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ANSI/CAN/UL/ULC 567A:2024

STANDARD FOR SAFETY

Emergency Breakaway Fittings, Swivel Connectors and Pipe-Connection Fittings for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 Percent (E0 – E85)

Approved American National Standard
ANSI

ANSI/UL 567A-2024

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National Standard of Canada

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UL Standard for Safety for Emergency Breakaway Fittings, Swivel Connectors and Pipe-Connection Fittings for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 Percent (E0 – E85), ANSI/CAN/UL/ULC 567A

Second Edition, Dated May 31, 2024

Summary of Topics

This new Second edition of ANSI/CAN/UL/ULC 567A dated May 31, 2024 is being issued as a new joint US/Canada Standard reflecting the latest ANSI and SCC approval dates and incorporating the proposal dated August 4, 2023.

The new requirements are substantially in accordance with Proposal(s) on this subject dated August 4, 2023.

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ANSI/UL 567A-2024

MAY 31, 2024

ANSI/CAN/UL/ULC 567A:2024

Standard for Emergency Breakaway Fittings, Swivel Connectors and Pipe-Connection Fittings for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 Percent (E0 – E85)

Prior to the first edition, the requirements for the products covered by this standard were included in the Outline of Investigation for Emergency Breakaway Fittings, Swivel Connectors and Pipe-Connection Fittings for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 Percent (E0 – E85), UL 567A.

First Edition – March, 2015

Second Edition

May 31, 2024

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

The most recent designation of ANSI/UL 567A as an American National Standard (ANSI) occurred on May 31, 2024. 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 May 31, 2024.

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Preface

This is the Second Edition of ANSI/CAN/UL/ULC 567A, Standard for Emergency Breakaway Fittings, Swivel Connectors and Pipe-Connection Fittings for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 Percent (E0 – E85).

ULSE 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 567A 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 Second Edition joint American National Standard and National Standard of Canada is based on, and now supersedes, the First Edition of UL 567A.

Requests for interpretation of this Standard should be sent to ULC Standards. The requests should be worded in such a manner as to permit a “yes” or “no” answer based on the literal text of the requirement concerned.

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 Collaborative Standards Development System (CSDS) at https://csds.ul.com.

This Edition of the Standard has been formally approved by the Technical Committee (TC) on Pipe Connectors For Petroleum Products And Lp-Gas, TC 567.

This list represents the TC 567 membership when the final text in this Standard was balloted. Since that time, changes in the membership may have occurred.

TC 567 Membership

Name	Representing	Interest Category	Region
D. Boyd	BP America Inc	Commercial /Industrial User	USA
D. Gross	Wal-Mart Stores Inc	Commercial /Industrial User	USA
W. Koch	Technology Resources International, Inc.	General Interest	USA
M. Lauber	OPW Fueling Components	Producer	USA
P. Layson	Applications Engineering Group Inc.	General Interest	USA
P. Legault	Integrated Review Services – Consulting	Government	Canada
J. Petersen	Petersen Engineering	General Interest	USA
J. Prusko	UL Standards & Engagement	TC Project Manager – Non-voting	USA
E. Riffle	Gilbarco Inc.	Producer	USA
W. Smith	Full Circle Inc.	Producer	USA
R. Vassos	Waleco Inc.	Producer	Canada
L. Werner	UL Standards & Engagement	TC Chair – Non-voting	Canada
E. Wolff-Klammer	UL Solutions	Testing and Standards Org	USA

International Classification for Standards (ICS): 23.040.60, 75.200, 75.160.20

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 emergency breakaway fittings, swivel connectors and pipe-connecting fittings of the threadless compression type. Connectors and fittings covered by these requirements are intended only for the following services.

1.2 Emergency breakaway fittings, swivel connectors and pipe-connecting fittings for gasoline/ethanol blends with nominal ethanol concentrations up to 85 % (E0 – E85) shall be constructed to comply with the following:

a) The requirements defined in UL/ULC 567, and

b) The requirements in this Standard.

1.3 A swivel connector is either a hose swivel or joint swivel. The swivel connector will allow radial movement and shall be constructed for use with the fluids shown in 1.5.

1.4 An emergency breakaway fitting is used between the outlet of the dispensing device and the hose nozzle valve and separates in the event that the coupling is subjected to an excessive pull force to safeguard against abnormally excessive pull force on the hose assembly and dispenser and prevent loss of liquid. An emergency breakaway fitting shall be constructed for use with the fluids shown in 1.5. The fittings shall be of the single-break or reconnectable type.

1.5 Emergency breakaway fittings, swivel connectors, and pipe-connecting fittings are intended for use with one or more of the following as applicable:

a) Gasoline formulated in accordance with the Standard Specification for Automotive Spark-Ignition Fuel, ASTM D4814;

b) Gasoline/ethanol blends with nominal ethanol concentrations up to 25 % ethanol (E25), consisting of gasoline formulated in accordance with the Standard Specification for Automotive Spark-Ignition Fuel, ASTM D4814, when blended with denatured fuel ethanol formulated to be consistent with the Standard Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel, ASTM D4806; or

c) Gasoline/ethanol blends with nominal ethanol concentrations above 25 % formulated in accordance with the Standard Specification in item (b) or formulated in accordance with the Standard Specification for Ethanol Fuel Blends for Flexible-Fuel Automotive Spark-Ignition Engines, ASTM D5798.

1.6 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 Repair Garages, NFPA 30A;

b) In Canada:

1) The National Fire Code of Canada;

2) Provincial or other Regulations.

1.7 These requirements do not cover devices intended for use with diesel, biodiesel, diesel/biodiesel blends, kerosene or fuel oil, which are covered under UL/ULC 567B.

1.8 These requirements do not cover devices intended for use with anhydrous ammonia or LP-Gas, which as covered under UL/ULC 567.

1.9 A hose assembly provided with a swivel connector or emergency breakaway fitting for use with fuels anticipated by these requirements shall comply with the applicable requirements in UL 330A.

1.10 Products intended to be rated for use with gasoline or gasoline/ethanol blends with nominal ethanol concentrations:

a) Up to 25 % (E0 – E25) shall be evaluated using the CE25a test fluid as the only applicable test fluid;

b) Up to 40 % (E0 – E40) shall be evaluated using both the CE25a and CE40a test fluid; or

c) Up to 85 % shall be evaluated using both the CE25a and the CE85a test fluids.

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 documents are referenced in this standard.

ASME B1.20.1, *Standard for Pipe Threads, General Purpose (Inch)*

ASTM A653/A653M, *Specification for Sheet Steel, 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 D4814, *Standard Specification for Automotive Spark-Ignition Fuel*

ASTM D5798, *Standard Specification for Ethanol Fuel Blends for Flexible-Fuel Automotive Spark-Ignition Engines*

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

NFPA 30, *Flammable and Combustible Liquids Code*

NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Garages*

NFC, National Fire Code of Canada

SAE J1681, *Recommended Practice for Gasoline, Alcohol, and Diesel Fuel Surrogates for Material Testing*

UL 87A, *Power-Operated Dispensing Devices for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 Percent (E0 – E85)*

UL 157, *Gaskets and Seals*

UL 330A, *Hose and Hose Assemblies for Use With Dispensing Devices Dispensing Gasoline and Gasoline/Ethanol Blends With Nominal Ethanol Concentrations Up To 85 Percent (E0 – E85)*

UL/ULC 567, *Emergency Breakaway Fittings, Swivel Connectors, and Pipe-Connection Fittings for Petroleum Products and LP-Gas*

UL/ULC 567B, *Emergency Breakaway Fittings, Swivel Connectors and Pipe-Connection Fittings for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil*

UL 969, *Marking and Labeling Systems*

UL 1332, *Organic Coatings for Steel Enclosures for Outdoor Use Electrical Equipment*

5 Glossary

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

5.2 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.

5.3 BLENDING OPTION – Dispensing devices may be provided with an option that blends two specific fuels into one fuel to be dispensed. This blending occurs at the dispenser level and can be in two forms:

a) Fixed blending – Blending at the dispenser level that blends two specific fuels into one fuel to be dispensed, and that fuel to be dispensed is fixed. For example, fixed blending includes blend options where gasoline and denatured fuel ethanol can be blended to achieve E85, which is the actual dispensed fuel.

b) Variable blending – Blending at the dispenser level that blends two specific fuels into the fuel to be dispensed, but the fuel to be dispensed can be any of a number of previously set points. For example, variable blending includes blend options where gasoline and E85 can be blended to achieve E40, E60, and E85 as the actual dispensed fuel.

5.4 FITTING, PIPE-CONNECTING – A fitting of the threadless compression seal-ring type for use in the assembly of dispensing devices to facilitate connection of piping or tubing. These fittings shall be made in the straight coupling style, as well as in the tee, ell, reducer, adapter, and other styles.

5.5 FITTING, RECONNECTABLE TYPE – An emergency breakaway fitting designed such that upon separation it is intended to be reconnected and reused when it is not damaged.

5.6 FITTING, SINGLE-BREAK TYPE – An emergency breakaway fitting that, upon separation, is not intended to be reconnected and reused.

5.7 GASOLINE/ETHANOL BLENDS – Blended fuels composed of a gasoline component and an ethanol component. The numerical value corresponding to the ethanol component determines the blend rating (such as E85 for 85 % ethanol, 15 % gasoline).

5.8 HOSE SWIVEL – A swivel connector with one end attached to a hose and the other end to an appurtenance. The hose swivel will allow radial movement of the hose and/or appurtenance to prevent the hose from twisting or having torsional stress.

5.9 PRESSURE INDICATING DEVICE – As used herein, the pressure indicating device means one of the following:

a) An analog gauge having a pressure range such that the test pressure is between 30 and 70 percent of the maximum scale reading of the gauge;

b) A digital pressure transducer, or other digital gauge, that is calibrated over a range of pressure that includes the test pressure; or

c) Other device that is equivalent to the devices in (a) or (b).

5.10 SEALS, DYNAMIC – A seal that is subject to mechanical movement or other applied forces that result in movement or flexing of the seal under normal use conditions.

5.11 SEALS, STATIC – A seal that is not subject to mechanical movement or other applied forces other than compressing forces that are applied during installation, after which, the seal is held in place during normal use conditions.

5.12 SWIVEL CONNECTOR – A type of swivel categorized as either a hose swivel or swivel joint.

5.13 SWIVEL JOINT – A swivel connector installed in a piping system with at least one end attached to a rigid pipe or other appurtenance that is firmly affixed. The swivel joint will allow radial movement of the pipe or other appurtenance attached to the swivel to prevent torsional stress.

CONSTRUCTION

6 General

6.1 Products shall be constructed for an operating pressure of not less than 50 pounds per square inch gauge (psig) (345 kPa) for the fluid confining portion of the device and 0.5 psig (3.45 kPa) for the vapor confining portion of the device, when provided, and an ultimate rupture pressure of not less than five times the design pressure.

6.2 An emergency breakaway fitting shall be constructed to separate in the event that the coupling is subjected to a pull force not less than 100 lb (445 N), and not to exceed 350 lb (1557 N).

7 Materials

7.1 Metallic materials

7.1.1 General

7.1.1.1 A metallic part, in contact with the fuels anticipated by these requirements, shall be resistant to the action of the fuel if degradation of the material will result in leakage of the fuel or if it will impair the function of the device. For all fuel ratings, see Corrosion due to fluid, 7.1.2.1. For products rated for gasoline/ethanol blends with nominal ethanol concentrations greater than 40 %, see Metallic materials – system level, 7.1.3.

7.1.1.2 The exposed surfaces of metallic parts shall be resistant to atmospheric corrosion if this corrosion will lead to leakage of the fluid or if it will impair the function of the device. The material shall comply with the requirements in Atmospheric corrosion, 7.1.2.2.

7.1.1.3 Metallic parts in contact with the fuels anticipated by these requirements shall not be constructed of lead, or materials that are substantially lead. In addition, no coatings or platings containing lead shall be used, such as terne-plated steel.

7.1.2 Metallic materials – material level

7.1.2.1 Corrosion due to fluid

7.1.2.1.1 All metallic materials used for fluid confining parts shall be resistant to corrosion caused by the fuels anticipated by these requirements. In addition, metallic materials, used internally in fluid confining parts, that are required to operate in some manner to address safety (e.g. plunger on a valve) shall be resistant to corrosion caused by these fuels. This requirement also applies to all tubing, piping, or other interconnection means between components. Compliance is verified by the Long Term Exposure Test, Section 12.

7.1.2.1.2 A coating or plating, applied to a base metal, shall be resistant to the action of the fuels anticipated by these requirements as determined by the Long Term Exposure Test, Section 12.

7.1.2.2 Atmospheric corrosion

7.1.2.2.1 Metallic materials used for fluid confining parts shall be resistant to atmospheric corrosion. In addition, metallic materials that are required to operate to address safety 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 1/4 inch (6.4 mm) if shown by production test to be free of leakage; and

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

7.1.2.2.2 A protective coating shall provide resistance against atmospheric corrosion to a degree not less than that provided by the protective coatings specified in 7.1.2.2.3.

7.1.2.2.3 Cadmium plating shall not be less than 0.0003 inch (0.008 mm) thick, and zinc plating shall not be less than 0.0005 inch (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 inch (0.0038 mm) thick. Metallic parts are considered to comply with 7.1.2.2.1 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 ASTM A653/A653M, or

b) Coatings which have been determined to be equivalent to G90 under the requirements of UL 1332.

7.1.2.2.4 A metallic material other than as described in 7.1.2.2.1 – 7.1.2.2.3 shall be painted or protected in a manner that has been determined to be equivalent.

7.1.3 Metallic materials – system level

7.1.3.1 Combinations of metallic materials in products rated for use with gasoline/ethanol blends with nominal ethanol concentrations greater than 40 % shall be chosen to reduce degradation due to galvanic corrosion in accordance with 7.1.3.2 – 7.1.3.4.

7.1.3.2 Table 7.1 shows the galvanic series for metallic materials exposed to a conductive solution of sea water. The most active material in a given combination will experience increased levels of corrosion, while the most passive material in the combination will experience reduced levels of corrosion. The greater the separation of the materials in the galvanic series of Table 7.1, the more pronounced the effects would be. Table 7.1 serves as a guide in selecting the appropriate test conditions based on manufacturer specified material combinations.

Table 7.1
Galvanic Series of Metal Materials

Most passive	Platinum
	Gold
	Graphite
	Silver
	Stainless Steel Type 316 (Passive)
	Stainless Steel Type 304 (Passive)
	Titanium
	13% Chromium Stainless Steel (Passive)
	76 Ni – 16 Cr –7 Fe Alloy (Passive)
	Nickel (Passive)
	Silver Solder

Table 7.1 Continued on Next Page

Table 7.1 Continued

	M-Bronze
	G-Bronze
	70:30 Cupro Nickel
	Silicon Bronze
	Copper
	Red Brass
	Aluminum Brass
	Admiralty Brass
	Yellow Brass
	60 Ni – 30 Mo – 6 Fe – 1 Mn
	76 Ni – 16 Cr – 7 Fe Alloy (Active)
	Nickel (Active)
	Manganese Bronze
	Tin
	Stainless Steel Type 316 (Active)
	Stainless Steel Type 304 (Active)
	13% Chromium Stainless Steel (Active)
	Cast Iron
	Wrought Iron
	Mild Steel
	Aluminum 2024
	Cadmium
	Alclad
	Aluminum 6053
	Aluminum 1100
	Galvanized Steel
	Zinc
	Magnesium Alloys
Most active	Magnesium
NOTE: Reprinted with permission from NACE. Based on table titled "Galvanic Series of Metals Exposed to Seawater" from NACE Corrosion Engineer's Reference Book, Third Edition © NACE International 2002.	

7.1.3.3 Plating, such as nickel plating, can be used to reduce or eliminate dissimilar metal contact areas, as long as the plating material complies with 7.1.3.2 as the contact metal. If used, the plating shall comply with the Long Term Exposure Test, Section 12.

7.1.3.4 Gaskets or nonmetallic spacers used to reduce or eliminate dissimilar metal contact areas, where permitted, shall be subjected to the applicable requirements for static seals in Nonmetallic materials, 7.2, when they are in contact with the fluid.

7.2 Nonmetallic materials

7.2.1 General

7.2.1.1 A nonmetallic part in contact with the fuels anticipated by these requirements, shall be resistant to the action of the fuel if degradation of the material will result in leakage of the fuel, or if it will impair the function of the device.

7.2.1.2 Gaskets or seals shall be designated as dynamic and/or static seals. See 5.10 and 5.11 respectively. If the type of seal cannot be determined, then the material shall be treated as both a static and a dynamic seal.

7.2.1.3 Gaskets and seals shall comply with the requirements as outlined in Nonmetallic materials – material level, 7.2.2, and Nonmetallic materials – system level, 7.2.3.

7.2.1.4 Nonmetallic materials in contact with the fuels anticipated by these requirements shall not be constructed of the following:

a) Polysulfide rubber;

b) Ethylene propylene diene monomer (EPDM) rubber;

c) Methyl-Methacrylate;

d) Polyvinyl Chloride (PVC);

e) Nylon 6/6; or

f) Polyurethane.

7.2.2 Nonmetallic materials – material level

7.2.2.1 Static seals

7.2.2.1.1 Static seals shall be evaluated in accordance with UL 157, modified as indicated in 7.2.2.1.2 – 7.2.2.1.4. If a specific material complies with these requirements, the material can be considered to be qualified for system level testing.

7.2.2.1.2 A static seal shall be constructed of a material that is acceptable in accordance with the scope of UL 157.

7.2.2.1.3 Static seals shall be subjected to the Volume Change and Extraction Test in accordance with UL 157, except for the following modifications:

a) The test duration shall be 1000 hours;

b) The applicable test fluids shall be as described in Annex A; and

c) For all materials, the average volume change shall not exceed 40 % swell (increase in volume) or 1 % shrinkage (decrease in volume). In addition, the weight loss shall not exceed 10 %. For coated fabrics, alternate limits can be used with the average volume change not exceeding 60 % swell or 5 % shrinkage, and the weight loss shall not exceed 20 %. There shall be no visual evidence of cracking or other degradation as a result of the exposure for any material including coated fabrics.

7.2.2.1.4 Static seals shall be subjected to the Compression Set Test in accordance with UL 157, except for the following modifications:

a) The test duration shall be 1000 hours.

b) The samples shall be immersed, at room temperature, in the test fluids [see (c)] while compressed for the entire test duration. No oven conditioning is required.

c) The applicable test fluids shall be as described in Annex A.

d) The recovery period shall consist of removing the sample from the compression device and immersing it in the applicable test fluid for 30 minutes at room temperature. The sample shall not be allowed to dry out due to exposure to air. The 30-minute immersion should use the same fluid as the test fluid for each sample.

e) For all materials, the average compressions set is calculated and shall not exceed 45 %. For coated fabrics, alternate limits can be used with the average compression set not exceeding 70 %.

Exception: This requirement does not apply to composite or thermoplastic gasket materials as defined in accordance with UL 157.

7.2.2.2 Dynamic seals

7.2.2.2.1 Dynamic seals shall be evaluated in accordance with UL 157, modified as indicated in 7.2.2.2.2 – 7.2.2.2.4. If a specific material complies with these requirements, the material can be considered to be qualified for system level testing.

7.2.2.2.2 A dynamic seal shall be constructed of a material that is acceptable in accordance with the scope of UL 157.

7.2.2.2.3 Dynamic seals shall be subjected to the Volume Change and Extraction Test in accordance with UL 157, except for the following modifications:

a) The test duration shall be 1000 hours;

b) The applicable test fluids shall be as described in Annex A; and

c) For all materials, the average volume change for a gasket or seal material shall not exceed 40 % swell (increase in volume) or 1 % shrinkage (decrease in volume). In addition, the weight loss shall not exceed 10 %. For coated fabrics, alternate limits can be used with the average volume change not exceeding 60 % swell or 5 % shrinkage, and the weight loss shall not exceed 20 %. There shall be no visual evidence of cracking or other degradation as a result of the exposure for any material including coated fabrics.

7.2.2.2.4 Dynamic seals shall be subjected to the Volume Change and Extraction Test in accordance with UL 157, except for the following modifications:

a) The test duration shall be 1000 hours;

b) The applicable test fluids shall be as described in Annex A; and

c) For all materials, the average tensile strength and the average elongation of materials shall not be less than 60 % of the as-received values. For coated fabrics, alternate limits can be used with the average tensile strength and the average elongation not less than 30 % of the as-received values.

7.2.3 Nonmetallic materials – system level

7.2.3.1 For all materials, gaskets and seals that have been shown to comply with the applicable requirements for static seals in UL 157, or with the requirements under material level tests shall be subjected to the system level tests for the applicable component after the Long Term Exposure Test, Section 12. Static seals shall be provided in accordance with 12.2.6.

7.3 Casting impregnation materials

7.3.1 Material level

7.3.1.1 Casting impregnation materials shall be evaluated at the material level in accordance with the requirements in UL 87A.

7.3.2 System level

7.3.2.1 The casting impregnation material, applied as intended to a casting, shall comply with the Long Term Exposure Test, Section 12. The casting shall not show indications of porosity leakage at any point during or after this test.

7.4 Internal parts

7.4.1 Nonmetallic parts located internally to a fluid confining part, degradation of which would not directly result in leakage, is not required to comply with Nonmetallic materials, 7.2. The part shall be tested in accordance with 7.4.2.

7.4.2 Internal nonmetallic parts shall be tested during the Long Term Exposure Test, Section 12. During this test, the part shall not degrade to the extent that visible particles can be observed in the fluid.

7.5 Blending options

7.5.1 Devices intended for use with dispensing equipment that provides for a variable blending option, at gasoline/ethanol blends with nominal ethanol concentrations above 25 %, shall be subjected to the Blending Cycling Test, Section 24.

7.5.2 Devices intended for use with dispensing equipment that provides for a fixed blending option, as gasoline/ethanol blends with nominal ethanol concentrations above 25 %, shall be evaluated in accordance with (a) or (b):

a) If intended to be located after the blending option such that it is only subjected to the final blended fuel, then the Blending Cycling Test, Section 24, is not required.

b) If intended to be located at or before the blending option such that it is subjected to different gasoline/ethanol blend levels, the meter shall be subjected to the Blending Cycling Test, Section 24.

7.5.3 Devices intended for use with dispensing equipment that provides for a variable or fixed blending of gasoline/ethanol blends with nominal ethanol concentrations below 25 % are considered acceptable without further evaluation for the blending option.

8 Swivel Connectors and Emergency Breakaway Fittings

8.1 A product shall provide electrical continuity from end-to-end so that when it is installed, continuity is provided for grounding of static charges. Such continuity shall be inherent in the construction and shall not be accomplished by a jumper wire.

9 Pipe-Connecting Fittings

9.1 A seal ring of a fitting shall not be exposed to physical damage when the sealing nut is tightened.

9.2 A fitting shall provide electrical continuity across the fitting for grounding of static charges. Such continuity shall be inherent in the construction and shall not be accomplished by a jumper wire.

9.3 A fitting for the connection of pipe or tubing shall be made to provide strength at least equal to that of a fitting constructed from one of the materials indicated in Table 9.1. The wall thickness shall not be less than that specified under the appropriate column.

Table 9.1
Material and Wall Thickness of Fittings

ASME B1.20.1 Pipe size of fitting, nominal in	Wall thickness, steel other than castings				Wall thickness, cast steel or malleable iron			
	Pipe fitting		Tube fitting		Pipe fitting		Tube fitting	
	in	(mm)	in	(mm)	in	(mm)	in	(mm)
1/4	0.088	(2.24)	0.078	(1.98)	0.095	(2.41)	0.085	(2.16)
3/8	0.091	(2.31)	0.081	(2.06)	0.100	(2.54)	0.090	(2.29)
1/2	0.109	(2.77)	0.099	(2.51)	0.105	(2.67)	0.095	(2.41)
3/4	0.113	(2.87)	0.103	(2.62)	0.120	(3.05)	0.110	(2.79)
1	0.133	(3.38)	0.123	(3.12)	0.134	(3.40)	0.124	(3.15)
1-1/4	0.140	(3.56)	0.130	(3.30)	0.145	(3.68)	0.135	(3.43)
1-1/2	0.145	(3.68)	0.135	(3.43)	0.155	(3.94)	0.145	(3.68)
2	0.154	(3.91)	0.144	(3.66)	0.173	(4.39)	0.163	(4.14)
2-1/2	0.203	(5.16)	0.193	(4.70)	0.210	(5.33)	0.200	(5.08)
3	0.216	(5.49)	0.206	(5.23)	0.231	(5.87)	0.221	(5.61)

9.4 A fitting shall permit insertion of a pipe or a tube a distance equal to at least 1-1/2 times the outside diameter of the pipe or tube for which it is intended.

9.5 The distance specified in 9.4 shall be measured from the inserted end of the pipe or tube to the outside face of the seal nut after tightening to the torque specified in Table 9.2.

Table 9.2
Tightening Torque for Pipe-Connecting Fittings

Pipe or tube size nominal in	Tightening torque lb-in	(N·m)
1/8	150	(17)
1/4	600	(68)
3/8	700	(79)
1/2	850	(96)
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)
Coaxial Connection	600	(68)

9.6 A fitting of the tee or ell form shall be constructed with integral stops, or shall be otherwise constructed to limit the distance the pipe or tube can be inserted into the fitting, thus preventing a restriction in the passage.

10 End Connections

10.1 Both ends of a swivel connector or emergency breakaway fitting shall be provided with pipe threads for connection of pipe or of pipe fittings, or with coaxial connections and shall be constructed with a section to serve as wrench flats. The minimum width of the flat surfaces shall be determined in accordance with Table 10.1.

Table 10.1
Width of Flat Surfaces

Pipe size nominal in	Raised flat surface[a] in	(mm)	Unraised flat surface in	(mm)
1/2	1/4	(6.4)	11/16	(17.5)
3/4	1/4	(6.4)	3/4	(19.1)
1	1/4	(6.4)	3/4	(19.1)
1-1/4	9/32	(7.1)	1	(25.4)
1-1/2	5/16	(7.9)	1	(25.4)
2	5/16	(7.9)	1	(25.4)
2-1/2	1/2	(12.7)	1	(25.4)
3	19/32	(15.1)	1-1/4	(31.8)
4	19/32	(15.1)	1-1/4	(31.8)
Coaxial Connection	5/16	(7.9)	1	(25.4)

[a] A raised flat is a surface with a diameter which is greater than the threaded portion of the male end of a swivel connector. The outside surface of the female end of a swivel connector or emergency breakaway fitting shall also be considered to be a raised flat.

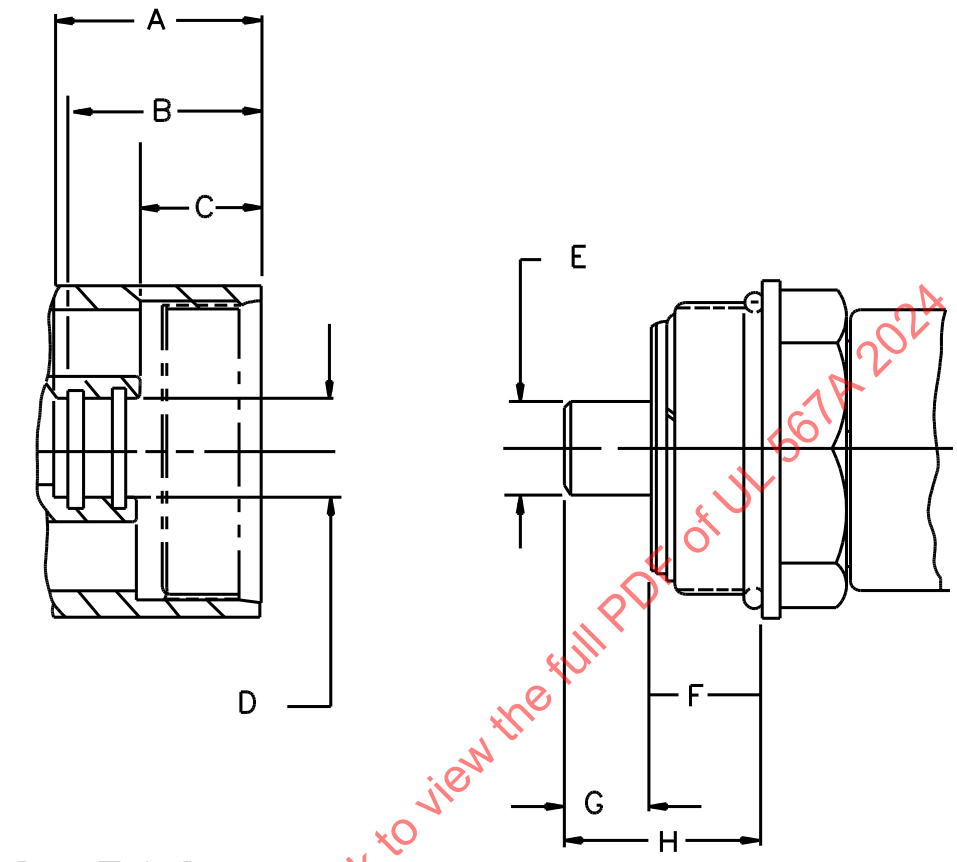
10.2 Pipe threads shall be in accordance with ASME B1.20.1.

Exception: Products 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 27.9.

10.3 The male connection of a coaxial type fitting shall have a 1-7/8 – 12 SAE external straight thread. The female connection of a coaxial type fitting shall have a 1-7/8 – 12 SAE internal straight thread. Coaxial type connections shall also have the dimensions as indicated in Figure 10.1.

Figure 10.1

Coaxial Type Connection



Item	in	(mm)
A	1.45 min	(36.8 min)
B	1.26 max	(32.0 max)
C	0.78 min	(19.8 min)
D	0.668 – 0.672	(17.0 – 17.1)
E	0.660 – 0.664	(16.8 – 16.9)
F	0.78 max	(19.8 max)
G	0.56 min	(14.2 min)
H	1.31 – 1.45	(33.3 – 36.8)

10.4 The couplings provided on coaxial type vapor recovery hose assemblies shall have male 1-7/8 – 12-SAE straight threads when the inner hose is intended to dispense the liquid fuel into the vehicle and 1-1/4 inch – 18 SAE Straight, M34 by 1.5 metric thread or 1 inch – 11-1/2 NPT threads , as required when the outer hose is intended to dispense the liquid fuel into the vehicle. All fittings shall be designed to fit the accessories connected to the hose couplings to form a leak tight connection. If the end connections of a vapor recovery fitting do not conform to these requirements or those specified in 10.3, the installation instructions which accompany each fitting shall indicate the specific equipment which shall be connected to the fitting.

PERFORMANCE

11 General

11.1 Representative samples of each size and specific construction of the product shall be subjected to the tests described in these requirements. Additional samples of parts constructed of nonmetallic materials are usually required for separate physical and chemical tests.

11.2 All tests shall be performed using the test fluids specified for that test. No substitution of test fluids is allowed. When the test indicates that CE25a, CE40a or CE85a shall be used, the test fluid shall be prepared as described in Annex A.

11.3 Water or other liquid is used to develop the required pressure in the Hydrostatic Strength Test, Section 20.

11.4 To reduce the effects of seal dry out due to removal of the test fluid after specific tests, the tests given in the test sequence of 11.5 shall be started within 4 hours of removal of the test fluid. If necessary to coordinate testing, the sample may be left filled with the most recent test fluid at room temperature until the next test is initiated. If the previous test used an aerostatic or hydrostatic source, the sample shall be filled with kerosene.

11.5 The tests in the following sequences shall be performed on one sample of a device as shown for each applicable test fluid as described in the Long Term Exposure Test, Section 12. The remaining tests in this standard may be performed in any order on the same samples or on additional samples as needed.

a) Reconnectable emergency breakaway fitting sequence:

1) Long Term Exposure Test, Section 12;

2) Electrical-Continuity Test, Section 13;

3) External Leakage Test, Section 14;

4) Pull Test – Emergency breakaway fitting, 21.2;

5) Seat Leakage Test, Section 15;

6) Endurance Test, Section 17;

7) Electrical-Continuity Test, Section 13;

8) External Leakage Test, Section 14;

9) Pull Test – Emergency breakaway fitting, 21.2;

10) Seat Leakage Test, Section 15; and

11) Hydrostatic Strength Test, Section 20.

b) Non-reconnectable emergency breakaway fitting sequence:

1) Long Term Exposure Test, Section 12;

2) Electrical-Continuity Test, Section 13;

3) External Leakage Test, Section 14;

4) Pull Test – Emergency breakaway fitting, 21.2;

5) Seat Leakage Test, Section 15; and

6) Hydrostatic Strength Test, Section 20.

c) Swivel connector sequence:

1) Long Term Exposure Test, Section 12;

2) Electrical-Continuity Test, Section 13;

3) External Leakage Test, Section 14;

4) Operation Test, Section 16;

5) Electrical-Continuity Test, Section 13;

6) External Leakage Test, Section 14; and

7) Hydrostatic Strength Test, Section 20.

d) Pipe-connection fitting sequence:

1) Long Term Exposure Test, Section 12;

2) Electrical-Continuity Test, Section 13;

3) External Leakage Test, Section 14;

4) Hydrostatic Strength Test, Section 20; and

5) Pull Test – Pipe-connecting fitting, 21.1.

11.6 For the External Leakage, Seat Leakage, and Hydrostatic Strength tests, a calibrated pressure indicating device (as described in 5.9), shall be used.

11.7 External and Seat Leakage tests on connectors or fittings intended to handle petroleum products shall use a source of aerostatic pressure such as air or nitrogen. When leakage is observed, the tests shall be repeated with kerosene, Soltrol® 170, or other liquid of comparable or lighter viscosity as the test medium.

NOTE: Soltrol® is a Registered Trademark of Chevron Phillips Chemical Company LP.

12 Long Term Exposure Test

12.1 General

12.1.1 The test outlined in 12.2 – 12.4 shall be performed on one or two samples of the device. If the product is rated for use with gasoline or a gasoline/ethanol blend with a nominal ethanol concentration of

up to 25 % (E0 – E25), then the test shall be performed using the CE25a test fluid. If the product is rated for use with gasoline or a gasoline/ethanol blends with a nominal ethanol concentration of up to 40 % (E0 – E40), then the test shall be performed using both the CE25a and CE40a test fluids. If the product is rated for use with a gasoline/ethanol blend with a nominal ethanol concentration of up to 85 %, then the test shall be performed using both the CE25a and the CE85a test fluids. See Annex A for the test fluids.

12.2 Samples

12.2.1 Samples of complete device shall be tested for each applicable test fluid. For non-reconnectable breakaway fittings subjected to the appropriate sequence in 11.5, two samples are needed for each applicable test fluid. All inlet and outlet openings of the samples shall be sealed in accordance with 12.2.3.

12.2.2 If platings or coatings are used internal to the device, additional samples may be used. See 12.4.2.

12.2.3 Closures shall be provided to seal off inlet and outlet openings of all samples in accordance with 12.2.1. These closures shall be fabricated of materials as specified in 12.2.5. The closures shall be provided with a 1/4 in NPT opening for connection to the test apparatus. All closures shall be installed by the manufacturer and provided with a torque rating. There will be no other adjustment to connections for the duration of the test.

12.2.4 Each pipe-connection fitting shall be made up with 24- to 36-in (600- to 900-mm) lengths of pipe or tubing. The end of the pipe or tube engaged by the fitting shall be without threads and free of burrs, whereas the opposite end shall be provided with pipe threads. The end of the pipe shall be inserted into the fitting a distance of one-half of maximum permitted by the design. Material selection for the pipe or tubing shall be in accordance with 12.2.5. The closures at the end of the pipe or tubing pieces used shall be fabricated of suitable materials and are not required to comply with 12.2.5.

12.2.5 Material combinations at the product and closure interface will be a specified by the manufacturer. All closures for devices rated for gasoline/ethanol blends with nominal ethanol concentrations up to 25 or 40 % shall be fabricated of suitable materials. All closures for devices rated for gasoline/ethanol blends with nominal ethanol concentrations above 25 % shall be fabricated of the materials representing permitted material to which the device may be connected; such as aluminum closures representing an aluminum fitting or tube. Table 7.1 shall be used to determine the worst case metal interactions. Materials that are specified by the manufacturer, but are not included in Table 7.1 shall be tested as necessary to represent worst case conditions.

12.2.6 Any O-rings, gaskets, or other sealing materials, shall be provided and installed by the manufacturer. The dynamic sealing devices or materials shall be the same as those that will be used in the final product installation. Static seals shall be representative of the seals being used in the final product installation. If the sealing device or material is not considered part of the device under test, but will be provided in the end product at the time of installation, a representative seal shall be provided for the test.

12.3 Method

12.3.1 The sample shall be exposed to the applicable test fluid in accordance with 12.1.1. The test fluids shall be prepared using the instructions in Annex A.

12.3.2 A quick connect device is connected to the 1/4 inch NPT connection at the inlet, and is used to fill the samples with the applicable test fluids. A source of pressure may be used to assist in filling or draining the samples, however, the pressure shall not exceed the rated pressure of the device under test. Once the samples are filled to exclude all air, they are closed off and sealed. The samples are then placed in the test chamber.

12.3.3 The chamber temperature is increased to 60 ±2 °C (140 ±4 °F). When the chamber reaches this temperature, the exposure period begins. The samples are exposed to the applicable test fluid at 60 ±2 °C (140 ±3.6 °F) for approximately 168 hours. At the end of this duration, the exposure period is halted and the chamber is allowed to cool. The samples are subjected to a 50 psi (347 kPa) pressure for one minute. The fluid is then drained from the samples and observed in accordance with 12.4.2. After this observation, the fluid is discarded. The samples are then immediately refilled with new test fluid and the chamber temperature is allowed to increase to 60 ±2 °C (140 ±3.6 °F) again. The total duration of the test shall equal 1,008 hours of exposure at 60 ±2 °C (140 ±3.6 °F).

12.3.4 At the end of the total exposure duration, the test fluid is left in the samples and the samples are removed from the chamber. The samples are then subjected to the test sequence as outlined in 11.5 and in accordance with 11.4. Prior to the initiation of the test sequence, the Long Term Exposure test fluid shall be drained and discarded.

12.3.5 If the device contains any parts or surfaces that are plated or coated, if the device uses casting impregnation materials to eliminate porosity leakage, or if the device contains internal nonmetallic parts, the plating, coating, impregnation, or internal parts are tested both during and after this exposure. See 12.4.2 and 12.4.4.

12.4 Results

12.4.1 There shall be no leakage during this test. If leakage is observed at any point during the test, the test shall be stopped.

12.4.2 For platings or coatings, there shall be no softening of the plating or coating material. Compliance is checked by observance of the drained test fluid. There shall be no evidence of visible flaking or material. In addition, there shall be no substantial discoloration of the test fluid when observing the drained fluid. Discoloration is an indication of chemical attack on the plating or coating internal to the device. In order to determine that the base metal is not exposed, visual inspections shall be made. If the visual inspection requires examination of internal surfaces, the samples shall be cut open to determine compliance. If this is necessary, additional samples can be used to determine compliance with this requirement, such that the remaining test sequence will not be disturbed by cutting open samples. However, both the samples to be cut open and the samples to be used for the test sequence are required to complete the Long Term Exposure Test, Section 12.

12.4.3 For casting impregnation materials, the sample shall not show evidence of porosity leakage during or after the fluid exposure duration.

12.4.4 For internal nonmetallic parts, there shall be no visible evidence of this material in the drained test fluid.

13 Electrical-Continuity Test

13.1 General

13.1.1 Breakaway devices and swivel connectors shall be tested using the test method as indicated in 13.2 or the alternate test method in 13.3.

13.1.2 For assemblies with more than one swivel connector, continuity shall be measured across the entire assembly while rotating each swivel connector independently.

13.2 Electrical continuity measurement

13.2.1 The electrical resistance across a device shall not exceed 0.5 MΩ.

13.2.2 The electrical continuity determination shall be made using a resistance indicating instrument. When a swivel is being tested, the swivel shall be rotated 360° with the leads of the instrument are attached, and the highest reading obtained shall be considered the resistance of the swivel connector.

13.3 Electrical continuity alternate method

13.3.1 Breakaway couplings and swivel connectors shall not have an electrical resistance greater than 5800 Ω/inch (2280 Ω/cm) when tested in accordance with 13.3.2.

13.3.2 The electrical resistance shall be measured by means of an appropriate ohmmeter. When a swivel is being tested, the swivel shall be rotated 360° while the leads of the ohmmeter are attached, and the highest reading obtained shall be considered the resistance of the swivel connector.

14 External Leakage Test

14.1 A device shall not leak when subjected to an aerostatic or hydrostatic source of pressure of 1-1/2 times its maximum design pressure, but not less than 75 psig (517 kPa), when tested as described below. Vapor confining components shall be subjected to a pressure of 0.75 psig (5.17 kPa).

14.2 The test sample shall be connected to a source of liquid or aerostatic pressure, and the opposite end shall be closed. A positive shutoff valve, and a pressure indicating device, as described in 5.9, shall be installed in the pressure supply piping. The pressure indicating device shall be installed between the shutoff valve and the test sample.

14.3 The sample pipe-connecting fitting made up with piping or tubing in accordance with 12.2.4 shall be placed on horizontal supports 30 inches (760 mm) apart. The sample shall then be tested for leakage in this position. While the test sample is under the pressure of the test liquid, sufficient load shall be placed on the fitting to cause maximum deflection of the connected pipe as permitted by the fitting design. While in the deflected position, the fitting shall be observed for leakage as described in 14.2.

15 Seat Leakage Test

15.1 An emergency breakaway fitting shall not leak past the seats when subjected to a hydrostatic or aerostatic test pressure starting at zero and increasing to 1-1/2 times its maximum design pressure, but not less than 75 psig (517 kPa), when tested as described below. This test is only conducted on the liquid path for vapor recovery products.

15.2 Both halves of an uncoupled sample of the emergency breakaway fitting shall be connected to a hydrostatic or aerostatic source of pressure. A positive shutoff valve, and a pressure indicating device, as described in 5.8, shall be installed in the pressure supply piping. The pressure indicating device shall be installed between the shutoff valve and the test sample. The pressure shall be increased gradually from zero and then maintained at 1-1/2 times the maximum design pressure, but not less than 75 psig (517 kPa). The test is then to be repeated at a pressure of 0.75 psi (5.17 kPa).

16 Operation Test

16.1 A swivel connector or emergency breakaway fitting which incorporates a swivel mechanism subjected to the Long Term Exposure Test, Section 12, shall be subjected to 100,000 cycles of operation as described in 16.2 – 16.4.

16.2 Prior to the test, the fluid confining portion of the sample shall be filled with kerosene or Soltrol®170. For the duration of the test, the liquid shall be under a pressure of 50 psig (345 kPa).

16.3 The operating mechanism shall be arranged so that, during each cycle of operation, each joint of a swivel mechanism is rotated through an arc of 180 +10/-0° at a rate between 6 and 10 cycles/minute. the manufacturer may request a faster rate but it shall not exceed 30 cycles per minute. If the connector is constructed with more than one joint of a swivel mechanism, and it is not feasible to operate all joints simultaneously, then it is possible for any one joint to be operated separately. Rotation of the joint 180 +10/-0° and then back to the initial position is considered 1 cycle of operation.

16.4 During the cycling, a 20 lbf (89 N) shall be applied to the swivel at an angle of 45° from the plane of rotation and in such a manner that the force is applied as a bending moment at that joint. The force shall be applied at the point on the swivel farthest from the joint. When necessitated by the swivel construction, the operation test shall be conducted on additional samples of the swivel with the load applied on the opposite side of the plane of rotation. See Figure 16.1 – Figure 16.4 for examples.

Exception: The load does not need to be applied to the opposite side of the plane of rotation, when a product incorporates more than one swivel joint and the other swivel joint rotates preventing the load from being applied on the opposite side.

Figure 16.1

Application of Test Force for Axial Swivel

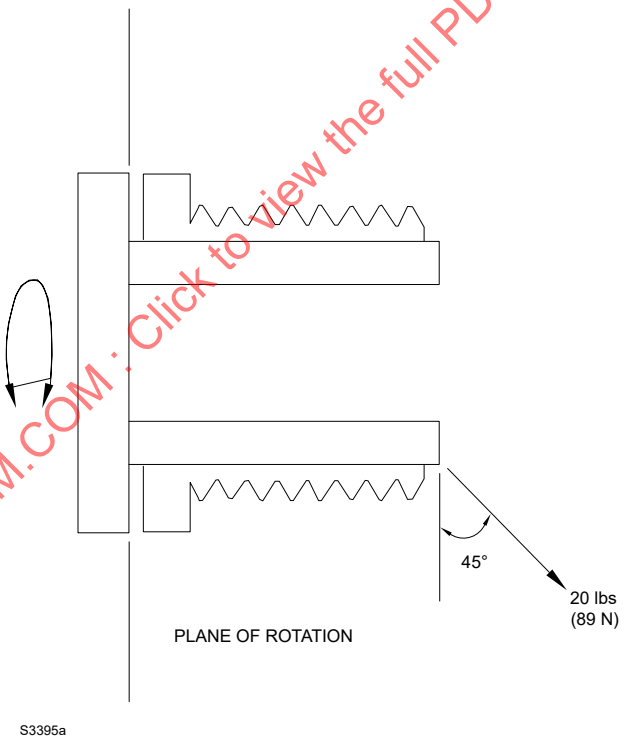


Figure 16.2

AlternateApplication of Test Force for Axial Swivel

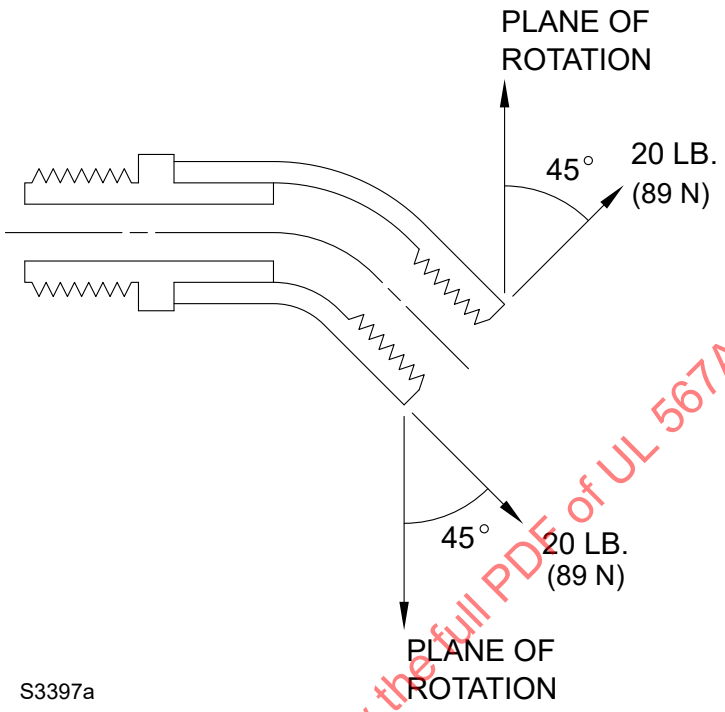


Figure 16.3

Application of Test Force for Compound Swivel

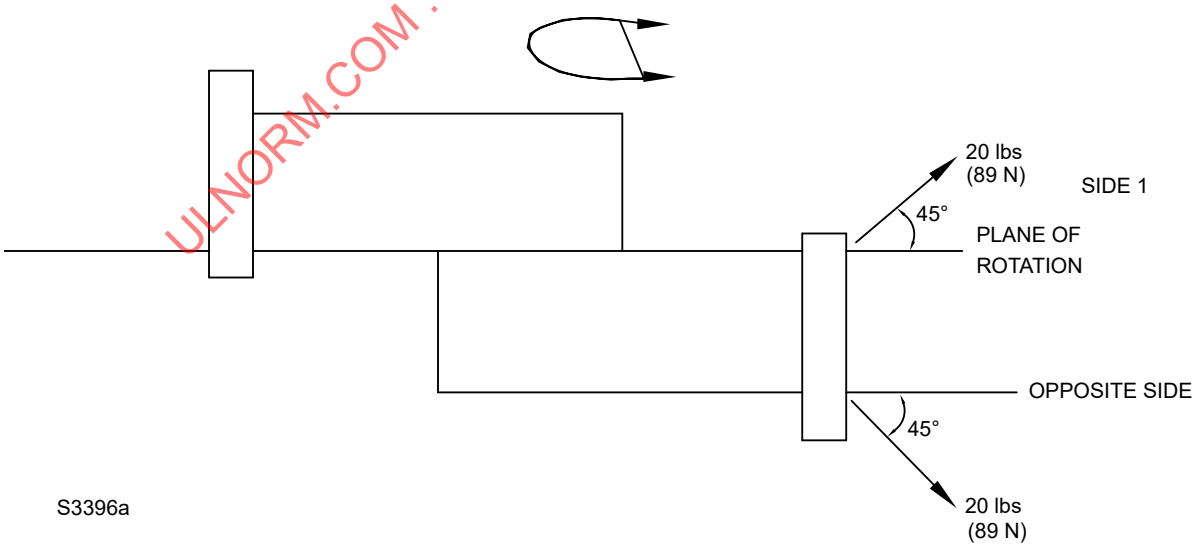
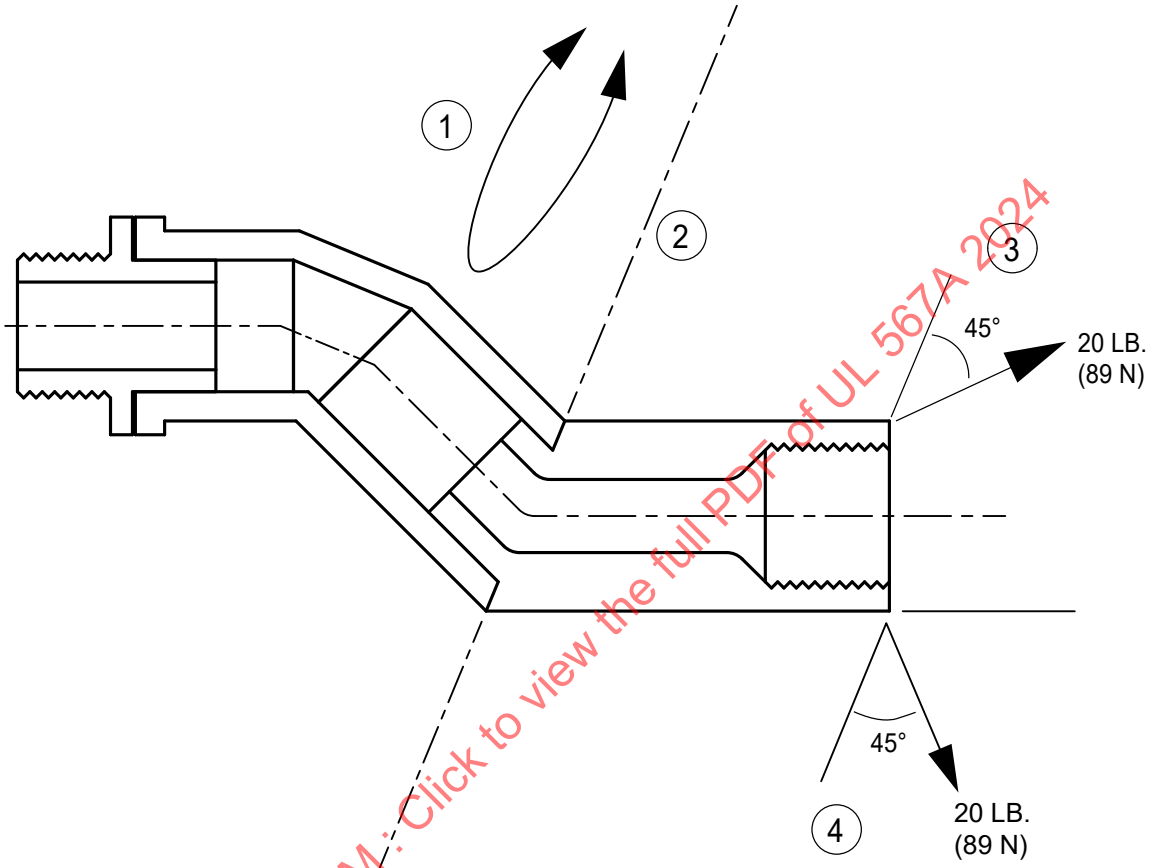


Figure 16.4

Application of Test Force on Compound Swivel with 45° Outlet



1 – Direction of Rotation

2 – Plane of Rotation

3 – Side One – fixed line is parallel to plane of rotation.

4 – Opposite Side – fixed line is parallel to plane of rotation.