

**NATIONAL  
FIRE CODES®**

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## **17.1 \* General.**

### **17.1.1**

Unless the requirements of 17.1.2 are met, types of hangers shall be in accordance with the requirements of Chapter 17.

### **17.1.2**

Hangers certified by a registered professional engineer to include all of the following shall be an acceptable alternative to the requirements of Chapter 17:

- (1) Hangers shall be designed to support five times the weight of the water-filled pipe plus 250 lb (115 kg) at each point of piping support.
- (2) These points of support shall be adequate to support the system.
- (3) The spacing between hangers shall not exceed the value given for the type of pipe as indicated in Table 17.4.2.1(a) or Table 17.4.2.1(b).
- (4) Hanger components shall be ferrous.
- (5) Detailed calculations shall be submitted, when required by the reviewing authority, showing stresses developed in hangers, piping, and fittings, and safety factors allowed.

## **17.1.3 Support of Non-System Components.**

### **17.1.3.1 \***

Sprinkler piping or hangers shall not be used to support non-system components.

### **17.1.3.2**

Sprinkler piping shall be permitted to utilize shared support assemblies in accordance with 17.1.4.

### **17.1.4**

Shared support assemblies shall be certified by a registered professional engineer in accordance with 17.1.2 and 17.1.4.

#### **17.1.4.1 \***

The design of a shared support assembly shall be based on either 17.1.4.1.1 or 17.1.4.1.2.

##### **17.1.4.1.1**

Sprinkler pipe and other distribution systems shall be permitted to be supported from a shared support assembly designed to support five times the weight of water-filled sprinkler pipe and other supported distribution systems plus 250 lb (115 kg), based on the allowable ultimate stress.

##### **17.1.4.1.2**

Sprinkler pipe and other distribution systems shall be permitted to be supported from a shared support assembly designed to support five times the weight of the water-filled sprinkler pipe plus 250 lb (115 kg), and one and one-half times the weight of all other supported distribution systems.

##### **17.1.4.1.3**

The building structure shall not be considered a shared support assembly.

##### **17.1.4.1.4 \***

The requirements of 17.1.4.1 shall not apply to 17.4.1.3.3.

##### **17.1.4.1.5**

Systems that are incompatible with the fire sprinkler systems based on vibration, thermal expansion and contraction, or other factors shall not share support assemblies.

## **17.1.5**

Where water-based fire protection systems are required to be protected against damage from earthquakes, hangers shall also meet the requirements of Section 18.7.

### 17.1.6 Listing.

#### 17.1.6.1 \*

Unless permitted by 17.1.6.2 or 17.1.6.3, the components of hanger assemblies that directly attach to the pipe, building structure, or racking structure shall be listed.

#### 17.1.6.2 \*

Mild steel hanger rods and hangers formed from mild steel rods shall be permitted to be not listed.

#### 17.1.6.3 \*

Fasteners as specified in 17.2.2, 17.2.3, and 17.2.4 shall be permitted to be not listed.

#### 17.1.6.4

Other fasteners shall be permitted as part of a hanger assembly that has been tested, listed, and installed in accordance with the listing requirements.

### 17.1.7 Component Material.

#### 17.1.7.1

Unless permitted by 17.1.7.2 or 17.1.7.3, hangers and their components shall be ferrous metal.

#### 17.1.7.2

Nonferrous components that have been proven by fire tests to be adequate for the hazard application, that are listed for this purpose, and that are in compliance with the other requirements of this section shall be acceptable.

#### 17.1.7.3

Holes through solid structural members shall be permitted to serve as hangers for the support of system piping, provided such holes are permitted by applicable building codes and the spacing and support provisions for hangers of this standard are satisfied.

### 17.2 Hanger Components.

#### 17.2.1 Hanger Rods.

##### 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	$\frac{3}{8}$	10
5	125	$\frac{1}{2}$	13
6	150		
8	200		
10	250	$\frac{5}{8}$	16
12	300	$\frac{3}{4}$	20
14	350	1	25
16	400	$1\frac{1}{4}$	32
18	450		
20	500		

Pipe Size		Diameter of Rod	
in.	mm	in.	mm
24	600		

**17.2.1.2**

Rods of smaller diameters than indicated in Table 17.2.1.1 shall be permitted where the hanger assembly has been tested and listed by a testing laboratory and installed within the limits of pipe sizes expressed in individual listings.

**17.2.1.3**

Where the pitch of the branch line is 6 in 12 or greater, a reduction in the lateral loading on branch line hanger rods shall be done by one of the following:

- (1)\* Second hanger installed in addition to the required main hangers
- (2) Lateral sway brace assemblies on the mains
- (3) Branch line hangers utilizing an articulating structural attachment
- (4) Equivalent means providing support to the branch line hanger rods

**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	$\frac{5}{16}$	8
$2\frac{1}{2}$ to 6	65 to 150	$\frac{3}{8}$	10
8	200	$\frac{1}{2}$	13
10 to 12	250 to 300	$\frac{3}{4}$	20
14 to 18	350 to 450	1	25
20 to 24	500 to 600	$1\frac{1}{4}$	32

**17.2.1.5 Eye Rods.****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	$\frac{3}{8}$	10	$\frac{3}{8}$	10
5	125	$\frac{1}{2}$	13	$\frac{1}{2}$	13
6	150				
8	200	$\frac{3}{4}$	20	$\frac{1}{2}$	13
10 to 12	250 to 300	1	25	$\frac{3}{4}$	20
14 to 18	350 to 450	$1\frac{1}{4}$	32	1	25

Pipe Size		Diameter of Rod			
		With Bent Eye		With Welded Eye	
in.	mm	in.	mm	in.	mm
20 to 24	500 to 600	1 $\frac{3}{4}$	45	1 $\frac{1}{4}$	32

**17.2.1.5.2**

Eye rods shall be secured with lock washers to prevent lateral motion.

**17.2.1.5.3**

Where eye rods are fastened to wood structural members, the eye rod shall be backed with a large flat washer bearing directly against the structural member, in addition to the lock washer.

**17.2.1.6 Threaded Sections of Rods.**

Threaded sections of rods shall not be formed or bent.

**17.2.2 \* Fasteners in Concrete.****17.2.2.1**

Unless prohibited by 17.2.2.2 or 17.2.2.3, the use of listed inserts set in concrete and listed post-installed anchors to support hangers shall be permitted for mains and branch lines.

**17.2.2.2**

Post-installed anchors shall not be used in cinder concrete, except for branch lines where the post-installed anchors are alternated with through-bolts or hangers attached to beams.

**17.2.2.3**

Post-installed anchors shall not be used in ceilings of gypsum or other similar soft material.

**17.2.2.4**

Unless the requirements of 17.2.2.5 are met, post-installed anchors shall be installed in a horizontal position in the sides of concrete beams.

**17.2.2.5**

Post-installed anchors shall be permitted to be installed in the vertical position under any of the following conditions:

- (1) When used in concrete having gravel or crushed stone aggregate to support pipes 4 in. (100 mm) or less in diameter
- (2) When post-installed anchors are alternated with hangers connected directly to the structural members, such as trusses and girders, or to the sides of concrete beams [to support pipe 5 in. (125 mm) or larger]
- (3) When post-installed anchors are spaced not over 10 ft (3 m) apart [to support pipe 4 in. (100 mm) or larger]

**17.2.2.6**

Holes for post-installed anchors in the side of beams shall be above the centerline of the beam or above the bottom reinforcement steel rods.

**17.2.2.7**

Holes for post-installed anchors used in the vertical position shall be drilled to provide uniform contact with the shield over its entire circumference.

**17.2.2.8**

The depth of the post-installed anchor hole shall not be less than specified for the type of shield used.

**17.2.2.9 Powder-Driven Studs.****17.2.2.9.1**

Powder-driven studs, welding studs, and the tools used for installing these devices shall be listed.

**17.2.2.9.2**

Pipe size, installation position, and construction material into which they are installed shall be in accordance with individual listings.

#### **17.2.2.9.3 \***

Where test records indicating the strength of the concrete into which studs are being driven are not available, representative samples of the concrete shall be tested to determine that the studs will hold a minimum load of 750 lb (340 kg) for 2 in. (50 mm) or smaller pipe; 1000 lb (454 kg) for 2½ in., 3 in., or 3½ in. (65 mm, 80 mm, or 90 mm) pipe; and 1200 lb (544 kg) for 4 in. or 5 in. (100 mm or 125 mm) pipe.

#### **17.2.2.9.4**

Increaser couplings shall be attached directly to the powder-driven studs.

### **17.2.2.10 Minimum Bolt or Rod Size for Concrete.**

#### **17.2.2.10.1**

The size of a bolt or rod used with a hanger and installed through concrete shall not be less than specified in Table 17.2.2.10.1.

**Table 17.2.2.10.1 Minimum Bolt or Rod Size for Concrete**

Pipe Size		Size of Bolt or 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

#### **17.2.2.10.2**

Holes for bolts or rods shall not exceed ⅛ in. (1.6 mm) greater than the diameter of the bolt or rod.

#### **17.2.2.10.3**

Bolts and rods shall be provided with flat washers and nuts.

### **17.2.3 Fasteners in Steel.**

#### **17.2.3.1 \***

Powder-driven studs, welding studs, and the tools used for installing these devices shall be listed.

#### **17.2.3.2**

Pipe size, installation position, and construction material into which they are installed shall be in accordance with individual listings.

#### **17.2.3.3**

Increaser couplings shall be attached directly to the powder-driven studs or welding studs.

#### **17.2.3.4**

Welding studs or other hanger parts shall not be attached by welding to steel less than US Standard, 12 gauge (2.8 mm).

### **17.2.3.5 Minimum Bolt or Rod Size for Steel.**

#### **17.2.3.5.1**

The size of a bolt or rod used with a hanger and installed through steel shall not be less than specified in Table 17.2.3.5.1.

**Table 17.2.3.5.1 Minimum Bolt or Rod Size for Steel**

Pipe Size		Size of Bolt or Rod	
in.	mm	in.	mm
Up to and including 4	100	$\frac{3}{8}$	10
5	125	$\frac{1}{2}$	13
6	150		
8	200		
10	250	$\frac{5}{8}$	15
12	300	$\frac{3}{4}$	20

**17.2.3.5.2**

Holes for bolts or rods shall not exceed  $\frac{1}{16}$  in. (1.6 mm) greater than the diameter of the bolt or rod.

**17.2.3.5.3**

Bolts and rods shall be provided with flat washers and nuts.

**17.2.4 Fasteners in Wood.****17.2.4.1 Drive Screws.****17.2.4.1.1**

Drive screws shall be used only in a horizontal position as in the side of a beam and only for 2 in. (50 mm) or smaller pipe.

**17.2.4.1.2**

Drive screws shall only be used in conjunction with hangers that require two points of attachments.

**17.2.4.2 Ceiling Flanges and U-Hooks with Screws.****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 $\frac{5}{16}$ in. × 1½ in. (8 mm × 40 mm)
		<b>Three Screw Ceiling Flanges</b>
Up to and including 2	50	Wood screw No. 18 × 1½ in.
2½	65	Lag screw $\frac{3}{8}$ in. × 2 in. (10 mm × 50 mm)
3	80	
3½	90	

<b>Pipe Size</b>		<b>Two Screw Ceiling Flanges</b>
<b>in.</b>	<b>mm</b>	
4	100	Lag screw $\frac{1}{2}$ in. $\times$ 2 in. (13 mm $\times$ 50 mm)
5	125	
6	150	
8	200	Lag screw $\frac{5}{8}$ in. $\times$ 2 in. (16 mm $\times$ 50 mm)
		<b>Four Screw Ceiling Flanges</b>
Up to and including 2	50	Wood screw No. 18 $\times$ 1 $\frac{1}{2}$ in.
2 $\frac{1}{2}$	65	Lag screw $\frac{3}{8}$ in. $\times$ 1 $\frac{1}{2}$ in. (10 mm $\times$ 40 mm)
3	80	
3 $\frac{1}{2}$	90	
4	100	Lag screw $\frac{1}{2}$ in. $\times$ 2 in. (13 mm $\times$ 50 mm)
5	125	
6	150	
8	200	Lag screw $\frac{5}{8}$ in. $\times$ 2 in. (16 mm $\times$ 50 mm)
		<b>U-Hooks</b>
Up to and including 2	50	Drive screw No. 16 $\times$ 2 in. or Wood screw No. 18 $\times$ 1 $\frac{1}{2}$ in. (8 mm $\times$ 40 mm) or Lag screw $\frac{5}{16}$ in. $\times$ 1 $\frac{1}{2}$ in. (8 mm $\times$ 40 mm)
2 $\frac{1}{2}$	65	Lag screw $\frac{3}{8}$ in. $\times$ 2 $\frac{1}{2}$ in. (10 mm $\times$ 65 mm)
3	80	
3 $\frac{1}{2}$	90	
4	100	Lag screw $\frac{1}{2}$ in. $\times$ 3 in. (13 mm $\times$ 75 mm)
5	125	
6	150	
8	200	Lag screw $\frac{5}{8}$ in. $\times$ 3 in. (16 mm $\times$ 75 mm)

**17.2.4.2.2**

When the thickness of planking and thickness of flange do not permit the use of screws 2 in. (50 mm) long, screws 1  $\frac{3}{4}$  in. (45 mm) long shall be permitted with hangers spaced not over 10 ft (3 m) apart.

**17.2.4.2.3**

When the thickness of beams or joists does not permit the use of screws 2½ in. (65 mm) long, screws 2 in. (50 mm) long shall be permitted with hangers spaced not over 10 ft (3 m) apart.

**17.2.4.3 Bolts, Rods, or Lag Screws.****17.2.4.3.1**

Unless the requirements of 17.2.4.3.2 are met, the size of bolt, rod, or lag screw used with a hanger and installed on the side of the beam shall not be less than specified in Table 17.2.4.3.1.

**Table 17.2.4.3.1 Minimum Bolt, Rod, or Lag Screw Sizes for Side of Beam Installation**

Pipe Size		Size of Bolt, Rod or Lag Screw		Length of Lag Screw Used with Wood Beams	
in.	mm	in.	mm	in.	mm
Up to and including 2	50	¾	10	2½	65
2½ to 6 (inclusive)	65 to 150	½	13	3	75
8	200	⅝	16	3	75

**17.2.4.3.2**

Where the thickness of beams or joists does not permit the use of screws 2½ in. (65 mm) long, screws 2 in. (50 mm) long shall be permitted with hangers spaced not over 10 ft (3 m) apart.

**17.2.4.3.3**

All holes for lag screws shall be pre-drilled ⅛ in. (3 mm) less in diameter than the maximum root diameter of the lag screw thread.

**17.2.4.3.4**

Holes for bolts or rods shall not exceed ⅛ in. (1.6 mm) greater than the diameter of the bolt or rod.

**17.2.4.3.5**

Bolts and rods shall be provided with flat washers and nuts.

**17.2.4.4 Wood Screws.**

Wood screws shall be installed with a screwdriver.

**17.2.4.5 Nails.**

Nails shall not be acceptable for fastening hangers.

**17.2.4.6 Screws in Side of Timber or Joists.****17.2.4.6.1**

Screws in the side of a timber or joist shall be not less than 2½ in. (65 mm) from the lower edge where supporting pipe is up to and including nominal 2½ in. (65 mm) and not less than 3 in. (75 mm) where supporting pipe is greater than nominal 2½ in. (65 mm).

**17.2.4.6.2**

The requirements of 17.2.4.6.1 shall not apply to 2 in. (50 mm) or thicker nailing strips resting on top of steel beams.

**17.2.4.7 Coach Screw Rods.****17.2.4.7.1 Minimum Coach Screw Rod Size.**

The size of coach screw rods shall not be less than the requirements of Table 17.2.4.7.1.



**Table 17.2.4.7.1 Minimum Coach Screw Rod Size**

Pipe Size		Diameter of Rod		Minimum Penetration	
in.	mm	in.	mm	in.	mm
Up to and including 4	100	$\frac{3}{8}$	10	3	75
Larger than 4	100	NP	NP	NP	NP

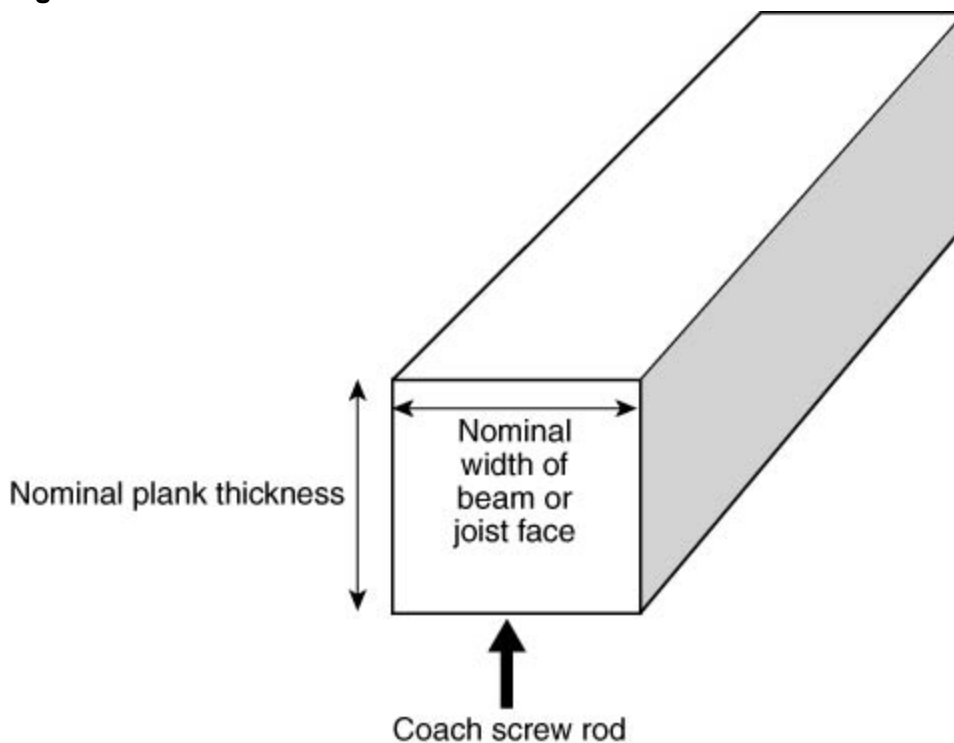
NP: Not permitted.

**17.2.4.7.2**

The minimum plank thickness and the minimum width of the lower face of beams or joists in which coach screw rods are used shall be not less than that specified in Table 17.2.4.7.2 and shown in Figure 17.2.4.7.2.

**Table 17.2.4.7.2 Minimum Plank Thicknesses and Beam or Joist Widths**

Pipe Size		Nominal Plank Thickness		Nominal Width of Beam or Joist Face	
in.	mm	in.	mm	in.	mm
Up to and including 2	50	3	75	2	50
$2\frac{1}{2}$	65	4	100	2	50
3	80	4	100	3	75
$3\frac{1}{2}$	90				
4	100				

**Figure 17.2.4.7.2 Dimensions for Structural Members with Coach Screw Rods.****17.2.4.7.3**

Coach screw rods shall not be used for support of pipes larger than 4 in. (100 mm) in diameter.

**17.2.4.7.4**

All holes for coach screw rods shall be predrilled  $\frac{1}{8}$  in. (3 mm) less in diameter than the maximum root diameter of the wood screw thread.

**17.3 \* Trapeze Hangers.****17.3.1**

For trapeze hangers, the minimum size of steel angle or pipe span between structural members shall be such that the section modulus required in Table 17.3.1(a) or Table 17.3.1(b) does not exceed the available section modulus of the trapeze member in Table 17.3.1(c) or Table 17.3.1(d).

**Table 17.3.1(a) Section Modulus Required for Trapeze Members (in.<sup>3</sup>)**

Span (ft)	Nominal Diameter of Pipe Being Supported — Schedule 10 Steel											
	1	1.25	1.5	2	2.5	3	3.5	4	5	6	8	10
1.5	0.08	0.08	0.09	0.09	0.10	0.11	0.12	0.13	0.15	0.18	0.26	0.34
2.0	0.11	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.20	0.24	0.34	0.45
2.5	0.14	0.14	0.15	0.16	0.17	0.18	0.20	0.21	0.25	0.30	0.43	0.56
3.0	0.16	0.17	0.18	0.19	0.20	0.22	0.24	0.26	0.31	0.36	0.51	0.67
3.5	0.19	0.20	0.21	0.22	0.24	0.26	0.28	0.30	0.36	0.42	0.60	0.78
4.0	0.22	0.22	0.24	0.25	0.27	0.30	0.32	0.34	0.41	0.48	0.68	0.89
4.5	0.24	0.25	0.27	0.28	0.30	0.33	0.36	0.38	0.46	0.54	0.77	1.01
5.0	0.27	0.28	0.30	0.31	0.34	0.37	0.40	0.43	0.51	0.60	0.85	1.12
5.5	0.30	0.31	0.33	0.34	0.37	0.41	0.44	0.47	0.56	0.66	0.94	1.23
6.0	0.33	0.34	0.35	0.38	0.41	0.44	0.48	0.51	0.61	0.71	1.02	1.34
6.5	0.35	0.36	0.38	0.41	0.44	0.48	0.52	0.56	0.66	0.77	1.11	1.45
7.0	0.38	0.39	0.41	0.44	0.47	0.52	0.56	0.60	0.71	0.83	1.19	1.56
7.5	0.41	0.42	0.44	0.47	0.51	0.55	0.60	0.64	0.76	0.89	1.28	1.68
8.0	0.43	0.45	0.47	0.50	0.54	0.59	0.63	0.68	0.82	0.95	1.36	1.79
8.5	0.46	0.48	0.50	0.53	0.58	0.63	0.67	0.73	0.87	1.01	1.45	1.90
9.0	0.49	0.50	0.53	0.56	0.61	0.66	0.71	0.77	0.92	1.07	1.53	2.01
9.5	0.52	0.53	0.56	0.60	0.64	0.70	0.75	0.81	0.97	1.13	1.62	2.12
10.0	0.54	0.56	0.59	0.63	0.68	0.74	0.79	0.85	1.02	1.19	1.70	2.23
10.5	0.57	0.59	0.62	0.66	0.71	0.78	0.83	0.90	1.07	1.25	1.79	2.35
11.0	0.60	0.62	0.65	0.69	0.74	0.81	0.87	0.94	1.12	1.31	1.87	2.46
11.5	0.63	0.64	0.68	0.72	0.78	0.85	0.91	0.98	1.17	1.37	1.96	2.57
12.0	0.65	0.67	0.71	0.75	0.81	0.89	0.95	1.02	1.22	1.43	2.04	2.68
12.5	0.68	0.70	0.74	0.78	0.85	0.92	0.99	1.07	1.27	1.49	2.13	2.79
13.0	0.71	0.73	0.77	0.81	0.88	0.96	1.03	1.11	1.33	1.55	2.21	2.90
13.5	0.73	0.76	0.80	0.85	0.91	1.00	1.07	1.15	1.38	1.61	2.30	3.02
14.0	0.76	0.78	0.83	0.88	0.95	1.03	1.11	1.20	1.43	1.67	2.38	3.13
14.5	0.79	0.81	0.86	0.91	0.98	1.07	1.15	1.24	1.48	1.73	2.47	3.24
15.0	0.82	0.84	0.89	0.94	1.02	1.11	1.19	1.28	1.53	1.79	2.56	3.35
15.5	0.84	0.87	0.92	0.97	1.05	1.14	1.23	1.32	1.58	1.85	2.64	3.46
16.0	0.87	0.90	0.95	1.00	1.08	1.18	1.27	1.37	1.63	1.91	2.73	3.58
Span (ft)	Nominal Diameter of Pipe Being Supported — Schedule 40 Steel											
	1	1.25	1.5	2	2.5	3	3.5	4	5	6	8	10
1.5	0.08	0.09	0.09	0.1	0.11	0.12	0.14	0.15	0.18	0.22	0.30	0.41

Span (ft)	Nominal Diameter of Pipe Being Supported — Schedule 10 Steel											
	1	1.25	1.5	2	2.5	3	3.5	4	5	6	8	10
2.0	0.11	0.11	0.12	0.13	0.15	0.16	0.18	0.20	0.24	0.29	0.40	0.55
2.5	0.14	0.14	0.15	0.16	0.18	0.21	0.23	0.25	0.30	0.36	0.50	0.69
3.0	0.16	0.17	0.18	0.20	0.22	0.25	0.27	0.30	0.36	0.43	0.60	0.82
3.5	0.19	0.20	0.21	0.23	0.26	0.29	0.32	0.35	0.42	0.51	0.70	0.96
4.0	0.22	0.23	0.24	0.26	0.29	0.33	0.36	0.40	0.48	0.58	0.80	1.10
4.5	0.25	0.26	0.27	0.29	0.33	0.37	0.41	0.45	0.54	0.65	0.90	1.23
5.0	0.27	0.29	0.30	0.33	0.37	0.41	0.45	0.49	0.60	0.72	1.00	1.37
5.5	0.30	0.31	0.33	0.36	0.40	0.45	0.50	0.54	0.66	0.79	1.10	1.51
6.0	0.33	0.34	0.36	0.39	0.44	0.49	0.54	0.59	0.72	0.87	1.20	1.64
6.5	0.36	0.37	0.40	0.42	0.48	0.54	0.59	0.64	0.78	0.94	1.31	1.78
7.0	0.38	0.40	0.43	0.46	0.52	0.58	0.63	0.69	0.84	1.01	1.41	1.92
7.5	0.41	0.43	0.46	0.49	0.55	0.62	0.68	0.74	0.90	1.08	1.51	2.06
8.0	0.44	0.46	0.49	0.52	0.59	0.66	0.72	0.79	0.96	1.16	1.61	2.19
8.5	0.47	0.48	0.52	0.56	0.63	0.70	0.77	0.84	1.02	1.23	1.71	2.33
9.0	0.49	0.51	0.55	0.59	0.66	0.74	0.81	0.89	1.08	1.30	1.81	2.47
9.5	0.52	0.54	0.58	0.62	0.70	0.78	0.86	0.94	1.14	1.37	1.91	2.60
10.0	0.55	0.57	0.61	0.65	0.74	0.82	0.90	0.99	1.20	1.45	2.01	2.74
10.5	0.58	0.60	0.64	0.69	0.77	0.86	0.95	1.04	1.26	1.52	2.11	2.88
11.0	0.60	0.63	0.67	0.72	0.81	0.91	0.99	1.09	1.32	1.59	2.21	3.01
11.5	0.63	0.66	0.70	0.75	0.85	0.95	1.04	1.14	1.38	1.66	2.31	3.15
12.0	0.66	0.68	0.73	0.78	0.88	0.99	1.08	1.19	1.44	1.73	2.41	3.29
12.5	0.69	0.71	0.76	0.82	0.92	1.03	1.13	1.24	1.5	1.81	2.51	3.43
13.0	0.71	0.74	0.79	0.85	0.96	1.07	1.17	1.29	1.56	1.88	2.61	3.56
13.5	0.74	0.77	0.82	0.88	0.99	1.11	1.22	1.34	1.62	1.95	2.71	3.70
14.0	0.77	0.80	0.85	0.91	1.03	1.15	1.26	1.39	1.68	2.02	2.81	3.84
14.5	0.80	0.83	0.88	0.95	1.07	1.19	1.31	1.43	1.74	2.1	2.91	3.97
15.0	0.82	0.86	0.91	0.98	1.10	1.24	1.35	1.48	1.8	2.17	3.01	4.11
15.5	0.85	0.88	0.94	1.01	1.14	1.28	1.4	1.53	1.86	2.24	3.11	4.25
16.0	0.88	0.91	0.97	1.05	1.18	1.32	1.44	1.58	1.92	2.31	3.21	4.39

Note: The table is based on a maximum bending stress of 15 ksi and a midspan concentrated load from 15 ft of water-filled pipe, plus 250 lb.

**Table 17.3.1(b) Section Modulus Required for Trapeze Members (mm<sup>3</sup>)**

Span (m)	Nominal Diameter of Pipe Being Supported — Schedule 10 Steel											
	25	32	40	50	65	80	90	100	125	150	200	250
0.5	1310	1310	1470	1470	1640	1800	1970	2130	2460	2950	4260	5570
0.6	1800	1800	1970	2130	2290	2460	2620	2790	3280	3930	5570	7370
0.8	2290	2290	2460	2620	2790	2950	3280	3440	4100	4920	7050	9180
0.9	2620	2790	2950	3110	3280	3610	3930	4260	5080	5900	8360	10980

Span (m)	Nominal Diameter of Pipe Being Supported — Schedule 10 Steel											
	25	32	40	50	65	80	90	100	125	150	200	250
1.1	3110	3280	3440	3610	3930	4260	4590	4920	5900	6880	9830	12780
1.2	3610	3610	3930	4100	4420	4920	5240	5570	6720	7870	11140	14580
1.4	3930	4100	4420	4590	4920	5410	5900	6230	7540	8850	12620	16550
1.5	4420	4590	4920	5080	5570	6060	6550	7050	8360	9830	13930	18350
1.7	4920	5080	5410	5570	6060	6720	7210	7700	9180	10820	15400	20160
1.8	5410	5570	5740	6230	6720	7210	7870	8360	10000	11630	16710	21960
2.0	5740	5900	6230	6720	7210	7870	8520	9180	10820	12620	18190	23760
2.1	6230	6390	6720	7210	7700	8520	9180	9830	11630	13600	19500	25560
2.3	6720	6880	7210	7700	8360	9010	9830	10490	12450	14580	20980	27530
2.4	7050	7370	7700	8190	8850	9670	10320	11140	13440	15570	22290	29330
2.6	7540	7870	8190	8690	9500	10320	10980	11960	14260	16550	23760	31140
2.7	8030	8190	8690	9180	10000	10820	11630	12620	15080	17530	25070	32940
2.9	8520	8690	9180	9830	10490	11470	12290	13270	15900	18520	26550	34740
3.0	8850	9180	9670	10320	11140	12130	12950	13930	16710	19500	27860	36540
3.2	9340	9670	10160	10820	11630	12780	13600	14750	17530	20480	29330	38510
3.4	9830	10160	10650	11310	12130	13270	14260	15400	18350	21470	30640	40310
3.5	10320	10490	11140	11800	12780	13930	14910	16060	19170	22450	32120	42110
3.7	10650	10980	11630	12290	13270	14580	15570	16710	19990	23430	33430	43920
3.8	11140	11470	12130	12780	13930	15080	16220	17530	20810	24420	34900	45720
4.0	11630	11960	12620	13270	14420	15730	16880	18190	21790	25400	36220	47520
4.1	11960	12450	13110	13930	14910	16390	17530	18850	22610	26380	37690	49490
4.3	12450	12780	13600	14420	15570	16880	18190	19660	23430	27370	39000	51290
4.4	12950	13270	14090	14910	16060	17530	18850	20320	24250	28350	40480	53090
4.6	13440	13770	14580	15400	16710	18190	19500	20980	25070	29330	41950	54900
4.7	13770	14260	15080	15900	17210	18680	20160	21630	25890	30320	43260	56700
4.9	14260	14750	15570	16390	17700	19340	20810	22450	26710	31300	44740	58670

Span (m)	Nominal Diameter of Pipe Being Supported — Schedule 40 Steel											
	25	32	40	50	65	80	90	100	125	150	200	250
0.5	1310	1470	1470	1640	1800	1970	2290	2460	2950	3610	4920	6720
0.6	1800	1800	1970	2130	2460	2620	2950	3280	3930	4750	6550	9010
0.8	2290	2290	2460	2620	2950	3440	3770	4100	4920	5900	8190	11310
0.9	2620	2790	2950	3280	3610	4100	4420	4920	5900	7050	9830	13440
1.1	3110	3280	3440	3770	4260	4750	5240	5740	6880	8360	11470	15730
1.2	3610	3770	3930	4260	4750	5410	5900	6550	7870	9500	13110	18030
1.4	4100	4260	4420	4750	5410	6060	6720	7370	8850	10650	14750	20160
1.5	4420	4750	4920	5410	6060	6720	7370	8030	9830	11800	16390	22450
1.7	4920	5080	5410	5900	6550	7370	8190	8850	10820	12950	18030	24740
1.8	5410	5570	5900	6390	7210	8030	8850	9670	11800	14260	19660	26870
2.0	5900	6060	6550	6880	7870	8850	9670	10490	12780	15400	21470	29170
2.1	6230	6550	7050	7540	8520	9500	10320	11310	13770	16550	23110	31460

Span (m)	Nominal Diameter of Pipe Being Supported — Schedule 10 Steel											
	25	32	40	50	65	80	90	100	125	150	200	250
2.3	6720	7050	7540	8030	9010	10160	11140	12130	14750	17700	24740	33760
2.4	7210	7540	8030	8520	9670	10820	11800	12950	15730	19010	26380	35890
2.6	7700	7870	8520	9180	10320	11470	12620	13770	16710	20160	28020	38180
2.7	8030	8360	9010	9670	10820	12130	13270	14580	17700	21300	29660	40480
2.9	8520	8850	9500	10160	11470	12780	14090	15400	18680	22450	31300	42610
3.0	9010	9340	10000	10650	12130	13440	14750	16220	19660	23760	32940	44900
3.2	9500	9830	10490	11310	12620	14090	15570	17040	20650	24910	34580	47190
3.4	9830	10320	10980	11800	13270	14910	16220	17860	21630	26060	36220	49330
3.5	10320	10820	11470	12290	13930	15570	17040	18680	22610	27200	37850	51620
3.7	10820	11140	11960	12780	14420	16220	17700	19500	23600	28350	39490	53910
3.8	11310	11630	12450	13440	15080	16880	18520	20320	24580	29660	41130	56210
4.0	11630	12130	12950	13930	15730	17530	19170	21140	25560	30810	42770	58340
4.1	12130	12620	13440	14420	16220	18190	19990	21960	26550	31950	44410	60630
4.3	12620	13110	13930	14910	16880	18850	20650	22780	27530	33100	46050	62930
4.4	13110	13600	14420	15570	17530	19500	21470	23430	28510	34410	47690	65060
4.6	13440	14090	14910	16060	18030	20320	22120	24250	29500	35560	49330	67350
4.7	13930	14420	15400	16550	18680	20980	22940	25070	30480	36710	50960	69650
4.9	14420	14910	15900	17210	19340	21630	23600	25890	31460	37850	52600	71940

Note: The table is based on a maximum bending stress of 103.4 MPa and a midspan concentrated load from 4.6 m of water-filled pipe, plus 114 kg.

**Table 17.3.1(c) Available Section Modulus of Common Trapeze Hangers (in.<sup>3</sup>)**

Pipe (in.)	Modulus (in. <sup>3</sup> )	Angles (in.)	Modulus (in. <sup>3</sup> )
<b>Schedule 10</b>			
1	0.12	$1\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{16}$	0.10
$1\frac{1}{4}$	0.19	$2 \times 2 \times \frac{1}{8}$	0.13
$1\frac{1}{2}$	0.26	$2 \times 1\frac{1}{2} \times \frac{3}{16}$	0.18
2	0.42	$2 \times 2 \times \frac{3}{16}$	0.19
$2\frac{1}{2}$	0.69	$2 \times 2 \times \frac{1}{4}$	0.25
3	1.04	$2\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{16}$	0.28
$3\frac{1}{2}$	1.38	$2\frac{1}{2} \times 2 \times \frac{3}{16}$	0.29
4	1.76	$2 \times 2 \times \frac{5}{16}$	0.30
5	3.03	$2\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{16}$	0.30
6	4.35	$2 \times 2 \times \frac{3}{8}$	0.35
		$2\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{4}$	0.39
		$3 \times 2 \times \frac{3}{16}$	0.41

Pipe (in.)	Modulus (in. <sup>3</sup> )	Angles (in.)	Modulus (in. <sup>3</sup> )
<b>Schedule 40</b>			
1	0.13	$3 \times 2\frac{1}{2} \times \frac{3}{16}$	0.43
$1\frac{1}{4}$	0.23	$3 \times 3 \times \frac{3}{16}$	0.44
$1\frac{1}{2}$	0.33	$2\frac{1}{2} \times 2\frac{1}{2} \times \frac{5}{16}$	0.48
2	0.56	$3 \times 2 \times \frac{1}{4}$	0.54
$2\frac{1}{2}$	1.06	$2\frac{1}{2} \times 2 \times \frac{3}{8}$	0.55
3	1.72	$2\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{8}$	0.57
$3\frac{1}{2}$	2.39	$3 \times 3 \times \frac{1}{4}$	0.58
4	3.21	$3 \times 3 \times \frac{5}{16}$	0.71
5	5.45	$2\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{2}$	0.72
6	8.50	$3\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{4}$	0.75
		$3 \times 2\frac{1}{2} \times \frac{3}{8}$	0.81
		$3 \times 3 \times \frac{3}{8}$	0.83
		$3\frac{1}{2} \times 2\frac{1}{2} \times \frac{5}{16}$	0.93
		$3 \times 3 \times \frac{7}{16}$	0.95
		$4 \times 4 \times \frac{1}{4}$	1.05
		$3 \times 3 \times \frac{1}{2}$	1.07
		$4 \times 3 \times \frac{5}{16}$	1.23
		$4 \times 4 \times \frac{5}{16}$	1.29
		$4 \times 3 \times \frac{3}{8}$	1.46
		$4 \times 4 \times \frac{3}{8}$	1.52
		$5 \times 3\frac{1}{2} \times \frac{5}{16}$	1.94
		$4 \times 4 \times \frac{1}{2}$	1.97
		$4 \times 4 \times \frac{5}{8}$	2.40
		$4 \times 4 \times \frac{3}{4}$	2.81
		$6 \times 4 \times \frac{3}{8}$	3.32
		$6 \times 4 \times \frac{1}{2}$	4.33
		$6 \times 4 \times \frac{3}{4}$	6.25
		$6 \times 6 \times 1$	8.57

**Table 17.3.1(d) Available Section Modulus of Common Trapeze Hangers (mm<sup>3</sup>)**

Pipe (mm)	Modulus (mm <sup>3</sup> )	Angles (mm)	Modulus (mm <sup>3</sup> )
<b>Schedule 10</b>			
25	19.7	$40 \times 40 \times 5$	1640

Pipe (mm)	Modulus (mm <sup>3</sup> )	Angles (mm)	Modulus (mm <sup>3</sup> )
32	31.1	50 × 50 × 3	2130
40	42.6	50 × 40 × 5	2950
50	68.8	50 × 50 × 5	3110
65	113	50 × 50 × 6	4100
80	170	65 × 40 × 5	4590
90	226	65 × 50 × 5	4750
100	288	50 × 50 × 8	4920
125	497	65 × 65 × 5	4920
150	713	50 × 50 × 10	5740
		65 × 65 × 6	6390
		80 × 50 × 5	6720
Schedule 40			
25	21.0	80 × 65 × 10	7050
32	38.0	80 × 80 × 5	7210
40	54.0	65 × 65 × 8	7870
50	92.0	80 × 50 × 6	8850
65	174.0	65 × 50 × 10	9010
80	282.0	65 × 65 × 10	9340
90	392.0	80 × 80 × 6	9500
100	526.0	80 × 80 × 8	11,600
125	893.0	65 × 65 × 15	11,800
150	1393.0	90 × 65 × 6	12,300
		80 × 65 × 10	13,300
		80 × 80 × 10	13,600
		90 × 65 × 8	15,200
		80 × 80 × 11	15,600
		100 × 100 × 6	17,200
		80 × 80 × 15	17,500
		100 × 80 × 8	20,200
		100 × 100 × 8	21,100
		100 × 80 × 10	23,900
		100 × 100 × 10	24,900
		125 × 90 × 8	31,800
		100 × 100 × 16	32,300
		100 × 100 × 8	39,300
		100 × 100 × 20	46,000
		150 × 100 × 10	54,400
		150 × 100 × 15	71,000
		150 × 100 × 20	102,000

**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.

**17.3.3**

Any other sizes or shapes giving equal or greater section modulus shall be acceptable.

**17.3.4**

All angles shall be installed with the longer leg vertical.

**17.3.5**

The trapeze member shall be secured to prevent slippage.

**17.3.6 \***

All components of each hanger assembly that attach to a trapeze member shall conform to 17.1.6 and be sized to support the suspended sprinkler pipe.

**17.3.7**

The ring, strap, or clevis installed on a pipe trapeze shall be manufactured to fit the pipe size of the trapeze member.

**17.3.8**

Holes for bolts or rods shall not exceed  $\frac{1}{16}$  in. (1.6 mm) greater than the diameter of the bolt or rod.

**17.3.9**

Bolts and rods shall be provided with flat washers and nuts.

**17.3.10**

Where angles are used for trapeze hangers and slotted holes are used, the slotted holes shall meet all of the following:

- (1) The length of each slotted hole shall not exceed 3 in. (75 mm).
- (2) The width of the slotted hole shall not exceed  $\frac{1}{16}$  in. (1.6 mm) greater than the bolt or rod diameter.
- (3) The minimum distance between slotted holes shall be 3 in. (75 mm) edge to edge.
- (4) The minimum distance from the end of the angle to the edge of the slotted hole shall be 3 in. (75 mm).
- (5) The number of slots shall be limited to three per section of angle.
- (6) The washer(s) required by 17.3.9 shall have a minimum thickness of one-half the thickness of the angle.
- (7) Washers and nuts required by 17.3.9 shall be provided on both the top and bottom of the angle.

**17.4 \* Installation of Pipe Hangers.****17.4.1 General.****17.4.1.1 Ceiling Sheathing.****17.4.1.1.1 \***

Unless the requirements of 17.4.1.1.2 are met, sprinkler piping shall be supported independently of the ceiling sheathing.

**17.4.1.1.2**

Toggle hangers shall be permitted only for the support of pipe  $1\frac{1}{2}$  in. (40 mm) or smaller in size under ceilings of hollow tile or metal lath and plaster.

**17.4.1.2 Storage Racks.**

Where sprinkler piping is installed in storage racks, piping shall be supported from the storage rack structure or building in accordance with all applicable provisions of Section 17.4 and Chapter 18.

**17.4.1.3 \* Building Structure.****17.4.1.3.1**

Sprinkler piping shall be substantially supported from the building structure, which must support the added load of the water-filled pipe plus 250 lb (115 kg) applied at the point of hanging, except where permitted by 17.4.1.1.2, 17.4.1.3.3, and 17.4.1.4.1.



**17.4.1.3.2**

Trapeze hangers shall be used where necessary to transfer loads to appropriate structural members.

**17.4.1.3.3 \* Flexible Sprinkler Hose Fittings.****17.4.1.3.3.1**

Listed flexible sprinkler hose fittings and their anchoring components intended for use in installations connecting the sprinkler system piping to sprinklers shall be installed in accordance with the requirements of the listing, including any installation instructions.

**17.4.1.3.3.2**

When installed and supported by suspended ceilings, the ceiling shall meet ASTM C635/C635M, *Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings*, and shall be installed in accordance with ASTM C636/C636M, *Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels*.

**17.4.1.3.3.3 \***

Where flexible sprinkler hose fittings exceed 6 ft (1.8 m) in length and are supported by a suspended ceiling in accordance with 17.4.1.3.3.2, a hanger(s) attached to the structure shall be required to ensure that the maximum unsupported length does not exceed 6 ft (1.8 m).

**17.4.1.3.3.4 \***

Where flexible sprinkler hose fittings are used to connect sprinklers to branch lines in suspended ceilings, a label limiting relocation of the sprinkler shall be provided on the anchoring component.

**17.4.1.4 Metal Deck.****17.4.1.4.1 \***

Branch line hangers attached to metal deck shall be permitted only for the support of pipe 1 in. (25 mm) or smaller in size, by drilling or punching the vertical portion of the metal deck and using through bolts.

**17.4.1.4.2**

The distance from the bottom of the bolt hole to the bottom of the vertical member shall be not less than  $\frac{3}{8}$  in. (10 mm).

**17.4.1.5**

Where sprinkler piping is installed below ductwork, piping shall be supported from the building structure or from the ductwork supports, provided such supports are capable of handling both the load of the ductwork and the load specified in 17.4.1.3.1.

**17.4.2 \* Maximum Distance Between Hangers.****17.4.2.1**

The maximum distance between hangers shall not exceed that specified in Table 17.4.2.1(a) or Table 17.4.2.1(b), except where the provisions of 17.4.4 apply.

**Table 17.4.2.1(a) Maximum Distance Between Hangers (ft-in.)**

	Nominal Pipe Size (in.)											
	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	5	6	8
Steel pipe except threaded lightwall	NA	12-0	12-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0
Threaded lightwall steel pipe	NA	12-0	12-0	12-0	12-0	12-0	12-0	NA	NA	NA	NA	NA
Copper tube	8-0	8-0	10-0	10-0	12-0	12-0	12-0	15-0	15-0	15-0	15-0	15-0
CPVC	5-6	6-0	6-6	7-0	8-0	9-0	10-0	NA	NA	NA	NA	NA
Ductile-iron pipe	NA	NA	NA	NA	NA	NA	15-0	NA	15-0	NA	15-0	15-0

NA: Not applicable.

**Table 17.4.2.1(b) Maximum Distance Between Hangers (m)**

	Nominal Pipe Size (mm)											
	20	25	32	40	50	65	80	90	100	125	150	200
Steel pipe except threaded lightwall	NA	3.7	3.7	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Threaded lightwall steel pipe	NA	3.7	3.7	3.7	3.7	3.7	3.7	NA	NA	NA	NA	NA
Copper tube	2.4	2.4	3.0	3.0	3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6
CPVC	1.7	1.8	2.0	2.1	2.4	2.7	3.0	NA	NA	NA	NA	NA
Ductile-iron pipe	NA	NA	NA	NA	NA	NA	4.6	NA	4.6	NA	4.6	4.6

NA: Not applicable.

#### **17.4.2.2**

The maximum distance between hangers for listed nonmetallic pipe shall be modified as specified in the individual product listings.

### **17.4.3 Location of Hangers on Branch Lines.**

#### **17.4.3.1**

Subsection 17.4.3 shall apply to the support of steel pipe or copper tube as specified in 7.3.1 and subject to the provisions of 17.4.2.

#### **17.4.3.2 \* Minimum Number of Hangers.**

##### **17.4.3.2.1**

Unless the requirements of 17.4.3.2.2 through 17.4.3.2.5 are met, there shall be not less than one hanger for each section of pipe.

##### **17.4.3.2.2 \***

Unless the requirements of 17.4.3.2.3 are met, where sprinklers are spaced less than 6 ft (1.8 m) apart, hangers spaced up to a maximum of 12 ft (3.7 m) shall be permitted.

##### **17.4.3.2.3**

For welded or mechanical outlets on a continuous section of pipe, hanger spacing shall be according to Table 17.4.2.1(a) or Table 17.4.2.1(b).

##### **17.4.3.2.4 \***

Starter lengths less than 6 ft (1.8 m) shall not require a hanger, unless on the end line of a sidefeed system or where an intermediate cross main hanger has been omitted.

##### **17.4.3.2.5 \***

A single section of pipe shall not require a hanger when the cumulative distance between hangers on the branch line does not exceed the spacing required by Table 17.4.2.1(a) and Table 17.4.2.1(b).

### **17.4.3.3 Clearance to Hangers.**

The distance between a hanger and the centerline of an upright sprinkler shall not be less than 3 in. (75 mm).

#### **17.4.3.4 \* Unsupported Lengths.**

##### **17.4.3.4.1**

For steel pipe, the unsupported horizontal length between the end sprinkler and the last hanger on the line shall not be greater than 36 in. (900 mm) for 1 in. (25 mm) pipe, 48 in. (1200 mm) for 1 ¼ in. (32 mm) pipe, and 60 in. (1500 mm) for 1 ½ in. (40 mm) or larger pipe.

##### **17.4.3.4.2**

For copper tube, the unsupported horizontal length between the end sprinkler and the last hanger on the line shall not be greater than 18 in. (450 mm) for 1 in. (25 mm) pipe, 24 in. (600 mm) for 1 ¼ in. (32 mm) pipe, and 30 in. (750 mm) for 1 ½ in. (40 mm) or larger pipe.

##### **17.4.3.4.3**

Where the limits of 17.4.3.4.1 and 17.4.3.4.2 are exceeded, the pipe shall be extended beyond the end sprinkler and shall be supported by an additional hanger.

#### **17.4.3.4.4 \* Unsupported Length with Maximum Pressure Exceeding 100 psi (6.9 bar) and Branch Line Above Ceiling Supplying Sprinklers in Pendent Position Below Ceiling.**

##### **17.4.3.4.4.1**

Where the maximum static or flowing pressure, whichever is greater at the sprinkler, applied other than through the fire department connection, exceeds 100 psi (6.9 bar) and a branch line above a ceiling supplies sprinklers in a pendent position below the ceiling, the hanger assembly supporting the pipe supplying an end sprinkler in a pendent position shall be of a type that restrains upward movement of the pipe.

##### **17.4.3.4.4.2**

The unsupported length between the end sprinkler in a pendent position or drop nipple and the last hanger on the branch line shall not be greater than 12 in. (300 mm) for steel pipe or 6 in. (150 mm) for copper pipe.

##### **17.4.3.4.4.3**

When the limit of 17.4.3.4.4.2 is exceeded, the pipe shall be extended beyond the end sprinkler and supported by an additional hanger.

##### **17.4.3.4.4.4**

Unless flexible hose fittings in accordance with 17.4.1.3.3.1 and ceilings in accordance with 17.4.1.3.3.2 are used, the hanger closest to the sprinkler shall be of a type that restrains the pipe from upward movement.

#### **17.4.3.5 \* Unsupported Armover Length.**

##### **17.4.3.5.1**

The cumulative horizontal length of an unsupported armover to a sprinkler, sprinkler drop, or sprig shall not exceed 24 in. (600 mm) for steel pipe or 12 in. (300 mm) for copper tube.

#### **17.4.3.5.2 \* Unsupported Armover Length with Maximum Pressure Exceeding 100 psi (6.9 bar) and Branch Line Above Ceiling Supplying Sprinklers in Pendent Position Below Ceiling.**

##### **17.4.3.5.2.1**

Where the maximum static or flowing pressure, whichever is greater at the sprinkler, applied other than through the fire department connection, exceeds 100 psi (6.9 bar) and a branch line above a ceiling supplies sprinklers in a pendent position below the ceiling, the cumulative horizontal length of an unsupported armover to a sprinkler or sprinkler drop shall not exceed 12 in. (300 mm) for steel pipe and 6 in. (150 mm) for copper tube.

##### **17.4.3.5.2.2**

Unless flexible sprinkler hose fittings in accordance with 17.4.1.3.3.1 are used, the hanger closest to the sprinkler shall be of a type that restrains upward movement of the pipe.

##### **17.4.3.5.2.3**

Where the armover exceeds the maximum unsupported length of 17.4.3.5.2.1, a hanger shall be installed so that the distance from the end sprinkler or drop nipple to the hanger is not greater than 12 in. (300 mm) for steel or 6 in. (150 mm) for copper, or the pipe shall be extended beyond the end sprinkler and shall be supported by an additional hanger.

##### **17.4.3.6 \***

Wall-mounted sidewall sprinklers shall be restrained to prevent movement.

#### **17.4.3.7 Sprigs.**

Sprigs 4 ft (1.2 m) or longer shall be restrained against lateral movement.

#### **17.4.4 Location of Hangers on Mains.**

##### **17.4.4.1**

Unless any of the requirements of 17.4.4.2 through 17.4.4.7 are met, hangers for mains shall be in accordance with 17.4.2, between each branch line, or on each section of pipe, whichever is the lesser dimension.

##### **17.4.4.2**

For welded or mechanical outlets on a continuous section of pipe, hanger spacing shall be according to Table 17.4.2.1(a) or Table 17.4.2.1(b).

#### **17.4.4.3**

For cross mains in steel pipe systems in bays having two branch lines, the intermediate hanger shall be permitted to be omitted, provided that a hanger attached to a purlin is installed on each branch line located as near to the cross main as the location of the purlin permits.

##### **17.4.4.3.1**

The remaining branch line hangers shall be installed in accordance with 17.4.3.

#### **17.4.4.4**

For cross mains in steel pipe systems only in bays having three branch lines, either side or center feed, one (only) intermediate hanger shall be permitted to be omitted, provided that a hanger attached to a purlin is installed on each branch line located as near to the cross main as the location of the purlin permits.

##### **17.4.4.4.1**

The remaining branch line hangers shall be installed in accordance with 17.4.3.

#### **17.4.4.5**

For cross mains in steel pipe systems only in bays having four or more branch lines, either side or center feed, two intermediate hangers shall be permitted to be omitted, provided the maximum distance between hangers does not exceed the distances specified in 17.4.2 and a hanger attached to a purlin on each branch line is located as near to the cross main as the purlin permits.

#### **17.4.4.6**

The unsupported length of the end of a main shall be no greater than one half the maximum allowable hanger spacing per Table 17.4.2.1(a) and Table 17.4.2.1(b).

#### **17.4.4.7**

At the end of the main, intermediate trapeze hangers shall be installed unless the main is extended to the next framing member with a hanger installed at this point, in which event an intermediate hanger shall be permitted to be omitted in accordance with 17.4.4.3, 17.4.4.4, and 17.4.4.5.

#### **17.4.4.8 \***

A single section of pipe shall not require a hanger when the cumulative distance between hangers on the main does not exceed the spacing required by Table 17.4.2.1(a) and Table 17.4.2.1(b).

### **17.4.5 Support of Risers.**

#### **17.4.5.1**

Risers shall be supported by riser clamps or by hangers located on the horizontal connections within 24 in. (600 mm) of the centerline of the riser.

#### **17.4.5.2**

Riser clamps supporting risers by means of set screws shall not be used.

#### **17.4.5.3 \***

Riser clamps anchored to walls using hanger rods in the horizontal position shall not be permitted to vertically support risers.

### **17.4.5.4 Multistory Buildings.**

#### **17.4.5.4.1**

In multistory buildings, riser supports shall be provided at the lowest level, at each alternate level above, above and below offsets, and at the top of the riser.

##### **17.4.5.4.2 \***

Supports above the lowest level shall also restrain the pipe to prevent movement by an upward thrust where flexible fittings are used.

##### **17.4.5.4.3**

Where risers are supported from the ground, the ground support shall constitute the first level of riser support.

**17.4.5.4.4**

Where risers are offset or do not rise from the ground, the first ceiling level above the offset shall constitute the first level of riser support.

**17.4.5.5**

Distance between supports for risers shall not exceed 25 ft (7.6 m).

**17.5 \* Pipe Stands.****17.5.1 General.****17.5.1.1**

Where pipe stands are used to support system piping, the requirements of Section 17.5 shall apply unless the requirements of 17.5.1.2 are met.

**17.5.1.2**

Pipe stands certified by a registered professional engineer to include all of the following shall be an acceptable alternative to the requirements of Section 17.5:

- (1) Pipe stands shall be designed to support five times the weight of water-filled pipe plus 250 lb (115 kg) at each point of piping support.
- (2) These points of support shall be adequate to support the system.
- (3) The spacing between pipe stands shall not exceed the value given for the type of pipe as indicated in Table 17.4.2.1(a) or Table 17.4.2.1(b).
- (4) Pipe stand components shall be ferrous.
- (5) Detailed calculations shall be submitted, when required by the reviewing authority, showing stresses developed in the pipe stand, the system piping and fittings, and safety factors allowed.

**17.5.1.3**

Where water-based fire protection systems are required to be protected against damage from earthquakes, pipe stands shall also meet the requirements of Section 18.8.

**17.5.2 Component Material.****17.5.2.1**

Pipe stands and their components shall be ferrous unless permitted by 17.5.2.2.

**17.5.2.2**

Nonferrous components that have been proven by fire tests to be adequate for the hazard application and that are in compliance with the other requirements of this section shall be acceptable.

**17.5.3 Sizing.****17.5.3.1 \***

The maximum heights for pipe stands shall be in accordance with Table 17.5.3.1(a) or Table 17.5.3.1(b) unless the requirements of 17.5.3.2 are met.

**Table 17.5.3.1(a) Maximum Pipe Stand Heights (ft)**

System Pipe Diameter (in.)†	Pipe Stand Diameter (in.)*					
	1½	2	2½	3	4	6
1½	6.6	9.4	11.3	13.8	18.0	26.8
2	4.4	9.4	11.3	13.8	18.0	26.8
2½	—	8.1	11.3	13.8	18.0	26.8
3	—	5.2	11.3	13.8	18.0	26.8
4 up to and including 8	—	—	—	—	14.7	26.8

\*Pipe stands are Schedule 40 pipe.

†System piping is assumed to be Schedule 40 (8 in. is Schedule 30).

**Table 17.5.3.1(b) Maximum Pipe Stand Heights (m)**

System Pipe Diameter (mm)†	Pipe Stand Diameter (mm)*					
	40	50	65	80	100	150
40	2	2.9	3.4	4.2	5.5	8.2
50	1.3	2.9	3.4	4.2	5.5	8.2
65	—	2.5	3.4	4.2	5.5	8.2
80	—	1.6	3.4	4.2	5.5	8.2
100 up to and including 200	—	—	—	—	4.5	8.2

\*Pipe stands are Schedule 40 pipe.

†System piping is assumed to be Schedule 40 (200 mm is Schedule 30).

#### **17.5.3.2 \***

Pipe diameters up to and including 10 in. (250 mm) Schedule 40 are permitted to be supported by 2 in. (50 mm) Schedule 40 diameter pipe stands when all of the following conditions are met:

- (1) The maximum height shall be 4 ft (1.2 m), as measured from the base of the pipe stand to the centerline of the pipe being supported.
- (2)\* The pipe stand shall be axially loaded.

#### **17.5.3.3**

The distance between pipe stands shall not exceed the values in Table 17.4.2.1(a) or Table 17.4.2.1(b).

### **17.5.4 Pipe Stand Base.**

#### **17.5.4.1**

The pipe stand base shall be secured by an approved method.

#### **17.5.4.2 \***

Pipe stand base plates shall be threaded malleable iron flanges or welded steel flanges in accordance with Table 7.4.1.

##### **17.5.4.2.1**

Pipes stands installed in accordance with 17.5.3.2 shall be permitted to use a welded steel plate.

#### **17.5.4.3 \***

Pipe stands shall be fastened to a concrete floor or footing using listed concrete anchors or other approved means.

#### **17.5.4.4**

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.

##### **17.5.4.4.1**

Pipe stands installed in accordance with 17.5.3.2 shall be permitted to use a minimum of two anchors to attach the base plate to the floor.

#### **17.5.4.5**

The minimum diameter for the anchors shall be  $\frac{1}{2}$  in. (15 mm) for pipe stand diameters up to and including 3 in. (80 mm) and  $\frac{5}{8}$  in. (16 mm) for pipe stands 4 in. (100 mm) diameter and larger.

##### **17.5.4.5.1**

Where the pipe stand complies with 17.5.3.2,  $\frac{3}{8}$  in. (10 mm) anchors shall be permitted.

## 17.5.5 Attaching to System Piping.

### 17.5.5.1

Piping shall be attached to the pipe stand with U-bolts or equivalent attachment, unless the requirements of 17.5.5.2 are met.

### 17.5.5.2

When a saddle-type pipe stand is utilized and the pipe is not subject to a net vertical upward force, a through-bolt or equivalent attachment is not required.

### 17.5.5.3 \*

Where a horizontal bracket is used to attach the system piping to the pipe stand, it shall not be more than 1 ft (0.3 m) as measured horizontally from the centerline of the pipe stand to the centerline of the supported pipe.

### 17.5.5.4

Horizontal support brackets shall be sized such that the section modulus required in Table 17.5.5.4 does not exceed the available section modulus from Table 17.3.1(c).

**Table 17.5.5.4 Required Section Modulus for Pipe Stand Horizontal Support Arms (in.<sup>3</sup>)**

Nominal Diameter of Pipe Being Supported (in.)	1	1 ¼	1 ½	2	2 ½	3	3 ½	4	5	6	8
Section modulus — Schedule 10 steel	0.22	0.23	0.24	0.25	0.30	0.36	0.42	0.49	0.66	0.85	1.40
Section modulus — Schedule 40 steel	0.22	0.24	0.24	0.27	0.36	0.45	0.54	0.63	0.86	1.13	1.64

For SI units, 1 in. = 25.4 mm.

Note: The table is based on the controlling section modulus determined for a concentrated load at a 1 ft (0.3 m) cantilever using: a) a maximum bending stress of 15 ksi (103 MPa) and a concentrated load equal to the weight of 15 ft (4.6 m) of water-filled pipe plus 250 lb (115 kg), or b) a maximum bending stress of 28 ksi (193 MPa) and a concentrated load equal to five times the weight of 15 ft (4.6 m) of water-filled pipe plus 250 lb (115 kg).

## 17.5.6 Thrust.

### 17.5.6.1 \*

System piping shall be supported and restrained to restrict movement due to sprinkler/nozzle reaction and water surges.

### 17.5.6.2 \*

Where thrust forces are anticipated to be high, a pipe ring or clamp shall secure the system piping to the pipe stand.

## 17.5.7 Exterior Applications.

### 17.5.7.1

Where required, pipe stands used in exterior applications shall be made of galvanized steel or other suitable corrosion-resistant materials.

### 17.5.7.2

A welded, threaded, grooved, or other approved cap shall be securely attached to the top of the pipe stand.