UL 203A

STANDARD FOR SAFETY

Sway Brace Devices for Sprinkler System Piping

UL Standard for Safety for Sway Brace Devices for Sprinkler System Piping, UL 203A

First Edition, Dated December 18, 2015

Summary of Topics

This reaffirmation of ANSI/UL 203A dated October 24, 2024 is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.

Text that has been changed in any manner or impacted by ULSE's electronic publishing system is marked with a vertical line in the margin.

The requirements are substantially in accordance with Proposal(s) on this subject dated March 29, 2024 and August 23, 2024.

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UL 203A

Standard for Sway Brace Devices for Sprinkler System Piping

Prior to the first edition, the requirements for the products covered by this standard were included in the Outline of Investigation for Sway Brace Devices for Sprinkler System Piping, UL 203A.

First Edition

December 18, 2015

This ANSI/UL Standard for Safety consists of the First Edition including revisions through October 24, 2024.

The most recent designation of ANSI/UL 203A as a Reaffirmed American National Standard (ANS) occurred on October 24, 2024. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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

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INTRODUCTION

1 Scope

1.1 These requirements cover sway brace devices intended to protect fire protection system piping in locations subject to earthquakes. These devices are intended for installation in accordance with the Standard for the Installation of Sprinkler Systems, NFPA 13.

1.2 These requirements cover restraint devices intended to restrict movement of fire protection piping.

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b) Is superseded by a requirement in this standard.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 Undated References

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.

5 Glossary

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

5.2 BRACE MEMBER – Structural component of a sway brace.

5.3 BRACE MEMBER NON-RIGID – Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes, ASTM A1023/A1023M, Table 7, Galvanized Steel Cable, as referenced by Standard Guidelines for the Structural Applications of Steel Cables for Buildings, ASCE-19.

5.4 FASTENER ADAPTER – Device to facilitate the use of additional fasteners for mounting a sway brace (See Figure A.4).

5.5 LOAD RATING, NONRIGID ASSEMBLY – The published maximum force to be applied to a non-rigid assembly, which is less than or equal to the manufacturer's specified minimum breaking strength of the cable divided by 2.2.

5.6 LOAD RATING, RIGID SWAY BRACE FITTINGS – The published maximum force to be applied to a component of a rigid sway brace.

5.7 NPS (NOMINAL PIPE SIZE) – A dimensionless designator for pipe sizes defined in standards including:

a) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless, ASTM A53/A53M;

b) Standard Specification for Electric-Resistance-Welded Steel Pipe, ASTM A135/A135M; and

c) Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use, ASTM A795/A795M

used to replace terms such as "Nominal Diameter" and "Nominal Size."

5.8 PERMANENT DEFORMATION – The distortion of a system pipe or brace member in excess of the requirements in Table 13.1.

5.9 RESTRAINT DEVICE – A mechanism that is a part of a hanger assembly or a separate device and is intended to limit interaction of the pipe with other portions of the structure and to limit stresses in the pipes to permissible limits.

5.10 RIGID SWAY BRACE – An assembly intended to attach the system piping to the building structure to resist earthquake loads in two directions commonly consisting of:

a) A sway brace fitting;

b) A brace member; and

c) A structure attachment fitting.

Examples of sway brace devices are shown in Appendix A.

5.11 STRUCTURE ADAPTER – A device to facilitate the attachment of a sway brace to a specific building structural member.

5.12 STRUCTURE ATTACHMENT FITTING – A device used to attach a sway brace directly to the building structure.

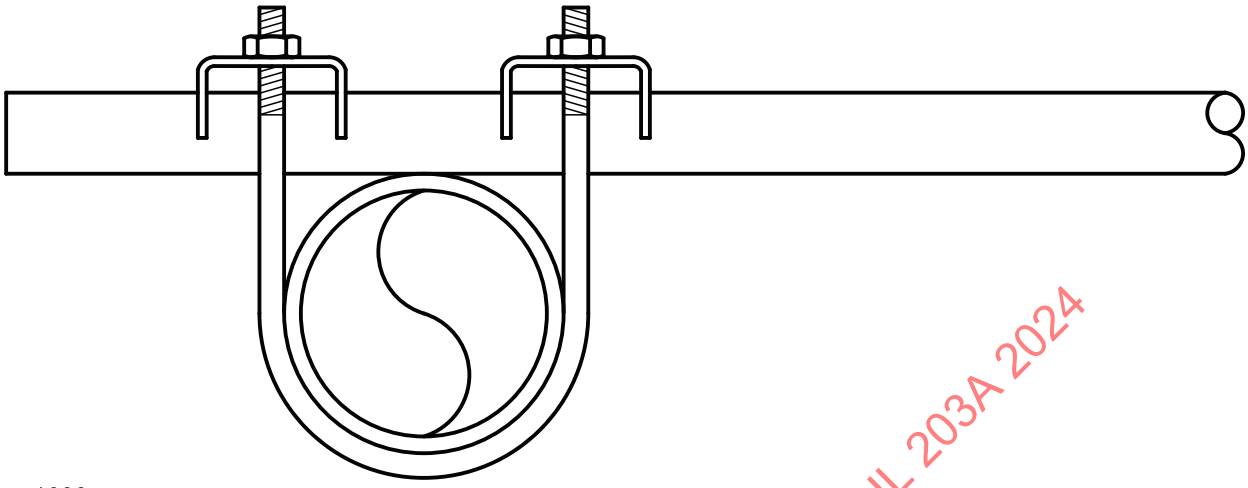
5.13 SWAY BRACE FITTING – A device used to attach the brace member of the sway brace to the system piping.

5.14 SWAY BRACE FITTING ADAPTER – A device to transition the attachment of the sway brace fitting to the sway brace member.

5.15 SWAY BRACE, LATERAL – A sway brace intended to resist differential movement perpendicular to the axis of the system piping. See Figure 5.1 as an example.

Figure 5.1

Lateral sway brace (End view)



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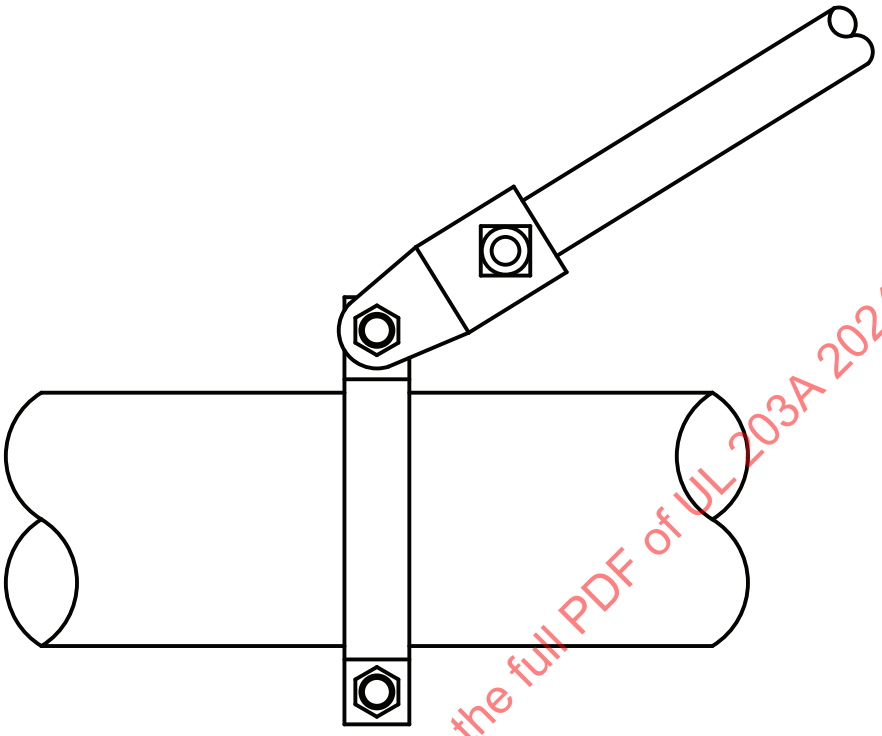
5.16 SWAY BRACE, LONGITUDINAL – A sway brace intended to resist differential movement parallel to the axis of the system piping. See Figure 5.2 as an example.

Figure 5.2

Longitudinal sway brace (Side view)



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5.17 SWAY BRACE, NON-RIGID – A sway brace intended for resisting loads in tension only. See Figure A.3 as an example

5.18 SWAY BRACE, RIGID – A sway brace intended for resisting both tension and compression loads.

CONSTRUCTION

6 General

6.1 A sway brace assembly shall be constructed for connection to the system piping and be able to withstand the appropriate test load specified in the Load Test, Section 9, for the corresponding pipe size.

6.2 A sway brace fitting shall be designed to directly attach to the system piping.

6.3 A brace member of a rigid sway brace shall be such that the maximum slenderness ratio l/r, where l is the length of the brace and r is the least radius of gyration, does not exceed that specified in the Standard for the Installation of Sprinkler Systems, NFPA 13.

6.4 The manufacturer of rigid type sway brace components and devices, fittings or structure attachment fittings are not required to supply the brace member. If the brace member is not provided, the manufacturer's installation instructions shall indicate the appropriate sway brace member configuration, material and size.

6.5 A structure attachment fitting or fastener adapter shall be constructed to use fasteners to secure the fitting to the building structure. When fasteners are provided with a structure attachment fitting, they shall be capable of withstanding the required test loads specified in Load Test, Section 9.

6.6 A structure attachment fitting or fastener adapter shall be constructed with the number of fastener holes and hole diameter sizes to accommodate the loads specified in the Standard for the Installation of Sprinkler Systems, NFPA 13.

6.7 A structure attachment fitting or fastener adapter shall be constructed with the hole diameter(s) not exceeding 1/16 in. larger than the intended fastener diameter.

6.8 A lateral sway brace component shall not be used as a part of longitudinal sway brace assemblies unless investigated for such use. Likewise, a longitudinal sway brace component shall not be used as part of lateral sway brace assemblies unless investigated for such use.

6.9 A Non-Rigid Sway Brace (Tension Only) using cable as the brace member shall consist of an assembly of cable and necessary hardware to secure the cable to structure attachment fitting or system pipe.

6.10 Galvanized carbon steel cable used in Non-Rigid Sway Braces (Tension Only) shall comply with the requirements of the Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes, ASTM A1023/A1023M, Table 7 for 7x7 and 7x19 small diameter specialty cord or equivalent. Stainless steel cable may also be used provided that it meets the requirements of the Standard Specification for Stainless Steel Wire Strand, ASTM A368 or the Standard Specification for Stainless Steel Rope Wire, ASTM A492 (as specified in Standard for the Installation of Sprinkler Systems, NFPA 13 and Standard Guidelines for the Structural Applications of Steel Cables for Buildings, ASCE 19).

6.11 A restraint device shall be constructed for sprinkler branch line piping of 2 NPS and smaller.

7 Materials

7.1 Components of sway brace assemblies shall be made of ferrous materials.

Exception: Nonferrous materials, such as plastics and zinc alloys, shall be permitted to be used when they have been investigated to verify resistance to external fire exposure, and loss of strength with aging and environmental exposure.

8 Protective Coatings

8.1 A sway brace fitting or structural attachment fitting or part of a fitting made of flat iron or steel, the thickness of the metal shall be at least #7 gauge (nominal 0.1793 inch), unless protected by coating as described in 8.2.

8.2 When protective coatings are used in accordance with 8.1, the following coatings meet the intent of this requirement:

a) A zinc coating having a minimum thickness of 0.0005 inch (0.0127 mm) on all outside surfaces and 0.0003 inch (0.0076 mm) on all inside surfaces. The thickness of the coating is to be established by the Metallic Coating Thickness Test, Section 11.

b) A hot-dipped mill galvanized sheet steel conforming with the coating designation G90 in Table I of the Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, ASTM A653/A653M, with not less than 40 percent of the zinc on any side, based on the minimum single spot test requirement in this ASTM Designation.

The weight of the zinc coating is to be determined by any equivalent method; however, in case of question, the weight of the coating shall be established in accordance with the test method of the Standard Test Method for Weight (Mass) of Coating or Iron or Steel Articles with Zinc or Zinc-Alloy Coatings, ASTM A90/A90M. The edges of a stamping complying with this requirement are not required to be plated.

c) Any other metallic or nonmetallic finish or combination of the two which, when subjected to comparative tests, indicates it provides corrosion protection equivalent to the coating by either (a) or (b) above.

8.3 Cable used as part of a non-rigid type sway brace assembly shall be constructed from carbon steel with a zinc coating in accordance with the Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes, ASTM A1023/A1023M, or equivalent corrosion resistant coating or material.

PERFORMANCE

9 Load Test

9.1 Rigid sway brace devices installed in accordance with the manufacturer's installation instructions on the appropriate pipe are to be installed in a tension-compression test apparatus in a manner duplicating as closely as possible their intended field installation. Rigid sway brace fittings, brace members, the simulated system pipe, or any other part of the brace assembly shall withstand 2.2 times either the manufacturer's rated load or the load specified in Table 9.1, whichever is greater, for one minute in both tension and compression without movement in excess of the criteria identified in 9.3. When the maximum installation angle is less than 90 degrees, the minimum rated load shall be equal to the test load at the maximum angle divided by the sine of the test brace angle, then divided by 2.2. The required test load shall be applied to the sway brace device in each installation angle indicated in 9.7. Where structure attachment fittings and adapters are tested utilizing angle blocks and the force is applied in-line with the brace member, the test load shall not be reduced based on the installation angle and the full test load shall be applied at each angle. Angle blocks shall not be used for sway brace fittings.

Exception: Structural attachment fittings and adapters may be rated at loads less than those specified in Table 9.1 and shall withstand 2.2 times the manufacturer's rated load, without reduction of the test load for one minute in both tension and compression.

Table 9.1
Minimum rated load

Sprinkler system pipe size, NPS	Minimum rated load,		Minimum test load,[a]	
	lb-f	(Newtons)	lb-f	(Newtons)
4 and smaller	680	(3025)	1496	(6655)
5,6	1090	(4849)	2398	(10667)
8	1370	(6094)	3014	(13407)
10	1885	(8385)	4147	(18446)
12	2550	(11342)	5610	(24954)

[a] This is the minimum test load at 90 degrees

9.2 Sway Brace devices installed in accordance with the manufacturer's installation instructions on the appropriate pipe are to be installed in a tension test apparatus in a manner duplicating as closely as possible their intended field installation. Non rigid fittings, cable, and any other part used in non-rigid sway brace assemblies shall be capable of maintaining 2.2 times the rated load applied in tension for one minute without movement in excess of the criteria identified in 9.3. The rated load shall be equal to the

minimum breaking strength of the cable divided by 2.2. The minimum breaking strength of the cable shall be as specified in 6.10.

9.3 The movement shall be the distance the component or test assembly moves while under the test load that would allow the system piping to move in field conditions. The movement of the component or assembly being tested shall be measured. The measurement for movement shall be made in each loading direction in tension and compression while under load, except non-rigid assemblies shall be measured in tension only. The measurement shall occur from the starting point of that loading direction. Once the product is in its intended field installation condition, measurements shall include preload of the sway brace fittings during the test cycle.

a) There shall be no deformation from cracking or detachment of a component.

b) Bending may be allowed provided that the allowed movement is not exceeded and there is no visual evidence of the component or assembly failure.

c) The applicable movement requirements in 9.4 and Table 9.2 are met.

9.4 For structure attachment fittings and adapters:

a) Where a structure attachment fitting is intended to be used with another component to attach to a brace member, the samples for testing shall utilize the components assembled as they are intended to be used in accordance with the manufacturer's use instructions. For example where a structure attachment fitting is intended to use an adapter to connect to the brace member, the structure attachment fitting shall be tested with the adapter.

b) No elongation or shortening of the test assembly in excess of 1 in. (25.4 mm).

Table 9.2
Movement requirements for sway brace fittings

Pipe size,		Max horizontal movement of system piping,		Test angle,	Max movement at test angle,	
Inches	(mm)	Inches	(mm)	Degrees	Inches	(mm)
< 4	(< 101.6)	1	(25.4)	30	0.50	(12.7)
< 4	(< 101.6)	1	(25.4)	45	0.70	(17.8)
< 4	(< 101.6)	1	(25.4)	60	0.86	(21.8)
< 4	(< 101.6)	1	(25.4)	90	1.00	(25.4)
≥ 4	(≥ 101.6)	2	(50.8)	30	1.00	(25.4)
≥ 4	(≥ 101.6)	2	(50.8)	45	1.41	(35.8)
≥ 4	(≥ 101.6)	2	(50.8)	60	1.73	(43.9)
≥ 4	(≥ 101.6)	2	(50.8)	90	2.00	(50.8)

9.5 A rigid sway brace fitting intended for use with more than one system pipe size shall be tested to a load value of at least the load corresponding to the largest system pipe size indicated in Table 9.1.

9.6 A rigid sway brace fitting and structure attachment fitting shall be tested separately, unless it is demonstrated that a test assembly (sway brace fitting, brace member and structure attachment fitting) yields equivalent results. The samples shall be assembled in accordance with the manufacturer's installation instructions.

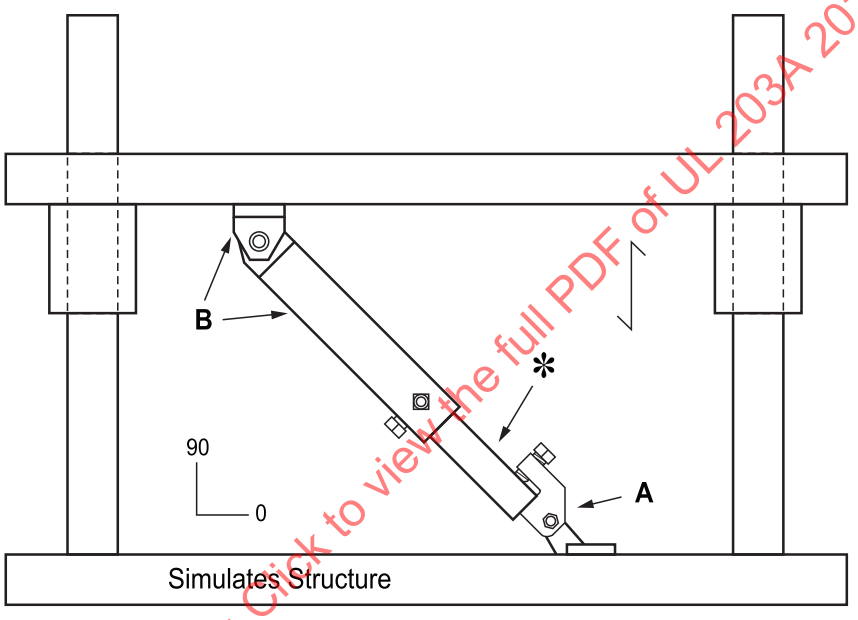
9.7 Sway brace devices shall be tested at installation angles of 30, 45, 60, and 90 degrees as permitted by the construction of the device. Structure attachment fittings and adapters shall also be tested at an angle of 0 degrees. See Figure 9.1 – Figure 9.6 for example test set ups.

The angles specified in the Load Test may not be attainable due to the construction or installation limits of the fittings. Where the angles cannot be attained, the maximum angle physically attainable approaching the required angle shall be used.

Figure 9.1

Example test set up for attachment fitting A

(Seismic test assembly simulating horizontal movement)



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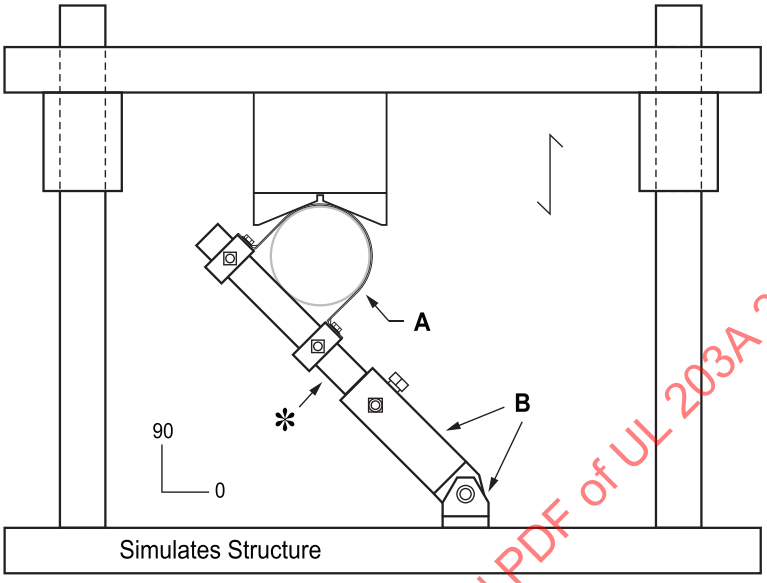
Note – Fitting B and *brace member length are not specified and shall be that required for testing Fitting A.

Figure 9.2

Example test set up for eccentric lateral sway brace fitting A

(Seismic test assembly simulating horizontal movement)



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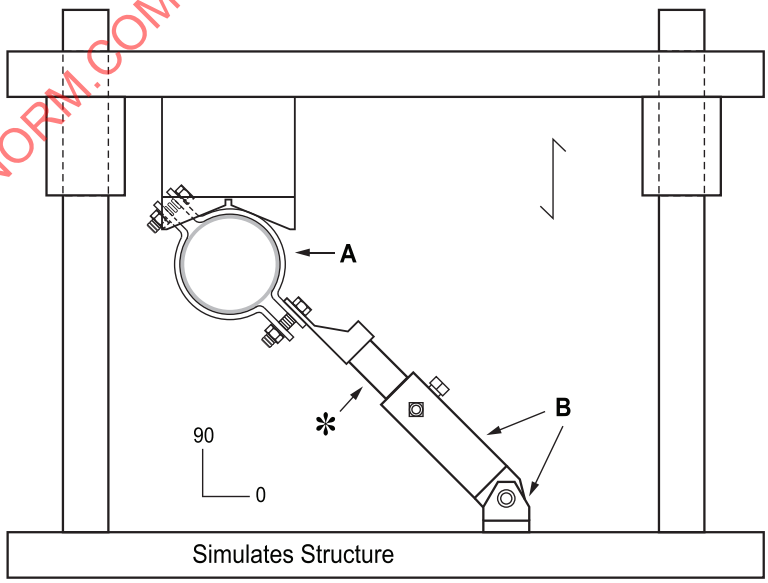
Note – Fitting B and *brace member length are not specified and shall be that required for testing Fitting A. The pipe representing the system piping is secured to the V-block.

Figure 9.3

Example test set up for concentric lateral sway brace fitting A

(Seismic test assembly simulating horizontal movement)



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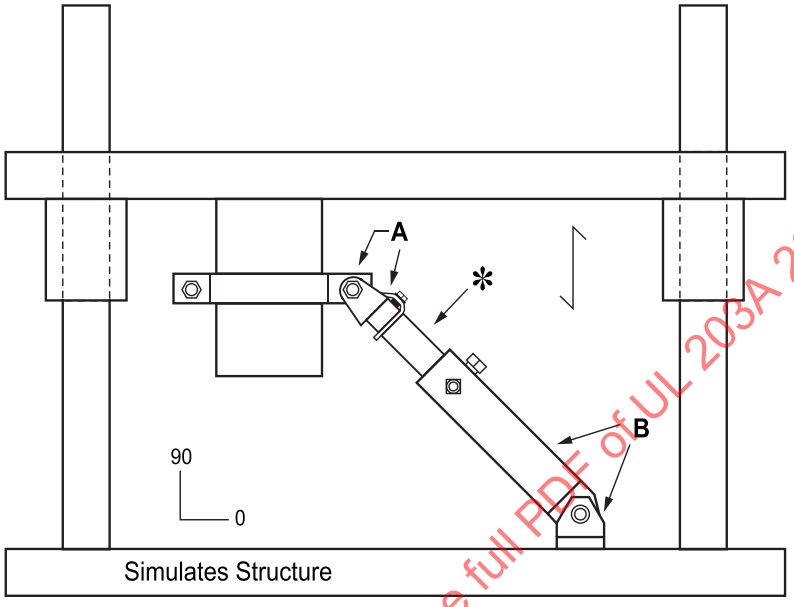
Note – Fitting B and *brace member length are not specified and shall be that required for testing Fitting A. The pipe representing the system piping is secured to the V-block.

Figure 9.4

Example test set up for longitudinal sway brace fitting A

(Seismic test assembly simulating horizontal movement)



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Note – Fitting B and *brace member length are not specified and shall be that required for testing Fitting A.

Figure 9.5

Example test set up for tension only on cable at brace angles

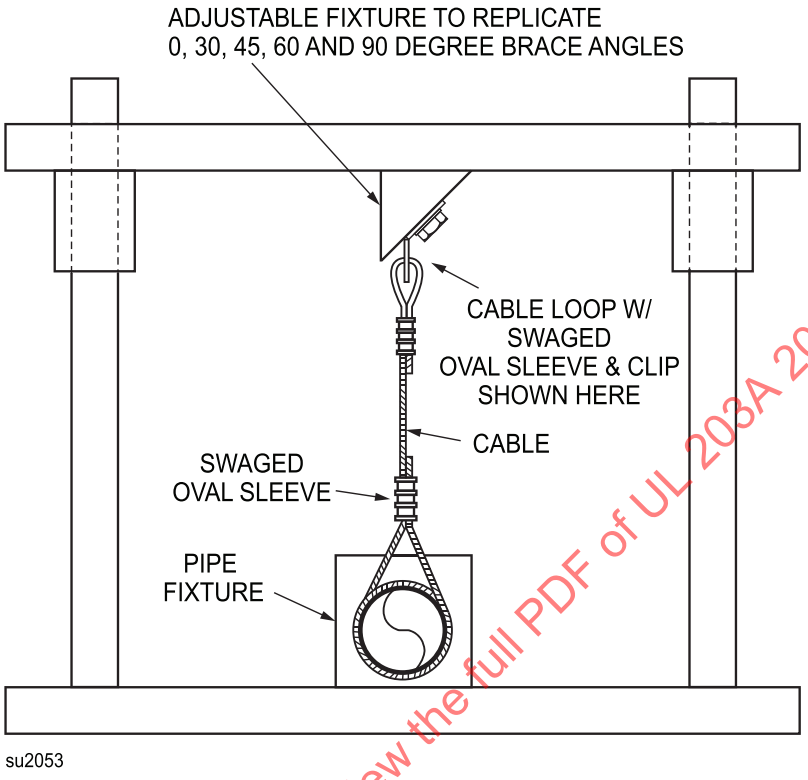
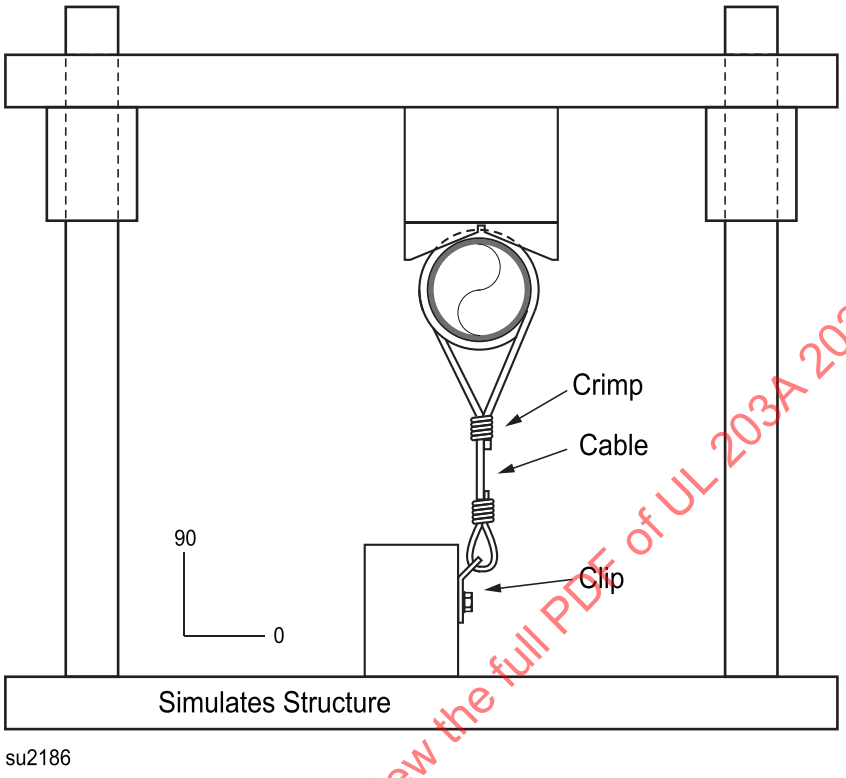


Figure 9.6

Example of alternative test set up for tension only on cable at brace angles



9.8 Where the test load is applied at an angle to the brace member, the load to be applied at each angle (y) shall be determined by dividing the maximum test load (L) by sine at the maximum test angle (x) times sine of the angle being tested (y). The following equation shall be used:

Test load at angle y =(L/Sine x°) * Sine y°

Example – 4-inch Sway Brace Fitting

maximum test angle = 90° (x) and load rating of 680 lb (L). Test load = 1496 lb. To test product at 30° (y), the following equation would be used:

(1496 lb/Sine 90°) * Sine 30° = 748 lb

Therefore the load to be applied at 30° = 748 lb.

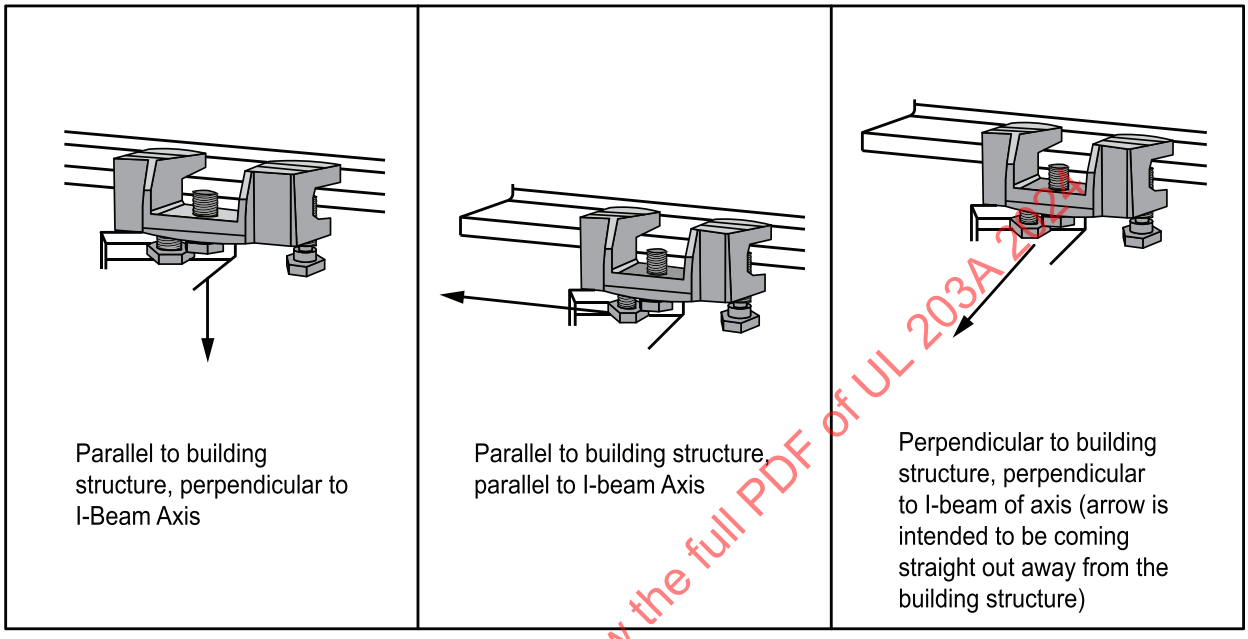
9.9 Lateral sway brace fittings shall be tested with a load applied perpendicular to the braced system pipe (See Figure 9.2 and Figure 9.3). The fittings shall be installed in the test apparatus with the simulated system pipe and the brace member rigidly restrained.

9.10 Structure attachment fittings or structural adapters intended to be used on sway brace assemblies shall be tested in a position simulating installation perpendicular and parallel to the building structure. The test load shall be applied in compression for 1 minute and released. The test load shall then be applied in tension for 1 minute and released. Where a structure attachment fitting is intended to provide bracing in more than one direction, an additional test load at the maximum allowable angle shall be applied in compression and tension. Where the structure attachment fitting is capable of positioning 90 degrees and

in the same plane as the second test load above, a third test load shall then to be applied in that direction. See Figure 9.7 for loading structural attachment fittings.

Figure 9.7

Loadings for adaptors or structural attachment fittings



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9.11 Structure attachment fittings or structural adaptors shall be tested attached to a flat steel plate that represents the building structural member.

9.12 Rigid Type sway brace fittings or assemblies shall be tested with the test load applied in compression for 1 minute and released. The test load for Rigid Type sway brace fittings or assemblies shall then be applied in tension for 1 minute and released.

9.13 A Non-rigid type sway brace assemblies shall be subjected to the test load applied only in tension for 1 minute and released.

9.14 The rated load for a rigid sway brace component shall not be less than the loads specified in Table 9.1 for the intended system pipe size, except for structure attachment fittings and adapters. The published rated load shall be that specified in Table 9.1 or a greater rating as determined by conformance with the testing requirements of this standard, referenced in 100 pound-force (444.8 N) increment values above Table 9.1 minimums. For example, a product approved for an 8 inch pipe size shall be at least 1400 pound-force (6228 N) to achieve a greater rating.

9.15 Sway brace fittings that use shear bolts or similar hardware shall be assembled for testing with the bolts tightened to the minimum torque value specified by the manufacturer.

10 Zinc Coating Thickness Test for Cable

10.1 Sway brace cable fabricated from carbon steel and protected from corrosion using zinc shall comply with the minimum coating thickness specified in the Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes, A1023/A1023M.

10.2 The test samples and method to determine the coating on the individual wire components shall be conducted in accordance with the Standard Specification for Zinc-Coated Steel Structural Wire Rope, ASTM A603, for Class A coating.

11 Metallic Coating Thickness Tests

11.1 The following tests in 11.2 – 11.9 shall be used to determine the thickness of a zinc coating for iron or steel fittings as described in Materials, Section 7. As an alternative to this test, a non-destructive test method as specified in the Standard Test Method for Measurement of Coating Thickness by X-Ray Spectrometry, ASTM B568, or an equivalent test method shall be used to determine the thickness of a zinc coating. Whenever referee measurements are required, the test described in 11.2 – 11.9 is to be used.

11.2 The solution used to conduct this test shall be made from distilled water and is to contain 200 grams per liter or reagent grade chromic acid (CrO3) and 50 grams per liter of chemically pure concentrated sulfuric acid (H2 SO4). The latter is equivalent to 27 milliliters per liter of chemically pure concentrated sulfuric acid, specific gravity 1.84, containing 96 percent of H2 SO4.

11.3 The test solution is to be contained in a glass vessel such as a separatory funnel with the outlet equipped with a stopcock and a capillary tube of 0.025 inch (0.64 mm) inside bore and 5.5 inches (139.7 mm) long. The lower end of the capillary tube shall be tapered to form a tip, the drops from which are 0.025 milliliters each. To preserve an effectively constant level, a small glass tube shall be inserted in the top of the funnel through a rubber stopper and its position is to be adjusted so that, when the stopcock is open, the rate of dropping is 100 ±5 drops per minute. An additional stopcock is permitted to be used in place of the glass tube to control the rate of dropping.

11.4 The sample and the test solution shall be conditioned to the test room ambient temperature, which shall be 21.1 – 32.2°C (70 – 90°F).

11.5 Each sample is to be thoroughly cleaned before testing. All grease, lacquer, paint, and other nonmetallic coatings are to be removed completely by means of solvents. Samples are then to be thoroughly rinsed in water and dried. Care is to be exercised to avoid contact of the cleaned surface with the hands or any foreign material.

11.6 The sample to be tested is to be supported from 0.7 – 1 inch (17.8 – 25.4 mm) below the orifice, so that the drops of solution strike the point to be tested and run off quickly. The surface to be tested is to be inclined 45 degrees from the horizontal.

11.7 The stopcock is to be opened and the time, in seconds, is to be measured until the dropping solution dissolves the protective metallic coating, exposing the base metal. The base material is exposed when the first appearance of the base metal is recognizable by the change in color.

11.8 Each sample of a test lot is to be subjected to test at three or more points, excluding cut, stenciled, and threaded surfaces, on the inside surface and at an equal number of points on the outside surface, at places where the metallic coating is expected to be the thinnest. On enclosures made from precoated sheets, the external corners that are subjected to the greatest deformation are able to have thin coatings.

11.9 The thickness of the coating being tested is to be calculated by specifying the appropriate thickness factor from Table 11.1 for the temperature at which the test was conducted and multiplying that factor by the time, in seconds, required to expose the base metal as noted in 11.8.

Table 11.1
Thickness of coating factors

Temperature		Thickness factors, 0.00001 inch (0.0003 mm) per second
°F	(°C)	Zinc plating
70	(21.1)	0.980
71	(21.7)	0.990
72	(22.2)	1.000
73	(22.8)	1.010
74	(23.3)	1.015
75	(23.9)	1.025
76	(24.4)	1.033
77	(25.0)	1.042
78	(25.6)	1.050
79	(26.1)	1.060
80	(26.7)	1.070
81	(27.2)	1.080
82	(27.8)	1.085
83	(28.3)	1.095
84	(28.9)	1.100
85	(29.4)	1.110
86	(30.0)	1.120
87	(30.6)	1.130
88	(31.1)	1.141
89	(31.7)	1.150
90	(32.2)	1.160

12 Restraint Device Load Test

12.1 Restraint Devices shall withstand a minimum force of 300 pounds-force (1334 N) without a displacement of more than 1/2 inch (12.4 mm) applied in tension or compression when installed in accordance with the manufacturer's instructions.

12.2 Restraint Devices installed in accordance with the manufacturer's installation instructions on the appropriate pipe are to be installed in a tension-compression test apparatus in a manner duplicating as closely as possible their intended field installation. Each assembly is then to be subjected to an increasing compressive load until a load of 300 pounds-force (1334 N) or a greater force specified in the manufacturer's installation instructions is applied for one minute, in a, manner to evaluate the restraining feature, and the displacement measured. The load is then applied in tension and the displacement measured.

12.3 Each assembly designed for compression is to be subjected to an increasing compressive load until a load of 300 pounds-force (1334 N) or a greater force specified in the manufacturer's installation

instructions is applied for one minute, in a manner to evaluate the restraining feature, and the displacement measured from the installed position without load.

12.4 Each assembly designed for tension is to be subjected to an increasing tension load until a load of 300 pounds-force (1334 N) or a greater force specified in the manufacturer's installation instructions is applied for one minute, in a manner to evaluate the restraining feature, and the displacement measured from the installed position without load.

12.5 Assemblies designed for tension and compression are to be subjected to their respective loads of 300 pounds-force (1334 N) or a greater force specified in the manufacturer's installation instructions is applied for one minute, in a manner to evaluate the restraining feature, and the displacement measured after each load cycle from the installed position without load.

12.6 Fittings for restraint devices capable of providing a point of rotation shall be subjected to compression and tension loads at both physical limits of rotation.

13 Assembly Test of Sway Brace Fitting

13.1 A sway brace member or system pipe shall not exhibit permanent deformation exceeding the dimensions in Table 13.1 after assembly.

Table 13.1
Deformation of system pipe or brace member

System Pipe or Brace Pipe Size, NPS	Permitted deformation, inches
1 – 2[a]	0.126
2 1/2 – 3	0.156
4 – 6	0.170
8 – 10	0.188
12	0.218

[a] Pipe or other structural configuration.

13.2 A sway brace component shall be assembled onto the simulated system pipe or brace member in accordance with the manufacturer's installation instructions. The fasteners shall be tightened to the maximum torque value as specified in the installation instructions or the maximum torque in the manufacturer's specified range for shear bolts or similar devices. The assembly shall be disassembled from the simulated system pipe or brace member and examined for permanent deformation within the geometry of the fitting (See definition in 5.8).

Exception: Deformation (dimpling of the brace pipe) is permitted where fasteners such as cone-point or cup-point bolts are intended to deform the brace pipe in the immediate areas of contact with the fastener.

14 Torque Test of Shear Bolts

14.1 Shear bolts or similar hardware used with sway brace equipment shall shear within the torque range specified by the manufacturer.

14.2 A minimum of 12 shear bolts or similar hardware are to be individually mounted with the shank in a clamping device. A torque is then gradually and uniformly applied as specified by the manufacturer until the device shears. The maximum torque attained shall be determined.

MARKINGS

15 General

15.1 Each sway brace fitting, structure attachment fitting, structural adapter, adapter fitting and restraint device shall be marked with the manufacturer's name or trademark, and model designation.

15.2 A sway brace shipped with a sway brace fitting and/or structure attachment fitting shall be marked with the manufacturer's name or trademark, model designation, sway brace fitting model(s), and structure attachment fitting model(s) intended for use with the sway brace.

15.3 Non-rigid type brace cable shall be continuously marked to indicate the cable size and rated load or with a color code that is explained in the manufacturer's installation instructions.

INSTALLATION INSTRUCTIONS

16 General

16.1 Installation instructions shall be provided with each sway brace fitting, structure attachment fitting, structural adapter, adapter fitting and restraint device, or smallest package, and shall include at least the following, when applicable:

a) Model designation and pipe size.

b) Assembly procedures for installation

c) The type and size of sway brace with which the sway brace fitting and structure attachment fitting are intended to be used.

d) Information on the location of the fasteners for a structural attachment fitting with multiple fastener holes. Also, the statement: "The required type, number and size of fasteners used for the structure attachment fitting shall be in accordance with NFPA 13."

e) Minimum torque requirements for:

1) The sway brace fitting attachment intended to connect the sprinkler system pipe and pipe type to the sway brace;

2) Connecting the structure attachment fitting to the sway brace; and

3) Connecting the sway brace fitting and the sway brace.

f) For structural attachment adapters, the minimum thickness and configuration of the structural member to be attached.

g) Instructions for applying torque to shear bolts or similar hardware.

h) Maximum rated load for the sway brace fitting and structure attachment fitting for use with the specified type and size of sway brace.

i) The statement: "Sway brace assemblies are intended to be installed in accordance with NFPA 13 and the manufacturer's installation instructions."

j) For Non-rigid type sway bracing, the following additional information is required:

1) Special tools required for installation.