

American National Standard/
CSA Standard For
**Automatic Gas Shutoff
Devices For Hot Water
Supply Systems**

11/13/2015 23:27:08 MST

AMERICAN NATIONAL STANDARD
ANSI Z21.87-2007

CSA STANDARD
CSA 4.6-2007

Second Edition - 2007
This Standard is based on the Standard for
Automatic Gas Shutoff Devices
For Hot Water Supply Systems
ANSI Z21.87-1999 • CSA 4.6-M99
and ANSI Z21.87a-2004 • CSA 4.6a-2004,
ANSI Z21.87b-2005 • CSA 4.6b-2005

APPROVED



July 19, 2007
American National Standards Institute, Inc.

IGAC

September 14, 2007
Interprovincial Gas Advisory Council
Effective in Canada May 1, 2009

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Published - October 2007

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Preface

This publication represents a basic standard for safe operation, substantial and durable construction, and acceptable performance of automatic gas shutoff devices for hot water supply systems. It is the result of years of experience in the manufacture, testing, installation, maintenance, inspection and research on automatic gas shutoff devices for hot water supply systems. There are risks of injury to persons inherent in appliances that, if completely eliminated, would defeat the utility of the appliance. The provisions in this standard are intended to help reduce such risks while retaining the normal operation of the appliance.

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 automatic gas shutoff devices for hot water supply systems, the safety construction and performance of which may exceed the various provisions specified herein. In its preparation, recognition has been given to possibilities of improvement through ingenuity of design. As progress takes place, revisions may become necessary. When they are believed desirable, recommendations or suggestions should be forwarded to the Chairman of the Z21/83 Committee, 8501 East Pleasant Valley Road, Cleveland, Ohio 44131, or the Chairman of CSA Technical Committee on Gas Appliances and Related Accessories, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6.

Safe and satisfactory operation of automatic gas shutoff devices for hot water supply systems depends to a great extent upon its proper installation, use and maintenance. It should be installed, as applicable, in accordance with the *National Fuel Gas Code, ANSI Z223.1*; the *Natural Gas and Propane Installation Code, CAN/CSA-B149.1*.

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

THIS STANDARD IS INTENDED TO BE USED BY THE MANUFACTURING SECTOR AND BY THOSE APPLYING THE EQUIPMENT AND BY THOSE RESPONSIBLE FOR ITS PROPER INSTALLATION. IT IS THE RESPONSIBILITY OF THESE USERS TO DETERMINE THAT IN EACH CASE THIS STANDARD IS SUITABLE FOR AND APPLICABLE TO THE SPECIFIC USE THEY INTEND.

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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 The Standard For Automatic Gas Shutoff Devices For Hot Water Supply Systems

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

With the onset of the Free Trade Agreement between the United States and Canada on January 2, 1988, significant attention was given to the harmonization of the United States and Canadian safety standards addressing gas-fired equipment for residential, commercial and industrial applications. It was believed that the elimination of the differences between the standards would remove potential trade barriers and provide an atmosphere in which North American manufacturers could market more freely in the United States and Canada. The harmonization of these standards was also seen as a step toward harmonization with international standards. Joint subcommittees were established to facilitate the standards harmonization process between the United States and Canada.

At its October 24, 1995 meeting, the Z21/CGA Joint Subcommittee on Standards for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems appointed an ad hoc working group to prepare a draft bi-national standard for Automatic Gas Shutoff Devices. By letter ballot dated May 16, 1997, the joint subcommittee approved sending the draft standard for public review and comment.

The first draft harmonized standard was based on current coverage from the American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems, Z21.22-1986, and the Canadian Gas Association Standard for Automatic Gas Shutoff Valves and Devices for Hot Water Supply Systems, CAN1-4.6-78.

Following reconsideration and modification of the proposed draft standard, in light of comments received, the joint relief valve subcommittee at its September 30, 1997 meeting, recommended the proposed draft standard to Accredited Standards Committee Z21/83 and the (Interim CSA) Standards Steering Committee for approval.

The proposed draft of the harmonized standard for automatic gas shutoff devices, as modified by the joint subcommittee, was approved by the Z21/83 Committee at its April 30, 1998 meeting, and by the CGA Standards Steering Committee by letter ballot dated October 27, 1998.

The first edition of the American National Standard/CSA Standard for Automatic Gas Shutoff Devices for Hot Water Supply Systems was approved by the Canadian Interprovincial Gas Advisory Council on January 21, 1999, and by the American National Standards Institute, Inc., on October 16, 1998.

The second edition of the American National Standard/CSA Standard for Automatic Gas Shutoff Devices for Hot Water Supply Systems was approved by the Canadian Interprovincial Gas Advisory Council on September 14, 2007, and by the American National Standards Institute, Inc., on July 19, 2007.

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

ANSI Z21.87-1999 • CSA 4.6-M99
ANSI Z21.87a-2004 • CSA 4.6a-2004
ANSI Z21.87b-2005 • CSA 4.6b-2005

The following identifies the designation and year of the second edition of the standard:

ANSI Z21.87-2007 • CSA 4.6-2007

Note: This the second edition of Z21.87 • CSA 4.6 incorporates changes to the 1999 edition and addenda thereto. Changes, other than editorial, are denoted by a vertical line in the margin.

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NOTE

This standard contains SI (Metric) equivalents to the yard/pound quantities, the purpose being to allow the standard to be used in SI (Metric) units. (IEEE/ASTM SI-10 or CAN/CSA Z234.1 are used as a guide in making metric conversion from yard/pound quantities.) 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. Except as noted if in Exhibit A, 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.

American National Standard/CSA Standard For Automatic Gas Shutoff Devices For Hot Water Supply Systems

Part I: Construction

1.1 Scope

1.1.1

This standard applies to newly produced automatic gas shutoff valves and devices constructed entirely of new, unused parts and materials.

When the term “device” is used in a provision of this standard, it refers to all types of automatic gas shutoff devices, unless otherwise specified.

1.1.2

An automatic gas shutoff device shall operate when the temperature sensing element is at 210°F (99°C) or less. A device with a higher operating temperature is not acceptable under this standard.

1.1.3

Exhibit A, Items Unique to the United States, contains provisions that are unique to the United States.

1.1.4

Exhibit B, Items Unique to Canada, contains provisions that are unique to Canada.

1.1.5

Exhibit C, List of Reference Standards, contains a list of reference standards.

1.2 General

1.2.1

An automatic gas shutoff valve shall be of the automatic reset type or the manual reset type.

A single-use type fusible cartridge or linkage shall not be employed in an automatic gas shutoff valve.

An automatic gas shutoff device designed to be part of an electrical system shall be of the automatic reset type, the manual reset type or the single-use type.

1.2.2

The construction of valves and shutoff devices shall be such that, in the course of normal handling and installation, they will not become damaged to an extent that would prevent their continued compliance with this standard.

1.2.3

The construction of parts not covered by this standard 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.

1.2.4

A gas shutoff device which is an integral assembly of a gas shutoff valve and an immersion type of temperature sensing element shall be constructed so that water will not pass into gas channels in the event of failure of parts immersed in water. Construction such that any surface exposed to water is without joints or seams, or has properly welded, brazed, silver-soldered or pressure-tight threaded joints, shall be considered as complying with this provision.

1.2.5

The electrical contacts of switches shall be totally enclosed to prevent the entrance of dust or foreign matter.

1.2.6

The electrical contacts of switches shall open to effect gas shutoff.

1.2.7

Thermistor(s) used in automatic gas shutoff devices shall comply with the applicable provisions of the *Standard for Thermistor-Type Devices, UL 1434*.

1.2.8

Thermistors used as temperature sensors shall not carry a load current.

1.3 Data Furnished By Manufacturer

The manufacturer shall furnish the following as appropriate, for use by the testing agency in examining devices under this standard.

- a. Drawings, blueprints, or photographs which describe each model, as specified by the testing agency.
- b. Shutoff and reset temperature.
- c. Each component of an automatic gas shutoff device shall be capable of operations throughout an ambient temperature range of 32°F (0°C) to 125°F (51.5°C). The manufacturer is allowed to specify temperatures below 32°F (0°C) and above 125°F (51.5°C).
- d. The fuel gases for which intended.
- e. Capacity with 1000 Btu/ft³ (37.26 MJ/m³), 0.64 specific gravity gas at a pressure drop of 1.0 in wc (249 Pa).
- f. Minimum and maximum electrical resistance.
- g. The rated current at rated voltage.
- h. Documentation and risk assessment for safety-related software (See [2.6.2](#)).

1.4 Materials

1.4.1

Polymeric insulating material(s) and enclosures shall comply with the *Standard for Polymeric Materials Use in Electrical Equipment Evaluations, UL 746C*. Dust covers are not considered to be enclosures and are exempt from this provision.

1.4.2

A polymeric part intended for the direct support of current-carrying parts, or as an electrical enclosure, shall be molded from material classified as 94-5VA, 95-5VB, 94V-0, or 94V-2 by the vertical burning test described in the *Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94* or the equivalent classification in the *Standard for Evaluation of Properties of Polymeric Materials CAN/CSA C22.2 No. 0.17*.

1.4.3

Devices employing a nonmetallic electrical enclosure shall withstand a 3.32 lb-ft (4.5 Nm) impact without exposure of live parts, impairment of operation, or creation of a risk of electrical shock.

Method of Test

The enclosure shall be mounted securely in a position of intended use on a surface representative of a typical installation. A 1.18 lb (535 g), 2 in (50.8 mm) diameter steel sphere is to be dropped from a height of 33.75 in (857 mm) or swung through a pendulum arc from a sufficient height to apply 3.32 lb-ft (4.5 Nm) of energy to the weakest section of the enclosure.

Following the impact, the device shall be examined and energized from a source of rated voltage and frequency and checked for normal operation. Cracking of the enclosure is acceptable if it does not impair operation of the device. Following the impact test the device shall comply with [2.2.1](#) (shutoff and reset temperatures).

1.5 Connections And Flow Areas

1.5.1

Tappings and threadings for connecting the device to tanks, gas pipes, water pipes or drains shall be provided with cleanly cut taper pipe threads in accordance with the *Standard for Pipe Threads, General Purpose (Inch), ANSI/ASME B1.20.1*.

Inlet and outlet connections shall be designed so that when a pipe which is threaded two threads beyond standard (for the size in question) is run into the threaded portion of a valve body, it will not materially reduce the capacity of the valve, distort any portion of the valve body, or adversely affect the operation of the valve.

1.5.2

All valve connections (inlet, outlet, etc.) shall be permanently marked to aid in correct installation of the device. Only markings which are stamped, etched, or cast on the valve shall be considered as complying with this provision.

1.6 Bolts, Nuts And Screws

Threads of bolts, nuts and screws used in the assembly of body parts or for installation of the device shall be in accordance with the *Standard for Unified Inch Screw Threads (UN and UNR Thread Form)*, *ANSI/ASME B1.1*; *International Organization for Standardization Standard for ISO General Purpose Screw Threads - Basic Profile, ISO 68-1*; or *General Purpose Metric Screw Threads - General Plan, ISO 261*.

1.7 Adjustments

1.7.1

Devices covered by this standard shall have no means for field adjustment of temperature settings.

1.7.2

An automatic gas shutoff device having a temperature sensing element shall have no means for removal of the sensing element without disassembly of the device.

1.8 Strength

1.8.1

The strength of all parts and joints of the body of the device shall be such that no evidence of leakage or permanent deformation will develop as a result of the tests specified herein.

1.8.2

The device shall be capable of withstanding, without deformation, breakage or leakage, the turning effort exerted to connect the device to a tank or piping specified in Table I, Turning Effect.

Method of Test

Five samples of each style of device shall be subjected to the tests specified and none shall show evidence of design failure.

A pipe wrench or open-end wrench shall be utilized to apply the turning force. The turning force shall be applied to the wrench grip of the device or to the body of the device if a wrench grip is not provided. The measured torque specified in Table I shall be applied to the completely assembled device in fitting it into a tank or extra heavy piping of suitable size. Pipe thread lubricants and sealants shall not be used. After the force has been applied for 15 minutes, it shall be released, the device removed and examined for deformation or breakage, and then subjected to the leakage test(s) specified in [2.3, Leakage](#).

1.8.3

All parts of an automatic gas shutoff valve subjected to gas pressure, except a diaphragm, shall withstand a static pressure of 2.5 psi (17.2 kPa).

Method of Test

A separate automatic gas shutoff valve not used for the conduct of other tests shall be used for this test.

The inlet and outlet of the valve shall be connected to a suitable hydraulic system under room temperature conditions [$77 \pm 10^\circ\text{F}$ ($25 \pm 5.5^\circ\text{C}$)].

The pressure shall be raised slowly to 2.5 psi (17.2 kPa) and held at that pressure for 1 minute.

For a diaphragm type valve, the diaphragm shall be substantially removed to permit the test medium to flow freely to both sides of the diaphragm chamber.

There shall be no sign of rupture or mechanical dislocation of parts of the enclosure communicating with the atmosphere.

1.8.4

A surface contact type gas shutoff device shall be constructed so as to provide means for holding the device securely against a tank without distorting the body or changing the electrical or operating characteristics.

1.9 Corrosion

1.9.1

Parts of a valve which are constantly in contact with water shall possess a resistance to corrosion equivalent to that of brass containing at least 60 percent copper.

1.9.2

Materials, or coatings of materials provided with protective coatings, for automatic mechanisms and current-carrying components exposed to fuel gases shall be resistant to moisture, sulfur compounds, corrosion and the effects of such gases. Parts containing in excess of 65 percent copper exposed to fuel gas, other than cast or forged bodies, shall be protected from the effects of sulfur-bearing compounds.

1.9.3

Surface of millivoltage switching contacts shall be of gold or equivalent.

1.9.4

Surfaces of electrical terminal connections shall be coated with tin or equivalently treated.

1.10 Thermal Sensing Element Tubes

For a device containing part(s) intended for contact with potable water, the manufacturer shall supply evidence satisfactory to the testing agency that material used as a protective coating for thermal sensing element tubes is suitable for the service, particularly with respect to toxicity, solubility, brittleness and temperature limits. Evidence of current certification under *National Sanitation Foundation Standard ANSI/NSF 14, Plastic Piping System Components and Related Materials* with appropriate end use shall be deemed acceptable.

1.11 Assembly

The construction of an automatic gas shutoff valve shall be such that operating parts are not capable of field disassembly. Use of tamper-resistant fastenings is acceptable.

1.12 Instructions

1.12.1

A device supplied for field installation shall be accompanied by complete and proper installation instructions. These instructions shall be reviewed by the testing agency for accuracy and compatibility with results of test from a technical standpoint.

1.12.2

Instructions for immersion type gas shutoff devices that do not have extension elements shall specify that the valve be mounted directly in a tank tapping located within the top 6 in (152 mm) of the tank and shall be adequately insulated and located so as to be isolated from flue gas heat or other ambient conditions that are not indicative of stored water temperature.

Instructions for a surface contact type gas shutoff device shall specify that the temperature sensing element be securely located against the exterior surface of the tank within 6 in (152 mm) of the top and shall be adequately insulated and located so as to be isolated from flue gas heat or other ambient conditions that are not indicative of stored water temperature.

Sketches or diagrams showing recommended methods of installation shall be provided.

1.13 Marking

1.13.1

Each automatic gas shutoff device and automatic gas shutoff valve shall bear a marking on which appears the following:

- a. Manufacturer's or dealer's name, trademark or symbol.
- b. Name or model number of the device.
- c. Symbol of the organization making the tests for compliance with this standard.

1.13.2

Each automatic gas shutoff device shall bear a separate marking indicating the date of manufacture. This marking shall be as specified in "a," "b" or "c" below:

- a. The date in the form of:
 1. The month, day and year; or
 2. The day, month and year.

The abbreviation of the month shall be at least the first three letters of the month. The day may be the Monday of the week and the year must be at least the last two digits of the year.

- b. A four digit code consisting of:
 1. The first and second digits indicating the calendar year in which the device was manufactured (e.g., 07 for 2007).
 2. The third and fourth digits indicating the week in which the device was manufactured (e.g., 03 for the third week of the year). For purposes of this marking, a week shall begin at 0001 hours on Sunday and end at 2400 hours on Saturday.

A four digit date code may be used for more than one week; however, it shall not be used for more than four consecutive weeks, nor for more than two weeks into the next calendar year.

Additional numbers, letters or symbols may follow the four digit number specified in "-a" and "-b." If additional numbers are used, they must be separated from the date code.

c. A five-digit code consisting of:

1. The first and second digits indicating the calendar year in which the automatic gas shutoff device was manufactured (e.g., 07 for 2007); and
2. The third, fourth and fifth digits indicating the day of the year in which the automatic gas shutoff device was manufactured (e.g., 183 for the one hundred and eighty-third day in the year 2007, which is July 2, 2007).

Additional numbers, letters or symbols may follow the five digit code. If additional numbers are used, they shall be separated from the five-digit code.

1.13.3

Automatic gas shutoff valves of the immersion type having extended elements shall be marked with the length in inches, to the nearest full inch, of the extension element beyond the inlet of the valve. This marking may be included as a suffix to the manufacturer's model or type number.

1.13.4

a. The markings specified in [1.13.1](#) through [1.13.3](#) and "-b" in this provision shall be securely affixed to the device and shall meet the following specifications. All metal marking materials shall be rustproof. All markings shall be suitable for application to the surfaces upon which applied and shall demonstrate suitable legibility as specified under 2.11, Marking Material Adhesion and Legibility.

b. A gas shutoff device shall be marked with the shutoff temperature or temperature code and corresponding identification number.

c. Also see [1.5.2](#).

1.13.5

Electrical devices supplied with current from an external source, except thermoelectric devices shall be marked with voltage and current rating and, if applicable, frequency rating.



Part II: Performance

2.1 General

The performance of a shutoff device observed during conduct of the tests prescribed herein shall show no indication that the device will not continue to comply with this standard in the course of normal usage.

2.2 Shutoff And Reset Temperatures

2.2.1

A gas shutoff device shall operate to shut off the gas supply within $\pm 10^{\circ}\text{F}$ (5.5°C) of the manufacturer's specified shutoff temperature, but in no case at a temperature greater than 210°F (99°C).

A gas shutoff device of other than the single-use type shall automatically reset or shall function to be manually resettable at a temperature not lower than 120°F (49°C).

Method of Test

Four devices shall be simultaneously tested installed on a suitable water bath. The four samples are to be provided with individual thermocouples complying with the next paragraph. The temperature sensing element of an immersion type of device shall be immersed in the water as in normal installation. A surface contact type of device shall be attached to the exterior of a side of the bath formed on a radius of 6 in (152 mm) with the temperature sensing element in contact with that surface. A 2 in (50.8 mm) thick pad of glass wool insulation extending at least 2 in (50.8 mm) beyond the device shall be placed directly over the device.

Operating temperatures shall be determined with a single No. 24 AWG (0.20 mm^2) thermocouple for each device. With immersion temperature sensing elements, the thermocouple shall be placed as close to the element as possible opposite the midpoint of its length. With surface contact temperature sensing elements, the thermocouple shall be silver-soldered to the interior surface of the bath immediately opposite the location of the geometrical center of the element.

The opening of an electrical circuit within a device is to be determined by any suitable means connected in a circuit typical of that in which the device is to be used.

The bath shall be filled with water and heated until the four test thermocouples indicate an average temperature 20°F (11°C) less than the manufacturer's specified shutoff temperature. The rate of heating then shall be controlled to cause a temperature rise of not less than 1°F (0.5°C) not more than 2°F (1°C) per minute. The temperature indicated by a test thermocouple at the instant the corresponding device functions shall be recorded.

With devices of other than the single-use type, the means for heating the bath shall then be shut off and cold water admitted in such a manner that it does not flow directly against the side of the bath in which the devices are installed. As the average temperature indicated by the test thermocouple approaches the reset temperature, the flow of water shall be controlled to cause a temperature decrease of not more than 1°F (0.5°C) per minute. At the instant the indicated temperature for each device reaches 120°F (49°C), the device shall have reset or shall have functioned to be resettable.

One determination of shutoff temperature and, if applicable, one verification of reset operation for each device shall be made. All shall comply.