not specifically covered herein can be examined to meet the criteria of this Standard and tested according to the appropriate functional needs.

1.7

This Standard does not apply to the following:

a) natural gas fuel system components incorporated during the manufacture of motor vehicles originally manufactured in compliance with the *Federal Motor Vehicle Safety Standards (FMVSS) for Compressed Natural Gas Fueled Vehicles* and the *Canadian Motor Vehicle Safety Standard (CMVSS);*
b) fuel containers;
c) stationary gas engines;
d) container mounting hardware;
e) electronic fuel management;
f) fuelling receptacles; or
g) three-way valves.

1.8

In the case of conflict between this Standard and federal, provincial, state, or local requirements, the government requirements should take precedence.

1.9

All references to "kPa (psi)" throughout this Standard should be considered gauge pressures, unless otherwise specified.