First Revision No. 1086-NFPA 13-2022 [Section No. 3.3.104]

3.3.108 Horizontal Force, F_{pw}.

The horizontal force due to seismic load acting on a ~~brace~~ sprinkler system at working stress levels. (AUT-HBS)

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 08:46:45 EDT 2022

Committee Statement

Committee Statement: Revised the definition of horizontal force to clarify that the seismic load acts on the entire system, not just a brace.

Response Message: FR-1086-NFPA 13-2022

Public Input No. 528-NFPA 13-2022 [Section No. 3.3.104]

First Revision No. 1130-NFPA 13-2022 [Section No. 3.3.198]

3.3.59 ~~Short Period Spectral Response Acceleration Parameter~~ Design Spectral Response Acceleration at Short Periods , $S_{~~S~~ DS}$.

The ~~maximum considered earthquake ground motion for 0.2-second~~ spectral response acceleration ~~(5 percent of critical damping), site Class B for a specific site~~ at short periods for the site of the building or structure being designed to satisfy the seismic requirements of ASCE/SEI 7 *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, based on ASCE/SEI 7 Chapter 22 seismic ground motion maps and Chapter 11 seismic design criteria, or directly from the ASCE/SEI 7 Hazard Tool, or by using the site-specific ground motion procedures of ASCE/SEI 7 Chapter 21 . (AUT-HBS)

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 16:41:20 EDT 2022

Committee Statement

Committee Statement: ASCE/SEI 7 ground motion values that are best utilized for sprinkler systems are now SDS and should be referred to as such. This aligns with other changes made to the seismic design method presented in NFPA 13 that is based on the updated ASCE/SEI 7 information.

Response Message: FR-1130-NFPA 13-2022

Public Input No. 531-NFPA 13-2022 [Section No. 3.3.198]

First Revision No. 1135-NFPA 13-2022 [Section No. 17.2.1.1]

17.2.1.1

Unless the requirements of 17.2.1.2 are met, hanger rod size shall be the same as that approved for use with the hanger assembly, and the size of rods shall not be less than that given in Table 17.2.1.1.

Table 17.2.1.1 Hanger Rod Sizes

Pipe Size		Diameter of Rod	
in.	mm	in.	mm
Up to and including 4	100	⅜	10
5	125	½	13
6	150		
8	200		
10	250	⅝	16
12	300	¾	20
14	350	1	25
16	400		
18	450		
20	500	1 ¼	32
24	600		

Supplemental Information

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13_AUT_HBS_FDM_17.2.1.1_FR1135.docx	For staff use only	

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 16:52:44 EDT 2022

Committee Statement

Committee Statement: Adding larger pipe sizes to the table, along with required hanger rod sizes. The sizes for the rods were selected based on information associated with listed clevis hangers.

Response Message: FR-1135-NFPA 13-2022

Public Input No. 261-NFPA 13-2022 [Section No. 17.2.1.1]

First Revision No. 1137-NFPA 13-2022 [Section No. 17.2.1.4]

17.2.1.4 U-Hooks.

The size of the rod material of U-hooks shall not be less than that given in Table 17.2.1.4.

Table 17.2.1.4 U-Hook Rod Sizes

Pipe Size		Hook Material Diameter	
in.	mm	in.	mm
Up to and including 2	50	5/16	8
2½ to 6	65 to 150	3/8	10
8	200	½	13
10 to 12	250 to 300	3/4	20
14 to 18	350 to 450	1	25
20 to 24	500 to 600	1 1/4	32

Supplemental Information

File Name	Description	Approved
13_AUT_HBS_FDM_17.2.1.4_FR1137.docx	For staff use only	

Submitter Information Verification

Committee: AUT-HBS

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Committee Statement

Committee Statement: Adding larger pipe sizes to the table, along with required hook material sizes. The sizes for the hooks align with 17.2.1.1.

Response Message: FR-1137-NFPA 13-2022

Public Input No. 262-NFPA 13-2022 [Section No. 17.2.1.4]

First Revision No. 1139-NFPA 13-2022 [Section No. 17.2.1.5.1]

17.2.1.5.1

The size of the rod material for eye rods shall not be less than specified in Table 17.2.1.5.1.

Table 17.2.1.5.1 Eye Rod Sizes

Pipe Size		Diameter of Rod			
		With Bent Eye		With Welded Eye	
in.	mm	in.	mm	in.	mm
Up to and including 4	100	⅜	10	⅜	10
5	125	½	13	½	13
6	150	½	13	½	13
8	200	¾	20	½	13
10 to 12	250 to 300	1	25	¾	20
14 to 18	350 to 450	1 ¼	32	1	25
20 to 24	500 to 600	1 ¾	45	1 ¼	32

Supplemental Information

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13_AUT_HBS_FDM_17.2.1.5.1_FR1139.docx	For staff use only	

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 17:13:05 EDT 2022

Committee Statement

Committee Statement: Adding larger pipe sizes to the table, along with required eye rod sizes. The sizes for the rods were selected based on information associated with listed clevis hangers. Revised the welded eye sizes for 14-18 and 20-24 to align with the other tables. Revised 400mm to 450mm editorially, as 18 inches is 450 mm.

Response Message: FR-1139-NFPA 13-2022

Public Input No. 264-NFPA 13-2022 [Section No. 17.2.1.5.1]

First Revision No. 1094-NFPA 13-2022 [Section No. 17.2.4.2.1]

17.2.4.2.1

Unless the requirements of 17.2.4.2.2 or 17.2.4.2.3 are met, for ceiling flanges and U-hooks, screw dimensions shall not be less than those given in Table 17.2.4.2.1.

Table 17.2.4.2.1 Screw Dimensions for Ceiling Flanges and U-Hooks

Pipe Size		Two Screw Ceiling Flanges
in.	mm	
Up to and including 2	50	Wood screw No. 18 × 1½ in. or Lag screw 5⁄16 in. × 1½ in. (8 mm × 40 mm)
		Three Screw Ceiling Flanges
Up to and including 2	50	Wood screw No. 18 × 1½ in.
2½	65	Lag screw ⅜ in. × 2 in. (10 mm × 50 mm)
3	80	
3½	90	
4	100	Lag screw ½ in. × 2 in. (13 mm × 50 mm)
5	125	
6	150	
8	200	Lag screw ⅝ in. × 2 in. (16 mm × 50 mm)
		Four Screw Ceiling Flanges
Up to and including 2	50	Wood screw No. 18 × 1½ in.
2½	65	Lag screw ⅜ in. × 1½ in. (10 mm × 40 mm)
3	80	
3½	90	
4	100	Lag screw ½ in. × 2 in. (13 mm × 50 mm)
5	125	
6	150	
8	200	Lag screw ⅝ in. × 2 in. (16 mm × 50 mm)
		U-Hooks
Up to and including 2	50	Drive screw No. 16 × 2 in. or Wood screw No. 18 × 1 ½ in. (8 mm × 40 mm) or Lag screw 5⁄16 in. × 1 ½ in. (8 mm × 40 mm)

Pipe Size		Two Screw Ceiling Flanges
in.	mm	
2½	65	Lag screw ⅜ in. × 2½ in. (10 mm × 65 mm)
3	80	
3½	90	
4	100	Lag screw ½ in. × 3 in. (13 mm × 75 mm)
5	125	
6	150	
8	200	Lag screw ⅝ in. × 3 in. (16 mm × 75 mm)

Supplemental Information

File Name	Description	Approved
13_AUT_HBS_FDM_17.2.4.2.1_FR1094.docx	For staff use only	

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 10:46:13 EDT 2022

Committee Statement

Committee Statement: Added additional fastener options for u-hooks hanging up to 2" pipe. Currently the only option is a drive screw and with the evolution of battery tools screw and lag options may be useful. Screw and lag sizes are based on 2 hole ceiling flange requirements.

Response Message: FR-1094-NFPA 13-2022

Public Input No. 265-NFPA 13-2022 [Section No. 17.2.4.2.1]

First Revision No. 1098-NFPA 13-2022 [New Section after 17.3.1]

17.3.2

Interpolation of the section modulus values in Table 17.3.1(a) and Table 17.3.1(b) shall not be permitted.

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 10:53:20 EDT 2022

Committee Statement

Committee Statement: The values in Table 17.3.1(a) and Table 17.3.1(b) are not allowed to be interpolated, which needs to be stated in the standard like other table values.

Renumber the remaining sections.

Response Message: FR-1098-NFPA 13-2022

Public Input No. 78-NFPA 13-2021 [New Section after 17.3.1]

First Revision No. 1345-NFPA 13-2022 [Section No. 17.5.4.4 [Excluding any Sub-Sections]]

A minimum of four anchors shall be used to attach the base plate to the floor, unless the requirements of 17.5.4.4.1 are met .

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Mon Oct 03 11:02:28 EDT 2022

Committee Statement

Committee Statement: Editorially aligns with other sections of this chapter. See 7.5.5.1 for example.

Response Message: FR-1345-NFPA 13-2022

First Revision No. 1109-NFPA 13-2022 [Section No. 18.1.2]

18.1.2

Alternative methods of providing earthquake protection of sprinkler systems based on a seismic analysis certified by a registered professional engineer such that system performance will be at least equal to that ~~of the building structure~~ required by ASCE/SEI 7, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures* , for components required to function for life-safety purposes after an earthquake under expected seismic forces shall be permitted.

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 13:12:14 EDT 2022

Committee Statement

Committee Statement: Allowing design with system performance equal to that of the building structure, as is currently the case, would not usually result in a design that is consistent with the requirements for life-safety components. Therefore, the reference to ASCE/SEI 7 is added to clarify this requirement.

Response Message: FR-1109-NFPA 13-2022

Public Input No. 521-NFPA 13-2022 [Section No. 18.1.2]

First Revision No. 1346-NFPA 13-2022 [Section No. 18.2.3.1]

18.2.3.1

The flexible couplings shall be installed as follows:

(1)* Within 24 in. (600 mm) of the top and bottom of all risers, unless the following provisions are met:

(a) In risers less than 3 ft (900 mm) in length, flexible couplings shall be permitted to be omitted.

(b) In risers 3 ft to 7 ft (900 mm to 2100 mm) in length, one flexible coupling shall be adequate.

(2) Within 12 in. (300 mm) above and within 24 in. (600 mm) below the floor in multistory buildings, unless the ~~following~~ provision in 18.2.3.1(3) is met.

(3)* In risers up to 7 ft (2.1 m) in length terminating above the roof assembly or top landing, the flexible coupling shall not be required above the landing or roof assembly.

(4) On both sides of concrete or masonry walls within 1 ft (300 mm) of the wall surface, unless clearance is provided in accordance with Section 18.4.

(5)* Within 24 in. (600 mm) of building expansion joints.

(6) Within 24 in. (600 mm) of the top of drops exceeding 15 ft (4.6 m) in length to portions of systems supplying more than one sprinkler, regardless of pipe size.

(7) Within 24 in. (600 mm) above and 24 in. (600 mm) below any intermediate points of support for a riser or other vertical pipe.

Supplemental Information

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13_HBS_18.2.3.1.docx	FINAL	

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Fri Oct 07 12:02:29 EDT 2022

Committee Statement

Committee Statement: Editorial revision to align with the MOS.

Response Message: FR-1346-NFPA 13-2022

First Revision No. 1292-NFPA 13-2022 [Section No. 18.5.5.2]

18.5.5.2*

The spacing between lateral sway braces shall be in accordance with either Table 18.5.5.2(a) through Table 18.5.5.2(n) or 18.5.5.3, based on the piping material of the sprinkler system.

Table 18.5.5.2(a) Maximum Load (F_{pw}) in Zone of Influence (lb), (F_y = 30 ksi) Schedule 10 Steel Pipe

Diameter of Pipe (in.) Being Braced	Lateral Sway Brace Spacing (ft)				
	20	25	30	35	40
1	~~111~~ 68	~~89~~ 54	~~73~~ 44	~~63~~ 38	~~52~~ 32
1¼	~~176~~ 107	~~141~~ 86	~~116~~ 70	~~99~~ 60	~~83~~ 50
1½	~~241~~ 146	~~193~~ 117	~~158~~ 96	~~136~~ 82	~~114~~ 69
2	~~390~~ 236	~~312~~ 189	~~256~~ 155	~~219~~ 133	~~183~~ 111
2½	~~641~~ 388	~~513~~ 311	~~420~~ 255	~~360~~ 218	~~301~~ 183
3	~~966~~ 585	~~773~~ 468	~~633~~ 384	~~543~~ 329	~~454~~ 275
3½	~~1281~~ 777	~~1025~~ 621	~~840~~ 509	~~720~~ 436	~~603~~ 365
4	~~1634~~ 991	~~1307~~ 792	~~1071~~ 649	~~918~~ 556	~~769~~ 466
5	~~2814~~ 1705	~~2251~~ 1364	~~1844~~ 1118	~~1581~~ 958	~~1324~~ 802
6 and larger*	~~4039~~ 2448	~~3231~~ 1959	~~2647~~ 1605	~~2269~~ 1375	~~1900~~ 1152

Note: ASTM A106 Grade B or ASTM A53 Grade B has an F_y = 35 ksi. An F_y = 30 ksi was used as a conservative value to account for differences in material properties as well as other operational stresses.

*Larger load values for larger diameter pipe can be used when justified by engineering analysis.

Table 18.5.5.2(b) Maximum Load (F_{pw}) in Zone of Influence (kg), (F_y = 207 N/mm^2) Schedule 10 Steel Pipe

Diameter of Pipe (mm) Being Braced	Lateral Sway Brace Spacing (m)				
	6.1	7.6	9.1	11	12
25	~~50~~ 31	~~40~~ 24	~~33~~ 20	~~29~~ 17	~~24~~ 15
32	~~80~~ 49	~~64~~ 39	~~53~~ 32	~~45~~ 27	~~38~~ 23
40	~~109~~ 66	~~88~~ 53	~~72~~ 44	~~62~~ 37	~~52~~ 31
50	~~177~~ 107	~~142~~ 86	~~116~~ 70	~~99~~ 60	~~83~~ 50
~~65~~ 60	~~291~~ 176	~~233~~ 141	~~191~~ 116	~~163~~ 99	~~137~~ 83
80	~~438~~ 265	~~351~~ 212	~~287~~ 174	~~246~~ 149	~~206~~ 125
90	~~581~~ 352	~~465~~ 282	~~381~~ 231	~~327~~ 198	~~273~~ 166
100	~~741~~ 450	~~593~~ 359	~~486~~ 294	~~416~~ 252	~~349~~ 211
125	~~1276~~ 773	~~1021~~ 619	~~836~~ 507	~~717~~ 435	~~601~~ 364
150 and larger *	~~1832~~ 1110	~~1466~~ 889	~~1201~~ 728	~~1029~~ 624	~~862~~ 523

Note: ASTM A106 Grade B or ASTM A53 Grade B has an F_y = 241 N/mm^2. An F_y = 207 N/mm^2 was used also as a conservative value to account for differences in material properties as well as other operational stresses.

*Larger load values for larger diameter pipe can be used when justified by engineering analysis.

Table 18.5.5.2(c) Maximum Load (F_{pw}) in Zone of Influence (lb), (F_y= 30 ksi) Schedule 40 Steel Pipe

Diameter of Pipe (in.) Being	Lateral Sway Brace Spacing (ft)

Braced	20	25	30	35	40
1	~~121~~ 73	~~97~~ 59	~~79~~ 48	~~68~~ 41	~~57~~ 34
1¼	~~214~~ 129	~~171~~ 104	~~140~~ 85	~~120~~ 73	~~100~~ 61
1½	~~306~~ 186	~~245~~ 149	~~201~~ 122	~~172~~ 104	~~144~~ 87
2	~~520~~ 315	~~416~~ 252	~~341~~ 207	~~292~~ 177	~~245~~ 148
2½	~~984~~ 597	~~787~~ 477	~~645~~ 391	~~553~~ 335	~~463~~ 281
3	~~1597~~ 968	~~1278~~ 774	~~1047~~ 634	~~897~~ 544	~~751~~ 455
3½	~~2219~~ 1345	~~1775~~ 1076	~~1455~~ 882	~~1247~~ 756	~~1044~~ 633
4	~~2981~~ 1807	~~2385~~ 1445	~~1954~~ 1184	~~1675~~ 1015	~~1402~~ 850
5	~~5061~~ 3067	~~4049~~ 2454	~~3317~~ 2010	~~2843~~ 1723	~~2381~~ 1443
6 and larger*	~~7893~~ 4784	~~6314~~ 3827	~~5173~~ 3136	~~4434~~ 2688	~~3713~~ 2251

Note: ASTM A106 Grade B or ASTM A53 Grade B has an F_y = 35 ksi. An F_y = 30 ksi was used as a conservative value to account for differences in material properties as well as other operational stresses.

*Larger load values for larger diameter pipe can be used when justified by engineering analysis.

Table 18.5.5.2(d) Maximum Load (F_{pw}) in Zone of Influence (kg), (F_y = 207 N/mm^2) Schedule 40 Steel Pipe

Diameter of Pipe (~~in.~~ mm) Being Braced	Lateral Sway Brace Spacing (m)				
	6.1	7.6	9.1	11	12
25	~~55~~ 33	~~44~~ 27	~~36~~ 22	~~31~~ 19	~~26~~ 15
32	~~97~~ 59	~~78~~ 47	~~63~~ 39	~~54~~ 33	~~45~~ 28
40	~~139~~ 84	~~111~~ 68	~~91~~ 55	~~78~~ 47	~~65~~ 39
50	~~236~~ 143	~~189~~ 114	~~155~~ 94	~~132~~ 80	~~111~~ 67
~~65~~ 60	~~446~~ 271	~~357~~ 216	~~293~~ 177	~~251~~ 152	~~210~~ 127
80	~~724~~ 439	~~580~~ 351	~~475~~ 288	~~407~~ 247	~~341~~ 206
90	~~1007~~ 610	~~805~~ 488	~~660~~ 400	~~566~~ 343	~~474~~ 287
100	~~1352~~ 820	~~1082~~ 655	~~886~~ 537	~~760~~ 460	~~636~~ 386
125	~~2296~~ 1391	~~1837~~ 1113	~~1505~~ 912	~~1290~~ 782	~~1080~~ 655
150 and larger *	~~3580~~ 2170	~~2864~~ 1736	~~2346~~ 1422	~~2011~~ 1219	~~1684~~ 1021

Note: ASTM A106 Grade B or ASTM A53 Grade B has an F_y = 241 N/mm^2. An F_y = 207 N/mm^2 was used also as a conservative value to account for differences in material properties as well as other operational stresses.

*Larger load values for larger diameter pipe can be used when justified by engineering analysis.

Table 18.5.5.2(e) Maximum Load (F_{pw}) in Zone of Influence (lb), (F_y = 30 ksi) Schedule 5 Steel Pipe

Diameter of Pipe (in.) Being Braced	Lateral Sway Brace Spacing (ft)				
	20	25	30	35	40
1	~~71~~ 42	~~56~~ 34	~~46~~ 28	~~40~~ 24	~~33~~ 20
1¼	~~116~~ 70	~~93~~ 56	~~76~~ 46	~~65~~ 39	~~55~~ 33
1½	~~154~~ 93	~~124~~ 74	~~101~~ 61	~~87~~ 52	~~73~~ 44
2	~~246~~ 148	~~197~~ 118	~~161~~ 97	~~138~~ 83	~~116~~ 70

Diameter of Pipe (in.) Being Braced	Lateral Sway Brace Spacing (ft)				
	20	25	30	35	40
2½	~~459~~ 276	~~367~~ 221	~~301~~ 181	~~258~~ 155	~~216~~ 130
3	~~691~~ 415	~~552~~ 332	~~453~~ 272	~~388~~ 233	~~325~~ 195
3½	~~910~~ 547	~~728~~ 438	~~597~~ 359	~~511~~ 307	~~428~~ 257
4 and larger *	~~1160~~ 697	~~928~~ 558	~~760~~ 457	~~652~~ 392	~~546~~ 328

Note: ASTM A106 Grade B or ASTM A53 Grade B has an F_y = 35 ksi. An F_y = 30 ksi was used as a conservative value to account for differences in material properties as well as other operational stresses.

*Larger load values for larger diameter pipe can be used when justified by engineering analysis.

Table 18.5.5.2(f) Maximum Load (F_{pw}) in Zone of Influence (kg), (F_y = 207 N/mm^2) Schedule 5 Steel Pipe

Diameter of Pipe (mm) Being Braced	Lateral Sway Brace Spacing (m)				
	6.1	7.6	9.1	11	12
25	~~32~~ 19	~~25~~ 15	~~21~~ 13	~~18~~ 11	~~15~~ 9
32	~~53~~ 32	~~42~~ 25	~~34~~ 21	~~29~~ 18	~~25~~ 15
40	~~70~~ 42	~~56~~ 34	~~46~~ 28	~~39~~ 24	~~33~~ 20
50	~~112~~ 67	~~89~~ 54	~~73~~ 44	~~63~~ 38	~~53~~ 32
~~65~~ 60	~~208~~ 125	~~166~~ 100	~~137~~ 82	~~117~~ 70	~~98~~ 59
80	~~313~~ 188	~~250~~ 151	~~205~~ 123	~~176~~ 106	~~147~~ 88
90	~~413~~ 248	~~330~~ 199	~~271~~ 163	~~232~~ 139	~~194~~ 117
100 and larger *	~~526~~ 316	~~421~~ 253	~~345~~ 207	~~296~~ 178	~~248~~ 149

Note: ASTM A106 Grade B or ASTM A53 Grade B has an F_y = 241 N/mm^2. An F_y = 207 N/mm^2 was used also as a conservative value to account for differences in material properties as well as other operational stresses.

*Larger load values for larger diameter pipe can be used when justified by engineering analysis.

Table 18.5.5.2(g) Maximum Load (F_{pw}) in Zone of Influence (lb), (F_y = 8 ksi) CPVC Pipe

Diameter of Pipe (in.) Being Braced	Lateral Sway Brace Spacing (ft)				
	20	25	30	35	40
¾	~~15~~ 9	~~12~~ 7	~~10~~ 6	~~8~~ 5	~~7~~ 4
1	~~28~~ 17	~~22~~ 13	~~18~~ 11	~~15~~ 9	~~13~~ 8
1¼	~~56~~ 34	~~45~~ 56	~~37~~ 46	~~30~~ 39	~~26~~ 33
1½	~~83~~ 50	~~67~~ 74	~~55~~ 61	~~45~~ 52	~~39~~ 44
2	~~161~~ 98	~~129~~ 118	~~105~~ 97	~~87~~ 83	~~76~~ 70
2½	~~286~~ 173	~~229~~ 221	~~188~~ 181	~~154~~ 155	~~135~~ 130
3	~~516~~ 313	~~413~~ 558	~~338~~ 457	~~278~~ 392	~~243~~ 328

Table 18.5.5.2(h) Maximum Load (F_{pw}) in Zone of Influence (kg), (F_y = 55 N/mm^2) CPVC Pipe

Diameter of Pipe (~~in.~~ mm) Being Braced	Lateral Sway Brace Spacing (m)				
	6.1	7.6	9.1	11	12

Diameter of Pipe (~~in.~~ mm) Being Braced	Lateral Sway Brace Spacing (m)				
	6.1	7.6	9.1	11	12
20	~~7~~ 4	~~5~~ 3	~~5~~ 3	4 2	~~3~~ 2
25	~~13~~ 8	~~10~~ 6	~~8~~ 5	~~7~~ 4	~~6~~ 4
32	~~25~~ 15	~~20~~ 25	~~17~~ 21	~~14~~ 18	~~12~~ 15
40	~~38~~ 23	~~30~~ 34	~~25~~ 28	~~20~~ 24	~~18~~ 20
50	~~73~~ 44	~~59~~ 54	~~48~~ 44	~~39~~ 38	~~34~~ 32
~~65~~ 60	~~130~~ 78	~~104~~ 100	~~85~~ 82	70	~~61~~ 59
80	~~234~~ 142	~~187~~ 253	~~153~~ 207	~~126~~ 178	~~110~~ 149

Table 18.5.5.2(i) Maximum Load (F_{pw}) in Zone of Influence (lb), (F_y = 30 ksi) Type M Copper Tube (with Soldered Joints)

Diameter of Pipe (in.) Being Braced	Lateral Sway Brace Spacing (ft)				
	20	25	30	35	40
¾	~~16~~ 10	~~13~~ 8	~~10~~ 6	~~9~~ 5	~~8~~ 5
1	~~29~~ 18	~~24~~ 14	~~19~~ 12	~~16~~ 10	~~14~~ 8
1¼	~~53~~ 32	~~42~~ 26	~~35~~ 21	~~28~~ 18	~~25~~ 15
1½	~~86~~ 52	~~69~~ 42	~~56~~ 34	~~46~~ 29	~~41~~ 25
2 and larger *	~~180~~ 109	~~144~~ 87	~~118~~ 72	~~97~~ 61	~~85~~ 51

*Larger load values for larger diameter pipe can be used when justified by engineering analysis.

Table 18.5.5.2(j) Maximum Load (F_{pw}) in Zone of Influence (kg), (F_y = ~~3~~ 207 N/mm^2) Type M Copper Tube (with Soldered Joints)

Diameter of Pipe (~~in.~~ mm) Being Braced	Lateral Sway Brace Spacing (m)				
	6.1	7.6	9.1	11	12
20	~~7.3~~ 5	~~5.9~~ 4	~~5~~ 3	~~4.1~~ 2	~~3.6~~ 2
25	~~13.2~~ 8	~~10.9~~ 6	~~8.6~~ 5	~~7.3~~ 5	~~6.4~~ 4
32	~~24~~ 15	~~19.1~~ 12	~~15.9~~ 10	~~12.7~~ 8	~~11.3~~ 7
40	~~39~~ 24	~~31.3~~ 19	~~25.4~~ 15	~~20.9~~ 13	~~18.6~~ 11
50 and larger *	~~81.6~~ 49	~~65.3~~ 39	~~53~~ 33	~~44~~ 28	~~38.6~~ 23

*Larger load values for larger diameter pipe can be used when justified by engineering analysis.

Table 18.5.5.2(k) Maximum Load (F_{pw}) in Zone of Influence (lb), (F_y = 9 ksi) Type M Copper Tube (with Brazed Joints)

Diameter of Pipe (in.) Being Braced	Lateral Sway Spacing (ft)				
	20	25	30	35	40
¾	~~6~~ 4	~~5~~ 3	4 2	~~3~~ 2	~~3~~ 2
1	~~11~~ 7	~~9~~ 6	~~7~~ 5	~~6~~ 4	~~5~~ 3
1¼	~~20~~ 12	~~16~~ 10	~~13~~ 8	~~12~~ 7	~~10~~ 6
1½	~~33~~ 20	~~27~~ 16	~~22~~ 13	~~19~~ 11	~~16~~ 10
2 and larger *	~~70~~ 42	~~56~~ 34	~~46~~ 28	~~39~~ 24	~~33~~ 20

*Larger load values for larger diameter pipe can be used when justified by engineering analysis.

Table 18.5.5.2(l) Maximum Load (F_{pw}) in Zone of Influence (kg), (F_y = 62 N/mm^2) Type M Copper Tube (with Brazed Joints)

Diameter of Pipe (mm) Being Braced	Lateral Sway Spacing (m)				
	6.1	7.6	9.1	11	12
20	~~3~~ 2	~~2~~ 1	~~2~~ 1	1	1
25	~~5~~ 3	4 3	~~3~~ 2	~~3~~ 2	~~2~~ 1
32	~~9~~ 5	~~7~~ 5	~~6~~ 4	~~5~~ 3	~~5~~ 3
40	~~15~~ 9	~~12~~ 7	~~10~~ 6	~~9~~ 5	~~7~~ 5
50 and larger *	~~32~~ 19	~~25~~ 15	~~21~~ 13	~~18~~ 11	~~15~~ 9

*Larger load values for larger diameter pipe can be used when justified by engineering analysis.

Table 18.5.5.2(m) Maximum Load (F_{pw}) in Zone of Influence (lb), (F_y = 9 ksi) Red Brass Pipe (with Brazed Joints)

Diameter of Pipe (in.) Being Braced	Lateral Sway Spacing (ft)				
	20	25	30	35	40
¾	~~34~~ 21	~~27~~ 17	~~22~~ 14	~~19~~ 12	~~16~~ 10
1	~~61~~ 37	~~49~~ 30	~~40~~ 24	~~35~~ 21	~~29~~ 18
1¼	~~116~~ 70	~~93~~ 56	~~76~~ 46	~~65~~ 40	~~55~~ 33
1½	~~161~~ 97	~~129~~ 78	~~105~~ 64	~~90~~ 55	~~76~~ 46
2 and larger *	~~272~~ 165	~~218~~ 132	~~178~~ 108	~~153~~ 93	~~128~~ 78

*Larger load values for larger diameter pipe can be used when justified by engineering analysis.

Table 18.5.5.2(n) Maximum Load (F_{pw}) in Zone of Influence (lb), (F_y = 62 N/mm^2) Red Brass Pipe (with Brazed Joints)

Diameter of Pipe (mm) Being Braced	Lateral Sway Spacing (m)				
	6.1	7.6	9.1	11	12
20	~~15~~ 10	~~12~~ 8	~~10~~ 6	~~9~~ 5	~~7~~ 5
25	~~28~~ 17	~~22~~ 14	~~18~~ 11	~~16~~ 10	~~13~~ 8
32	~~53~~ 32	~~42~~ 25	~~35~~ 21	~~30~~ 18	~~25~~ 15
40	~~73~~ 44	~~59~~ 35	~~48~~ 29	~~41~~ 25	~~35~~ 21
50 and larger *	~~124~~ 75	~~99~~ 60	~~81~~ 49	~~70~~ 42	~~58~~ 35

*Larger load values for larger diameter pipe can be used when justified by engineering analysis.

A.18.5.5.2

The maximum horizontal brace forces (F_{pw}) versus sway brace spacings in Table 18.5.5.2(a) through Table 18.5.5.2(n) were developed based on required horizontal seismic forces and allowable stresses appropriate for the pipe itself to allow designers to continue to use familiar concepts, such as zone of influence, to lay out and proportion braces while ensuring compatibility with modern seismic requirements. The spacing of braces was determined using the provisions of ASCE/SEI 7, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, assuming steel pipe with threaded or grooved connections for Table 18.5.5.2(a) through Table 18.5.5.2(f). The tabulated values are based on conservative simplifying assumptions. A detailed engineering analysis, taking into account the properties of the specific system, might provide greater spacing. However, in order to control deflections, in no case should the lateral sway brace spacing exceed 40 ft (12.2 m). See also A.18.5.9.1 and Annex E .

18.5.5.2.1

Specially listed nonstandard pipe shall be permitted using the values in Table 18.5.5.2(e) and Table 18.5.5.2(f) or with values provided by the manufacturer.

18.5.5.2.2

Spacing shall not exceed a maximum interval of 40 ft (12 m) on center.

18.5.5.2.3

The maximum permissible load in the zone of influence of a sway brace shall not exceed the values given in Table 18.5.5.2(a) through Table 18.5.5.2(n) or the values calculated in accordance with 18.5.5.3.

18.5.5.2.4

When determining permissible loads in accordance with 18.5.5.2 or 18.5.5.2.1 on a main with varying sizes, the allowable load shall be based on the smallest pipe size within the zone of influence.

Supplemental Information

File Name	Description	Approved
13_AUT_HBS_FDM_18.5.5.2_FR1292.docx	For staff use only	

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Thu Aug 04 10:05:32 EDT 2022

Committee Statement

Committee Statement: The load tables have been updated to incorporate new seismic forces for piping from ASCE/SEI 7. In addition, the footnote for larger diameter piping has been clarified to avoid confusion on the use of larger pipe sizes. Editorial revisions were made for tables with incorrect units. A.18.5.5.2 is revised to align with other changes made throughout the document to align with ASCE/SEI 7. Removed the title of ASCE/SEI 7 per the MOS.

Response Message: FR-1292-NFPA 13-2022

Public Input No. 540-NFPA 13-2022 [Section No. A.18.5.5.2]

Public Input No. 537-NFPA 13-2022 [Section No. 18.5.5.2]

Public Input No. 171-NFPA 13-2022 [Section No. 18.5.5.2 [Excluding any Sub-Sections]]

Public Input No. 254-NFPA 13-2022 [Section No. 18.5.5.2 [Excluding any Sub-Sections]]

First Revision No. 1293-NFPA 13-2022 [Section No. 18.5.5.11]

18.5.5.11*

The lateral sway bracing required by 18.5.5 shall be permitted to be omitted when 18.5.5.11.1 for branch lines or 18.5.5.11.2 for mains is met.

A.18.5.5.11

The use of U-hooks and wraparounds are an acceptable alternative to the lateral sway bracing requirements when following 18.5.5.11.1 and 18.5.5.11.2 .

18.5.5.11.1

Branch lines shall comply with the following:

(1) The branch lines shall be individually supported by wraparound u-hooks or u-hooks arranged to keep pipe tight to the structural element, provided the legs are bent out at least 30 degrees from the vertical and the maximum length of each leg and the rod size satisfies the conditions of Table 18.5.11.8(a) through Table 18.5.11.8(f), or the length of the rod shall be calculated.

(2) At least 75 percent of all the hangers on the branch line shall meet the requirements of 18.5.5.11.1(1).

(3) Consecutive hangers on the branch line shall not be permitted to exceed the limitation in 18.5.5.11.1(1).

18.5.5.11.2

Mains shall comply with all the following:

(1) The main piping shall be individually supported by wraparound u-hooks or u-hooks arranged to keep pipe tight to the structural element provided the legs are bent out at least 30 degrees from the vertical and the maximum length of each leg and rod size satisfies the conditions of Table 18.5.11.8(a) through Table 18.5.11.8(f).

(2) At least 75 percent of all the hangers on the main shall meet the requirements of 18.5.5.11.2(1).

(3) Consecutive hangers on the main shall not be permitted to exceed the limitation in 18.5.5.11.2(1).

(4) The seismic coefficient (C_p) shall not exceed 0.5.

(5) The nominal pipe diameter shall not exceed 6 in. (150 mm) for feed mains and 4 in. (100 mm) for cross mains.

(6) Hangers shall not be omitted in accordance with 17.4.4.3, 17.4.4.4, or 17.4.4.5.

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Thu Aug 04 12:57:39 EDT 2022

Committee Statement

Committee Statement:	Added annex text to clarify that U-hooks and wraparounds can be acceptable alternatives to lateral sway bracing requirements.
Response Message:	FR-1293-NFPA 13-2022

Public Input No. 255-NFPA 13-2022 [Section No. 18.5.5.11 [Excluding any Sub-Sections]]

First Revision No. 1148-NFPA 13-2022 [Section No. 18.5.9.3]

18.5.9.3

The horizontal force, F_{pw}, acting on the brace shall be taken as $F_{pw} = C_p W_p$, where C_p= 0.754 S_{DS}, and S_{DS} is ~~the seismic coefficient selected in Table 18.5.9.3 utilizing~~ the short period response parameter, ~~S_s~~ .

~~Table 18.5.9.3 Seismic Coefficient Table~~

~~S_s~~	~~Default C_p~~	~~Site Class–Specific C_p~~			
		~~A~~	~~B~~	~~C~~	~~D~~
~~0.33 or less~~	~~0.24~~	~~0.13~~	~~0.14~~	~~0.21~~	~~0.24~~
~~0.4~~	~~0.28~~	~~0.15~~	~~0.17~~	~~0.25~~	~~0.28~~
~~0.5~~	~~0.33~~	~~0.19~~	~~0.21~~	~~0.31~~	~~0.33~~
~~0.6~~	~~0.37~~	~~0.23~~	~~0.26~~	~~0.36~~	~~0.37~~
~~0.7~~	~~0.41~~	~~0.27~~	~~0.30~~	~~0.40~~	~~0.41~~
~~0.8~~	~~0.45~~	~~0.30~~	~~0.34~~	~~0.45~~	~~0.45~~
~~0.9~~	~~0.51~~	~~0.34~~	~~0.38~~	~~0.51~~	~~0.48~~
~~1.0~~	~~0.56~~	~~0.38~~	~~0.42~~	~~0.56~~	~~0.52~~
~~1.1~~	~~0.62~~	~~0.42~~	~~0.47~~	~~0.62~~	~~0.55~~
~~1.2~~	~~0.68~~	~~0.45~~	~~0.51~~	~~0.68~~	~~0.58~~
~~1.3~~	~~0.73~~	~~0.49~~	~~0.55~~	~~0.73~~	~~0.61~~
~~1.4~~	~~0.79~~	~~0.53~~	~~0.59~~	~~0.79~~	~~0.66~~
~~1.5~~	~~0.84~~	~~0.56~~	~~0.63~~	~~0.84~~	~~0.70~~
~~1.6~~	~~0.90~~	~~0.60~~	~~0.68~~	~~0.90~~	~~0.75~~
~~1.7~~	~~0.96~~	~~0.64~~	~~0.72~~	~~0.96~~	~~0.80~~
~~1.8~~	~~1.01~~	~~0.68~~	~~0.76~~	~~1.01~~	~~0.84~~
~~1.9~~	~~1.07~~	~~0.71~~	~~0.80~~	~~1.07~~	~~0.89~~
~~2.0~~	~~1.12~~	~~0.75~~	~~0.84~~	~~1.12~~	~~0.94~~
~~2.1~~	~~1.18~~	~~0.79~~	~~0.89~~	~~1.18~~	~~0.98~~
~~2.2~~	~~1.24~~	~~0.83~~	~~0.93~~	~~1.24~~	~~1.03~~
~~2.3~~	~~1.29~~	~~0.86~~	~~0.97~~	~~1.29~~	~~1.08~~
~~2.4~~	~~1.35~~	~~0.90~~	~~1.01~~	~~1.35~~	~~1.12~~
~~2.5~~	~~1.40~~	~~0.94~~	~~1.05~~	~~1.40~~	~~1.17~~
~~2.6~~	~~1.46~~	~~0.98~~	~~1.10~~	~~1.46~~	~~1.22~~
~~2.7~~	~~1.52~~	~~1.01~~	~~1.14~~	~~1.52~~	~~1.26~~
~~2.8~~	~~1.57~~	~~1.05~~	~~1.18~~	~~1.57~~	~~1.31~~
~~2.9~~	~~1.63~~	~~1.09~~	~~1.22~~	~~1.63~~	~~1.36~~
~~3.0~~	~~1.68~~	~~1.12~~	~~1.26~~	~~1.68~~	~~1.40~~
~~3.1~~	~~1.74~~	~~1.16~~	~~1.31~~	~~1.74~~	~~1.45~~
~~3.2~~	~~1.80~~	~~1.20~~	~~1.35~~	~~1.80~~	~~1.50~~
~~3.3~~	~~1.85~~	~~1.24~~	~~1.39~~	~~1.85~~	~~1.54~~
~~3.4~~	~~1.91~~	~~1.27~~	~~1.43~~	~~1.91~~	~~1.59~~
~~3.5~~	~~1.96~~	~~1.31~~	~~1.47~~	~~1.96~~	~~1.64~~
~~3.6~~	~~2.02~~	~~1.35~~	~~1.52~~	~~2.02~~	~~1.68~~
~~3.7~~	~~2.08~~	~~1.39~~	~~1.56~~	~~2.08~~	~~1.73~~
~~3.8~~	~~2.13~~	~~1.42~~	~~1.60~~	~~2.13~~	~~1.78~~
~~3.9~~	~~2.19~~	~~1.46~~	~~1.64~~	~~2.19~~	~~1.82~~
~~4.0~~	~~2.24~~	~~1.50~~	~~1.68~~	~~2.24~~	~~1.87~~

18.5.9.3.1*

The value of S_s S_{DS} ~~from Table 18.5.9.3~~ shall be obtained from the ~~authority having jurisdiction~~ AHJ or ~~from seismic hazard maps~~ the ASCE/SEI 7, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, Hazard Tool .

A.18.5.9.3.1

See https://asce7hazardtool.online/.

18.5.9.3.2*

The ~~default~~ value of C_p ~~from Table 18.5.9.3~~ S_{DS} shall be ~~used~~ determined using the ASCE/SEI 7, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures* , default site soil class unless 18.5.9.3.2.1 is met.

A.18.5.9.3.2

The default site soil class is used when soil properties are not known in sufficient detail to determine the site class. The default site condition considers Site Class C (very dense sand or hard clay), Site Class CD (dense sand or very stiff clay) and Site Class D (medium dense sand or stiff clay) to determine the controlling value of S_{DS} based on which of these three site classes results in the largest amplification of bedrock ground motions.

18.5.9.3.2.1*

The use of a site class–specific C_p value of S_{DS}, obtained from the authority having jurisdiction, ~~from Table 18.5.9.3~~ shall be permitted.

~~**18.5.9.3.2.2***~~

~~Where site class E or F is applicable, the authority having jurisdiction shall confirm whether it is acceptable to use the method outlined in 18.5.9.3 and 18.5.9.4 or an alternative method in accordance with 18.1.2 to determine F_{pw} .~~

~~**A.18.5.9.3.2.2**~~

~~When a structure is built on a site class E or F, the building design might incorporate features apart from the assumptions used in this standard for how a building will move when subjected to seismic forces. In these situations, the approaches used to protect mechanical systems should be confirmed.~~

~~**18.5.9.3.3***~~

~~Linear interpolation shall be permitted to be used for intermediate values of S_s .~~

~~A.18.5.9.3.3~~

~~As linear interpolation of Table 18.5.9.3 is permitted, the following equation can be used to achieve the interpolated values:~~

$$C_p = C_{p-\text{low}} + \frac{C_{p-\text{high}} - C_{p-\text{low}}}{S_{s-\text{high}} - S_{s-\text{low}}}\left(S_s - S_{s-\text{low}}\right)$$ ~~[A.18.5.9.3.3]~~

~~where:~~

~~C_p = seismic coefficient value being sought~~

~~$C_{p\ \text{low}}$ = next lower seismic coefficient value from Table 18.5.9.3~~

~~$C_{p\ \text{high}}$ = next higher seismic coefficient value from Table 18.5.9.3~~

~~S_s = spectral response as defined in 3.3.207~~

~~$S_{s\ \text{low}}$ = next lower S_s value from Table 18.5.9.3~~

~~$S_{s\ \text{high}}$ = next higher S_s value from Table 18.5.9.3~~

18.5.9.3.3*

Where the height of the component attachment to the structure is between 51 percent and 75 percent of the average roof height, the C_p value shall be permitted to be multiplied by a factor of 0.875.

18.5.9.3.4

Where the height of the component attachment to the structure is less than 50 percent of the average roof height, the C_p value shall be permitted to be multiplied by a factor of 0.75. *(See Figure A.18.5.9.3.3.)*

Supplemental Information

File Name	Description	Approved
13_AUT_HBS_FDM_18.5.9.3_FR1148.docx	For staff use only	

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 18:37:25 EDT 2022

Committee Statement

Committee Statement: Revised to refer to SDS. Deleting table 18.5.9.3 because it is no longer applicable. This is part of the overall coordination based on the work of the ASCE/SEI 7 task group. Renumber subsequent sections.

Response Message: FR-1148-NFPA 13-2022

Public Input No. 547-NFPA 13-2022 [New Section after 18.5.9.3.2]

Public Input No. 545-NFPA 13-2022 [Section No. 18.5.9.3]

First Revision No. 1152-NFPA 13-2022 [Section No. 18.5.9.4]

18.5.9.4*

The horizontal force, F_{pw}, acting on the brace and the F_{pw} versus brace spacing limits based on piping stresses shall be permitted to be determined in accordance with 13.3.1 of ASCE/SEI 7, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, multiplied by 0.7 to convert to allowable stress design (ASD).

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 18:59:16 EDT 2022

Committee Statement

Committee Statement: Revised to clarify that there are considerations around the horizontal force and brace spacing limitations due to loading.

Response Message: FR-1152-NFPA 13-2022

Public Input No. 548-NFPA 13-2022 [Section No. 18.5.9.4]

First Revision No. 1154-NFPA 13-2022 [Section No. 18.5.9.6.1]

18.5.9.6.1*

When riser nipples are provided in systems requiring seismic protection, they shall satisfy the requirements of 18.5.9.6.2 unless the following requirements are met:

(1) Where riser nipples are 4 ft (1.2 m) or less in length and C_p is ~~0.50~~ 0.3 or less

(2) Where riser nipples are 3 ft (900 mm) or less in length and C_p is less than ~~0.67~~ 0.4

(3) Where riser nipples are 2 ft (600 mm) or less in length and C_p is less than is ~~1.0~~ 0.6

A.18.5.9.6.1

Where the C_p is ~~1.0~~ 0.6 or greater, the calculation should be done for any riser nipple length. The loads in this condition can rapidly exceed the yield strength. Where Schedule 10 and Schedule 40 steel pipe are used, the section modulus can be found in Table 17.3.1(c) or Table 17.3.1(d). Table A.18.5.9.6.1 illustrates when the required yield strength calculation based on riser nipple length is necessary. The riser nipple should be measured from the top of the cross main to the bottom of the branch line.

Table A.18.5.9.6.1 Required Yield Strength Calculation Based on Riser Nipple Length on C_p

Riser Nipple Length	Seismic Coefficient			
	$C_p \leq$ ~~0.50~~ 0.3	$C_p \leq$ ~~0.67~~ 0.4	$C_p <$ ~~1.0~~ 0.6	$C_p >$ ~~1.0~~ 0.6
>4 ft (>1.2 m)	X	X	X	X
≤4 ft (≤1.2 m)		X	X	X
≤3 ft (≤915 mm)			X	X
≤2 ft (≤610 mm)				X

Note: Conditions marked X are required to satisfy the equation provided in 18.5.9.6.2.

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 19:07:18 EDT 2022

Committee Statement

Committee Statement: Modified Cp values to align with the new Cp values throughout the document in coordination with ASCE/SEI 7. Added annex text to clarify how a riser nipple should be measured.

Response Message: FR-1154-NFPA 13-2022

Public Input No. 550-NFPA 13-2022 [Section No. 18.5.9.6.1]

Public Input No. 551-NFPA 13-2022 [Section No. A.18.5.9.6.1]

First Revision No. 1156-NFPA 13-2022 [Section No. 18.5.9.6.2]

18.5.9.6.2

If the calculated value as determined by the following equation is equal to or greater than the allowable yield strength of the riser nipple, F_Y, the longitudinal seismic load of each line shall be evaluated individually, and branch lines shall be provided with longitudinal sway bracing in accordance with 18.5.6:

$$1.65\ \frac{\left(H_r \cdot W_p \cdot C_p\right)}{S} \geq F_y \qquad \textbf{[18.5.9.6.2]}$$

where:

H_r = length of riser nipple piping (in.)

W_p = tributary weight (lb) for the branch line or portion of branch line within the zone of influence including the riser nipple

C_p = seismic coefficient

S = sectional modulus of the riser nipple pipe

F_y = allowable yield strength of 30,000 psi (2070 bar) for steel, 30,000 psi (2070 bar) for copper (soldered), and 8000 psi (550 bar) for CPVC

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 19:15:02 EDT 2022

Committee Statement

Committee Statement: Coefficient added to coordinate with changes made to Cp to align with ASCE/SEI 7 throughout the document.

Response Message: FR-1156-NFPA 13-2022

Public Input No. 558-NFPA 13-2022 [Section No. 18.5.9.6.2]

First Revision No. 1113-NFPA 13-2022 [Section No. 18.5.10]

18.5.10 Net Vertical Forces.

Where the ~~horizontal seismic load used~~ C_p exceeds 0.5 ~~W_p~~ and the brace angle is less than 45 degrees from vertical or where the ~~horizontal seismic load used~~ C_p exceeds 1.0 ~~W_p~~ and the brace angle is less than 60 degrees from vertical, the braces shall be arranged to resist the net vertical force produced by the horizontal load.

Submitter Information Verification

Committee: AUT-HBS

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Committee Statement

Committee Statement: The section has been updated to refer to Cp, as the seismic coefficient is used throughout the chapter. Editorially added the 1.0 as it was unintentionally omitted.

Response Message: FR-1113-NFPA 13-2022

Public Input No. 354-NFPA 13-2022 [Section No. 18.5.10]

First Revision No. 1158-NFPA 13-2022 [Section No. 18.5.12.2]

18.5.12.2*

For individual fasteners, unless alternative allowable loads are determined and certified by a registered professional engineer, the loads determined in 18.5.9 shall not exceed the allowable loads provided in Table 18.5.12.2(a) through Table 18.5.12.2(m) or 18.5.12.7.

Table 18.5.12.2(a) Maximum Load for Wedge Anchors in 3000 psi (207 bar) Lightweight Cracked Concrete on Metal Deck

Max F_{pw} (lb) for Wedge Anchors in 3000 psi Sand Lightweight Cracked Concrete on 4½ in. Flute Width Metal Deck ~~(lb)~~												
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Max. Flute Center Offset (in.)	A $Pr \leq 2.0$	B $Pr \leq 1.1$	C $Pr \leq 0.7$	D $Pr \leq 1.2$	E $Pr \leq 1.1$	F $Pr \leq 1.1$	G $Pr \leq 1.4$	H $Pr \leq 0.9$	I $Pr \leq 0.8$
⅜	2.375	6.25	1	123	183	233	—	—	—	—	—	—
½	3.750	6.25	1	147	231	310	—	—	—	—	—	—
⅝	3.875	6.25	1	188	292	387	—	—	—	—	—	—
¾	4.500	6.25	1	255	380	486	—	—	—	—	—	—
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Max. Flute Center Offset (in.)	A $2.0 < Pr \leq 3.5$	B $1.1 < Pr \leq 1.8$	C $0.7 < Pr \leq 1.0$	D $1.2 < Pr \leq 1.7$	E $1.1 < Pr \leq 1.8$	F $1.1 < Pr \leq 2.0$	G $1.4 < Pr \leq 1.9$	H $0.9 < Pr \leq 1.3$	I $0.8 < Pr \leq 1.1$
⅜	2.375	6.25	1	79	133	193	—	—	—	—	—	—
½	3.750	6.25	1	86	160	247	—	—	—	—	—	—
⅝	3.875	6.25	1	113	204	311	—	—	—	—	—	—
¾	4.500	6.25	1	165	275	402	—	—	—	—	—	—
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Max. Flute Center Offset (in.)	A $3.5 < Pr \leq 5.0$	B $1.8 < Pr \leq 2.5$	C $1.0 < Pr \leq 1.3$	D $1.7 < Pr \leq 2.2$	E $1.8 < Pr \leq 2.5$	F $2.0 < Pr \leq 2.9$	G $1.9 < Pr \leq 2.4$	H $1.3 < Pr \leq 1.7$	I $1.1 < Pr \leq 1.4$
⅜	2.375	6.25	1	56	104	165	—	—	—	—	—	—
½	3.750	6.25	1	60	121	205	—	—	—	—	—	—
⅝	3.875	6.25	1	79	157	260	—	—	—	—	—	—
¾	4.500	6.25	1	116	216	343	—	—	—	—	—	—
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Max. Flute Center Offset (in.)	A $5.0 < Pr \leq 6.5$	B $2.5 < Pr \leq 3.2$	C $1.3 < Pr \leq 1.6$	D $2.2 < Pr \leq 2.7$	E $2.5 < Pr \leq 3.2$	F $2.9 < Pr \leq 3.8$	G $2.4 < Pr \leq 2.9$	H $1.7 < Pr \leq 2.1$	I $1.4 < Pr \leq 1.7$
⅜	2.375	6.25	1	43	85	144	—	—	—	—	—	—
½	3.750	6.25	1	46	94	175	—	—	—	—	—	—
⅝	3.875	6.25	1	60	124	224	—	—	—	—	—	—
¾	4.500	6.25	1	89	177	299	—	—	—	—	—	—

Pr: Prying factor range *(see A.18.5.12.2 for additional information).*

Table 18.5.12.2(b) Maximum Load for Wedge Anchors in 3000 psi (207 bar) Lightweight Cracked Concrete

Max F_{pw} (lb) for Wedge Anchors in 3000 psi Lightweight Cracked Concrete ~~(lb)~~

Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				Pr ≤ 2.0	*Pr* ≤ 1.1	*Pr* ≤ 0.7	*Pr* ≤ 1.2	*Pr* ≤ 1.1	*Pr* ≤ 1.1	*Pr* ≤ 1.4	*Pr* ≤ 0.9	*Pr* ≤ 0.8
⅜	2.375	5	4	142	216	280	162	216	256	139	208	244
½	3.750	6	6	200	314	419	243	314	362	209	312	365
⅝	3.875	6	6	259	394	512	297	394	467	255	380	446
¾	4.500	7	8	356	552	731	424	552	641	365	544	636
Diameter (in.)	**Min. Nom. Embedment (in.)**	**Min. Slab Thickness (in.)**	**Min. Edge Distance (in.)**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
				2.0 < *Pr* ≤ 3.5	**1.1 < *Pr* ≤ 1.8**	**0.7 < *Pr* ≤ 1.0**	**1.2 < *Pr* ≤ 1.7**	**1.1 < *Pr* ≤ 1.8**	**1.1 < *Pr* ≤ 2.0**	**1.4 < *Pr* ≤ 1.9**	**0.9 < *Pr* ≤ 1.3**	**0.8 < *Pr* ≤ 1.1**
⅜	2.375	5	4	89	154	229	133	154	157	117	170	204
½	3.750	6	6	119	218	335	195	218	209	172	250	299
⅝	3.875	6	6	163	281	418	244	281	286	215	311	373
¾	4.500	7	8	214	386	588	343	386	376	303	438	525
Diameter (in.)	**Min. Nom. Embedment (in.)**	**Min. Slab Thickness (in.)**	**Min. Edge Distance (in.)**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
				3.5 < *Pr* ≤ 5.0	**1.8 < *Pr* ≤ 2.5**	**1.0 < *Pr* ≤ 1.3**	**1.7 < *Pr* ≤ 2.2**	**1.8 < *Pr* ≤ 2.5**	**2.0 < *Pr* ≤ 2.9**	**1.9 < *Pr* ≤ 2.4**	**1.3 < *Pr* ≤ 1.7**	**1.1 < *Pr* ≤ 1.4**
⅜	2.375	5	4	62	119	194	113	119	108	101	144	175
½	3.750	6	6	83	167	279	163	167	144	147	208	254
⅝	3.875	6	6	113	218	354	207	218	197	186	263	320
¾	4.500	7	8	150	297	492	288	297	259	259	367	447
Diameter (in.)	**Min. Nom. Embedment (in.)**	**Min. Slab Thickness (in.)**	**Min. Edge Distance (in.)**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
				5.0 < *Pr* ≤ 6.5	**2.5 < *Pr* ≤ 3.2**	**1.3 < *Pr* ≤ 1.6**	**2.2 < *Pr* ≤ 2.7**	**2.5 < *Pr* ≤ 3.2**	**2.9 < *Pr* ≤ 3.8**	**2.4 < *Pr* ≤ 2.9**	**1.7 < *Pr* ≤ 2.1**	**1.4 < *Pr* ≤ 1.7**
⅜	2.375	5	4	47	97	168	98	97	82	89	125	154
½	3.750	6	6	63	130	239	140	130	109	128	178	220
⅝	3.875	6	6	87	178	306	179	178	150	163	228	281
¾	4.500	7	8	115	234	422	248	234	197	226	315	389

Pr: Prying factor range *(see A.18.5.12.2 for additional information)*.

Table 18.5.12.2(c) Max F_{pw} (lb) for Maximum Load for Wedge Anchors in 3000 psi (207 bar) Normal Weight Cracked Concrete

Max F_{pw} (lb) for Wedge Anchors in 3000 psi Normal Weight Cracked Concrete ~~(lb)~~

Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				Pr ≤ 2.0	*Pr* ≤ 1.1	*Pr* ≤ 0.7	*Pr* ≤ 1.2	*Pr* ≤ 1.1	*Pr* ≤ 1.1	*Pr* ≤ 1.4	*Pr* ≤ 0.9	*Pr* ≤ 0.8
⅜	2.375	5	4	189	274	342	197	274	340	170	251	297
½	3.750	6	6	272	423	563	326	423	490	281	419	490

Max F_{pw} (lb) for Wedge Anchors in 3000 psi Normal Weight Cracked Concrete ~~(lb)~~												
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A $Pr \leq 2.0$	B $Pr \leq 1.1$	C $Pr \leq 0.7$	D $Pr \leq 1.2$	E $Pr \leq 1.1$	F $Pr \leq 1.1$	G $Pr \leq 1.4$	H $Pr \leq 0.9$	I $Pr \leq 0.8$
⅝	3.875	6	6	407	623	814	472	623	733	406	605	709
¾	4.500	7	8	613	940	1232	715	940	1104	615	916	1073
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A $2.0 < Pr \leq 3.5$	B $1.1 < Pr \leq 1.8$	C $0.7 < Pr \leq 1.0$	D $1.2 < Pr \leq 1.7$	E $1.1 < Pr \leq 1.8$	F $1.1 < Pr \leq 2.0$	G $1.4 < Pr \leq 1.9$	H $0.9 < Pr \leq 1.3$	I $0.8 < Pr \leq 1.1$
⅜	2.375	5	4	125	203	288	167	203	219	147	212	256
½	3.750	6	6	162	295	451	263	295	285	233	337	403
⅝	3.875	6	6	252	441	662	386	441	442	341	492	590
¾	4.500	7	8	378	665	999	583	665	662	515	744	892
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A $3.5 < Pr \leq 5.0$	B $1.8 < Pr \leq 2.5$	C $1.0 < Pr \leq 1.3$	D $1.7 < Pr \leq 2.2$	E $1.8 < Pr \leq 2.5$	F $2.0 < Pr \leq 2.9$	G $1.9 < Pr \leq 2.4$	H $1.3 < Pr \leq 1.7$	I $1.1 < Pr \leq 1.4$
⅜	2.375	5	4	92	162	249	145	162	159	130	184	225
½	3.750	6	6	113	226	377	220	226	196	199	281	342
⅝	3.875	6	6	176	341	557	326	341	304	293	415	506
¾	4.500	7	8	264	514	841	493	514	456	443	627	763
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A $5.0 < Pr \leq 6.5$	B $2.5 < Pr \leq 3.2$	C $1.3 < Pr \leq 1.6$	D $2.2 < Pr \leq 2.7$	E $2.5 < Pr \leq 3.2$	F $2.9 < Pr \leq 3.8$	G $2.4 < Pr \leq 2.9$	H $1.7 < Pr \leq 2.1$	I $1.4 < Pr \leq 1.7$
⅜	2.375	5	4	70	134	220	128	134	121	116	162	200
½	3.750	6	6	87	178	323	190	178	149	173	241	298
⅝	3.875	6	6	135	276	481	283	276	232	258	359	442
¾	4.500	7	8	203	413	725	426	413	348	389	541	667

Pr: Prying factor range *(see A.18.5.12.2 for additional information)*.

Table 18.5.12.2(d) Maximum Load for Wedge Anchors in 4000 psi (276 bar) Normal Weight Cracked Concrete

Max F_{pw} (lb) for Wedge Anchors in 4000 psi Normal Weight Cracked Concrete ~~(lb)~~												
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A $Pr \leq 2.0$	B $Pr \leq 1.1$	C $Pr \leq 0.7$	D $Pr \leq 1.2$	E $Pr \leq 1.1$	F $Pr \leq 1.1$	G $Pr \leq 1.4$	H $Pr \leq 0.9$	I $Pr \leq 0.8$
⅜	2.375	5	4	206	293	360	208	293	370	179	264	313

Max F_{pw} (lb) for Wedge Anchors in 4000 psi Normal Weight Cracked Concrete ~~(lb)~~												
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$Pr \leq 2.0$	$Pr \leq 1.1$	$Pr \leq 0.7$	$Pr \leq 1.2$	$Pr \leq 1.1$	$Pr \leq 1.1$	$Pr \leq 1.4$	$Pr \leq 0.9$	$Pr \leq 0.8$
½	3.750	6	6	304	466	610	353	466	548	304	453	531
⅝	3.875	6	6	469	716	935	542	716	844	467	694	814
¾	4.500	7	8	657	997	1293	750	997	1182	646	959	1125
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$2.0 < Pr \leq 3.5$	$1.1 < Pr \leq 1.8$	$0.7 < Pr \leq 1.0$	$1.2 < Pr \leq 1.7$	$1.1 < Pr \leq 1.8$	$1.1 < Pr \leq 2.0$	$1.4 < Pr \leq 1.9$	$0.9 < Pr \leq 1.3$	$0.8 < Pr \leq 1.1$
⅜	2.375	5	4	138	221	307	178	221	242	157	226	272
½	3.750	6	6	188	330	495	289	330	330	255	368	442
⅝	3.875	6	6	291	508	761	444	508	511	392	566	678
¾	4.500	7	8	414	711	1057	617	711	725	544	786	942
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$3.5 < Pr \leq 5.0$	$1.8 < Pr \leq 2.5$	$1.0 < Pr \leq 1.3$	$1.7 < Pr \leq 2.2$	$1.8 < Pr \leq 2.5$	$2.0 < Pr \leq 2.9$	$1.9 < Pr \leq 2.4$	$1.3 < Pr \leq 1.7$	$1.1 < Pr \leq 1.4$
⅜	2.375	5	4	103	177	268	156	177	179	139	197	241
½	3.750	6	6	131	255	417	244	255	227	219	310	378
⅝	3.875	6	6	203	393	641	375	393	352	337	477	582
¾	4.500	7	8	289	553	894	524	553	500	470	665	810
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$5.0 < Pr \leq 6.5$	$2.5 < Pr \leq 3.2$	$1.3 < Pr \leq 1.6$	$2.2 < Pr \leq 2.7$	$2.5 < Pr \leq 3.2$	$2.9 < Pr \leq 3.8$	$2.4 < Pr \leq 2.9$	$1.7 < Pr \leq 2.1$	$1.4 < Pr \leq 1.7$
⅜	2.375	5	4	80	148	237	139	148	138	125	175	216
½	3.750	6	6	100	205	360	211	205	173	192	268	330
⅝	3.875	6	6	156	319	554	325	319	268	296	413	509
¾	4.500	7	8	222	452	774	455	452	381	414	577	711

Pr: Prying factor range *(see A.18.5.12.2 for additional information)*.

Table 18.5.12.2(e) Maximum Load for Wedge Anchors in 6000 psi (414 bar) Normal Weight Cracked Concrete

Max F_{pw} (lb) for Wedge Anchors in 6000 psi Normal Weight Cracked Concrete ~~(lb)~~												
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$Pr \leq 2.0$	$Pr \leq 1.1$	$Pr \leq 0.7$	$Pr \leq 1.2$	$Pr \leq 1.1$	$Pr \leq 1.1$	$Pr \leq 1.4$	$Pr \leq 0.9$	$Pr \leq 0.8$

Max F_{pw} (lb) for Wedge Anchors in 6000 psi Normal Weight Cracked Concrete ~~(lb)~~												
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A $Pr \leq 2.0$	B $Pr \leq 1.1$	C $Pr \leq 0.7$	D $Pr \leq 1.2$	E $Pr \leq 1.1$	F $Pr \leq 1.1$	G $Pr \leq 1.4$	H $Pr \leq 0.9$	I $Pr \leq 0.8$
⅜	2.375	5	4	225	313	379	219	313	402	189	277	329
½	3.750	6	6	354	529	676	392	529	637	337	500	589
⅝	3.875	6	6	546	812	1036	601	812	981	517	766	902
¾	4.500	7	8	763	1127	1429	829	1127	1370	714	1055	1243
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A $2.0 < Pr \leq 3.5$	B $1.1 < Pr \leq 1.8$	C $0.7 < Pr \leq 1.0$	D $1.2 < Pr \leq 1.7$	E $1.1 < Pr \leq 1.8$	F $1.1 < Pr \leq 2.0$	G $1.4 < Pr \leq 1.9$	H $0.9 < Pr \leq 1.3$	I $0.8 < Pr \leq 1.1$
⅜	2.375	5	4	153	240	327	190	240	267	167	240	289
½	3.750	6	6	228	382	559	326	382	400	287	414	498
⅝	3.875	6	6	353	589	859	500	589	617	441	636	764
¾	4.500	7	8	496	822	1190	693	822	868	611	881	1058
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A $3.5 < Pr \leq 5.0$	B $1.8 < Pr \leq 2.5$	C $1.0 < Pr \leq 1.3$	D $1.7 < Pr \leq 2.2$	E $1.8 < Pr \leq 2.5$	F $2.0 < Pr \leq 2.9$	G $1.9 < Pr \leq 2.4$	H $1.3 < Pr \leq 1.7$	I $1.1 < Pr \leq 1.4$
⅜	2.375	5	4	115	194	288	168	194	200	149	211	258
½	3.750	6	6	161	299	477	279	299	278	250	354	431
⅝	3.875	6	6	249	462	733	429	462	431	384	544	663
¾	4.500	7	8	354	647	1019	596	647	612	534	756	921
Diameter (in.)	Min. Nom. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A $5.0 < Pr \leq 6.5$	B $2.5 < Pr \leq 3.2$	C $1.3 < Pr \leq 1.6$	D $2.2 < Pr \leq 2.7$	E $2.5 < Pr \leq 3.2$	F $2.9 < Pr \leq 3.8$	G $2.4 < Pr \leq 2.9$	H $1.7 < Pr \leq 2.1$	I $1.4 < Pr \leq 1.7$
⅜	2.375	5	4	91	163	257	150	163	157	135	189	233
½	3.750	6	6	123	246	415	243	246	212	221	308	380
⅝	3.875	6	6	192	380	639	375	380	329	341	475	585
¾	4.500	7	8	272	533	891	523	533	467	475	662	815

Pr: Prying factor range *(see A.18.5.12.2 for additional information)*.

Table 18.5.12.2(f) Maximum Load for Metal Deck Inserts in 3000 psi (207 bar) Lightweight Cracked Concrete on Metal Deck

Max F_{pw} (lb) for Metal Deck Inserts in 3000 psi Sand Lightweight Cracked Concrete on 4½ in. Flute Width Metal Deck ~~(lb)~~												
Diameter	Min. Effect.	Min. Slab	Max.	A	B	C	D	E	F	G	H	I

(in.)	Embedment (in.)	Thickness (in.)	Flute Center Offset (in.)	Pr ≤ 2.0	Pr ≤ 1.1	Pr ≤ 0.7	Pr ≤ 1.2	Pr ≤ 1.1	Pr ≤ 1.1	Pr ≤ 1.4	Pr ≤ 0.9	Pr ≤ 0.8
⅜	1.750	6.25	1	135	192	236	—	—	—	—	—	—
½	1.750	6.25	1	138	199	247	—	—	—	—	—	—
⅝	1.750	6.25	1	138	199	247	—	—	—	—	—	—
¾	1.750	6.25	1	164	257	344	—	—	—	—	—	—
Diameter (in.)	**Min. Effect. Embedment (in.)**	**Min. Slab Thickness (in.)**	**Max. Flute Center Offset (in.)**	**A 2.0 < Pr ≤ 3.5**	**B 1.1 < Pr ≤ 1.8**	**C 0.7 < Pr ≤ 1.0**	**D 1.2 < Pr ≤ 1.7**	**E 1.1 < Pr ≤ 1.8**	**F 1.1 < Pr ≤ 2.0**	**G 1.4 < Pr ≤ 1.9**	**H 0.9 < Pr ≤ 1.3**	**I 0.8 < Pr ≤ 1.1**
⅜	1.750	6.25	1	90	144	201	—	—	—	—	—	—
½	1.750	6.25	1	91	148	209	—	—	—	—	—	—
⅝	1.750	6.25	1	91	148	209	—	—	—	—	—	—
¾	1.750	6.25	1	97	178	275	—	—	—	—	—	—
Diameter (in.)	**Min. Effect. Embedment (in.)**	**Min. Slab Thickness (in.)**	**Max. Flute Center Offset (in.)**	**A 3.5 < Pr ≤ 5.0**	**B 1.8 < Pr ≤ 2.5**	**C 1.0 < Pr ≤ 1.3**	**D 1.7 < Pr ≤ 2.2**	**E 1.8 < Pr ≤ 2.5**	**F 2.0 < Pr ≤ 2.9**	**G 1.9 < Pr ≤ 2.4**	**H 1.3 < Pr ≤ 1.7**	**I 1.1 < Pr ≤ 1.4**
⅜	1.750	6.25	1	67	115	175	—	—	—	—	—	—
½	1.750	6.25	1	67	118	181	—	—	—	—	—	—
⅝	1.750	6.25	1	67	118	181	—	—	—	—	—	—
¾	1.750	6.25	1	67	136	229	—	—	—	—	—	—
Diameter (in.)	**Min. Effect. Embedment (in.)**	**Min. Slab Thickness (in.)**	**Max. Flute Center Offset (in.)**	**A 5.0 < Pr ≤ 6.5**	**B 2.5 < Pr ≤ 3.2**	**C 1.3 < Pr ≤ 1.6**	**D 2.2 < Pr ≤ 2.7**	**E 2.5 < Pr ≤ 3.2**	**F 2.9 < Pr ≤ 3.8**	**G 2.4 < Pr ≤ 2.9**	**H 1.7 < Pr ≤ 2.1**	**I 1.4 < Pr ≤ 1.7**
⅜	1.750	6.25	1	52	96	155	—	—	—	—	—	—
½	1.750	6.25	1	52	98	160	—	—	—	—	—	—
⅝	1.750	6.25	1	52	98	160	—	—	—	—	—	—
¾	1.750	6.25	1	52	106	196	—	—	—	—	—	—

Pr: Prying factor range *(see A.18.5.12.2 for additional information)*.

Table 18.5.12.2(g) Maximum Load for Wood Form Inserts in 3000 psi (207 bar) Lightweight Cracked Concrete

Max F_{pw} (lb) for Wood Form Inserts in 3000 psi Lightweight Cracked Concrete ~~(lb)~~												
Diameter (in.)	**Min. Effect. Embedment (in.)**	**Min. Slab Thickness (in.)**	**Min. Edge Distance (in.)**	**A Pr ≤ 2.0**	**B Pr ≤ 1.1**	**C Pr ≤ 0.7**	**D Pr ≤ 1.2**	**E Pr ≤ 1.1**	**F Pr ≤ 1.1**	**G Pr ≤ 1.4**	**H Pr ≤ 0.9**	**I Pr ≤ 0.8**
⅜	1.100	4	6	224	316	387	223	316	401	193	283	336
½	1.690	4	6	252	376	480	278	376	454	239	355	418
⅝	1.750	4	8	252	376	480	278	376	454	239	355	418

Max F_{pw} (lb) for Wood Form Inserts in 3000 psi Lightweight Cracked Concrete ~~(lb)~~												
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$Pr \leq 2.0$	$Pr \leq 1.1$	$Pr \leq 0.7$	$Pr \leq 1.2$	$Pr \leq 1.1$	$Pr \leq 1.1$	$Pr \leq 1.4$	$Pr \leq 0.9$	$Pr \leq 0.8$
¾	1.750	4	8	252	376	480	278	376	454	239	355	418
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$2.0 < Pr \leq 3.5$	$1.1 < Pr \leq 1.8$	$0.7 < Pr \leq 1.0$	$1.2 < Pr \leq 1.7$	$1.1 < Pr \leq 1.8$	$1.1 < Pr \leq 2.0$	$1.4 < Pr \leq 1.9$	$0.9 < Pr \leq 1.3$	$0.8 < Pr \leq 1.1$
⅜	1.100	4	6	150	239	331	192	239	264	169	243	293
½	1.690	4	6	163	272	398	231	272	286	204	294	354
⅝	1.750	4	8	163	272	398	231	272	286	204	294	354
¾	1.750	4	8	163	272	398	231	272	286	204	294	354
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$3.5 < Pr \leq 5.0$	$1.8 < Pr \leq 2.5$	$1.0 < Pr \leq 1.3$	$1.7 < Pr \leq 2.2$	$1.8 < Pr \leq 2.5$	$2.0 < Pr \leq 2.9$	$1.9 < Pr \leq 2.4$	$1.3 < Pr \leq 1.7$	$1.1 < Pr \leq 1.4$
⅜	1.100	4	6	113	193	290	169	193	196	150	213	260
½	1.690	4	6	115	213	339	198	213	199	178	251	307
⅝	1.750	4	8	115	213	339	198	213	199	178	251	307
¾	1.750	4	8	115	213	339	198	213	199	178	251	307
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$5.0 < Pr \leq 6.5$	$2.5 < Pr \leq 3.2$	$1.3 < Pr \leq 1.6$	$2.2 < Pr \leq 2.7$	$2.5 < Pr \leq 3.2$	$2.9 < Pr \leq 3.8$	$2.4 < Pr \leq 2.9$	$1.7 < Pr \leq 2.1$	$1.4 < Pr \leq 1.7$
⅜	1.100	4	6	88	161	257	150	161	152	135	190	234
½	1.690	4	6	88	175	296	173	175	152	157	219	271
⅝	1.750	4	8	88	175	296	173	175	152	157	219	271
¾	1.750	4	8	88	175	296	173	175	152	157	219	271

Pr: Prying factor range *(see A.18.5.12.2 for additional information)*.

Table 18.5.12.2(h) Maximum Load for Wood Form Inserts in 3000 psi (207 bar) Normal Weight Cracked Concrete

Max F_{pw} (lb) for Wood Form Inserts in 3000 psi Normal Weight Cracked Concrete ~~(lb)~~												
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$Pr \leq 2.0$	$Pr \leq 1.1$	$Pr \leq 0.7$	$Pr \leq 1.2$	$Pr \leq 1.1$	$Pr \leq 1.1$	$Pr \leq 1.4$	$Pr \leq 0.9$	$Pr \leq 0.8$
⅜	1.100	4	6	248	342	411	237	342	444	205	300	357
½	1.690	4	6	297	443	565	327	443	535	282	418	492
⅝	1.750	4	8	297	443	565	327	443	535	282	418	492
¾	1.750	4	8	297	443	565	327	443	535	282	418	492

Max F_{pw} (lb) for Wood Form Inserts in 3000 psi Normal Weight Cracked Concrete (lb)												
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$Pr \leq 2.0$	$Pr \leq 1.1$	$Pr \leq 0.7$	$Pr \leq 1.2$	$Pr \leq 1.1$	$Pr \leq 1.1$	$Pr \leq 1.4$	$Pr \leq 0.9$	$Pr \leq 0.8$
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$2.0 < Pr \leq 3.5$	$1.1 < Pr \leq 1.8$	$0.7 < Pr \leq 1.0$	$1.2 < Pr \leq 1.7$	$1.1 < Pr \leq 1.8$	$1.1 < Pr \leq 2.0$	$1.4 < Pr \leq 1.9$	$0.9 < Pr \leq 1.3$	$0.8 < Pr \leq 1.1$
⅜	1.100	4	6	170	264	357	207	264	298	182	261	315
½	1.690	4	6	192	321	468	272	321	336	240	347	416
⅝	1.750	4	8	192	321	468	272	321	336	240	347	416
¾	1.750	4	8	192	321	468	272	321	336	240	347	416
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$3.5 < Pr \leq 5.0$	$1.8 < Pr \leq 2.5$	$1.0 < Pr \leq 1.3$	$1.7 < Pr \leq 2.2$	$1.8 < Pr \leq 2.5$	$2.0 < Pr \leq 2.9$	$1.9 < Pr \leq 2.4$	$1.3 < Pr \leq 1.7$	$1.1 < Pr \leq 1.4$
⅜	1.100	4	6	129	215	315	184	215	224	163	231	282
½	1.690	4	6	135	251	399	233	251	235	209	296	361
⅝	1.750	4	8	135	251	399	233	251	235	209	296	361
¾	1.750	4	8	135	251	399	233	251	235	209	296	361
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$5.0 < Pr \leq 6.5$	$2.5 < Pr \leq 3.2$	$1.3 < Pr \leq 1.6$	$2.2 < Pr \leq 2.7$	$2.5 < Pr \leq 3.2$	$2.9 < Pr \leq 3.8$	$2.4 < Pr \leq 2.9$	$1.7 < Pr \leq 2.1$	$1.4 < Pr \leq 1.7$
⅜	1.100	4	6	104	181	282	165	181	179	148	208	256
½	1.690	4	6	104	207	348	204	207	179	185	258	319
⅝	1.750	4	8	104	207	348	204	207	179	185	258	319
¾	1.750	4	8	104	207	348	204	207	179	185	258	319

Pr: Prying factor range *(see A.18.5.12.2 for additional information)*.

Table 18.5.12.2(i) Maximum Load for Wood Form Inserts in 4000 psi (276 bar) Normal Weight Cracked Concrete

Max F_{pw} (lb) for Wood Form Inserts in 4000 psi Normal Weight Cracked Concrete (lb)												
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$Pr \leq 2.0$	$Pr \leq 1.1$	$Pr \leq 0.7$	$Pr \leq 1.2$	$Pr \leq 1.1$	$Pr \leq 1.1$	$Pr \leq 1.4$	$Pr \leq 0.9$	$Pr \leq 0.8$
⅜	1.100	4	6	270	364	431	249	364	482	215	313	374
½	1.690	4	6	335	493	623	361	493	602	311	459	541
⅝	1.750	4	8	344	511	653	378	511	618	326	482	568
¾	1.750	4	8	344	511	653	378	511	618	326	482	568

Max F_{pw} (lb) for Wood Form Inserts in 4000 psi Normal Weight Cracked Concrete (lb)												
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$Pr \leq 2.0$	$Pr \leq 1.1$	$Pr \leq 0.7$	$Pr \leq 1.2$	$Pr \leq 1.1$	$Pr \leq 1.1$	$Pr \leq 1.4$	$Pr \leq 0.9$	$Pr \leq 0.8$
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$2.0 < Pr \leq 3.5$	$1.1 < Pr \leq 1.8$	$0.7 < Pr \leq 1.0$	$1.2 < Pr \leq 1.7$	$1.1 < Pr \leq 1.8$	$1.1 < Pr \leq 2.0$	$1.4 < Pr \leq 1.9$	$0.9 < Pr \leq 1.3$	$0.8 < Pr \leq 1.1$
⅜	1.100	4	6	188	287	379	220	287	330	193	277	334
½	1.690	4	6	218	361	520	303	361	382	266	384	462
⅝	1.750	4	8	222	371	541	315	371	389	278	400	481
¾	1.750	4	8	222	371	541	315	371	389	278	400	481
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$3.5 < Pr \leq 5.0$	$1.8 < Pr \leq 2.5$	$1.0 < Pr \leq 1.3$	$1.7 < Pr \leq 2.2$	$1.8 < Pr \leq 2.5$	$2.0 < Pr \leq 2.9$	$1.9 < Pr \leq 2.4$	$1.3 < Pr \leq 1.7$	$1.1 < Pr \leq 1.4$
⅜	1.100	4	6	145	236	338	197	236	251	175	247	302
½	1.690	4	6	157	284	446	261	284	271	233	330	403
⅝	1.750	4	8	157	290	461	270	290	271	242	342	417
¾	1.750	4	8	157	290	461	270	290	271	242	342	417
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$5.0 < Pr \leq 6.5$	$2.5 < Pr \leq 3.2$	$1.3 < Pr \leq 1.6$	$2.2 < Pr \leq 2.7$	$2.5 < Pr \leq 3.2$	$2.9 < Pr \leq 3.8$	$2.4 < Pr \leq 2.9$	$1.7 < Pr \leq 2.1$	$1.4 < Pr \leq 1.7$
⅜	1.100	4	6	117	201	305	178	201	202	160	224	275
½	1.690	4	6	120	234	390	229	234	207	207	290	357
⅝	1.750	4	8	120	239	402	236	239	207	214	299	368
¾	1.750	4	8	120	239	402	236	239	207	214	299	368

Pr: Prying factor range *(see A.18.5.12.2 for additional information)*.

Table 18.5.12.2(j) Maximum Load for Wood Form Inserts in 6000 psi (414 bar) Normal Weight Cracked Concrete

Max F_{pw} (lb) for Wood Form Inserts in 6000 psi Normal Weight Cracked Concrete (lb)												
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$Pr \leq 2.0$	$Pr \leq 1.1$	$Pr \leq 0.7$	$Pr \leq 1.2$	$Pr \leq 1.1$	$Pr \leq 1.1$	$Pr \leq 1.4$	$Pr \leq 0.9$	$Pr \leq 0.8$
⅜	1.100	4	6	302	395	458	264	395	537	228	332	397
½	1.690	4	6	385	551	680	394	551	690	339	499	591
⅝	1.750	4	8	421	627	800	463	627	756	399	591	696
¾	1.750	4	8	421	627	800	463	627	756	399	591	696

Max F_{pw} (lb) for Wood Form Inserts in 6000 psi Normal Weight Cracked Concrete (lb)										
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	A	B	C	D	E	F	G	H	I
				$Pr \leq 2.0$	$Pr \leq 1.1$	$Pr \leq 0.7$	$Pr \leq 1.2$	$Pr \leq 1.1$	$Pr \leq 1.1$	$Pr \leq 1.4$	$Pr \leq 0.9$	$Pr \leq 0.8$
				A	B	C	D	E	F	G	H	I
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	$2.0 < Pr \leq 3.5$	$1.1 < Pr \leq 1.8$	$0.7 < Pr \leq 1.0$	$1.2 < Pr \leq 1.7$	$1.1 < Pr \leq 1.8$	$1.1 < Pr \leq 2.0$	$1.4 < Pr \leq 1.9$	$0.9 < Pr \leq 1.3$	$0.8 < Pr \leq 1.1$
⅜	1.100	4	6	216	319	409	237	319	379	207	297	360
½	1.690	4	6	256	413	578	336	413	449	296	426	512
⅝	1.750	4	8	272	454	662	386	454	476	340	491	589
¾	1.750	4	8	272	454	662	386	454	476	340	491	589
				A	B	C	D	E	F	G	H	I
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	$3.5 < Pr \leq 5.0$	$1.8 < Pr \leq 2.5$	$1.0 < Pr \leq 1.3$	$1.7 < Pr \leq 2.2$	$1.8 < Pr \leq 2.5$	$2.0 < Pr \leq 2.9$	$1.9 < Pr \leq 2.4$	$1.3 < Pr \leq 1.7$	$1.1 < Pr \leq 1.4$
⅜	1.100	4	6	169	267	370	215	267	292	190	270	329
½	1.690	4	6	192	330	503	293	330	332	262	371	452
⅝	1.750	4	8	192	356	565	331	356	332	296	419	511
¾	1.750	4	8	192	356	565	331	356	332	296	419	511
				A	B	C	D	E	F	G	H	I
Diameter (in.)	Min. Effect. Embedment (in.)	Min. Slab Thickness (in.)	Min. Edge Distance (in.)	$5.0 < Pr \leq 6.5$	$2.5 < Pr \leq 3.2$	$1.3 < Pr \leq 1.6$	$2.2 < Pr \leq 2.7$	$2.5 < Pr \leq 3.2$	$2.9 < Pr \leq 3.8$	$2.4 < Pr \leq 2.9$	$1.7 < Pr \leq 2.1$	$1.4 < Pr \leq 1.7$
⅜	1.100	4	6	138	229	337	196	229	238	176	246	303
½	1.690	4	6	147	275	445	260	275	253	235	328	405
⅝	1.750	4	8	147	293	493	289	293	253	263	366	451
¾	1.750	4	8	147	293	493	289	293	253	263	366	451

Pr: Prying factor range *(see A.18.5.12.2 for additional information)*.

Table 18.5.12.2(k) Maximum Load for Connections to Steel Using Unfinished Steel Bolts

Connections to Steel (Values Assume Bolt Perpendicular to Mounting Surface)																		
Diameter of Unfinished Steel Bolt (in.)																		
¼									⅜									
A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I	
400	500	600	300	500	650	325	458	565	900	1200	1400	800	1200	1550	735	1035	1278	
Diameter of Unfinished Steel Bolt (in.)																		
½									⅝									
A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I	
1600	2050	2550	1450	2050	2850	1300	1830	2260	2500	3300	3950	2250	3300	4400	2045	2880	3557	

Table 18.5.12.2(l) Maximum Load for Through-Bolts in Sawn Lumber or Glue-Laminated Timbers

Through-Bolts in Sawn Lumber or Glue-Laminated Timbers (Load Perpendicu																							
Length of Bolt in Timber (in.)		Bolt Diameter (in.)																					
		½									⅝												
		A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I	A	B	C
	1½	115	165	200	135	230	395	130	215	310	135	190	235	155	270	460	155	255	380	155	220	2
	2½	140	200	240	160	280	480	165	275	410	160	225	280	185	320	550	190	320	495	180	255	3
	3½	175	250	305	200	350	600	200	330	485	200	285	345	230	400	685	235	405	635	220	310	3
	5½	—	—	—	—	—	—	—	—	—	280	395	485	325	560	960	315	515	735	310	440	5

Note: Wood fastener maximum capacity values are based on the 2001 National Design Specifications (NDS) for wood with a specific gravity of 0.35. Values for other types of wood can be obtained by multiplying the above values by the factors in Table 18.5.12.2(n).

Table 18.5.12.2(m) Maximum Load for Lag Screws and Lag Bolts in Wood

Lag Screws and Lag Bolts in Wood (Load Perpendicular to Grain — Holes Predrilled Us																							
Length of Bolt in Timber (in.)		Lag Bolt Diameter (in.)																					
		⅜									½												
		A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I	A	B	C
	3½	165	190	200	170	220	310	80	120	170	—	—	—	—	—	—	—	—	—	—	—	—
	4½	180	200	200	175	235	350	80	120	170	300	355	380	315	400	550	145	230	325	—	—	—
	5½	190	200	200	175	245	380	80	120	170	320	370	380	320	420	610	145	230	325	435	525	55
	6½	195	205	200	175	250	400	80	120	170	340	375	380	325	435	650	145	230	325	465	540	55

Note: Wood fastener maximum capacity values are based on the 2001 National Design Specifications (NDS) for wood with a specific gravity of 0.35. Values for other types of wood can be obtained by multiplying the above values by the factors in Table 18.5.12.2(n).

Table 18.5.12.2(n) Factors for Wood Based on Specific Gravity

Specific Gravity of Wood	Multiplier
0.36 thru 0.49	1.17
0.50 thru 0.65	1.25
0.66 thru 0.73	1.50

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 19:20:00 EDT 2022

Committee Statement

Committee Statement: The table headings were revised because it was unclear what the force was that the (lb) was referring to. The added language clarifies this for all tables.

Response Message: FR-1158-NFPA 13-2022

Public Input No. 173-NFPA 13-2022 [Section No. 18.5.12.2]

First Revision No. 1160-NFPA 13-2022 [Section No. 18.5.12.7.3.3]

18.5.12.7.3.3

Allowable maximum loads shall be based on anchor capacities given in approved evaluation service reports, where the calculation of allowable stress design (ASD) allowable shear and tension values are determined in accordance with Chapter 17 of ACI 318, *Building Code Requirements for Structural Concrete and Commentary,* and include the effects of prying, the brace angle, and the over strength factor (Ω_{0p} =2.0).

Submitter Information Verification

Committee: AUT-HBS

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Committee Statement

Committee Statement: Updating the omega variable to coordinate with ASCE/SEI 7.

Response Message: FR-1160-NFPA 13-2022

Public Input No. 561-NFPA 13-2022 [Section No. 18.5.12.7.3.3]

First Revision No. 1163-NFPA 13-2022 [Section No. 18.5.12.7.5]

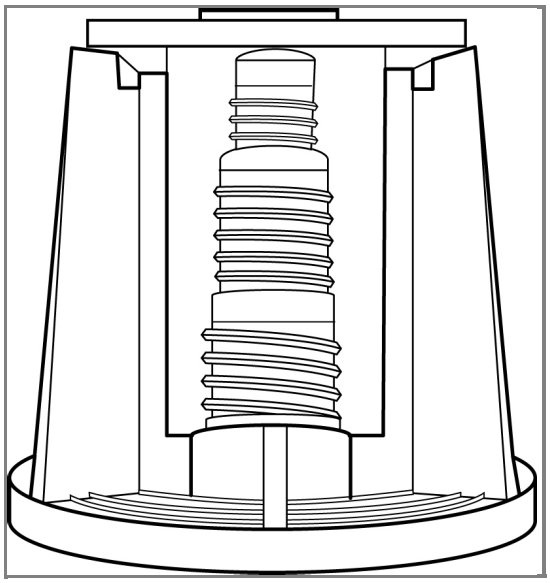
18.5.12.7.5*

Headed cast-in specialty inserts (i.e., concrete inserts) as prescribed in Table 18.5.12.2(a) through Table 18.5.12.2(j) shall be prequalified for seismic applications in accordance with ICC-ES AC446, *Acceptance Criteria for Headed Cast-in Specialty Inserts in Concrete*, and installed in accordance with the manufacturer's instructions.

A.18.5.12.7.5

For any multithread anchor, special care must be taken when reviewing the manufacturer's data sheet and report to validate which anchor diameter(s) can be used for seismic bracing. See Figure A.18.5.12.7.5 for an example of a multithread anchor.

Figure A.18.5.12.7.5 Example of a Multithread Anchor.



Supplemental Information

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Committee Statement

Committee Statement: Added an annex section and figure to provide information regarding multithread anchors.

Response Message: FR-1163-NFPA 13-2022

Public Input No. 259-NFPA 13-2022 [New Section after A.18.6.1]

Public Input No. 260-NFPA 13-2022 [New Section after A.18.6.1]

First Revision No. 1162-NFPA 13-2022 [Section No. 18.6.4]

18.6.4*

Branch lines shall be laterally restrained at intervals not exceeding those specified in Table 18.6.4(a) or Table 18.6.4(b) based on branch line diameter and the value of C_p.

Table 18.6.4(a) Maximum Spacing [ft (m)] of Steel Pipe Restraints

Pipe [in. (mm)]	Seismic Coefficient, C_p			
	$C_p \leq 0.50$	$0.5 < C_p \leq 0.71$	$0.71 < C_p \leq 1.40$	$C_p > 1.40$
½ (15)	~~34 (10.3)~~ 26 (8.1)	~~29 (8.8)~~ 23 (6.9)	~~20 (6.1)~~ 16 (4.7)	~~18 (5.5)~~ 14 (4.3)
¾ (20)	~~38 (11.6)~~ 30 (9.0)	~~32 (9.7)~~ 25 (7.6)	~~23 (7.0)~~ 18 (5.5)	~~20 (6.1)~~ 16 (4.7)
1 (25)	~~43 (13.1)~~ 33 (10.2)	~~36 (11.0)~~ 28 (8.5)	~~26 (7.9)~~ 20 (6.2)	~~22 (6.7)~~ 17 (5.2)
1¼ (32)	~~46 (14.0)~~ 36 (10.9)	~~39 (11.9)~~ 30 (9.3)	~~27 (8.2)~~ 21 (6.4)	~~24 (7.3)~~ 19 (5.7)
1½ (40)	~~49 (14.9)~~ 38 (11.6)	~~41 (12.5)~~ 32 (9.7)	~~29 (8.8)~~ 23 (6.9)	~~25 (7.6)~~ 19 (5.9)
2 (~~50~~ 53)	~~53 (16.1)~~ 41 (12.6)	~~45 (13.7)~~ 35 (10.7)	~~31 (9.4)~~ 24 (7.4)	~~27 (8.2)~~ 21 (6.4)

Table 18.6.4(b) Maximum Spacing [ft (m)] of CPVC, Copper, and Red Brass Pipe Restraints

Pipe [in. (mm)]	Seismic Coefficient, C_p			
	$C_p \leq 0.50$	$0.5 < C_p \leq 0.71$	$0.71 < C_p \leq 1.40$	$C_p > 1.40$
½ (15)	~~26 (7.9)~~ 20 (6.2)	~~22 (6.7)~~ 17 (5.2)	~~16 (4.9)~~ 12 (3.8)	~~13 (4.0)~~ 10 (3.1)
¾ (20)	~~31 (9.4)~~ 24 (7.4)	~~26 (7.9)~~ 20 (6.2)	~~18 (5.5)~~ 14 (4.3)	~~15 (4.6)~~ 12 (3.6)
1 (25)	~~34 (10.3)~~ 26 (8.1)	~~28 (8.5)~~ 22 (6.6)	~~20 (6.1)~~ 16 (4.7)	~~17 (5.2)~~ 13 (4.0)
1¼ (32)	~~37 (11.3)~~ 29 (8.8)	~~31 (9.4)~~ 24 (7.4)	~~22 (6.7)~~ 17 (5.2)	~~19 (5.8)~~ 15 (4.5)
1½ (40)	~~40 (12.2)~~ 31 (9.5)	~~34 (10.3)~~ 26 (8.1)	~~24 (7.3)~~ 19 (5.7)	~~20 (6.1)~~ 16 (4.7)
2 (~~50~~ 53)	~~45 (13.7)~~ 35 (10.7)	~~38 (11.6)~~ 30 (9.0)	~~27 (8.2)~~ 21 (6.4)	~~23 (7.0)~~ 18 (5.5)

A.18.6.4

Modern seismic codes require branch lines to be restrained, both to limit interaction of the pipe with other portions of the structure and to limit stresses in the pipes to permissible limits. The maximum spacing between restraints is dependent on the seismic coefficient, C_p, as shown in Table 18.6.4(a). Table 18.6.4(a) has been limited to 2 in. (50 mm) lines and smaller, because branch lines 2½ in. (65 mm) or larger are required to be seismically braced. See also 18.5.9.1 .

It is not the intent of this section to require restraint of piping associated with valve trim, water motor gong piping, air or nitrogen supply piping, or other piping that is not essential to the operation of the sprinkler system. Essential piping such as fire pump sensing lines and diesel fuel lines are some examples of small piping that should be restrained.

Supplemental Information

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Committee Statement

Committee Statement: Revised tables to align with changes made to coordinate with ASCE/SEI 7. Added additional reference in annex to refer to 18.5.9.1, which also helps to explain the application.

Response Message: FR-1162-NFPA 13-2022

Public Input No. 560-NFPA 13-2022 [Section No. A.18.6.4]

Public Input No. 559-NFPA 13-2022 [Section No. 18.6.4]

First Revision No. 1123-NFPA 13-2022 [Section No. 18.6.7]

18.6.7

Drops ~~and armovers~~ , armovers, and flexible sprinkler hose fittings shall not require restraint.

Submitter Information Verification

Committee: AUT-HBS

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Committee Statement

Committee Statement: This revision clarifies that flexible sprinkler hose fittings, like hard piped armovers or drops, do not require seismic restraint.

Response Message: FR-1123-NFPA 13-2022

Public Input No. 377-NFPA 13-2022 [Section No. 18.6.7]

First Revision No. 1103-NFPA 13-2022 [Section No. A.17.1]

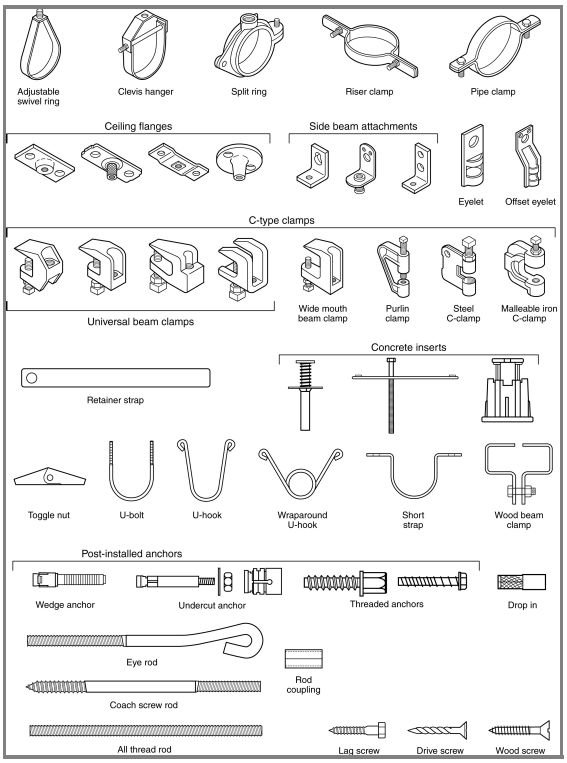
A.17.1

Throughout Chapter 17, metric units have been included where practicable. There are subjects, (e.g., section modulus) where a metric conversion might not be useful. In such situations, it is recommended to consult local requirements and products to determine whether support components are adequate for the loads, including appropriate safety factors.

See Figure A.17.1. As an alternative to the conventional method of hanging pipe from the structure using attachments and rod, the piping can be simply laid on the structural member, provided the structure can adequately support the added load in accordance with 17.4.1.3.1 and the maximum distance between supports required by Chapter 17 is not exceeded. Listed pipe should still be installed and supported in accordance with its listing limitations.

To prevent movement, the pipe should be secured with an approved device to the structure and located such that the system piping remains in its original location and position.

Figure A.17.1 Common Types of Acceptable Hangers.



Supplemental Information

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13_AUT_HBS_FDM_A.17.1_FR1103.pdf	For staff use only	

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Committee Statement

Committee Statement: The figure was updated to show newer examples of concrete anchors.

Response Message: FR-1103-NFPA 13-2022

Public Input No. 257-NFPA 13-2022 [Section No. A.17.1]

First Revision No. 1124-NFPA 13-2022 [Section No. A.18.3]

A.18.3

Plan and elevation views of a seismic separation assembly configured with flexible elbows are shown in Figure A.18.3(a) ~~or~~ , Figure A.18.3(b), and Figure A.18.3(c) .

The extent of permitted movement should be sufficient to accommodate calculated differential motions during earthquakes. In lieu of calculations, permitted movement can be made at least twice the actual separations, at right angles to the separation as well as parallel to it.

Figure A.18.3(a) Seismic Separation Assembly in which 8 in. (200 mm) Separation Crossed by Pipes Up to 4 in. (100 mm) in Nominal Diameter. (For other separation distances and pipe sizes, lengths and distances should be modified proportionally.)

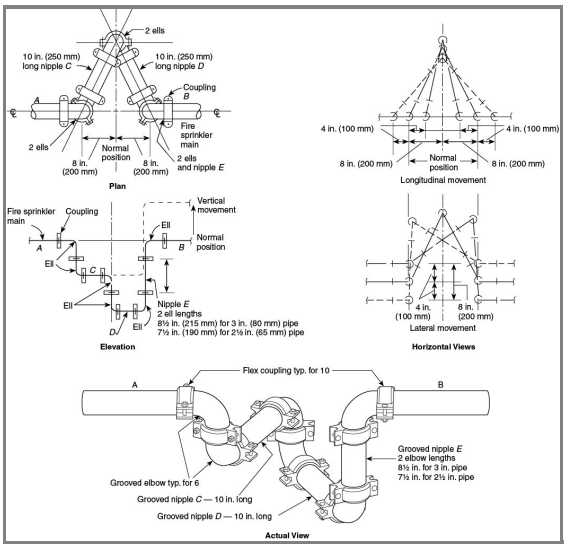


Figure A.18.3(b) Seismic Separation Assembly Incorporating Flexible Piping.

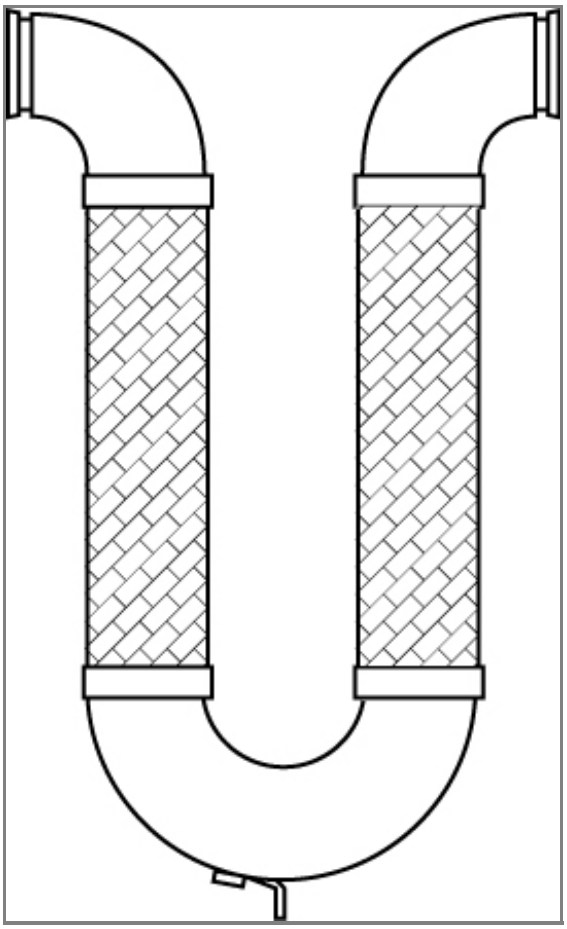
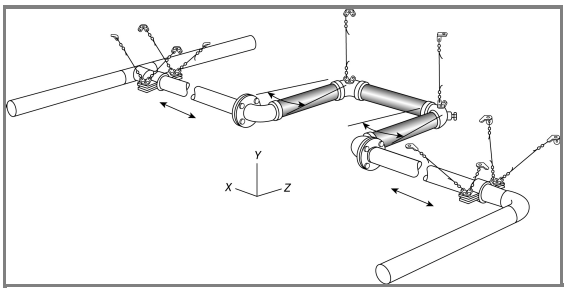


Figure A.18.3(c) Seismic Separation Assembly Incorporating Flexible Piping.



Supplemental Information

File Name	Description	Approved
13_AUT_HBS_FDM_A.18.3_c_FR1124.jpg	For staff use only	

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 15:00:15 EDT 2022

Committee Statement

Committee Statement: A new figure showing a different version of a seismic separation assembly utilizing flexible piping was appropriate to add in this section. Revised the charging statement to reference the newly added figure.

Response Message: FR-1124-NFPA 13-2022

Public Input No. 258-NFPA 13-2022 [Section No. A.18.3]

Public Input No. 162-NFPA 13-2022 [Section No. A.18.3]

First Revision No. 1111-NFPA 13-2022 [Section No. A.18.5.5.10]

A.18.5.5.10

This does not apply to piping supported by or suspended from trapeze hangers.

The use of short hangers is an acceptable alternative to the lateral sway bracing requirements when following 18.5.5.10.1 and 18.5.5.10.2 .

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 13:39:09 EDT 2022

Committee Statement

Committee Statement: Added annex material to clarify that short hangers are an acceptable way to accomplish the requirements of 18.5.5.10.1 and 18.5.5.10.2 because the committee agreed with the intent of the proposal but felt the annex was a more appropriate location.

Response Message: FR-1111-NFPA 13-2022

Public Input No. 256-NFPA 13-2022 [Section No. 18.5.5.10 [Excluding any Sub-Sections]]

First Revision No. 1107-NFPA 13-2022 [Section No. A.18.5.9.1]

A.18.5.9.1

The factors used in the computation of the horizontal seismic load should be available from several sources, including the project architect or structural engineer or the authority having jurisdiction. In addition, the ground motion parameter S_{s} S_{DS}, is available using maps or software developed by the U.S. Geological Survey and the American Society of Civil Engineers (ASCE) . The approach presented in NFPA 13 is compatible with the requirements of ASCE/SEI 7, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, which provides the seismic requirements for model building codes. Sprinkler systems are emergency systems and as such should be designed for an importance factor (I_p) of 1.5. Seismic ~~load equations allow the reduction of the seismic force by a component response modification factor (R_p) that reflects the ductility of the system; systems where braced piping is primarily joined by threaded fittings should be considered less ductile than systems where braced piping is joined by welded or mechanical-type fittings. In addition, a factor, a_p , is used to account for dynamic amplification of nonstructural systems supported by structures. Currently, steel piping systems typically used for fire sprinklers are assigned an R_p factor of 4.5 and an a_p factor of 2.5~~ forces for sprinkler system bracing and piping depend on amplification factors that account for the height in the structure (H_f) and the component resonance ductility (C_{AR}), as well as reduction factors that account for the structure ductility (R_μ) and the component strength (R_{po}). For piping supported above grade in a building, H_f can be as large as 3.5 (for piping located at the roof) and R_μ can be as small as 1.3 when the lateral force-resisting system of the building is undetermined. For sway braces above grade in a building, C_{AR} is taken as 1.0 and R_{po} is taken as 1.5. However, horizontal seismic forces used to determine stresses in above-grade sprinkler pipe (i.e., due to bending between sway braces) require that C_{AR} be taken as 2.2 and R_{po} be taken as 2.0. Thus, the horizontal seismic forces used to determine bending stresses in the sprinkler pipe itself are 65 percent larger than the horizontal seismic forces used to design the braces. This difference accounts for the behavior of piping with joints made by threading, bonding, compressions couplings, and grooved couplings under seismic loading. The differences in seismic forces have been accounted for when determining the maximum F_{pw} values in Table 18.5.5.2(a) through Table 18.5.5.2(n) and the spacing of branch line restraints in Table 18.6.4(a) and Table 18.6.4(b) , which are based on the allowable bending stress in the pipe .

Supplemental Information

File Name	Description	Approved
13_AUT_HBS_FDM_A.18.5.9.1_FR1107.docx	For staff use only	

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 12:57:36 EDT 2022

Committee Statement

Committee Statement: Revised to reflect new variables used in ASCE/SEI 7, which all tie to calculating horizontal force.

Response Message: FR-1107-NFPA 13-2022

Public Input No. 542-NFPA 13-2022 [Section No. A.18.5.9.1]

First Revision No. 1153-NFPA 13-2022 [Section No. A.18.5.9.5]

A.18.5.9.5

S_s DS is a measure of earthquake shaking intensity. S_s DS shall be ~~taken as~~ based on the maximum considered earthquake ground motion for 0.2-second spectral response acceleration (5 percent of critical damping), ~~Site Class B~~ for the default site soil class when the soil properties are not known in sufficient detail to determine the site class *(see A.18.5.9.3.2)* . The data are available from the authority having jurisdiction or, in the United States, ~~from~~ using maps developed by the U.S. Geological Survey or the ASCE/SEI 7, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures,* Hazard Tool . All that is required to get S_s DS is the latitude and longitude of the project site.

The horizontal force factor was given as F_p in earlier editions of NFPA 13. It has been changed to F_{pw}, to clearly indicate that it is a working, not an ultimate, load. In model building codes, F_p is used to denote the strength design level load.

It is not the intent of this section to default to the C_p value of 0.5 before attempts to determine the value of S_s DS and related coefficient value for C_p are made, such as on-line information provided by the ~~U.S. Geological Survey~~ ASCE/SEI 7 Hazard Tool website.

Submitter Information Verification

Committee: AUT-HBS

Submittal Date: Wed Jul 27 19:03:03 EDT 2022

Committee Statement

Committee Statement: Revised to align with ASCE/SEI 7.

Response Message: FR-1153-NFPA 13-2022

Public Input No. 549-NFPA 13-2022 [Section No. A.18.5.9.5]