ULC Standards
Normes ULC

JOINT CANADA-UNITED STATES
NATIONAL STANDARD

ANSI/CAN/UL/ULC 1349:2023

STANDARD FOR SAFETY

LP-Gas Vaporizers

Approved American National Standard
ANSI

ANSI/UL 1349-2023

scc ccn

SCC FOREWORD

National Standard of 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.

UL Standard for Safety for LP-Gas Vaporizers, ANSI/CAN/UL/ULC 1349

First Edition, Dated February 27, 2023

Summary of Topics

This First Edition of ANSI/CAN/UL/ULC 1349, Standard for LP-Gas Vaporizers, dated February 27, 2023 is a new joint standard and reflects the latest ANSI and SCC approval dates and to incorporate the proposals dated March 11, 2022 and June 24, 2022.

The new requirements are substantially in accordance with Proposal(s) on this subject dated March 11, 2022 and June 24, 2022.

No Text on This Page

ANSI/UL 1349-2023

FEBRUARY 27, 2023

1

ANSI/CAN/UL/ULC 1349:2023

Standard for LP-Gas Vaporizers

First Edition

February 27, 2023

This ANSI/CAN/UL/ULC Safety Standard consists of the First Edition.

The most recent designation of ANSI/UL 1349 as an American National Standard (ANSI) occurred on February 27, 2023. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, Preface or SCC Foreword.

This standard has been designated as a National Standard of Canada (NSC) on February 27, 2023.

No Text on This Page

CONTENTS

INSTRUCTIONS

Preface

This is the First Edition of ANSI/CAN/UL/ULC 1349, Standard for LP-Gas Vaporizers.

UL is accredited by the American National Standards Institute (ANSI) and the Standards Council of Canada (SCC) as a Standards Development Organization (SDO). ULC Standards is accredited by the Standards Council of Canada (SCC) as a Standards Development Organization (SDO).

This Standard has been developed in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization.

This ANSI/CAN/UL/ULC 1349 Standard is under continuous maintenance, whereby each revision is approved in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization. In the event that no revisions are issued for a period of four years from the date of publication, action to revise, reaffirm, or withdraw the standard shall be initiated.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

Comments or proposals for revisions on any part of the Standard may be submitted at any time. Proposals should be submitted via a Proposal Request in the On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

To purchase UL Standards, visit the UL Standards Sales Site at http://www.shopulstandards.com/HowToOrder.aspx or call tollfree 1-888-853-3503.

This Edition of the Standard has been formally approved by the UL Standards Technical Panel (STP) on Valves and Safety Relief Valves for Anhydrous Ammonia and LP-Gas, STP 125.

This list represents the STP 125 membership when the final text in this standard was balloted. Since that time, changes in the membership may have occurred.

STP 125 Membership

Name	Representing	Interest Category	Region
Fredenburg, Richard	North Carolina Department of Agriculture & Consumer Services	AHJ	USA
Hoffmann, Richard	R A Hoffman Engineering P C, Dba Hoffman & Feige	General	USA
Kim, Yeon	US Consumer Product Safety Commission	Non voting member	USA
Ko, Solomon	TSSA	AHJ	Ontario
Legault, Peter	Integrated Review Services	General	Canada
Lemoff, Theodore	T Lemoff	General	USA
Mailvaganam, Miles	M Mailvaganam	General	Ontario
Nikolic, Djordje	Algas-SDI International	Producer	USA
Petersen, James	Petersen Engineering	General	USA
Prusko, Jeffrey	UL Standards & Engagement	Project Manager – Non-voting	USA
Saunders, Kirk	White Mountain Oil & Propane Inc	Commercial / Industrial User	USA
Swiecicki, Bruce	National Propane Gas Association	General	USA
Thomas, Chad	Engineered Controls International Inc	Producer	USA
Vandini, Thomas	Quality Steel Corp	Producer	USA
Wade, John A.	ULC Standards	STP Chair – Non-voting	Canada
Wolf, Erich	Cavagna North America	Producer	USA
Wolff-Klammer, Edgar	UL Solutions	Testing & Standards Org	USA
Zuck, Jim	Marshall Excelsior Corp	Producer	USA

International Classification for Standards (ICS): 71.120, 75.200

For further information on UL standards, please contact:

Underwriters Laboratories Inc.
Telephone: (613) 755-2729
E-mail: ULCStandards@ul.com
Web site: ulse.org

This Standard is intended to be used for conformity assessment.

The intended primary application of this standard is stated in its scope. It is important to note that it remains the responsibility of the user of the standard to judge its suitability for this particular application.

CETTE NORME NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS FRANÇAISE ET ANGLAISE

INTRODUCTION

1 Scope

1.1 These requirements cover liquefied petroleum gas (LP-Gas) vaporizers of the stationary type.

1.2 Vaporizers covered by these requirements are intended to be installed and used in accordance with the applicable Codes and Regulations as determined by the Authority Having Jurisdiction (AHJ), such as, but not limited to:

a) In the United States:

1) Liquified Petroleum Gas Code; NFPA 58;

2) National Electrical Code, NFPA 70.

b) In Canada:

1) Natural Gas and Propane Installation Code, CAN/CSA-B149 Series;

2) Canadian Electrical Code, CSA C22.1, Part 1;

3) Provincial or other regulations.

2 Components

2.1 Except as indicated in this clause, a component of a product covered by this standard shall comply with the requirements for that component.

2.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

2.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

3 Units of Measurement

3.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

4 Referenced Publications

4.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

4.2 The following documents are referenced in this standard. Users are encouraged to apply the most recent edition of the reference indicated below.

ANSI Z21.15/CSA 9.1, *Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves*

ANSI Z21.20, *Automatic Gas Ignition Systems and Components*

ASME Boiler and Pressure Vessel Code, *Section I, Rules for Construction of Power Boilers, and bear the code symbol "S", and Section VIII, Division I, Rules for Construction of Pressure Vessels*

ANSI/ASME B36.10M, *Welded and Seamless Wrought Steel Pipe*

ASTM B858, *Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys*

CAN/CSA-B149.1, *Natural Gas and Propane Installation Code*

CAN/CSA-B149.2, *Canadian Propane Storage and Handling Code*

CSA C22.1, Part I , *Canadian Electrical Code*

CSA B51, *Boiler, Pressure Vessel, and Pressure Piping Code*

CSA C22.2 No. 139, *Electrically Operated Valves*

CSA C22.2 No. 24, *Temperature-Indicating and -Regulating Equipment*

CAN/CSA-C22.2 No. 199, *Combustion Safety Controls and Solid State Igniters for Gas- and Oil-Burning Equipment*

CSA-C22.2 No. 0.15-01, *Adhesive Labels*

CSA E60730-2-6 ,*Automatic Electrical Controls – Part 2-6: Particular Requirements for Automatic Electrical Pressure Sensing Controls Including Mechanical Requirements*

CSA E60730-2-9, *Automatic Electrical Controls – Part 2-9: Particular Requirements for Temperature Sensing Controls*

CSA E60730-2-15, *Automatic Electrical Controls – Part 2-15: Particular Requirements for Automatic Electrical Air Flow, Water Flow and Water Level Sensing Controls*

CSA 6.5, *CSA Standard for Automatic Valves for Gas Appliances*

CSA 9.1, *Manually operated gas valves for appliances, appliance connector valves and hose end valves*

NFPA 58, *Liquefied Petroleum Gas Code*

NFPA 70, *National Electrical Code*

UL 109, *Tube Fittings for Flammable and Combustible Fluids, Refrigeration Service, and Marine Use*

UL/ULC 125, *Flow Control Valves for Anhydrous Ammonia and LP-Gas*

ANSI/CAN/UL 132, *Safety Relief Valves for Anhydrous Ammonia and LP-Gas*

ANSI/CAN/UL 144, *LP-Gas Regulators*

UL 157, *Gaskets and Seals*

UL 353, *Limit Controls*

UL 372, *Primary Safety Controls for Gas- and Oil-Fired Appliances*

UL 429, *Electrically Operated Valves*

UL 644, *Container Assemblies For LP-Gas*

UL/ULC 842, *Valves for Flammable and Combustible Liquids*

UL 873, *Temperature-Indicating and Regulating Equipment*

UL 969, *Marking and Labeling Systems*

UL 1203, *Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations*,

UL 60730-2-5 / ANSI Z21.20 / CSA C22.2 No. 60730-2-5, *Automatic Electrical Controls for Household and Similar Use, Part 2-5: Particular Requirements for Automatic Electrical Burner Control Systems*

UL 60730-2-6, *Automatic Electrical Controls – Part 2-6: Particular Requirements for Automatic Electrical Pressure Sensing Controls Including Mechanical Requirements*

UL 60730-2-9,*Automatic Electrical Controls – Part 2-9: Particular Requirements for Temperature Sensing Controls*

UL 60730-2-15,*Automatic Electrical Controls – Part 2-15: Particular Requirements for Automatic Electrical Air Flow, Water Flow and Water Level Sensing Controls*

5 Glossary

5.1 For the purpose of this standard, the following definitions apply.

5.2 AEROSTATIC – Employing the use of air, nitrogen, helium, or any other inert gases.

5.3 LIQUEFIED PETROLEUM GAS (LP-GAS or LPG) – Any material having a vapor pressure not exceeding that allowed for commercial propane composed predominantly of the following hydrocarbons, either by themselves (excluding propylene) or as mixtures: propane, propylene, butane (normal butane or iso-butane) and butylenes.

5.4 VAPORIZER – A device, other than a container, that receives LP-Gas in liquid form and adds sufficient heat to convert the liquid to gaseous state.

5.5 VAPORIZER, DIRECT-FIRED – A type of vaporizer in which the heat energy is furnished by direct flame impingement onto a heat exchange surface in contact with liquid LP-Gas.

5.6 VAPORIZER, ELECTRIC – A type of vaporizer in which electrical energy is used as a source of heat. They are further classified by how the electrical energy is applied to the LP-Gas.

5.7 VAPORIZER, ELECTRIC, DIRECT-IMMERSION – A type of vaporizer that has an electric element immersed directly into the LP-Gas liquid and vapor.

5.8 VAPORIZER, ELECTRIC, INDIRECT – An immersion-type vaporizer that has the electric element immersed into an interface solution that is in contact with the LP-Gas heat exchanger or applies electrical energy to an intermediate heat sink.

5.9 VAPORIZER, INDIRECT (or INDIRECT-FIRED) – A vaporizer in which heat energy is furnished by steam, hot water, the ground, surrounding air, or other heated medium to a vaporizing chamber or to tubing, pipe coils, or other heat exchange surface containing the liquid LP-Gas. The heating of the medium is at a point remote from the vaporizer portion containing the LP-Gas. This definition includes a direct-fired water-bath vaporizer (the water bath is the heat transfer medium).

CONSTRUCTION

6 General Requirements – All Vaporizers

6.1 LP-Gas vaporizers shall include all of the components necessary for its intended function and installation, and shall be furnished as a single unit or assembly. The container(s) shall meet the requirements of 8.1.

6.2 Electrical components, when incorporated into the assembly of a LP-Gas vaporizer, including the means provided in the assembly for electrical connections, shall comply with the following requirements for equipment for use in hazardous locations, Class I, Group D, Division 1 or 2, (or Zone 1 or 2, respectively), as appropriate:

a) For National Electrical Code, NFPA 70, Articles 500 and 501 (Article 505 for Zone Classification) applications, in accordance with the Liquefied Petroleum Gas Code, NFPA 58.

b) For Canadian Electrical Code, CSA C22.1, Part I, or Table 7.6 for Electrical Classifications , applications, in accordance with the Canadian Propane Storage and Handling Code, CAN/CSA-B149.2. Heating or cooling coils shall not be installed in the LP-Gas container, in accordance with the Canadian Propane Storage and Handling Code, CAN/CSA-B149.2.

Such components shall comply with the applicable standard for the protection technique employed; for example explosion proof equipment shall comply with the Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations, UL 1203.

Exception No. 1: When electrical components are provided in the assembly of a direct-fired vaporizer, or the direct fired water-bath vaporizer, the above described electrical components need only to comply with the requirements for ordinary (nonhazardous) locations and for outdoor use locations.

Exception No. 2: When electrical components are provided in the assembly of an indirect vaporizer, and the electrical components are installed 15 ft (4.5 m), or more, measured in a horizontal distance from any LP-Gas connections or joints in the LP-Gas equipment, the above described electrical components need only to comply with the requirements for ordinary (nonhazardous) locations and for outdoor use locations, as appropriate.

6.3 LP-Gas vaporizers shall be provided with automatic means to prevent the passage of the flow of liquid LP-Gas from the vaporizer to its vapor discharge piping.

6.4 Each vaporizer shall be equipped with a spring-loaded pressure relief valve that complies with 6.10. The minimum rate of discharge in cubic feet per minute (cfm) air shall be the greater of the two methods of calculation noted in (a) and (b) below:

a) Based upon conservative heat transfer calculations by assuming the vaporizing chamber is at its normal maximum liquid level, and the vaporizer is at maximum heating capacity, the maximum vapor generating capacity shall be determined in accordance with the Operation Test, Section 14. This vapor rate shall be converted into an equivalent air capacity rate. The minimum rate of discharge of the relief valve shall not be less than 150 % of this vaporizing capacity.

b) The minimum rate of discharge of the relief valve shall not be less than the relief valve capacity noted in the Standard for Container Assemblies for LP-Gas, UL 644, using a surface area that is the sum of the vaporizer container surface and the LP-Gas wetted exterior surface

Exception: Vaporizers of the electric, indirect-fired type, or direct-fired type with container surface areas less than 20 ft^2 may be in accordance with either (a) or (b).

6.5 Fusible plug devices shall not be used as relief devices.

6.6 Manual shutoff valves that control the flow of gas to the vaporizer or burner assembly or container shall have a pressure rating in accordance with 25.1 and the following standards as applicable:

a) Standard for Flow Control Valves for Anhydrous Ammonia and LP-Gas, UL/ULC 125, or if rated at 1 psig or less, comply with the Standard for Valves for Flammable and Combustible Liquids, UL/ULC 842.

b) ANSI Z21.15/CSA 9.1, Manually operated gas valves for appliances, appliance connector valves and hose end valves.

6.7 Solenoid operated shutoff valves shall comply with safety valves in the Standard for Electrically Operated Valves, UL 429 for the United States or Electrically Operated Valves, CSA C22.2 139 for Canada. If the valves are required to comply with 6.2, they shall also comply with the Standard for Explosion Proof and Dust-Ignition Proof Electrical Equipment for Use in Hazardous (Classified) Locations, UL 1203.

6.8 Solenoid operated shutoff valves shall be valves rated as CI, in compliance with ANSI Z21.21/CSA 6.5, CSA Standard for Automatic Valves for Gas Appliances. If the valves are required to comply with 6.2, they shall also comply with the appropriate Canadian hazardous locations standard(s) with respect to risk of explosion for the protection method(s) utilized.

6.9 Pressure regulators shall comply with the Standard for LP-Gas Regulators, ANSI/CAN/UL 144.

6.10 Relief Valves shall comply with the Standard for Safety Relief Valves for Anhydrous Ammonia and LP-Gas, ANSI/CAN/UL 132. They shall be installed in that portion of the container that communicates with vapor, unless used for the purpose of hydrostatic relieving.

6.11 Tubing fittings, if used, shall comply with gas fittings as described in the Standard for Tube Fittings for Flammable and Combustible Fluids, Refrigeration Service, and Marine Use, UL 109.

7 Direct Fired Vaporizers

7.1 In addition to the requirements of General Requirements – All Vaporizers, Section 6, direct-fired vaporizers shall comply with this section.

7.2 The relief valve shall not be subjected to temperatures in excess of 140 °F (60 °C).

7.3 A means for manually turning off the gas to the main burner and pilot shall be provided and shall comply with 6.6.

7.4 Direct-fired vaporizers shall be equipped with a primary safety control that complies with the Standard for Primary Safety Controls for Gas- and Oil-Fired Appliances, UL 372 or the Standard for Automatic Gas Ignition Systems and Components, ANSI Z21.20-2005 for the USA or CAN/CSA-C22.2 No.199, Combustion Safety Controls and Solid State Igniters for Gas- and Oil-Burning Equipment for Canada, or Bi-National Standard UL 60730-2-5 / ANSI Z21.20 / CAN/CSA C22.2 No. 60730-2-5 as applicable to shut off the flow of gas to the main burner if the pilot light is extinguished. This control may also have a temperature or pressure limit control that meets the intent of 7.6.

7.5 If the pilot flow exceeds 2000 Btu/hr (2 MJ/hr), the safety control shall also shut off the flow of gas to the pilot.

7.6 Direct-fired vaporizers shall be equipped with a control in accordance with 7.7 to prevent the heating system from raising the LP-Gas pressure above the design pressure rating of the vaporizer equipment, and to prevent raising the pressure within the storage container that supplies the vaporizer above the MAWP of the container. This control can be either pressure or temperature activated.

7.7 Pressure limit controls shall comply with the Standard for Limit Controls, UL 353, CSA-C22.2 No. 24, Temperature-Indicating and -Regulating Equipment, UL 60730-2-6, Automatic Electrical Controls – Part 2-6: Particular Requirements for Automatic Electrical Pressure Sensing Controls Including Mechanical Requirements, or CSA E60730-2-6, Automatic Electrical Controls – Part 2-6: Particular Requirements for Automatic Electrical Pressure Sensing Controls Including Mechanical Requirements. Liquid level limit controls shall comply with the Standard for Limit Controls, UL 353, CSA-C22.2 No. 24, Temperature-Indicating and -Regulating Equipment, UL 60730-2-15, Automatic Electrical Controls – Part 2-15: Particular Requirements for Automatic Electrical Air Flow, Water Flow and Water Level Sensing Controls, or CSA E60730-2-15, Automatic Electrical Controls – Part 2-15: Particular Requirements for Automatic Electrical Air Flow, Water Flow and Water Level Sensing Controls. Temperature limit controls shall comply with the Standard for Temperature-Indicating and Regulating Equipment, UL 873, Standard for Limit Controls, UL 353, CSA-C22.2 No. 24 Temperature-Indicating and -Regulating Equipment, UL 60730-2-9, Automatic Electrical Controls – Part 2-9: Particular Requirements for Temperature Sensing Controls, or CSA E60730-2-9, Automatic Electrical Controls – Part 2-9: Particular Requirements for Temperature Sensing Controls as appropriate. A regulating or operating control meets this requirement.

8 Containers and Piping

8.1 Containers that are part of a vaporizer assembly shall be constructed in accordance with the ASME Boiler and Pressure Vessel Code, Section I, Rules for Construction of Power Boilers, and bear the code symbol “S”, Section VIII, Division I, Rules for Construction of Pressure Vessels and bear the code symbol “U” or CSA B51 Boiler, Pressure Vessel, and Pressure Piping Code and bear the code a CRN as applicable. In either case the MAWP of the containers shall be in accordance with 25.1.

Exception: Containers that are excluded from the ASME Code or CSA B51 Boiler, Pressure Vessel, and Pressure Piping Code due to size are not required to comply with 8.1.

8.2 Containers that comply with the Exception to 8.1 shall meet the requirements of the External Leakage and Hydrostatic Pressure Tests, Sections 12 and 16, respectively.

8.3 Material specifications for piping shall comply with 9.2. Pipe sections shall comply with the requirements of the Deformation Test, Section 11, if incorporating female threaded sections, the External Leakage Test, Section 12, and the Hydrostatic Pressure Test, Section 16.

8.4 Flexible hose connectors shall not be used in the vaporizer assembly.

9 Materials

9.1 LP-Gas-confining or operating parts of a vaporizer shall have the strength and durability to provide reliable service of the parts and of the assembly.

9.2 Liquid or pressure confining parts shall be made from steel, ductile or malleable iron, brass or aluminum. Non-ductile cast iron (regular gray iron) shall not be used for LP-Gas-confining or operating parts of vaporizers. This does not prohibit the use of nodular iron.

Exception: LP-Gas regulators that meet ANSI/CAN/UL 144 may use zinc.

9.3 A part in contact with LP-Gas shall be resistant to the action of such fluid.

9.4 With reference to the requirement in 9.3, elastomeric materials such as valve disc or soft seat, a seal ring, a diaphragm, or a gasket shall be subjected to:

a) The Accelerated Aging Test, Section 20;

b) The LP-Gas Compatibility Test, Section 21; and

c) The Low Temperature Test, Section 22.

Polymeric materials that are part of a component and which are exposed to LP-Gas shall be subjected to the Accelerated Aging Test, Section 20 and the LP-Gas Compatibility Test, Section 21.

Exception: Acetal polymers, chlorotrifluorethylene polymers, tetrafluorethylene, fluorinated ethylene propylene polymers and polyamides of composition polyhexamethylene adipamide or polycaproamide polymers (nylon 6, 6/6 or 6/16) shall only be subjected to the Accelerated Aging Test, Section 20.

9.5 A brazing material used for joining pressure-confining parts of an assembly shall have a melting point (solidus temperature) of no less than 1,000 °F (538 °C). This requirement is not meant to prohibit the welding of aluminum.

9.6 When corrosion of a part interferes with the proper function of a component, the part shall be of a corrosion-resistant material or be provided with a corrosion-resistant protective coating.

9.7 A protective coating shall provide resistance against corrosion, to a degree no less than that provided by the protective coatings specified in 9.8.

9.8 Cadmium and nickel plating shall have a thickness of no less than 0.0003 inch (0.008 mm), and zinc plating shall have a thickness of no less than 0.0005 inch (0.013 mm).

Exception: On parts where threads constitute the major portion of the area, the thickness of the cadmium or zinc plating shall be no less than 0.00015 inch (0.0038 mm).

9.9 When warping of a casting affects the tightness of liquid-confining joints or the proper fit of parts, the casting shall be stress-relieved to reduce the risk of warping.

9.10 A LP-Gas-confining or operating part made of drawn brass or machined from brass rod, that contains more than 15 % zinc, shall be capable of withstanding, without cracking, the Moist Ammonia Air Stress Cracking Test, Section 23, for copper and copper alloys.

PERFORMANCE

10 General

10.1 Representative samples of each type of vaporizer or component, as appropriate, shall be subjected to the tests in this document.

10.2 For leakage tests, a source of aerostatic pressure such as air, nitrogen or other non-corrosive gas shall be used. Aerostatic pressure shall be maintained at maximum test pressure for at least 1 minute. The pressure shall be applied gradually to the test pressure.

10.3 For the hydrostatic pressure test, water or other liquid shall be used. The pressure shall be maintained at maximum test pressure for at least 1 min.

10.4 Unless otherwise indicated the tests are conducted at room temperature [70 ±10 °F (21 ±5.5 °C)].

11 Deformation Test

11.1 Joints in a valve shall not leak, nor shall there be evidence of loosening of joints, distortion, or other damage resulting from the stress imposed on pipe-threaded sections when tested in accordance with these requirements.

11.2 A representative sample of each valve, or pipe section, as appropriate, shall be used in this test. The sample shall be rigidly anchored or otherwise supported. A length of Schedule 80 pipe shall be connected to a female pipe threaded section of the valve or pipe section. The male threads shall have pipe joint sealing compound or polytetrafluoroethylene (PTFE) tape applied to them first or be coated as specified by the manufacturer. Each length of Schedule 80 pipe is then to be tightened to the torque specified in Table 11.1.

Table 11.1
Torque Requirements

Pipe size, nominal inches[a]	Outside diameter,		Torque,	
	inches	(mm)	pound-inches	(N·m)
1/8	0.4	(10.29)	150	(17)
1/4	0.5	(13.72)	250	(28)
3/8	0.7	(17.15)	450	(51)
1/2	0.8	(21.34)	800	(90)
3/4	1.1	(26.67)	1000	(113)
1	1.3	(33.40)	1200	(136)
1-1/4	1.7	(43.18)	1450	(164)
1-1/2	1.9	(48.26)	1550	(175)
2	2.4	(60.96)	1650	(186)
2-1/2	2.9	(73.66)	1750	(198)
3	3.5	(88.90)	1800	(203)
4	4.5	(114.30)	1900	(214)

[a] Welded and Seamless Wrought Steel Pipe, ANSI/ASME B36.10M

11.3 After the torque force has been applied to each connected pipe, the test sample shall be subjected to the External Leakage Test, Section 12.

11.4 Upon removal of the pipe from the test sample, there shall be no loosening of threaded body joints.

12 External Leakage Test

12.1 Each valve or pipe section not covered by the ASME code, following the Deformation Test, Section 11, shall be free from leakage through stem or body seals or other joints, and shall not show evidence of porosity in the body, when tested as described in 10.2, at any pressure between 0 and 1-1/2 times the rated pressure of the valve or pipe section.

12.2 During this test, one sample of each size and type of valve or pipe section shall be connected to a source of pressure, in accordance with 10.2, applied to the inlet, with the outlet plugged or closed and the valve seat, if appropriate, in an open position. A positive shut-off valve and a pressure gauge having a pressure range of no less than 1-1/2 times, nor more than 2 times, the test pressure shall be installed in the pressure supply system close to the test sample. The pressure gauge shall be installed between the pressure supply and the sample under test. While under the applied test pressure, in accordance with 10.2, the sample shall be submerged in water to detect leakage, or all joints and body casting surfaces shall be brushed with soap and water mixture or by using another appropriate method.

13 Seat Leakage Tests

13.1 General

13.1.1 A valve or similar device that is used to comply with 6.3, following the Deformation Test, Section 11 and External Leakage Test, Section 12, as applicable, shall be subjected to this test.

13.1.2 A valve exposed only to LP-Gas liquid shall be subjected to the method described in 13.2. A capacity control valve exposed to LP-Gas vapor shall be subjected to the method described in 13.3.

13.1.3 All seat leakage tests employing a gas as the test medium shall be maintained for at least 1 min. All seat leakage tests employing a liquid as the test medium shall be maintained for at least 5 min.

13.2 Liquid test

13.2.1 A valve for liquids shall not leak past the seat when subjected to a pressure of 1.5 times rated pressure of the valve or pipe section.

13.2.2 To verify compliance with 13.2.1, the inlet of the test valve shall be connected to a system utilizing the appropriate test medium. This test shall be conducted with the valve in its intended position of installation. The valve shall be in the closed position assumed as the result of intended operation. The pressure shall be increased gradually from zero and then maintained at 1.5 times rated pressure of the valve or pipe section.

13.3 Gas test

13.3.1 A valve for vapor shall not leak past the seat in excess of that indicated in Table 13.1 when subjected to a pressure of 1.5 times maximum rated pressure of the valve or pipe section.

Table 13.1
Maximum Allowable Seat Leakage

Port diameter	Maximum allowable leakage[a] cc/h
Port diameter 38.1 mm (1-1/2 in) nominal or less	650, or as specified by the manufacturer
Port diameter over 38.1 mm (1-1/2 in) nominal	5.9/mm (150/in) of port circumference, or as specified by the manufacturer
[a] At standard atmospheric conditions of 15.6 °C (60 °F) and a barometric pressure of 101 kPa (30 in of mercury).	

13.3.2 To verify compliance with 13.3.1, the inlet of the test valve shall be connected to a system capable of supplying clean air or other test gas at the test pressures. A tight connection shall be made to the valve outlet, terminating in tubing. The open end of this outlet shall be located within an inverted graduated cylinder which is calibrated in cubic centimeters. The inverted cylinder shall be closed by a water seal. The apparatus shall be adjusted so that:

a) The end of the outlet tube is located approximately 12.7 mm (0.5 in) above the water level within the inverted graduated cylinder; and

b) The water within and exterior to the graduated cylinder is at the same level.

With these adjustments made, the water level within the graduated cylinder shall be recorded. With the valve in the closed position assumed as the result of intended operation, the test medium at the specified test pressure shall be applied to the valve inlet for a minimum test period of 2 min. During this time, the vertical position of the graduated cylinder shall be adjusted, when required, to maintain the same water level within and exterior to it. At the end of the test period and with the water within and exterior to the graduated cylinder at the same level, the level of water within the graduated cylinder is again recorded. From the change of volume within the graduated cylinder, the leakage rate shall be calculated according to the following formula:

$$R = V \times \frac{60}{m}\left(\frac{520}{460 + t} \times \frac{P}{30}\right)$$

In which:

R is the leakage rate in cubic centimeters per hour,

V is the increase in volume within graduated cylinder during test,

m is the time of test in minutes,

t is the ambient temperature during test in °F [(1.8 x °C) + 32],

P is the barometric pressure during test in inches of mercury (kPa x 0.3)

13.3.3 Instead of the method described in 13.3.2, leakage may be measured by a flow meter installed on the inlet side of the valve under test which indicates, for the test medium employed, the maximum flow rates permitted.

14 Operation Test

14.1 Each type of vaporizer shall be operated as intended in normal operation, in accordance with the manufacturer's instructions and 14.2 and 14.3 as appropriate. During operation there shall be no evidence of pressures or temperatures exceeding manufacturer's rated limits, and liquid shall not be discharged into