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NATIONAL STANDARD

ANSI/CAN/UL/ULC 331:2023

STANDARD FOR SAFETY

Strainers for Flammable and Combustible Liquids, Anhydrous Ammonia and Non-potable Water

Approved American National Standard
ANSI

ANSI/UL 331-2023

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SCC FOREWORD

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UL Standard for Safety for Strainers for Flammable and Combustible Liquids, Anhydrous Ammonia and Non-potable Water, ANSI/CAN/UL/ULC 331

Ninth Edition, Dated February 22, 2023

Summary of Topics

This Ninth Edition of ANSI/CAN/UL/ULC 331, Standard for Strainers for Flammable and Combustible Liquids, Anhydrous Ammonia and Non-potable Water, dated February 22, 2023 is a new joint Canada-US standard and reflects the latest ANSI and SCC approval dates and incorporates the proposals dated September 16, 2022.

The new requirements are substantially in accordance with Proposal(s) on this subject dated September 16, 2022.

No Text on This Page

ANSI/UL 331-2023

FEBRUARY 22, 2023

ANSI/CAN/UL/ULC 331:2023

Standard for Strainers for Flammable and Combustible Liquids, Anhydrous Ammonia and Non-potable Water

The first edition was titled Standard for Strainers for Hazardous Fluids.

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Ninth Edition

February 22, 2023

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

The most recent designation of ANSI/UL 331 as an American National Standard (ANSI) occurred on February 22, 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 22, 2023.

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Preface

This is the Ninth Edition of ANSI/CAN/UL/ULC 331, Standard for Strainers for Flammable and Combustible Liquids, Anhydrous Ammonia and Non-potable Water.

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 331 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 Power-Operated Pumps for Petroleum Dispensing Products, STP 79.

This list represents the STP 79 membership when the final text in this standard was balloted. Since that time, changes in the membership may have occurred.

STP 79 Membership

Name	Representing	Interest Category	Region
Angelique Dupont	Suntec Industries France	Producer	France
Miles Ebert	Fill-Right Company	Producer	USA
Gregory Hatch	Franklin Fueling System	Producer	USA
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STP 79 Membership Continued on Next Page

STP 79 Membership Continued

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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 complete, self-contained strainer or filter assemblies intended for use with designated flammable and combustible liquids, anhydrous ammonia (fertilizer grade), and non-potable water. Flammable and combustible liquid strainers or filter assemblies are used in residential and commercial fuel-burning, dispensing, and handling facilities. Although these devices are designated as strainers, they may be either strainers or filters according to the common terminology of the industry.

1.2 The term flammable and combustible liquids as used in this standard means fuel oil, gasoline, kerosene, and similar petroleum products, liquefied petroleum gas (LP-Gas or propane), and manufactured and natural fuel gas.

1.3 These requirements do not cover the following:

a) Strainers for handling liquids under cryogenic conditions;

b) Strainers for marine use;

c) Strainers for automotive fuel lines;

d) Strainers for handling refrigerants;

e) Strainers for use in such facilities as chemical, petrochemical, petroleum, and utility power plants;

f) Strainers for use in fluid-power (hydraulic and pneumatic) applications;

g) Strainers for use with gasoline or gasoline/ethanol blends, which are covered under the Standard for Strainers for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 Percent (E0 – E85), UL 331A; and

h) Strainers for use with diesel fuel, biodiesel fuel, diesel/biodiesel blends, kerosene, or fuel oil, which are covered under the Standard for Strainers for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations Up to 20 Percent (B20), Kerosene, and Fuel Oil, UL 331B.

1.4 Requirements for strainers for non-potable water are provided in Annex A.

1.5 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; et

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

b) In Canada:

1) The National Fire Code of Canada;

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

3) Provincial or other Regulations.

2 Components

2.1 Except as indicated in 2.2, 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 publications are referenced in this Standard:

ANSI/ASME B1.20.1, *Pipe Threads, General Purpose, Inch*

ASTM A47, *Standard Specification for Malleable Iron Castings*

ASTM A395, *Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures*

ASTM A536, *Standard Specification for Ductile Iron Castings*

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*

ANSI/ASTM D975, *Standard Specification for Diesel Fuel Oils*

ASTM D1835, *Standard Specification for Liquefied Petroleum (LP) Gases*

ANSI/ASTM D3699, *Standard Specification for Kerosene*

ANSI/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*

ASTM E11, *Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves*

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*

UL 157, *Gaskets and Seals*

UL 746C, *Polymeric Materials – Use in Electrical Equipment Evaluations*

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

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

5 Glossary

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

5.2 ASTM IRM 903/IRM 903 – High-swelling petroleum base oil described in ASTM D471.

5.3 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.

5.4 FLAMMABLE AND COMBUSTIBLE LIQUIDS – The fuels are formulated in accordance with Regulation of Fuels and Fuel Additives, 40 CFR 80, and the following:

a) Gasoline formulated in accordance with 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 ANSI/ASTM D4806;

c) Diesel fuel formulated in accordance with ANSI/ASTM D975;

d) Kerosene formulated in accordance with ANSI/ASTM D3699; and

e) Fuel oil (heating fuel) formulated in accordance with ASTM D396.

5.5 FLAMMABLE LIQUID – A liquid having a flash point below 100 °F (37.8 °C) and a vapour pressure not exceeding 40 psig [275 kPa (absolute)] at 100 °F (37.8 °C) and as defined in the National Fire Code of Canada and NFPA 30.

5.6 LIQUEFIED PETROLEUM GAS (LP-GAS, LPG or PROPANE) – Any material having a vapor pressure not exceeding that allowed for commercial propane, as defined in ASTM D1835, that is composed predominantly of the following hydrocarbons, either by themselves (excluding propylene) or as mixtures: propane, propylene, butane (normal butane or isobutane) and butylenes.

CONSTRUCTION

6 General

6.1 A strainer shall include all of the components necessary for its intended function and installation and shall be furnished as a complete assembly.

6.2 The construction of a strainer shall be such that parts can be reassembled in the intended manner after being dismantled to the extent needed for servicing.

6.3 A strainer shall be constructed so that, when in its intended operating position, any air trapped within will not reduce the rate of liquid flow or the effective strainer capacity.

6.4 A strainer employing a strainer element intended to be cleaned or replaced shall permit the removal of the element without disconnecting piping.

6.5 A strainer element shall be constructed so that joints or seals required to prevent fluid bypass of the element may be maintained.

6.6 A strainer shall be constructed so that, when the screen or filter element is removed for cleaning, all foreign matter (sediment and dirt) will be removed or can be removed without the probability of any foreign matter being deposited in the outlet side of the strainer.

7 Capacity

7.1 A strainer that is intended to protect the smallest orifice in oil burning equipment shall comply with the requirements in this section.

Exception: This requirement does not apply to strainers intended for use in fuel oil transfer or recirculating piping systems. Refer to 21.1(g).

7.2 A strainer element of the wire cloth, perforated, or plate type shall have a maximum orifice (diameter) size or plate separation of:

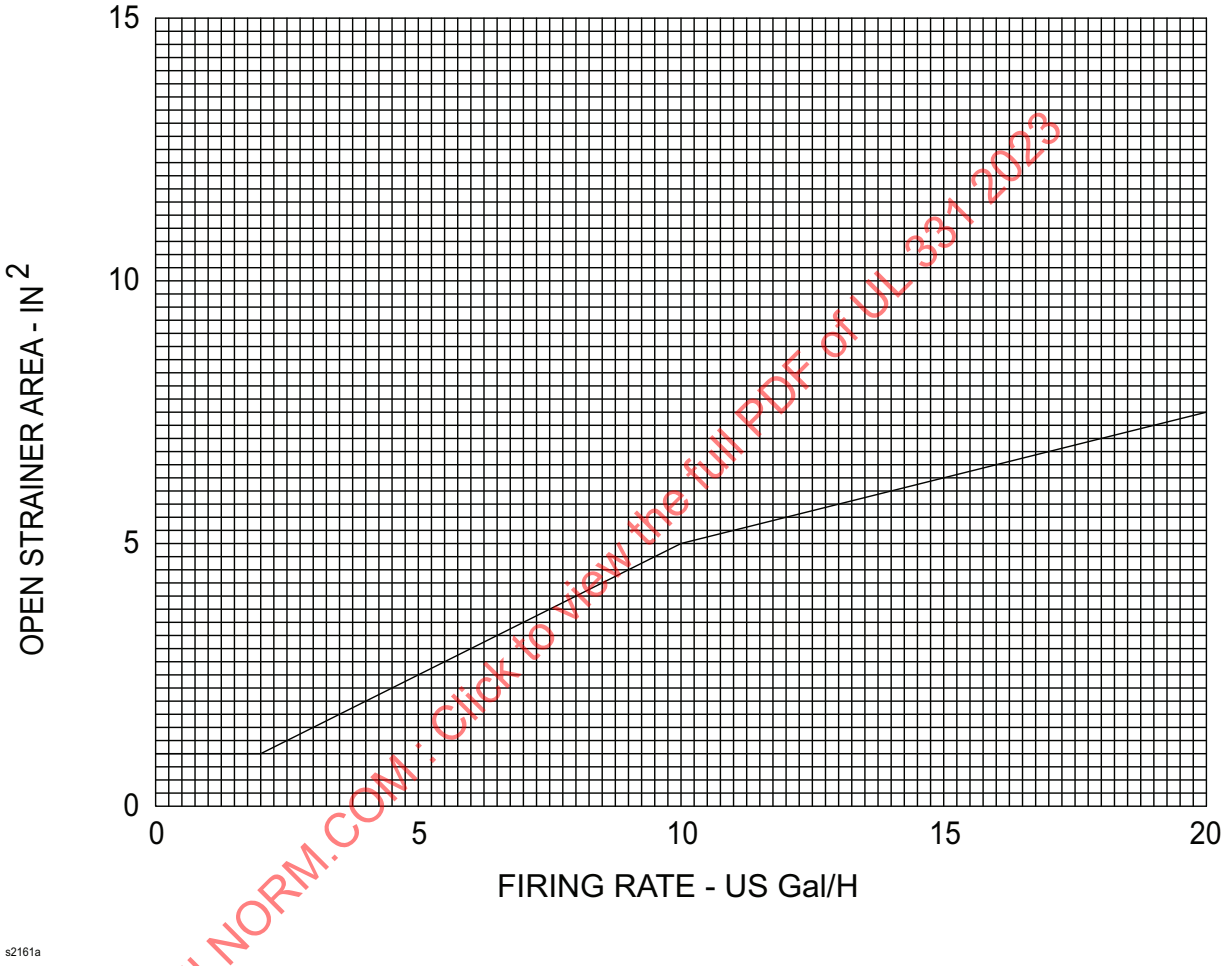
a) 0.027 in (0.69 mm) if the strainer is intended for use with No. 1 or 2 grade fuel oil; and

b) 0.056 in (1.42 mm) if the strainer is intended for use with No. 4, 5, or 6 grade fuel oil service.

7.3 Each strainer assembly shall be rated for capacity in terms of the maximum firing rate of the burner equipment as expressed in US gal/h (L/h) of fuel oil. For strainers employing wire cloth or perforated screens, Figure 7.1 – Figure 7.3 specify minimum areas of screen opening based upon the grade of fuel oil used and the firing rate of the equipment to be served.

Figure 7.1

Strainer area for No. 1 grade fuel oil



NOTES:

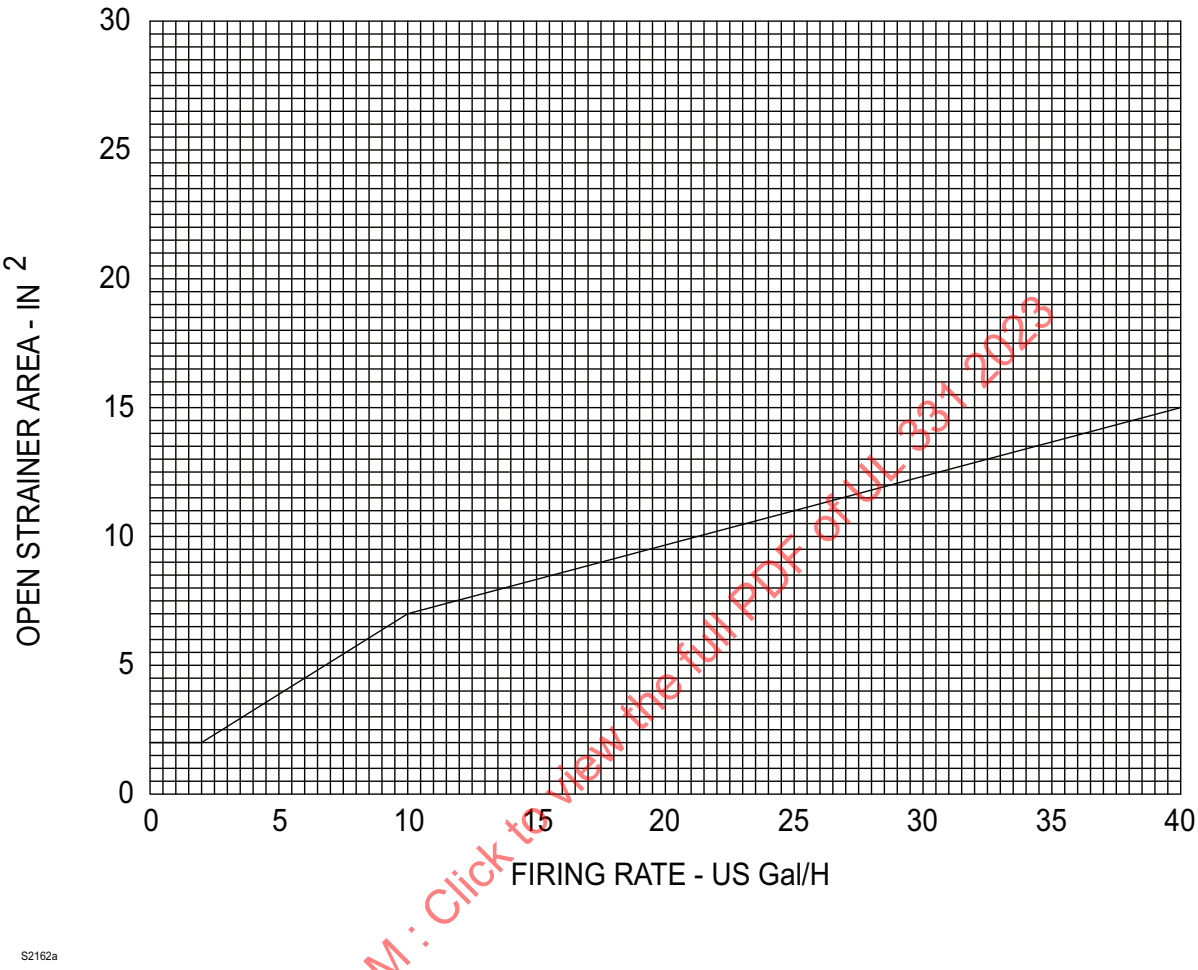
1) Fuel oil as designated by Specification for Fuel Oils, ANSI/ASTM D396;

2) 1 in^2 = 6.45 cm^2;

3) 1 US Gal = 3.79 L.

Figure 7.2

Strainer area for No. 2 grade fuel oil



NOTES:

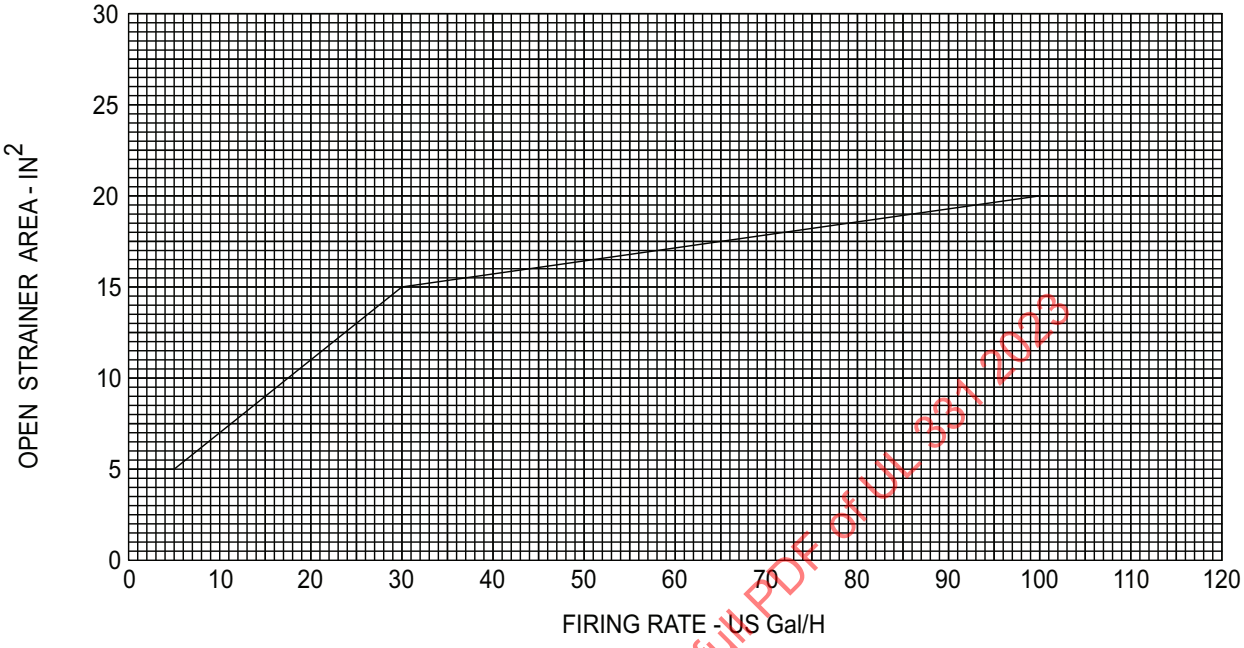
1) Fuel oil as designated by Specification for Fuel Oils, ANSI/ASTM D396;

2) 1 in^2 = 6.45 cm^2;

3) 1 US gal = 3.79 L.

Figure 7.3

Strainer area for Nos. 4, 5, 6 grade fuel oils



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NOTES:

1) Fuel oils as designated by Specification for Fuel Oils, ANSI/ASTM D396;

2) 1 in^2 = 6.45 cm^2;

3) 1 US gal = 3.79 L.

7.4 The capacity of each size and type of element shall be determined. If possible, this shall be accomplished by calculation as outlined in 7.5 for wire cloth types. Elements other than this, such as filter elements of felt, cotton waste, ceramics, and the like, shall be subjected to the Clogging Test – Strainers for Oil Burners, Section 18, to:

a) Establish ratings by comparison to established properties of wire cloth or perforated screens; and

b) Determine that the filter-type element will not pass particles that will be retained by the standard wire-mesh strainer element used for comparison.

7.5 A wire-cloth element has an open area equal to the total area of the cloth minus the area covered by seams, ribs, and supports multiplied by the screen factor. The screen factor is that percentage of open area of the cloth to the whole area. If the screen factor is unknown, it may be calculated as follows:

$$Screen\ factor = (1 - ND) \times (1 - nd)$$

in which:

N is the number of wires in warp per inch (per mm),

D is the diameter of wire in warp in inches (mm),

n is the number of wires in the shoot per inch (per mm), and

d is the diameter of wire in the shoot in inches (mm).

8 Materials

8.1 A part in contact with the fluid to be handled shall be resistant to the action of such fluid.

8.2 Zinc, copper, and copper-base alloys, such as brass, that are subject to rapid destructive action by ammonia in the presence of water shall not be used for anhydrous ammonia service.

8.3 Except as indicated in 8.4 and 8.5, fluid-containing parts other than a seal ring or a gasket shall have a melting point (solidus temperature) of not less than 950 °F (510 °C) and an ultimate tensile strength of not less than 10,000 psi (69 MPa) at 400 °F (204 °C).

Exception: For a strainer for an oil burner, an oil-containing part, other than a base (head) unit, that includes a material of melting point (solidus temperature) less than 950 °F (510 °C) is allowed to be installed if:

a) The part is protected by a fusible-link shut-off valve with a temperature rating of not more than 350 °F (177 °C). The fusible-link shut-off valve shall comply with UL/ULC 842; and

b) The part is suitable for exposure to the intended fuel and the part complies with the requirements of the Resistance to Impact Test and the Mold Stress-Relief Distortion Test, in accordance with UL 746C, with the following parameters:

1) With regard to the Resistance to Impact Test, the drop impact test shall be conducted utilizing a concrete floor or an equivalent nonresilient floor in lieu of a hardwood surface;

2) With regard to the Resistance to Impact Test, the ball impact test shall be conducted with the impact requirements of 5.0 ft·lb (6.8 J); and

3) With regard to the Mold Stress-Relief Distortion Test, the part shall be placed in an air oven maintained at 158 °F (70 °C) for at least 7 h.

8.4 A body and a closure for anhydrous ammonia and LP-Gas service shall be of steel, ductile (nodular) iron, Grade 60-40-18 or 65-45-12, as described in ASTM A395, or ASTM A536, or malleable iron complying with ASTM A47, or the equivalent. In addition, brass or bronze may be used for such a part for LP-Gas service.

8.5 A brazing material used in joining fluid-confining parts of a strainer for LP-Gas shall have a melting point (solidus temperature) of not less than 1724 °F (940 °C). Brazing shall not be used on strainers for anhydrous ammonia. See 8.2.

8.6 If atmospheric corrosion of a part may interfere with the intended function of the strainer or permit external leakage, the part shall be of corrosion-resistant material or be provided with a corrosion-resistant protective coating.

Exception: A corrosion-resistant protective coating need not be provided on ferrous materials used for fluid-confining parts having the thickness specified in Table 8.1.

Table 8.1
Thickness for Uncoated Non-Stainless Ferrous Materials

Fluid in contact with material	Minimum thickness			
	Sheet metal,		Sand castings,	
	in	(mm)	in	(mm)
Anhydrous ammonia	1/8	(3.2)	1/4	(6.4)
Manufactured and natural fuel gases	0.067	(1.70)	3/16	(4.8)
LP-gas	1/8	(3.2)	1/4	(6.4)
Fuel oils	0.042	(1.07)	1/8	(3.2)
Gasoline	a		1/4	(6.4)

[a] Shall be at least 0.093 in (2.36 mm), corrosion protected or not.

8.7 A protective coating shall provide resistance against corrosion to a degree not less than that provided by the protective coating specified in 8.8.

8.8 Cadmium plating shall not be less than 0.0003 in (0.008 mm) thick, and zinc plating shall not be less than 0.0005 in (0.013 mm) thick, except on parts where threads constitute the major portion of the area, in which case the cadmium or zinc plating shall not be less than 0.00015 in (0.0038 mm) thick. See 8.2.

8.9 A wire-cloth element, if finer than 60 mesh, shall be resistant to corrosion. A 60-mesh or coarser element shall be resistant to the fluid it is intended to contact.

9 Bodies and Covers

9.1 An opening threaded for connection of pipe shall be threaded in accordance with ANSI/ASME B1.20.1.

Exception: Strainers 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 21.1.

9.2 A strainer for attachment to pipe larger than 3-inch nominal size shall be provided with flanged pipe connections. Flanges shall conform to the appropriate American National Standard for pipe flanges and flanged fittings covering the material from which the flange is made or shall be of a construction found by investigation to be equivalent for the specific application.

9.3 Cleanout and drain openings shall be closed by a standard pipe plug, a threaded, shouldered plug, or a wing-nut plug. The specified plugs shall be supplied with a seal to prevent leakage; that shall be compatible with the intended fuel(s), as demonstrated by compliance with the performance requirements of this standard. A strainer intended for use with gasoline shall have brass plugs or, if of steel, they shall be coated to retard corrosion.

9.4 A strainer provided with a screwed cover shall employ either ground joints, gaskets, or O-rings that shall be compatible with the intended fuel(s). If a gasket or O-ring is used, it shall be retained by the body, cover, or cap when the part is removed and shall not be damaged when the cover or cap is screwed in place.

9.5 A flat gasket employed with a bolted cover shall be cemented to the cover or body unless the construction is such that the gasket will be retained by either the body or cover when the cover is removed.

Exception: Cementing or retaining of the gasket is not necessary provided a complete set of new gaskets is furnished with each replacement cartridge for a strainer that employs a cartridge-type filtering element.

9.6 A plant fiber gasket shall not be less than 1/32 in (0.8 mm) thick.

9.7 A cork gasket shall be graphited on one side and the other side shall be cemented in place so the gasket will not be blown out.

10 Stuffing Boxes

10.1 If packing is used to prevent leakage around a stem, and the construction is such that it is necessary for the user to adjust or renew the packing during usage or as wear occurs, a stuffing box complying with the requirements in 10.2 – 10.8 shall be provided.

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

10.3 A stuffing box gland shall be made of corrosion-resistant material.

10.4 A stuffing box shall be fully packed prior to shipment of the strainer.

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

10.6 If corrosion of a stem will cause damage to a packing or seal material and result in leakage, the stem shall be of a corrosion-resistant material.

10.7 A stem shall be constructed so that it cannot be completely withdrawn from the strainer by reverse rotation. Threads of a stem shall not enter a stuffing box recess.

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

11 Springs

11.1 The construction and application of a spring employed in a strainer shall be such that it is not likely to fail because of corrosion, fatigue, overstress, or wear, if failure of the spring will allow the strainer elements to become displaced.

PERFORMANCE

12 General

12.1 Except as otherwise indicated, representative samples of a strainer shall be subjected to the tests described in Sections 13 – 19.

12.2 For a series of strainer designs in which the bodies differ in size only, three representative samples shall be chosen to include the largest, smallest, and one intermediate size. For a strainer design series having a single body size, one sample is sufficient.

12.3 A strainer is to be investigated for a specific fluid or fluids, and for the service conditions, for which it is to be recommended, such as fluid temperature and fluid pressure. Refer to 17.3.

13 Tests on Synthetic-Rubber Parts

13.1 A synthetic-rubber part in contact with one of the fluids specified in Table 13.1 shall not show excessive volume change or loss of weight as specified in 13.3, when considered on the basis of its intended function, following immersion in the specified test fluid in accordance with the requirements in UL 157.

Table 13.1
Test Liquids for Synthetic-Rubber Materials

Fluid in contact with part	Test fluid
LP-Gas	n-Hexane
Anhydrous ammonia	Liquid anhydrous ammonia
Manufactured and natural fuel gases	IRM Oil No. 903 (ASTM D471) and n-Hexane
Fuel oils, Nos. 1 and 2, and kerosene	IRM Oil No. 903 (ASTM D471)
Fuel oils, Nos. 4, 5, and 6	IRM Oil No. 903 (ASTM D471)
Gasoline	A and C reference fuels (ASTM D471)
Gasoline blends, alcohol	85 % C Reference Fuels (ASTM D471) and 15 % of specific blending fluid (Ethanol, Methanol)
Heated fuel oils	No. 6 fuel oil at 250 °F (157 °C)
Oxygenate	90 % C Reference Fuels (ASTM D471) and 10 % of oxygenate (ETBE, MTBE, TAME) and 80 % C reference Fuels (ASTM D471) and 20 % of oxygenate (ETBE, MTBE, TAME)
Other fuels	C Reference Fuels (ASTM D471) and specific percentage of specified blending fluid

13.2 The Immersion-Extraction Test is not to be conducted with Reference Fuel A or IRM 903 oil.

13.3 With reference to the requirements in 13.1, the change in volume shall not be more than 25 % swelling (40 % in Reference Fuel C or Fuel C blends) or 1 % shrinkage, and the weight loss (extraction) shall not be more than 10 %.

Exception: If the limits for volume change or weight loss are exceeded, a complete strainer assembly shall be filled with the appropriate test liquid for at least 70 h and then shall comply with the requirements for the Deformation and External-Leakage Test, Section 14, and the Hydrostatic-Strength Test, Section 15.

13.4 Synthetic rubber part that is in contact with fluids, shall not crack or show visible evidence of deterioration following exposure to oven aging, as specified in the requirements in UL 157. The maximum service temperature used to determine the conditioning time and temperature for oven aging shall be 140 °F (60 °C) unless the product is designated for use at a higher temperature.

13.5 UL 157, provides for the testing of either finished elastomeric parts, sheet, or slab material. Sheet or slab material shall be tested when the elastomeric parts are O-rings having a diameter of less than 1 in (25.4 mm). The material tested shall be the same as that used in the product, regardless of whether finished elastomeric parts, sheet, or slab material is tested.

14 Deformation and External-Leakage Test

14.1 When tested as specified in 14.2 – 14.6, a strainer shall not leak, nor shall there be evidence of damage resulting from:

a) The application of 1.5 times maximum rated pressure for at least 1 min;

b) The tightening of threaded parts used for care and servicing; and

c) The turning effort exerted on openings threaded for piping.

14.2 Representative strainer assemblies shall be rigidly supported. Any bolts, pipe plugs, or threaded parts detached for care and servicing of the strainer are to be tightened with a torque wrench to the value specified in Table 14.1 or Table 14.2. Samples with threads other than those specified in Table 14.1 or Table 14.2 shall be torqued as specified by the manufacturer.

Table 14.1
Torque Requirements for Screws

American standard screw size	Torque,		I.S.O. screw size, mm	Torque,	
	lb-in	(N·m)		lb-in	(N·m)
–	–	–	4	7	(0.8)
No. 8	9	(1.0)	4.5	12	(1.4)
No. 10	15	(1.7)	5	19	(2.7)
1/4 in	50	(5.6)	6	40	(4.5)
–	–	–	7	70	(7.9)
5/16 in	100	(11.3)	8	100	(11.3)
–	–	–	9	130	(14.7)
3/8 in	150	(16.9)	10	165	(18.6)
7/16 in	200	(22.6)	12	230	(26.0)
1/2 in	250	(28.2)	14	295	(33.3)
9/16 in	300	(33.9)	–	–	–

Table 14.2
Torque Requirements for Pipe Connections

Pipe size, nominal inches	Torque, lb-in	Torque, (N·m)
1/8	150	(16.9)
1/4	250	(28.2)
3/8	450	(50.8)
1/2	800	(90.4)
3/4	1000	(113)
1	1200	(136)
1-1/4	1450	(164)
1-1/2	1550	(175)
2	1650	(186)
2-1/2	1750	(198)
3	1800	(203)

14.3 The sample strainer used in this test shall be rigidly anchored or otherwise supported. A length of Schedule 80 pipe shall be connected to a female pipe threaded section of the body, the male threads having first been lubricated with SAE No. 10 machine oil. Each pipe is then to be tightened to the torque specified in Table 14.2.

14.4 The strainer is then to be subjected for at least 1 min to a hydrostatic pressure of 1.5 times maximum rated pressure, but not less than 18 psig (124 kPa).

14.5 The strainer parts used for care and servicing of the strainer are then to be alternately removed and replaced 25 times, tightening each time with a torque wrench to the value specified in Table 14.1 or Table 14.2. Samples with threads other than those specified in Table 14.1 or Table 14.2 shall be torqued as specified by the manufacturer. The pressure test described in 14.4 is then to be repeated.

14.6 Any bolts or threaded parts used for care and servicing of the strainer are then to be tightened with a torque wrench to twice the value specified in Table 14.1 or Table 14.2. Samples with threads other than those specified in Table 14.1 or Table 14.2 shall be torqued to twice the value as specified by the manufacturer. The pressure test described in 14.4 is then to be repeated.

15 Hydrostatic-Strength Test

15.1 All parts of a strainer that are subjected to pressure during intended use shall withstand for at least 1 min, without rupture or permanent distortion, a hydrostatic pressure of five times the maximum rated pressure, but not less than 60 psig (414 kPa).

15.2 All samples used in the Deformation and External-Leakage Test, Section 14, shall be subjected to this test.

16 Element-Collapse Test

16.1 A strainer element shall not collapse when totally clogged and subjected for at least 1 min to a differential hydrostatic pressure of 18 psi (124 kPa).

16.2 The strainer element openings shall be closed with tape, lacquer, or other means. A hydrostatic pressure is then to be applied to exert the differential pressure between the inlet and outlet sides of the element.

17 Pressure-Drop Test – Strainers for Oil Burners

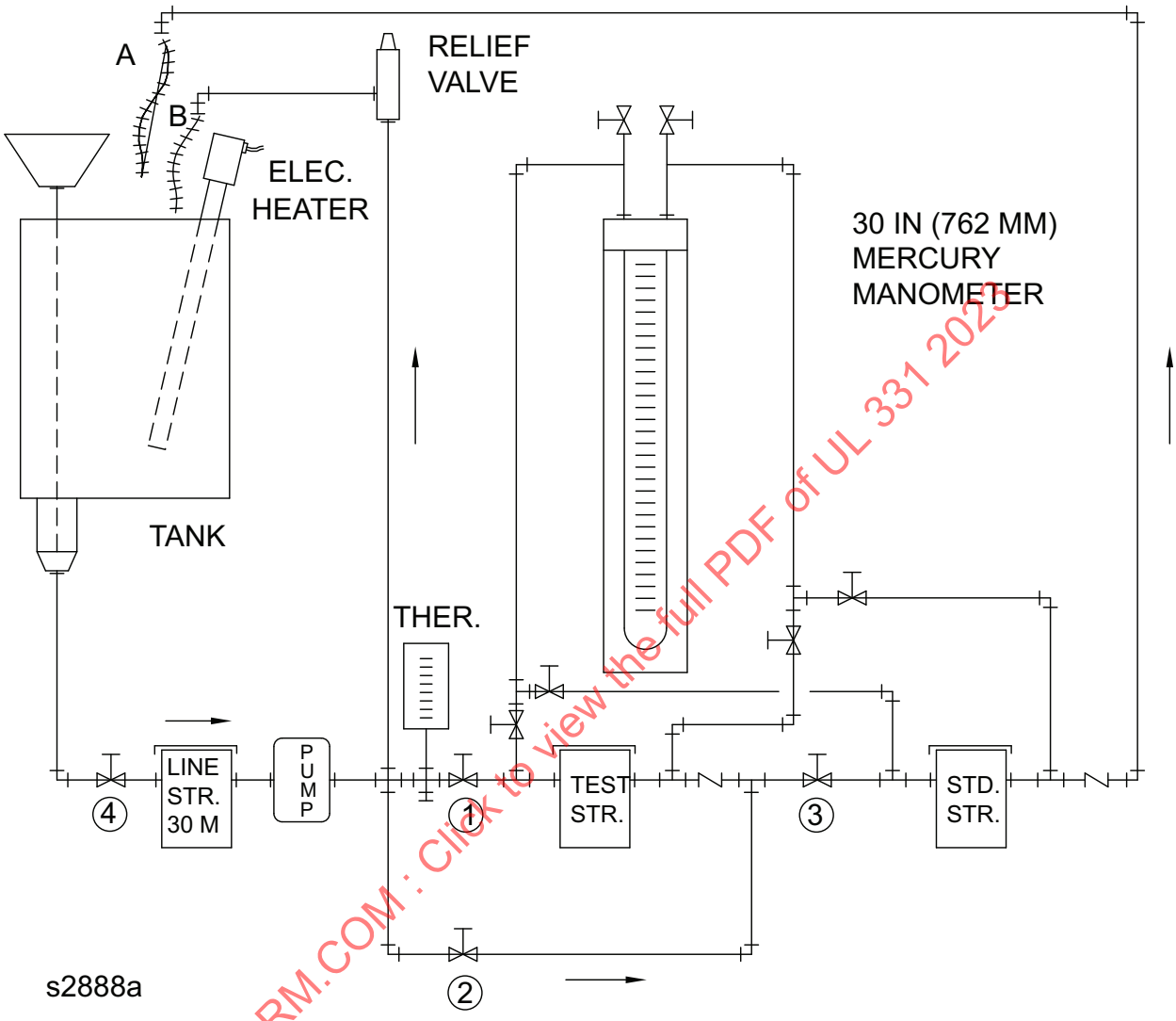
17.1 A filter-type element when clean, other than the wire-cloth or perforated type (that is, filter elements, such as felt, cotton waste, or ceramics), shall not cause a pressure differential between inlet and outlet openings in excess of 2.04 in mercury (6.9 kPa) when passing the intended grade of fuel oil at the rated capacity of the strainer. When a range of fuel oils is specified for use with the strainer, the test shall be performed with the fuel oil with the highest viscosity.

17.2 The sample strainer assembly shall be connected into a system of piping similar to that illustrated in Figure 17.1. The pump shall have a capacity in excess of the sample strainer rating. A conveniently sized reservoir shall be filled with clean fuel oil corresponding to the grade intended for use with the strainer. The strainer and valve (4) upstream from the pump are provided to protect the pump and are not a necessary part of the apparatus.

17.3 A strainer design that meets the requirements of this standard for a specific grade of fuel oil may be identified for use with that or any lighter grades. The viscosity of the fuel oil employed in the test shall be consistent with the viscosity that may be encountered in service. The fuel oil used shall be circulated through the sample strainer until the liquid temperature indicated at the thermometer is that which will indicate the liquid has the viscosity specified in Table 17.1.

Figure 17.1

Test Apparatus for Pressure Drop and Clogging Test



17.4 A mercury U-tube manometer or the equivalent shall be used for measuring pressure differentials between the inlet and outlet connections of the sample strainer. Pumped oil shall be returned to the reservoir through lines A and B (see Figure 17.1) that are to have swivel joints or flexible means of outlet so that liquid can be collected in separate containers for flow measurement purposes.

17.5 The pump shall be started with valves 1, 3, and 4 opened and valve 2 closed. Valve 1 then shall be regulated until the pressure differential indicated by the mercury manometer is 2.04 in (1 psi or 6.9 kPa). The flow rate as measured at overflow A shall be used to determine the capacity rating of the strainer.

Table 17.1
Minimum Viscosity for Pressure Drop Test

Fuel oil CS12 Grade No. 1	45 SSU
Fuel oil CS12 Grade No. 2	75 SSU
Fuel oil CS12 Grade No. 4	1000 SSU
Fuel oil CS12 Grade No. 5	4000 SSU
Fuel oil CS12 Grade No. 6	4000 SSU
NOTE – SSU refers to Saybolt Seconds Universal.	

18 Clogging Test – Strainers for Oil Burners

18.1 A filter-type element (see 17.1) shall not cause a pressure differential between inlet and outlet openings in excess of 20 in of mercury (68 kPa) when compared to the clogging characteristics of a standard wire-mesh strainer element of equal capacity rating. The filter-type element shall not pass particles that will be retained by the standard wire-mesh strainer element used for comparison.

18.2 The test apparatus shall be as described in 17.2 and 17.3. The pump shall be of any reasonable capacity. The liquid employed shall be any clean No. 1 or No. 2 grade fuel oil.

18.3 The clogging material to be employed shall be of any specification approximating the following, as this test is performed on a comparative basis. The material employed shall be in the form of oven-dried, sieve-analyzed buckwheat flour approximating that specified as option 1 or option 2 in Table 18.1.

Table 18.1
Sieve Analysis of Clogging Material

U.S.A. Standard sieve No. (Percentage by weight to create clogging material)	
Option 1	**Option 2**
30 – 40 (1%)	30 – 80 (20%)
40 – 50 (6%)	80 – 100 (4%)
50 – 60 (5%)	100 – 120 (5%)
60 – 70 (6%)	120 – 140 (9%)
70 – 80 (2%)	140 – 200 (35%)
80 – 100 (4%)	200 – 325 (23%)
100 – 120 (5%)	Finer than 325 (4%)
120 – 140 (9%)	

Table 18.1 Continued on Next Page