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NATIONAL STANDARD

ANSI/CAN/UL/ULC 842:2020

STANDARD FOR SAFETY

Valves for Flammable and Combustible Liquids

Approved American National Standard
ANSI
ANSI/UL 842-2020

Standards Council of Canada
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SCC FOREWORD

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UL Standard for Safety for Valves for Flammable and Combustible Liquids, ANSI/CAN/UL/ULC 842

Eleventh Edition, Dated August 25, 2020

Summary of Topics

This new edition of ANSI/CAN/UL/ULC 842 dated August 25, 2020 Standard for Valves for Flammable and Combustible Liquids, has been issued to reflect the latest ANSI and SCC approval dates, and to incorporate the proposals dated September 6, 2019 and January 31, 2020.

The new requirements are substantially in accordance with Proposal(s) on this subject dated September 6, 2019 and January 31, 2020.

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AUGUST 25, 2020

ANSI/UL 842-2020

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ANSI/CAN/UL/ULC 842:2020

Standard for Valves for Flammable and Combustible Liquids

The first edition was titled Construction and Performance of Hazardous Liquid Valves. The second edition was titled Valves for Hazardous Liquids. The third and fourth editions were titled Valves for Flammable Liquids and Fuel Gases.

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Eleventh Edition

August 25, 2020

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

The most recent designation of ANSI/UL 842 as an American National Standard (ANSI) occurred on August 25, 2020. 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 August 25, 2020.

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Preface

This is the Eleventh Edition of ANSI/CAN/UL/ULC 842, Standard for Valves for Flammable and Combustible Liquids.

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 842 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.

This joint American National Standard and National Standard of Canada is based on, and now supersedes, the Tenth Edition of UL 842 and Fourth Edition of CAN/ULC-S651.

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.

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This Edition of the Standard has been formally approved by the UL Standards Technical Panel (STP) on Valves for Flammable Fluids, STP 842.

This list represents the STP 842 membership when the final text in this standard was balloted. Since that time, changes in the membership may have occurred.

STP 842 Membership

Name	Representing	Interest Category	Region
Barker, Ann-Marie	Technical Standards and Safety Authority	AHJ	Ontario
Bishoff, Mark	Lorax Systems Inc.	Producer	Canada
Boyd, Dennis	BP America Inc.	Commercial/Industrial User	USA
Dutton, John	J Dutton	General Interest	Canada

STP 842 Membership Continued on Next Page

STP 842 Membership Continued

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Kuehn, Justin	Franklin Fueling Systems	Producer	USA
Legault, Pierre	Integrated Review Services – Consulting	General Interest	Canada
Manger, Peter	OPW Fueling Components	Producer	USA
Petersen, James	Petersen Engineering	General Interest	USA
Prusko, Jeffrey	Underwriters Laboratories Inc.	Project Manager – Non-voting	USA
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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 valves that are intended to be used for the control of flammable and combustible liquids and their vapors. They are of the type commonly used in piping systems and in the assembly of motor fuel dispensing and fuel burning equipment. Valves covered by this standard are for use with flammable liquids which are handled at temperatures normally within the range of -29°C (-20°F) to 52°C (125°F).

1.2 These requirements cover valves of the manually operated, pressure operated, or temperature operated types, or combinations of such to the exclusion of types operated wholly or partially by electricity. When they form a part of an assembly which provides for additional functions or service, the requirements are outside the scope of these requirements.

1.3 These requirements do not cover the following:

a) Valves for handling liquids under cryogenic conditions.

b) Valves for general refinery service, offshore and pipe line terminals, natural gas processing plants, gas distribution systems, petrochemical processing facilities, or the like.

c) Constant-level oil valves and electrically operated valves.

d) Relief valves and pressure regulators for liquefied petroleum gas (LP-Gas) service.

e) Shutoff, emergency shutoff and check valves for liquefied petroleum gas (LP-Gas) in the liquid phase.

f) Manually operated gas valves of the plug and body or rotating disc type which are evaluated under the Standard for Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves, ANSI Z21.15.

g) Valves covered by the Standard for Gas Appliance Pressure Regulators, ANSI Z21.18; the Standard for Automatic Valves for Gas Appliances, ANSI Z21.21; or the Standard for Gas Appliance Thermostats, ANSI Z21.23.

h) Hose nozzles covered by UL 2586 Hose Nozzle Valves or CAN/ULC-S620 Hose Nozzle Valves.

i) Valves covered by the Standard for Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 125 PSI (Sizes NPS 1/2 through NPS 2), ANSI/ASME B16.33; and Manually Operated Metallic Gas Valves for Use in Aboveground Piping Systems up to 5 PSI ANSI/ASME B16.44.

1.4 Products covered by this Standard 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) Flammable and Combustible Liquids Code, NFPA 30;

2) Code for Motor Fuel Dispensing Facilities and Garages, NFPA 30A;

3) Standard for the Installation of Oil-Burning Equipment, NFPA 31.

b) In Canada:

1) The National Fire Code of Canada; and or

2) CSA B139, Installation Code for Oil Burning Equipment;

3) Provincial or other Regulations.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.1.2 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.

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

2.1.4 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.

2.2 Units of measurement

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

2.3 Referenced publications

2.3.1 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.

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

UL Standards

UL 157, *Gaskets and Seals*
UL 969, *Marking and Labeling Systems*
UL 1332, *Organic Coatings for Steel Enclosures for Outdoor Use Electrical Equipment*
UL 2586, *Hose Nozzle Valves*

ULC Standards

CAN/ULC-S620, *Standard for Hose Nozzle Valves for Flammable and Combustible Liquids*

Other Standards

ANSI/ASME B1.20.1, *Pipe Threads, General Purpose, Inch*
ANSI/ASME B16.33, *Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 175 psi (Sizes NPS 1/2 through NPS 2)*
ANSI/ASME B16.44, *Manually Operated Metallic Gas Values for use in Above Ground Piping Systems up to 5 psi*
ANSI Z21.15, *Manually Operated Gas Valves For Appliances, Appliance Connector Valves And Hose End Valves*
ANSI Z21.18, *Gas Appliance Pressure Regulators*
ANSI Z21.21, *Automatic Valves For Gas Appliances*
ANSI Z21.23, *Gas Appliance Thermostats*
ASTM A653/A653M, *Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process*
ASTM B858, *Standard Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys*
ASTM D396, *Standard Specification for Fuel Oils*
ASTM D471, *Standard Test Method for Rubber Property – Effect of Liquids*
ASTM D975, *Standard Specification for Diesel Fuel*
ASTM D3699, *Standard Specification for Kerosine*
ASTM D4806, *Standard Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel*
ASTM D4814, *Standard Specification for Automotive Spark-Ignition Engine Fuel*
CSA B139, *Installation Code for Oil Burning Equipment*
CSA C22.2, *Adhesive Labels*
NFC, *National Fire Code of Canada*
NFPA 30, *Flammable and Combustible Liquids Code*
NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Garages*
NFPA 31, *Standard for the Installation of Oil-Burning Equipment*

Abbreviations

ANSI – American National Standards Institute
ASME – American Society of Mechanical Engineers
ASTM – American Society for Testing and Materials
CSA – CSA Group
NFPA – National Fire Protection Association

Copies are available from SES at http://www.ses-standards.org/ or from other standards resellers.

3 Glossary

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

3.2 ASTM IRM 903/IRM 903 – A high-swelling petroleum base oil described in ASTM D471, Standard Test Method for Rubber Property-Effect of Liquids.

3.3 ASTM REFERENCE FUEL H – 85 % of combined 70 % Isooctane +30 % Toluene, by volume, +15 % Anhydrous Denatured Ethanol, by volume.

3.4 AUTHORITY HAVING JURISDICTION (AHJ) – The governmental body responsible for the enforcement of any part of this Standard or the official or agency designated by that body to exercise such a function.

3.5 EMERGENCY SHUTOFF VALVES – A device intended for installation at the inlet of remote control type flammable and combustible liquid dispensing devices. They are normally held open by a mechanical holding means. They incorporate a fusible element and close automatically in the event of exposure to fire or break-off resulting from severe impact. They are designed for an operating pressure of not less than 345 kPa (50 psi).

3.6 FLAMMABLE AND COMBUSTIBLE LIQUIDS – Fuel oil, gasoline, diesel, kerosene, and similar petroleum products which are formulated in accordance with Regulation of Fuels and Fuel Additives, 40 CFR 80, and the following:

a) Gasoline formulated in accordance with the Standard Specification for Automotive Spark-Ignition Engine Fuel, ANSI/ASTM D4814.

b) Gasoline/ethanol blends at levels designated as "gasohol" (E10) or less formulated in accordance with ANSI/ASTM D4814, when blended with denatured fuel ethanol formulated in accordance with the Standard Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel, ANSI/ASTM D4806.

c) Diesel fuel formulated in accordance with the Standard Specification for Diesel Fuel Oils, ANSI/ASTM D975.

d) Kerosene formulated in accordance with the Standard Specification for Kerosine, ANSI/ASTM D3699.

e) Fuel oil (heating fuel) formulated in accordance with the Standard Specification for Fuel Oils, ANSI/ASTM D396.

f) Liquefied petroleum gas (LP-Gas) in the gaseous phase, not in excess of 6.9 kPa (1 psi), and manufactured and natural fuel gases.

3.7 FLAMMABLE LIQUID –- Any liquid having a flashpoint below 37.8°C (100°F) and having a vapour pressure not exceeding 275 kPa (40 psi) (absolute) at 37.8°C (100°F) and as defined in the National Fire Code of Canada.

3.8 FUSIBLE LINK VALVES – Valves intended for use in lines conveying fuel gas, gasoline, or fuel oil which function to close when the temperature in the vicinity of the valve exceeds the fusing temperature of the fusible element. They are designed for an operating pressure of 124 kPa (18 psi) or less and the fusible element operating at 74°C (165°F) or less.

3.9 SHUTOFF VALVE – A type of valve that incorporates a seat and seat disc member that will close an internal orifice to prevent further flow of fluid through the valve.

3.10 SHUTOFF VALVE, AUTOMATIC – A type of shutoff valve that uses energy (other than electricity) to open and close the valve member, based upon some external input.

3.11 SHUTOFF VALVE, MANUAL – A type of shutoff valve that incorporates a handle, lever, handwheel or other element that anticipates human manipulation of the element to close the valve member.

CONSTRUCTION

4 Assembly

4.1 All valves

4.1.1 When a valve requires the use of special pipe flanges, gaskets, bolts, or other special fittings or parts for making an installation, such parts shall be furnished by the manufacturer with each valve.

4.1.2 Two or more subassemblies intended to be assembled in the field as a unit shall be capable of being joined together without requiring any of the subassemblies to be cut, drilled, welded or otherwise altered.

4.1.3 When two or more valves or actuating devices, or both, are to be used together as one unit, the entire assembly is, for the purpose of these requirements, to be considered and tested as one valve.

4.1.4 A seat disc shall be attached to its poppet or holder or otherwise assembled so as to prevent it from becoming dislocated under service conditions as determined by the Endurance Test, Section 18. The means to secure the disc shall not rely upon cement or adhesive.

4.1.5 A brazing material used for joining liquid confining parts of a valve shall have a melting point (solidus temperature) of minimum 538°C (1000°F).

4.2 Emergency shutoff valves and shutoff valves

4.2.1 Neither an emergency shutoff valve nor a shutoff valve shall be equipped with a bypass or with a means to prevent it from closing completely.

4.2.2 The requirement in 4.2.1 does not apply to a feature provided to permit a take-off to recirculate liquid or to supply a pilot or other individually controlled outlet.

4.2.3 The appropriate operating positions or the direction of movement shall be clearly indicated for a manual operating lever or reset handle included in a nonself-closing type valve.

4.2.4 An automatic shutoff valve shall not be equipped with means for manually latching the valve in the open position in a manner which prevents the valve from functioning as a shutoff.

4.2.5 When a mechanically actuated indicator is provided to show whether the main valve is open or shut, it shall be visible from a distance of at least 1.52 m (5 ft).

4.2.6 A shutoff valve shall close independently of the energy supplied by the medium flowing. The medium flowing is not prohibited from being used to exert supplementary forces on the valve seat.

4.2.7 An emergency shutoff valve shall not be equipped with means for manually latching the valve in the open position in a manner that will prevent the valve from functioning under emergency conditions.

4.2.8 An emergency shutoff valve shall close automatically in the event of applied forces such as described in Weak Section Strength Test, Section 17, or in fire exposure to the dispensing unit, such as described in Fire Test, Section 16.

4.2.9 An emergency valve shall close independently of the energy supplied by the medium flowing.

5 Materials

5.1 Liquid-confining parts of a valve or operating parts shall have the strength and durability to provide reliable service of the parts and of the assembly, when failure of the part may result in leakage or hazardous operation.

5.2 A material other than a valve disc or soft seat, a seal ring, a diaphragm, or a gasket shall have a melting point (solidus temperature) of minimum 510°C (950°F) and a tensile strength of minimum 69 MPa (10,000 psi) at 204°C (400°F).

5.3 A part in contact with the liquid to be handled shall be resistant to the action of such liquid.

With reference to this requirement, all elastomeric materials shall be subjected to:

a) Volume change test, 22.2;

b) Weight loss test, 22.3; and

c) Accelerated aging test, 22.4.

Exception No. 1: Polymeric materials for LP-Gas service shall be subjected to (a) and (b).

Exception No. 2: Acetal polymers, polychlorotrifluorethylene polymers, tetrafluorethylene, fluorinated ethylene propylene polymers and polyamides of composition polyhexamethylene adipamide or polycaproamide polymers (nylon 6, 6/6 or 6/16) are exempt from to (a), (b), and (c).

5.4 Metallic materials used for liquid confining parts shall be resistant to atmospheric corrosion. In addition, metallic materials that are required to operate to address safety (e.g. thermal links on shear valves) shall be resistant to atmospheric corrosion. Ferrous materials of a thickness specified in the following items are acceptable for the preceding when uncoated:

a) A casting having a wall thickness of not less than 0.25 inch (6.4 mm) if shown by production testing to be free of leakage and

b) Fabricated sheet steel parts having a minimum wall thickness of 0.093 in (2.36 mm).

5.5 A protective coating shall provide resistance against corrosion to a degree not less than that provided by the protective coatings specified in 5.6.

5.6 Cadmium plating shall be minimum 0.0003 in (0.008 mm) thick and zinc plating shall be minimum 0.0005 in (0.013 mm) thick other than on parts where threads constitute the major portion of the area, in which case the thickness of the cadmium or zinc plating shall be minimum 0.00015 in (0.0038 mm). Metallic parts are also considered to comply with 5.4 when they are protected against atmospheric corrosion by:

a) Hot dipped, mill galvanized sheet steel complying with the coating designation G90 in Table I of the Specification for Sheet Steel, Zinc Coated (Galvanized) or Zinc-Iron-Alloy Coated (Galvannealed) by the Hot Dip Process, ASTM A653/A653M, or

b) Coatings which have been determined to be equivalent to G90 under the requirements of the Standard for Organic Coatings for Steel Enclosures for Outdoor Use Electrical Equipment, UL 1332.

5.7 A metallic material, protective coating, or cadmium plating, other than as described in 5.4 to 5.6 shall be painted or protected in a manner that has been determined to be equivalent.

5.8 A plant fiber gasket used to seal a liquid-retaining joint shall be not more than 1/32 inch (0.8 mm) thick. A cork composition gasket shall be shellacked in place on one side and coated with graphite on the other. A synthetic rubber gasket shall have a thickness of not less than 1/64 inch (0.4 mm) and not more than 3/32 inch (2.4 mm).

6 Bodies and Covers

6.1 A threaded section of a body intended for the connection of pipe shall have a section to serve as a wrench grip.

6.2 Pipe threads shall be in accordance with the Standard for Pipe Threads, General Purpose (Inch), ANSI/ASME B1.20.1.

Exception: Valves intended for use in installations where pipe fittings incorporate other than NPT type threads shall be permitted to be provided with pipe threads complying with a national pipe thread standard compatible with those fittings. The pipe thread type shall be identified in accordance with 26.4.

6.3 Joints in a body formed of two or more parts shall be prevented from loosening as the result of the turning effort exerted by connecting or disconnecting piping. See the Deformation Test, Section 12.

6.4 A valve assembly intended for attachment to pipe larger than 102 mm (4 in) nominal size shall be provided with flanged pipe connections. A flange shall conform to the appropriate American National Standard for Pipe Flanges and Flanged Fittings covering the material from which the flange is made. See 4.1.2.

6.5 Openings for bolts or screws used for assembly shall not extend through the outer walls of a body into a liquid-handling section.

6.6 Each cleanout and drain opening shall be closed by a standard pipe plug or a threaded shouldered plug. A gasket shall be retained by the valve body or by the plug when the plug is removed.

7 Seals and Stuffing Boxes

7.1 A valve shall include a stuffing box or other means for sealing to prevent leakage at the valve stem.

7.2 When packing is used to prevent leakage around a valve stem, and when it is required for the user to adjust or renew the packing during intended usage or as wear occurs, a stuffing box conforming to the following shall be used.

a) The stuffing box shall be provided with a removable, shouldered, unthreaded follower gland, with a nut or other means for adjusting the gland to maintain pressure on the packing.

b) The stuffing box gland shall be made of corrosion resistant material.

c) The stuffing box shall be fully packed prior to shipment of the valve.

7.3 An adjustable stuffing box used to seal an automatically actuated stem of a valve shall be such that any adjustment of the packing take-up will not bind the stem sufficiently to prevent the valve from functioning automatically.

7.4 A spring-loaded follower gland shall employ a spring made of corrosion resistant material or of material provided with a corrosion resistant coating.

7.5 When corrosion of a valve stem could result in damage to a packing or seal material and results in leakage, or binding of the assembly, the stem shall be of corrosion resistant material or be provided with a corrosion resistant coating or treatment.

7.6 A valve stem shall not be capable of being completely withdrawn from the valve by reverse rotation. Threads of a valve stem shall not enter a stuffing box recess.

7.7 A stem shall be of sufficient length to permit repacking the stuffing box without requiring the part to be dismantled.

8 Diaphragms and Bellows

8.1 A valve in which a flexible diaphragm, bellows, or similar construction constitutes the only liquid seal shall have the atmospheric side of the diaphragm or bellows enclosed in a casing intended to limit external leakage in the event of diaphragm or bellows rupture, or shall have provision for connection of a vent pipe or tubing intended to be routed to the outdoors or other location.

8.2 A valve shall not leak under conditions of ruptured diaphragm or bellows from an unthreaded vent opening or around any pins, stems, or linkage passing through the housing in excess of the following rate when the valve is tested to its maximum rated pressure:

a) 28 L/h (1 ft^3/h) of a 0.64 specific gravity gas for a valve for use only with fuel gases having specific gravities less than 1.0;

b) 14 L/h (0.5 ft^3 /h) of a 1.53 specific gravity gas for a valve for use with LP-Gas;

c) 1.00 L/h (61 in^3/h) of water for a valve for use with gasoline, kerosene, and Nos. 1 and 2 fuel oil;

d) 2.00 L/h (122 in^3/h) of the lightest grade of fuel oil heavier than No. 2 for which a valve is to be used.

8.3 A diaphragm or bellows shall be protected from damage.

8.4 Metal parts coming in contact with a diaphragm or bellows shall have no sharp edges, burrs, projections, or the like which cause chafing or abrasion of the diaphragm or bellows.

9 Springs

9.1 A spring shall be guided and arranged to minimize binding, buckling, or other interference with its free movement. When required, ends of a spring shall be closed and squared.

10 Operating Mechanisms

10.1 Screws and nuts used to attach operating parts to movable members shall be upset or otherwise locked to prevent loosening.

10.2 A manually-operated mechanism of a valve shall provide free movement of all parts.

PERFORMANCE

11 General

11.1 Except as otherwise indicated, representative samples of each type of valve are to be subjected to the tests described in these requirements. Additional samples of parts constructed of nonmetallic

materials, such as seal materials and valve seat discs, shall be provided as required for physical and chemical tests.

11.2 When a series of valves is to be investigated in which the bodies differ in size only, three representative samples are to be chosen to include the largest, smallest, and one intermediate size.

11.3 A valve is to be investigated for a specific liquid or liquids and for the service conditions for which it is to be recommended, such as ambient and liquid temperature and liquid pressure. When a valve is intended for use with a specific grade of fuel oil, it is capable of being used with that or any lighter grade.

11.4 A valve which is intended to be mounted in a definite position, shall be tested in that position.

11.5 Leakage tests for fuel gas valves are to use a source of aerostatic pressure such as air.

11.6 Leakage tests for liquid handling valves are not prohibited from being conducted with air. When leakage is observed, the tests shall be repeated with kerosene, Soltrol 170, or fuel oil consistent with the service for which the valve is used. A solvent considered equivalent to “white gasoline” is one having a Kauri Butanol value of 44.

11.7 Water or other nonhazardous liquid is not prohibited from being used for developing the required pressure in a hydrostatic pressure strength test.

11.8 A valve provided with a fusible element or other device that will close the valve automatically when subjected to heat or fire shall be subjected to the Fire Test, Section 16.

12 Deformation Test

12.1 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.

12.2 Each sample valve used in this test is to be rigidly anchored or otherwise supported. A length of Schedule 80 pipe, sufficient to provide for wrench engagement, is to be connected to each female pipe threaded section of the body. 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 pipe is then to be tightened across the valve body to the torque specified by the manufacturer or in Table 12.1, whichever is greater.

Table 12.1
Torque requirements for pipe connections

Pipe size, nominal in	Outside diameter,		Torque,	
	mm	(in)	N·m	(in·lb)
1/8	10.29	(0.405)	17	(150)
1/4	13.72	(0.540)	28	(250)
3/8	17.15	(0.675)	51	(450)
1/2	21.34	(0.840)	90	(800)
3/4	26.67	(1.050)	113	(1000)
1	33.40	(1.315)	137	(1200)

Table 12.1 Continued on Next Page

Table 12.1 Continued

Pipe size, nominal in	Outside diameter,		Torque,	
	mm	(in)	N·m	(in·lb)
1-1/4	42.16	(1.660)	164	(1450)
1-1/2	48.26	(1.900)	175	(1550)
2	60.33	(2.375)	186	(1650)
2-1/2	73.03	(2.875)	198	(1750)
3	88.90	(3.500)	203	(1800)
4	114.30	(4.500)	215	(1900)

12.3 After the torque force has been applied to each connected pipe, the test sample is to be subjected to the External Leakage Test, Section 13.

12.4 Upon removal of the pipe from the test sample, the assembly is to be examined for loosening of body joints.

13 External Leakage Test

13.1 Fuel gas valves

13.1.1 A fuel gas valve subject to pressure on both inlet and outlet connections shall not leak externally at a rate in excess of 200 cc/h (12.2 in^3/h) when subjected to a pressure of 1-1/2 times the maximum rated pressure, but not less than 3.4 kPa (0.5 psi) with the valve in the open position and the outlet sealed.

13.1.2 The inlet of the test valve is to be connected to a system capable of supplying clean air or other test medium at the specified test pressure. The outlet of the valve is to be sealed. Any bypass or other opening not essential to the operation of the valve during this test is to be sealed unless it discharges in the main liquid stream before the outlet of the valve. The test liquid is to be admitted and maintained at the specified test pressure. In the case of diaphragm elements which, in intended usage, are subjected to gas pressure on both sides of the diaphragm, the test pressure is to be applied to both sides of the diaphragm slowly and without shock to avoid stressing the diaphragm.

13.1.3 Leakage shall be observed by a flowmeter capable of indicating, for the test liquid employed, a flow rate of 200 cc/h (12.2 in^3/h). A valve is considered as complying with 13.1.1 when, with the liquid-containing parts of the test valve submerged in water to a depth of approximately 25.4 mm (1 in) while under the test pressure, no bubbles indicating leakage are observed.

Instead of the method described in this paragraph, leakage may be measured by an inverted graduated cylinder, which is calibrated in cubic centimeters. The inverted cylinder is to be closed by a water seal. The apparatus is to be adjusted so that 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 so that 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 is to be recorded.

With the valve in the closed position assumed as the result of intended operation, the test liquid at the specified test pressure is to be applied to the valve inlet for a test period of minimum 2 min. During this time, the vertical position of the graduated cylinder is to 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 is to 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 degrees F [(1.8 x degrees C) +32]; and

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

13.1.4 All external leakage tests employing a gas as the test medium are to be maintained for a minimum of 1 min, except where otherwise stated.

13.2 Fuel gas valves intended to discharge to atmosphere

13.2.1 A fuel gas valve intended to discharge to atmosphere shall not leak externally at a rate in excess of 0.2 L/h (12.2 in^3/h) when subjected to a pressure of 1-1/2 times the maximum rated pressure, but not less than 3.4 kPa (0.5 psi) with the valve in the closed position and the outlet open and when subjected to a pressure of 1-1/2 times the maximum rated pressure, but not less than 3.4 kPa (0.5 psi) with the valve in the open position and the outlet sealed.

13.2.2 The inlet of the test valve is to be connected to a system capable of supplying clean air or other test medium at the specified test pressure. The outlet of the valve is to be sealed or open as indicated in 13.2.1. Any bypass or other openings are to be closed so that pressure can be applied to the inlet side of the valve only. Observations for leakage are to be conducted in accordance with the provisions of 13.1.3.

13.2.3 All external leakage tests employing a gas as the test medium are to be maintained for a minimum of 1 min, except where otherwise stated.

13.3 Diaphragm-type fuel gas valves

13.3.1 Leakage through a diaphragm-type fuel gas valve, when pressure is applied to one side of the diaphragm only, shall not exceed that specified in Table 14.1 when tested with a pressure of 1-1/2 times maximum rated pressure, but not less than 3.4 kPa (0.5 psi).

13.3.2 To verify compliance with 13.3.1, the escapement orifice, bypass connection, and other openings are to be closed so that pressure can be applied to one side of the diaphragm only. The method of test outlined in 14.3.2 is to be used, but the outlet tubing is to be so attached as to collect any leakage from the valve outlet and the bleed connection.

13.3.3 All external leakage tests employing a gas as the test medium are to be maintained for at least 1 min.

13.4 Liquid handling valves

13.4.1 A liquid handling valve subject to pressure on both inlet and outlet connections shall not leak through stem or body seals or other joints, or show evidence of porosity in castings when subjected to any pressure between 0 and 1-1/2 times the rated operating pressure.

Exception: Mechanical leak detecting valves with vent lines connected back to the storage tank do not have to comply.

13.4.2 During this test, the inlet of the valve is to be connected to a source of pressure using a test medium as indicated by 11.6. The outlet of the valve is to be sealed. A positive shutoff valve and a pressure gauge having a pressure range of not less than 1-1/2 times nor more than 2 times the test pressure are to be installed in the pressure supply piping. The pressure gauge is to be installed between the shutoff valve and the sample under test. The pressure is to be increased gradually from zero and then maintained at 1-1/2 times rated pressure while being observed for evidence of external leakage.

13.4.3 All external leakage tests employing a liquid as the test medium are to be maintained for a minimum of 5 min.

13.4.4 All external leakage tests employing a gas as the test medium are to be maintained for a minimum of 1 min.

14 Seat Leakage Test

14.1 General

14.1.1 The seat leakage test is conducted on as received samples and after the Endurance Test, Section 18.

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

14.2 Liquid shutoff valves

14.2.1 A shutoff valve for liquids shall not leak past the seat when subjected to any pressure between 0 and 1-1/2 times maximum rated pressure.

Exception: Emergency valves with secondary poppets (on the discharge end) that incorporate pressure relief valve cores.

14.2.2 To verify compliance with 14.2.1, the inlet of the test valve is to be connected to a system utilizing the appropriate test medium. This test is to be conducted with the valve in its intended position of installation. The valve is to be in the closed position assumed as the result of intended operation. The pressure is to be increased gradually from zero and then maintained at 1-1/2 times rated pressure. The test is then to be repeated at a pressure of 1.7 kPa (0.25 psi).

14.3 Fuel gas shutoff valves

14.3.1 A shutoff valve for fuel gases shall not leak past the seat in excess of that indicated in Table 14.1 when subjected to a pressure of 1.7 kPa (0.25 psi) and at a pressure of 1-1/2 times maximum rated pressure, but not less than 3.4 kPa (0.5 psi). This test is to be conducted with the valve in its intended orientation of installation.

Table 14.1
Maximum allowable seat leakage

Type of gas	Maximum allowable leakage[a] cc/h
Natural and manufactured gas	5400
LP-gas:	
Port diameter 38.1 mm (1-1/2 in) nominal or less	650
Port diameter over 38.1 mm (1-1/2 in) nominal	5.9/mm (150/in) of port circumference
[a] At standard atmospheric conditions of 15.6°C (60°F) and a barometric pressure of 101 kPa (30 in of mercury).	

14.3.2 To verify compliance with 14.3, the inlet of the test valve is to be connected to a system capable of supplying clean air or other test gas at the test pressures. A tight connection is to be made to the valve outlet, terminating in tubing. The open end of this outlet tube is to be located within an inverted graduated cylinder which is calibrated in cubic centimeters. The inverted cylinder is to be closed by a water seal. The apparatus is to be adjusted so that 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 so that 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 is to be recorded. With the valve in the closed position assumed as the result of intended operation, the test medium at the specified test pressure is to be applied to the valve inlet for a minimum test period of 2 min. During this time, the vertical position of the graduated cylinder is to 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 is to 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 degrees F [(1.8 x degrees C) +32]; and

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

14.3.3 Instead of the method described in this paragraph, leakage is capable of being 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.

15 Operation Test

15.1 General

15.1.1 An automatically operated valve intended for use with fuel oil, other than a fusible link valve, and emergency shutoff valve shall function while handling the liquid for which it is intended and under the temperature condition designated in Table 15.1.

Table 15.1
Temperatures for test

Kind of valve	Temperature, ambient and liquid
Oil valves for Nos. 1, 2, 4, and 5 fuel oils and liquids of like viscosity	0°C (32°F)
Oil valves for Nos. 5 and 6 fuel oils and liquids of like viscosity for use on burners and similar applications provided with means to permit liquid flow beyond valve only while liquid is heated to a predetermined temperature	Minimum temperature specified for testing purposes by manufacturer, but not more than 45°C (113°F)

15.1.2 The temperature attained on or in a valve for use with a hot liquid, with that hot liquid flowing through the valve, shall not affect the function of the valve or cause seat leakage in shutoff valves. See 15.1.8.

15.1.3 Prior to the beginning of this test, a valve is to be found in compliance with the requirements for deformation, external leakage, and seat leakage.

15.1.4 In conducting the operation test on a valve, 305 mm (12 in) lengths of pipe of the rated size are to be fitted in the inlet and outlet openings of the valve to be tested. The pipe is to be arranged as a framework so that the valve will be mounted or suspended away from other heat conducting bodies. Black pipe is to be used; copper tubing is not prohibited from being used when the construction of the valve so indicates.

15.1.5 When a maximum closing time is to be stipulated for a shutoff valve, the time so stipulated is to be as determined under the temperature-pressure conditions, within the ratings for the valve, causing the slowest closing. For this determination, the temperature and pressure are not to exceed the ratings for the valve; the ambient temperature and the liquid temperature are to be not less than those specified in Table 15.1; and the pressure on the test valve disc is to be not less than the minimum rated pressure, which is to be 76 mm (3 in) of water for valves rated at not more than 3.4 kPa (0.5 psi).

15.1.6 When a valve is to be tested for use in an ambient temperature always exceeding 25°C (77°F), the test assembly as described in 15.1.4 is to be placed in an enclosure in which the stipulated ambient temperature is maintained during the test.

15.1.7 When a valve is to be tested for handling a liquid at a temperature exceeding the ambient temperature for which the valve is intended, the test valve is to be connected into a piping system conveying the test fluid at the stipulated temperature. The test liquid is to be the liquid the valve is intended to handle or a similar liquid having a specific heat approximating that of the intended liquid. When a valve is intended for use with more than one liquid, the test is to be made with the liquid (or a similar liquid) evaluated to represent the maximum temperature conditions. Otherwise the test arrangement is to be in accordance with 15.1.4 and 15.1.6.

15.1.8 The operation of a valve during the test is to demonstrate acceptable performance in its intended service. A shutoff valve is not to leak past the seat under the various conditions of temperature, viscosity, and pressure imposed during the test.

16 Fire Test

16.1 A fusible link shutoff valve and an emergency shutoff valve shall operate to limit contribution of flammable liquid to a fire, when tested in accordance with 16.2 to 16.8. An example of the test configuration is shown on Figure 16.1.

Figure 16.1

Test configuration