

KSCU & KSCC SEISMIC RESTRAINT CABLE KIT CAPACITIES

MODEL KSCU RESTRAINT CABLE ASSEMBLY SPECIFICATIONS						
MODEL	GRIPPLE CONNECTOR TYPE	WIRE ROPE DIAMETER (mm [in.])	A (in.)	B (in.)	CABLE ASSEMBLY WORKING LOAD LIMIT @ 5:1* (lbs.)	MINIMUM CABLE ASSEMBLY SEISMIC LOAD RATING** (lbs.)
KSCU-2	HANG-FAST No. 2	2 [1/16]	0.69	1.00	100	250
KSCU-3	HANG-FAST No. 3	3 [1/8]	1.75	1.00	200	500
KSCU-4	HANG-FAST No. 4	5 [3/16]	1.88	1.00	495	1,238
KSCU-5	LOCKABLE 6 mm	6 [1/4]	1.81	1.00	1,100	2,750

* Published **GRIPPLE** load rating for suspended overhead components.

** Minimum Cable Assembly Seismic Load Rating is one half of five times the Working Load Limit.

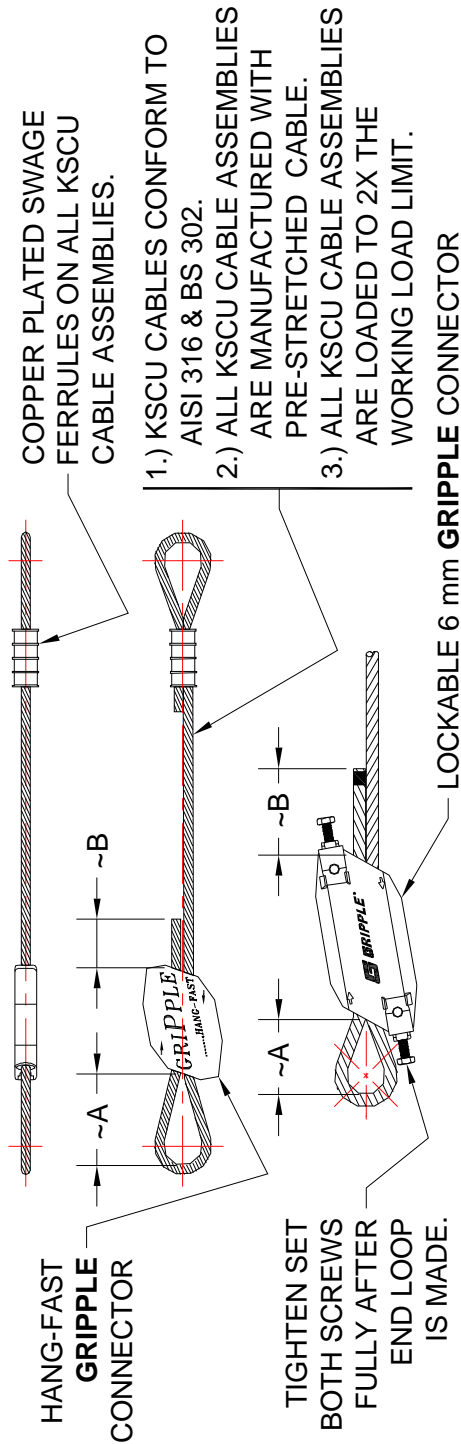


Figure A1.1-1; Model KSCU Restraint Cable Specifications

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MODEL KSCC RESTRAINT CABLE ASSEMBLY SPECIFICATIONS

MODEL	WIRE ROPE DIAMETER A (in.)	NUMBER OF STRANDS	WIRES PER STRAND	TYPE OF CORE	CABLE TYPE	B (in.)	C (in.)	D (in.)	No. OF CLIPS PER END LOOP	MINIMUM CABLE BREAKING STRENGTH (lbs.)	MINIMUM CABLE ASSEMBLY SEISMIC TENSILE RATING (lbs.)
KSCC-250	1/4	7	19	STRAND	AIRCRAFT	7	3/4	3-3/16	3	7,000	2,625
KSCC-375	3/8	7	19	STRAND	AIRCRAFT	9-1/2	7/8	3-15/16	3	14,400	5,400
KSCC-500	1/2	6	19	IWRC	STANDARD-EIP	15-1/4	1-1/16	4-11/16	4	26,600	9,975

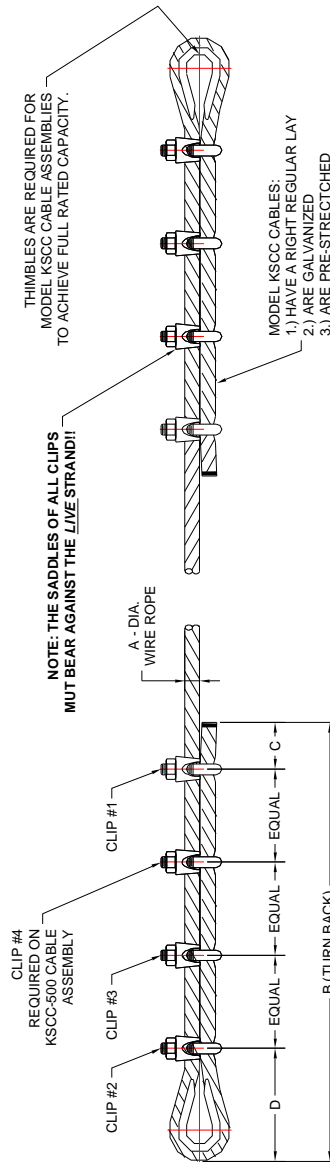


Figure A1.1-2; Model KSCC Restraint Cable Specifications

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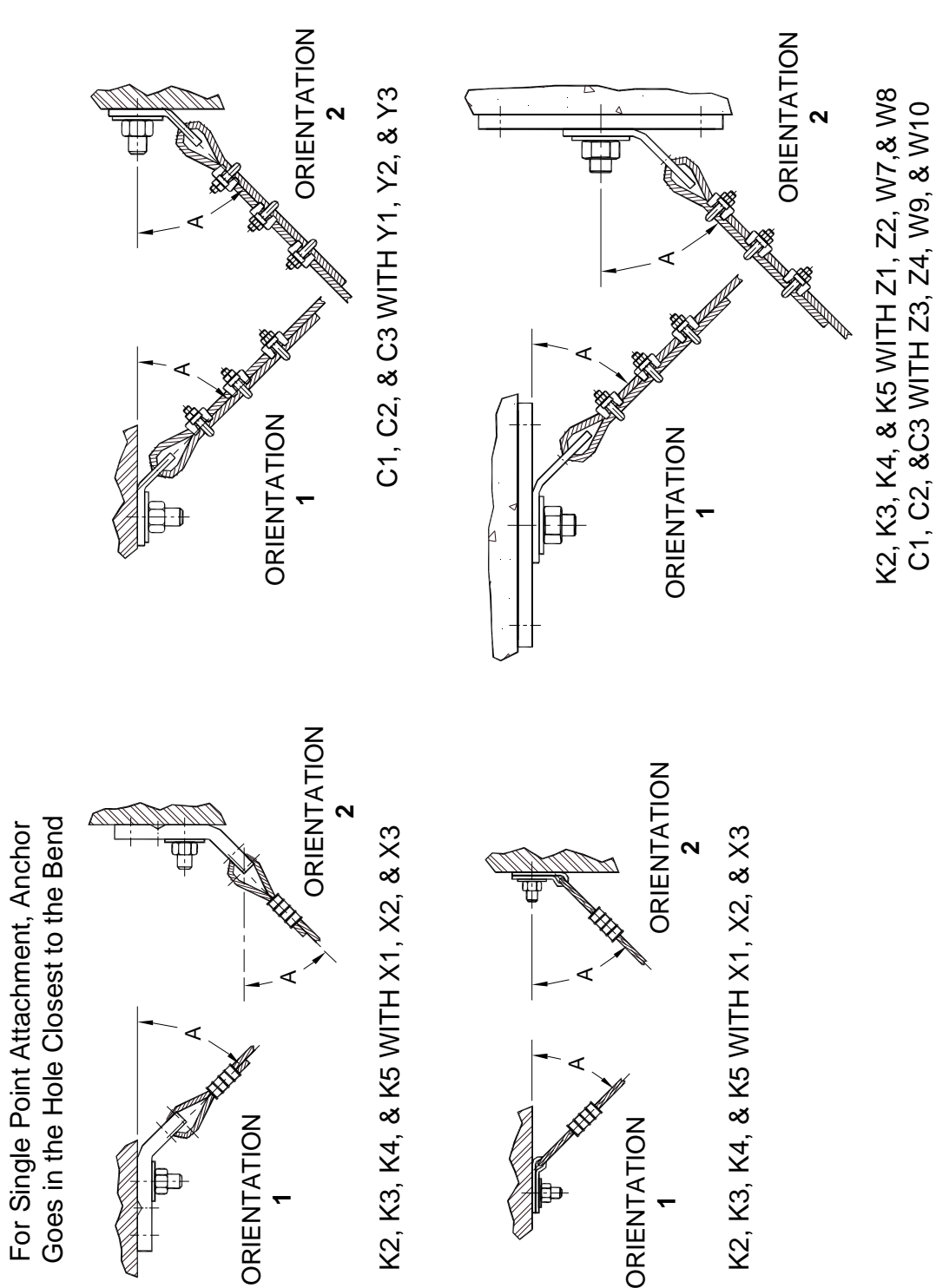


Figure A1-3; Definition of Orientation 1 and Orientation 2 for Bracket Mounting to Structure

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Table A1.1-1; KSCU & KSCC Restraint Cable Kit Capacities for Bolt to Steel Attachment – Orientation 1
(All Listed Forces Are LRFD Values)

		Maximum Cable Angle (°)	KNC Restraint Kit Code														
			K2 KSCU-2		K3 KSCU-3		K4 KSCU-4		K5 KSCU-5		C1 KSCC-250		C2 KSCC-375		C3 KSCC-500		
			Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	
KNC Attachment Kit Code	X1 (1) 1/4-20 UNC A307 Bolt	45	247	---	495	---											
		60	175	---	350	---											
	X2 (1) 3/8-16 UNC A307 Bolt	45	247	---	495	I	1,226	III									
		60	175	---	350	I	867	II									
	X3 (1) 1/2-13 UNC A307 Bolt	45							2,717	IV							
		60							1,672	III							
	Y1 (1) 5/8-11 UNC A307 Bolt	45									2,599	IV					
		60									1,838	III					
	Y2 (1) 3/4-10 UNC A307 Bolt	45											5,346	V	7,996	V	
		60											3,780	IV	4,313	IV	
	Y3 (1) 7/8-9 UNC A307 Bolt	45															
		60															

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(All Listed Forces Are LRFD Values)

		Maximum Cable Angle (°)	KNC Restraint Kit Code													
			K2 KSCU-2		K3 KSCU-3		K4 KSCU-4		K5 KSCU-5		C1 KSCC-250		C2 KSCC-375		C3 KSCC-500	
			Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class
KNC Attachment Kit Code	X1 (1) 1/4-20 UNC A307 Bolt	45	247	---	495	I										
		60	175	---	350	I										
	X2 (1) 3/8-16 UNC A307 Bolt	45	247	---	495	I	1,226	III								
		60	175	---	350	I	867	II								
	X3 (1) 1/2-13 UNC A307 Bolt	45							2,717	IV						
		60							1,672	III						
	Y1 (1) 5/8-11 UNC A307 Bolt	45									2,599	IV				
		60									1,838	III				
	Y2 (1) 3/4-10 UNC A307 Bolt	45											5,346	V	7,996	V
		60											3,780	IV	4,313	IV
	Y3 (1) 7/8-9 UNC A307 Bolt	45														
		60														

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(All Listed Forces Are LRFD Values)

KNC Attachment Kit Code	Maximum Cable Angle (°)	KNC Restraint Kit Code													
		K2 KSCU-2		K3 KSCU-3		K4 KSCU-4		K5 KSCU-5		C1 KSCC-250		C2 KSCC-375		C3 KSCC-500	
		Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class
X1 ¹ (1) KCAB-25	45	182	---	182	---										
	60	111	---	111	---										
X2 (1) KCCAB-38	45	247	---	380	I	380	I	380	I						
	60	175	---	237	---	237	---	237	---						
X3 (1) KCCAB-50	45					830	II	830	II						
	60					515	II	515	II						
Y1 (1) KCCAB-63	45									1,074	III	1,193	III	1,193	III
	60									531	II	655	II	655	II
Y2 (1) KCCAB-75	45									1,620	III	1,798	III	1,798	III
	60									801	II	987	II	987	II
Y3 ² (1) KCAB-88	45									1,632	III				
	60									783	II				
Z1 (2) KCCAB-38	45			495	I	1,160	III	1,160	III						
	60			350	I	696	II	696	II						
Z2 (4) KCCAB-38	45			495	I	1,226	III	2,319	IV						
	60			350	I	867	II	1,392	III						
Z3 (2) KCCAB-50	45									2,422	IV	2,375	IV	2,375	IV
	60									1,462	III	1,458	III	1,458	III
Z4 (4) KCCAB-50	45									2,599	IV	4,750	IV	4,750	IV
	60									1,838	III	2,916	IV	2,916	IV

¹ KNC Attachment Kit Coded X1 is not rated for seismic attachment to concrete for 2003 IBC or 2006 IBC.

² KNC Attachment Kit Coded Y3 is not rated for seismic attachment to concrete for 2003 IBC or 2006 IBC.

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Table A1.1-4; KSCU & KSCC Restraint Cable Kit Capacities for Concrete Attachment – Orientation 2
(All Listed Forces Are LRFD Values)

		Maximum Cable Angle (°)	KNC Restraint Kit Code															
			K2 KSCU-2		K3 KSCU-3		K4 KSCU-4		K5 KSCU-5		C1 KSCC-250		C2 KSCC-375		C3 KSCC-500			
			Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class		
KNC Attachment Kit Code	X1 ³ (1) KCAB-25	45	182	---	182	---												
		60	162	---	162	---												
	X2 (1) KCCAB-38	45	247	---	380	I	380	I	380	I								
		60	175	---	324	I	324	I	324	I								
	X3 (1) KCCAB-50	45					830	II	830	II								
		60					714	II	714	II								
	Y1 (1) KCCAB-63	45									1,074	III	1,193	III	1,193	III		
		60									1,352	III	1,229	III	1,229	III		
	Y2 (1) KCCAB-75	45									1,620	III	1,798	III	1,798	III		
		60									1,838	III	1,854	III	1,854	III		
	Y3 ⁴ (1) KCAB-88	45									1,632	III						
		60									1,838	III						
	Z1 (2) KCCAB-38	45			495	I	1,160	III	1,160	III								
		60			350	I	867	II	972	II								
	Z2 (4) KCCAB-38	45			495	I	1,226	III	2,319	IV								
		60			350	I	867	II	1,672	III								
	Z3 (2) KCCAB-50	45									2,422	IV	2,375	IV	2,375	IV		
		60									1,838	III	1,989	III	1,989	III		
	Z4 (4) KCCAB-50	45									2,599	IV	4,750	IV	4,750	IV		
		60									1,838	III	3,780	IV	3,977	IV		

³ KNC Attachment Kit Coded X1 is not rated for seismic attachment to concrete for 2003 IBC or 2006 IBC.

⁴ KNC Attachment Kit Coded Y3 is not rated for seismic attachment to concrete for 2003 IBC or 2006 IBC.

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Table A1.1-5; KSCU & KSCC Restraint Cable Kit Capacities for Attachment to Wood – Orientation 1
(All Listed Forces Are LRFD Values)

		Maximum Cable Angle (°)	KNC Restraint Kit Code																
			K2 KSCU-2		K3 KSCU-3		K4 KSCU-4		K5 KSCU-5		C1 KSCC-250		C2 KSCC-375		C3 KSCC-500				
			Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class			
KNC Attachment Kit Code	W1 (1) 1/4" Lag Screw	45	219	---	219	---													
		60	152	---	152	---													
	W2 (1) 3/8" Lag Screw	45	247	---	402	I	443	I	443	I									
		60	175	---	295	I	308	I	308	I									
	W3 (1) 1/2" Lag Screw	45					709	II	709	II									
		60					502	II	502	II									
	W4 (1) 5/8" Lag Screw	45											1,089	III	1,089	III			
		60											759	II	759	II			
	W5 (1) 3/4" Lag Screw	45									1,411	III	1,475	III	1,475	III			
		60									879	II	1,037	III	1,037	III			
	W6 (1) 7/8" Lag Screw	45									1,822	III							
		60									1,147	III							
	W7 (2) 3/8" Lag Screws	45			495	I	1,093	III	1,093	III									
		60			350	I	835	II	835	II									
	W8 (4) 3/8" Lag Screws	45			495	I	1,226	III	2,185	IV									
		60			350	I	867	II	1,670	III									
	W9 (2) 1/2" Lag Screws	45									1,673	III	1,663	III	1,663	III	1,663	III	
		60									1,308	III	1,306	III	1,306	III	1,306	III	
	W10 (4) 1/2" Lag Screws	45									2,599	IV	3,327	IV	3,327	IV	3,327	IV	
		60									1,838	III	2,612	IV	2,612	IV	2,612	IV	

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Table A1.1-6; KSCU & KSCC Restraint Cable Kit Capacities for Attachment to Wood – Orientation 2
(All Listed Forces Are LRFD Values)

		Maximum Cable Angle (°)	KNC Restraint Kit Code															
			K2 KSCU-2		K3 KSCU-3		K4 KSCU-4		K5 KSCU-5		C1 KSCC-250		C2 KSCC-375		C3 KSCC-500			
			Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class	Horizontal Seismic Rating (LRFD) (lbs)	Force Class		
KNC Attachment Kit Code	W1 (1) 1/4" Lag Screw	45	219	---	219	---												
		60	155	---	155	---												
	W2 (1) 3/8" Lag Screw	45	247	---	402	I	443	I	443	I								
		60	175	---	264	I	312	I	312	I								
	W3 (1) 1/2" Lag Screw	45					709	II	709	II								
		60					486	I	486	I								
	W4 (1) 5/8" Lag Screw	45											1,089	III	1,089	III		
		60											708	II	708	II		
	W5 (1) 3/4" Lag Screw	45									1,411	III	1,475	III	1,475	III		
		60									950	II	950	II	950	II		
	W6 (1) 7/8" Lag Screw	45									1,822	III						
		60									1,207	III						
	W7 (2) 3/8" Lag Screws	45			495	I	1,093	III	1,093	III								
		60			350	I	671	II	671	II								
	W8 (4) 3/8" Lag Screws	45			495	I	1,226	III	2,185	IV								
		60			350	I	867	II	1,343	III								
	W9 (2) 1/2" Lag Screws	45									1,673	III	1,663	III	1,663	III		
		60									1,016	III	1,016	III	1,016	III		
	W10 (4) 1/2" Lag Screws	45									2,599	IV	3,327	IV	3,327	IV		
		60									1,838	III	2,031	IV	2,031	IV		

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KSCU & KSCC NON-ISOLATED RESTRAINED WEIGHT CAPACITY

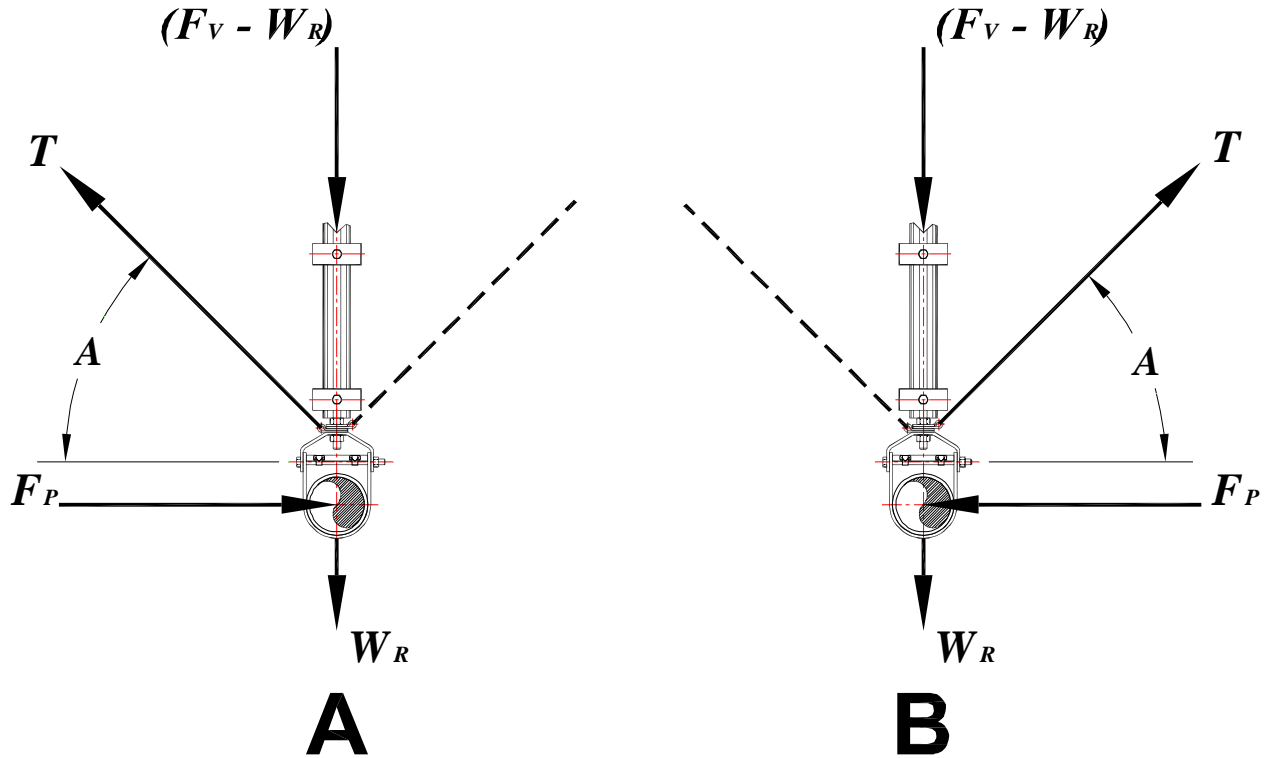


Figure A1.2-1; Forces Acting on a Cable Restrained Single Hanger Rod Supported Pipe or Duct

Introduction:

The purpose of this appendix is to define the capacities of the KSCU and KSCC Seismic Restraint Cable Kits in terms of the building acceleration which they will be able to resist. The capacities expressed in Gs will allow restraints and restraint spacings to be determined when the demand acceleration is known on a particular floor of a building. The basic equation for force and acceleration is given below.

$$F_P = M_R a_E$$

Equation A1.2-1

KSCU & KSCC NON-ISOLATED RESTRAINED WEIGHT CAPACITY

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Where:

F_p = the horizontal seismic force acting on the pipe or duct.

M_R = the mass of the pipe or duct that is being restrained.

a_E = the acceleration of the attachment point of the pipe or duct due to the earthquake acceleration.

The horizontal seismic force may be expressed in terms of the cable tension as follows.

$$F_p = T \cos(A) \quad \text{Equation A1.2-2}$$

Where:

A = the seismic restraint installation angle measured with respect to the horizontal.

T = the tension in the cable generated by the horizontal seismic force.

The mass of the pipe or duct will be;

$$M_R = \frac{W_R}{g} = \frac{w_R S_R}{g} \quad \text{Equation A1.2-3}$$

Where:

S_R = the maximum seismic restraint spacing.

W_R = the weight of the pipe or duct that is being restrained.

g = the acceleration due to gravity.

w_R = the distributed weight of the pipe or duct that is being restrained, see Appendix A2.0 and A3.0.

Then, Equation A1.2-1 may be rewritten as follows.

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$$TCos(A) = \left(\frac{w_R S_R}{g} \right) a_E$$

Equation A1.2-4

Let the cable tension be equal to the maximum allowable Seismic Cable Tension Rating (T_A) in (ASD) units, and solve for the acceleration.

$$a_E = \frac{g T_A Cos(A)}{w_R S_R}$$

Equation A1.2-5

And;

$$G = \frac{a_E}{g} = \frac{T_A Cos(A)}{w_R S_R} = \frac{T_A Cos(A)}{W_R} \text{ ASD}$$

Equation A1.2-6

$$G = \frac{a_E}{g} = \frac{1.4 T_A Cos(A)}{w_R S_R} = \frac{1.4 T_A Cos(A)}{W_R} \text{ LRFD}$$

Equation A1.2-7

If the desired G level is known from the code based analysis, then the allowable restrained weight may be computed.

$$W_R = \frac{T_A Cos(A)}{G} \text{ ASD}$$

Equation A1.2-8

$$W_R = \frac{1.4 T_A Cos(A)}{G} \text{ LRFD}$$

Equation A1.2-9

The designation codes for the cable kits and attachment kits provided by Kinetics Noise Control are given in Tables A1.2-1 through A1.2-3.

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Table A1.2-1; Seismic Restraint Cable Kit vs. Code Cross-Reference

KNC Restraint Kit Code	Restraint Kit Description
K2	KSCU-2 Cable Kit – 2 mm Cable & GRIPPLE HANGFAST No, 2 Connectors
K3	KSCU-3 Cable Kit – 3 mm Cable & GRIPPLE HANGFAST No, 3 Connectors
K4	KSCU-4 Cable Kit – 5 mm Cable & GRIPPLE HANGFAST No, 4 Connectors
K5	KSCU-5 Cable Kit – 6 mm Cable & GRIPPLE Lockable 6 mm Connectors
C1	KSCC-250 Cable Kit – 1/4" Cable & Saddle + U-bolt Connectors
C2	KSCC-375 Cable Kit – 3/8" Cable & Saddle + U-bolt Connectors
C3	KSCC-500 Cable Kit – 1/2" Cable & Saddle + U-bolt Connectors
F	Direct Mounted to Floor or Roof Using Anchor Bolts
W	Direct Mounted to Wall Using Anchor Bolts

Table A1.2-2; Structural Concrete/Steel Attachment Kit vs. Code Cross-Reference

KNC Attachment Kit Code	Attachment Kit Description per Restraint Cable Note: Through bolts & nuts of the same size may be used for each kit and code shown below.
X1	(1) 1/4" Concrete Anchor (with Grommet)
X2	(1) 3/8" Concrete Anchor
X3	(1) 1/2" Concrete Anchor
Y1	(1) 5/8" Concrete Anchor
Y2	(1) 3/4" Concrete Anchor
Y3	(1) 7/8" Concrete Anchor
Z1	(2) 3/8" Concrete Anchors with Oversized Base Plate
Z2	(4) 3/8" Concrete Anchors with Oversized Base Plate
Z3	(2) 1/2" Concrete Anchors with Oversized Base Plate
Z4	(4) 1/2" Concrete Anchors with Oversized Base Plate

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Table A1.2-3; Structural Wood/Steel Attachment Kit vs. Code Cross-Reference

KNC Attachment Kit Code	Attachment Kit Description per Restraint Cable Note: Through bolts & nuts of the same size may be used for each kit and code shown below.
W1	(1) 1/4" Lag Screw (with Grommet)
W2	(1) 3/8" Lag Screw
W3	(1) 1/2" Lag Screw
W4	(1) 5/8" Lag Screw
W5	(1) 3/4" Lag Screw
W6	(1) 7/8" Lag Screw
W7	(2) 3/8" Lag Screws with Oversized Base Plate
W8	(4) 3/8" Lag Screws with Oversized Base Plate
W9	(2) 1/2" Lag Screws with Oversized Base Plate
W10	(4) 1/2" Lag Screws with Oversized Base Plate

Table A1.2-4; **K2** Restraint Seismic Cable Kit Restrained Weight Capacity (lbs – LRFD)
Restraint Installation Angle = 45°

Horizontal Acceleration Gs	Attachment Kit Designation					
	X2 (Steel)		X2 (Concrete)		W2 (Wood)	
	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2
0.25	988	988	988	988	988	988
0.50	494	494	494	494	494	494
0.75	329	329	329	329	329	329
1.00	247	247	247	247	247	247
1.25	198	198	198	198	198	198
1.50	165	165	165	165	165	165
2.00	124	124	124	124	124	124
3.00	82	82	82	82	82	82

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Table A1.2-5; **K3** Restraint Seismic Cable Kit Restrained Weight Capacity (lbs – LRFD)
Restraint Installation Angle = 45°

Horizontal Acceleration Gs	Attachment Kit Designation							
	X2 (Steel)		X2 (Concrete)		W2 (Wood)		W7 (Wood)	
	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2
0.25	1980	1980	1520	1520	1608	1608	1980	1980
0.50	990	990	760	760	804	804	990	990
0.75	660	660	507	507	536	536	660	660
1.00	495	495	380	380	402	402	495	495
1.25	396	396	304	304	322	322	396	396
1.50	330	330	253	253	268	268	330	330
2.00	248	248	190	190	201	201	248	248
3.00	165	165	127	127	134	134	165	165

Table A1.2-6; **K4** Restraint Seismic Cable Kit Restrained Weight Capacity (lbs – LRFD)
Restraint Installation Angle = 45°

Horizontal Acceleration Gs	Attachment Kit Designation											
	X3 (Steel)		X3 (Concrete)		Z1 (Concrete)		W3 (Wood)		W7 (Wood)		W8 (Wood)	
	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2
0.25	4904	4904	3320	3320	4640	4640	2836	2836	4372	4372	4904	4904
0.50	2452	2452	1660	1660	2320	2320	1418	1418	2186	2186	2452	2452
0.75	1635	1635	1107	1107	1547	1547	945	945	1457	1457	1635	1635
1.00	1226	1226	830	830	1160	1160	709	709	1093	1093	1226	1226
1.25	981	981	664	664	928	928	567	567	874	874	981	981
1.50	817	817	553	553	773	773	473	473	729	729	817	817
2.00	613	613	415	415	580	580	355	355	547	547	613	613
3.00	409	409	277	277	387	387	236	236	364	364	409	409

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Table A1.2-7; **K5** Restraint Seismic Cable Kit Restrained Weight Capacity (lbs – LRFD)
Restraint Installation Angle = 45°

Horizontal Acceleration Gs	Attachment Kit Designation													
	X3 (Steel)		X3 (Concrete)		Z1 (Concrete)		Z2 (Concrete)		W3 (Wood)		W7 (Wood)		W8 (Wood)	
	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2
0.25	10868	10868	3320	3320	4640	4640	9276	9276	2836	2836	4372	4372	8740	8740
0.50	5434	5434	1660	1660	2320	2320	4638	4638	1418	1418	2186	2186	4370	4370
0.75	3623	3623	1107	1107	1547	1547	3092	3092	945	945	1457	1457	2913	2913
1.00	2717	2717	830	830	1160	1160	2319	2319	709	709	1093	1093	2185	2185
1.25	2174	2174	664	664	928	928	1855	1855	567	567	874	874	1748	1748
1.50	1811	1811	553	553	773	773	1546	1546	473	473	729	729	1457	1457
2.00	1359	1359	415	415	580	580	1160	1160	355	355	547	547	1093	1093
3.00	906	906	277	277	387	387	773	773	236	236	364	364	728	728

Table A1.2-8; **C1** Restraint Seismic Cable Kit Restrained Weight Capacity (lbs – LRFD)
Restraint Installation Angle = 45°

Horizontal Acceleration Gs	Attachment Kit Designation											
	Y2 (Steel)		Y2 (Concrete)		Z3 (Concrete)		W6 (Wood)		W9 (Wood)		W10 (Wood)	
	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2
0.25	10396	10396	6480	6480	9688	9688	7288	7288	6692	6692	10396	10396
0.50	5198	5198	3240	3240	4844	4844	3644	3644	3346	3346	5198	5198
0.75	3465	3465	2160	2160	3229	3229	2429	2429	2231	2231	3465	3465
1.00	2599	2599	1620	1620	2422	2422	1822	1822	1673	1673	2599	2599
1.25	2079	2079	1296	1296	1938	1938	1458	1458	1338	1338	2079	2079
1.50	1733	1733	1080	1080	1615	1615	1215	1215	1115	1115	1733	1733
2.00	1300	1300	810	810	1211	1211	911	911	837	837	1300	1300
3.00	866	866	540	540	807	807	607	607	558	558	866	866

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Table A1.2-9; **C2** Restraint Seismic Cable Kit Restrained Weight Capacity (lbs – LRFD)
Restraint Installation Angle = 45°

Horizontal Acceleration Gs	Attachment Kit Designation													
	Y2 (Steel)		Y2 (Concrete)		Z3 (Concrete)		Z4 (Concrete)		W5 (Wood)		W9 (Wood)		W10 (Wood)	
	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2
0.25	21384	21384	7192	7192	9500	9500	19000	19000	5900	5900	6652	6652	13308	13308
0.50	10692	10692	3596	3596	4750	4750	9500	9500	2950	2950	3326	3326	6654	6654
0.75	7128	7128	2397	2397	3167	3167	6333	6333	1967	1967	2217	2217	4436	4436
1.00	5346	5346	1798	1798	2375	2375	4750	4750	1475	1475	1663	1663	3327	3327
1.25	4277	4277	1438	1438	1900	1900	3800	3800	1180	1180	1330	1330	2662	2662
1.50	3564	3564	1199	1199	1583	1583	3167	3167	983	983	1109	1109	2218	2218
2.00	2673	2673	899	899	1188	1188	2375	2375	738	738	832	832	1664	1664
3.00	1782	1782	599	599	792	792	1583	1583	492	492	554	554	1109	1109

Table A1.2-10; **C3** Restraint Seismic Cable Kit Restrained Weight Capacity (lbs – LRFD)
Restraint Installation Angle = 45°

Horizontal Acceleration Gs	Attachment Kit Designation													
	Y2 (Steel)		Y2 (Concrete)		Z3 (Concrete)		Z4 (Concrete)		W5 (Wood)		W9 (Wood)		W10 (Wood)	
	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2
0.25	31984	31984	7192	7192	9500	9500	19000	19000	5900	5900	6652	6652	13308	13308
0.50	15992	15992	3596	3596	4750	4750	9500	9500	2950	2950	3326	3326	6654	6654
0.75	10661	10661	2397	2397	3167	3167	6333	6333	1967	1967	2217	2217	4436	4436
1.00	7996	7996	1798	1798	2375	2375	4750	4750	1475	1475	1663	1663	3327	3327
1.25	6397	6397	1438	1438	1900	1900	3800	3800	1180	1180	1330	1330	2662	2662
1.50	5331	5331	1199	1199	1583	1583	3167	3167	983	983	1109	1109	2218	2218
2.00	3998	3998	899	899	1188	1188	2375	2375	738	738	832	832	1664	1664
3.00	2665	2665	599	599	792	792	1583	1583	492	492	554	554	1109	1109

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Table A1.2-11; **K2** Restraint Seismic Cable Kit Restrained Weight Capacity (lbs – LRFD)
Restraint Installation Angle = 60°

Horizontal Acceleration Gs	Attachment Kit Designation					
	X2 (Steel)		X2 (Concrete)		W2 (Wood)	
	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2
0.25	700	700	700	700	700	700
0.50	350	350	350	350	350	350
0.75	233	233	233	233	233	233
1.00	175	175	175	175	175	175
1.25	140	140	140	140	140	140
1.50	117	117	117	117	117	117
2.00	88	88	88	88	88	88
3.00	58	58	58	58	58	58

Table A1.2-12; **K3** Restraint Seismic Cable Kit Restrained Weight Capacity (lbs – LRFD)
Restraint Installation Angle = 60°

Horizontal Acceleration Gs	Attachment Kit Designation									
	X2 (Steel)		X2 (Concrete)		Z1 (Concrete)		W2 (Wood)		W7 (Wood)	
	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2
0.25	1400	1400	948	1296	1400	1400	1180	1056	1400	1400
0.50	700	700	474	648	700	700	590	528	700	700
0.75	467	467	316	432	467	467	393	352	467	467
1.00	350	350	237	324	350	350	295	264	350	350
1.25	280	280	190	259	280	280	236	211	280	280
1.50	233	233	158	216	233	233	197	176	233	233
2.00	175	175	119	162	175	175	148	132	175	175
3.00	117	117	79	108	117	117	98	88	117	117

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Table A1.2-13; **K4** Restraint Seismic Cable Kit Restrained Weight Capacity (lbs – LRFD)
Restraint Installation Angle = 60°

Horizontal Acceleration Gs	Attachment Kit Designation											
	X3 (Steel)		X3 (Concrete)		Z1 (Concrete)		W3 (Wood)		W7 (Wood)		W8 (Wood)	
	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2
0.25	3468	3468	2060	2856	2784	3468	2008	1944	3340	2684	3468	3468
0.50	1734	1734	1030	1428	1392	1734	1004	972	1670	1342	1734	1734
0.75	1156	1156	687	952	928	1156	669	648	1113	895	1156	1156
1.00	867	867	515	714	696	867	502	486	835	671	867	867
1.25	694	694	412	571	557	694	402	389	668	537	694	694
1.50	578	578	343	476	464	578	335	324	557	447	578	578
2.00	434	434	258	357	348	434	251	243	418	336	434	434
3.00	289	289	172	238	232	289	167	162	278	224	289	289

Table A1.2-14; **K5** Restraint Seismic Cable Kit Restrained Weight Capacity (lbs – LRFD)
Restraint Installation Angle = 60°

Horizontal Acceleration Gs	Attachment Kit Designation													
	X3 (Steel)		X3 (Concrete)		Z1 (Concrete)		Z2 (Concrete)		W3 (Wood)		W7 (Wood)		W8 (Wood)	
	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2
0.25	6688	6688	2060	2856	2784	3888	5568	6688	2008	2008	3340	2684	6680	5372
0.50	3344	3344	1030	1428	1392	1944	2784	3344	1004	1004	1670	1342	3340	2686
0.75	2229	2229	687	952	928	1296	1856	2229	669	669	1113	895	2227	1791
1.00	1672	1672	515	714	696	972	1392	1672	502	502	835	671	1670	1343
1.25	1338	1338	412	571	557	778	1114	1338	402	402	668	537	1336	1074
1.50	1115	1115	343	476	464	648	928	1115	335	335	557	447	1113	895
2.00	836	836	258	357	348	486	696	836	251	251	418	336	835	672
3.00	557	557	172	238	232	324	464	557	167	167	278	224	557	448

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Table A1.2-15; **C1** Restraint Seismic Cable Kit Restrained Weight Capacity (lbs – LRFD)
Restraint Installation Angle = 60°

Horizontal Acceleration Gs	Attachment Kit Designation											
	Y2 (Steel)		Y2 (Concrete)		Z3 (Concrete)		W6 (Wood)		W9 (Wood)		W10 (Wood)	
	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2
0.25	7352	7352	3204	7352	5848	7352	4588	4828	5232	4064	7352	7352
0.50	3676	3676	1602	3676	2924	3676	2294	2414	2616	2032	3676	3676
0.75	2451	2451	1068	2451	1949	2451	1529	1609	1744	1355	2451	2451
1.00	1838	1838	801	1838	1462	1838	1147	1207	1308	1016	1838	1838
1.25	1470	1470	641	1470	1170	1470	918	966	1046	813	1470	1470
1.50	1225	1225	534	1225	975	1225	765	805	872	677	1225	1225
2.00	919	919	401	919	731	919	574	604	654	508	919	919
3.00	613	613	267	613	487	613	382	402	436	339	613	613

Table A1.2-16; **C2** Restraint Seismic Cable Kit Restrained Weight Capacity (lbs – LRFD)
Restraint Installation Angle = 60°

Horizontal Acceleration Gs	Attachment Kit Designation													
	Y2 (Steel)		Y2 (Concrete)		Z3 (Concrete)		Z4 (Concrete)		W5 (Wood)		W9 (Wood)		W10 (Wood)	
	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2
0.25	15120	15120	3948	7416	5832	7956	11664	15120	5228	3800	5224	4064	10448	8124
0.50	7560	7560	1974	3708	2916	3978	5832	7560	2614	1900	2612	2032	5224	4062
0.75	5040	5040	1316	2472	1944	2652	3888	5040	1743	1267	1741	1355	3483	2708
1.00	3780	3780	987	1854	1458	1989	2916	3780	1307	950	1306	1016	2612	2031
1.25	3024	3024	790	1483	1166	1591	2333	3024	1046	760	1045	813	2090	1625
1.50	2520	2520	658	1236	972	1326	1944	2520	871	633	871	677	1741	1354
2.00	1890	1890	494	927	729	995	1458	1890	654	475	653	508	1306	1016
3.00	1260	1260	329	618	486	663	972	1260	436	317	435	339	871	677

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Table A1.2-17; **C3** Restraint Seismic Cable Kit Restrained Weight Capacity (lbs – LRFD)
Restraint Installation Angle = 60°

Horizontal Acceleration Gs	Attachment Kit Designation													
	Y2 (Steel)		Y2 (Concrete)		Z3 (Concrete)		Z4 (Concrete)		W5 (Wood)		W9 (Wood)		W10 (Wood)	
	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2	Orientation 1	Orientation 2
0.25	17252	17252	3948	7416	5832	7956	11664	15908	4148	3800	5224	4064	10448	8124
0.50	8626	8626	1974	3708	2916	3978	5832	7954	2074	1900	2612	2032	5224	4062
0.75	5751	5751	1316	2472	1944	2652	3888	5303	1383	1267	1741	1355	3483	2708
1.00	4313	4313	987	1854	1458	1989	2916	3977	1037	950	1306	1016	2612	2031
1.25	3450	3450	790	1483	1166	1591	2333	3182	830	760	1045	813	2090	1625
1.50	2875	2875	658	1236	972	1326	1944	2651	691	633	871	677	1741	1354
2.00	2157	2157	494	927	729	995	1458	1989	519	475	653	508	1306	1016
3.00	1438	1438	329	618	486	663	972	1326	346	317	435	339	871	677

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STANDARD STEEL PIPE DATA

Table A2.1-1; Non-Insulated Standard Steel Pipe – Water

Nominal Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight (lb/ft)	Water Weight (lb/ft)	Pipe + Water Weight (lb/ft)
3/4	1.050	0.824	1.13	0.23	1.36
1	1.315	1.049	1.68	0.37	2.05
1 1/4	1.660	1.380	2.27	0.65	2.92
1 1/2	1.900	1.610	2.71	0.88	3.60
2	2.375	2.067	3.65	1.45	5.10
2 1/2	2.875	2.469	5.79	2.07	7.86
3	3.500	3.068	7.57	3.20	10.77
3 1/2	4.000	3.548	9.10	4.28	13.38
4	4.500	4.026	10.78	5.52	16.30
5	5.563	5.047	14.60	8.67	23.27
6	6.625	6.065	18.95	12.52	31.47
8	8.625	7.981	28.52	21.68	50.20
10	10.750	10.020	40.44	34.17	74.61
11	11.750	11.000	45.51	41.18	86.69
12	12.750	12.000	49.51	49.01	98.52
14	14.000	13.250	54.51	59.75	114.26
16	16.000	15.250	62.51	79.15	141.66
18	18.000	17.250	70.51	101.27	171.79
20	20.000	19.250	78.52	126.12	204.63
22	22.000	21.250	86.52	153.68	240.20
24	24.000	23.250	94.52	183.97	278.49
30	30.000	29.250	118.52	291.18	409.71
36	36.000	35.250	142.53	422.89	565.42
42	42.000	41.250	166.53	579.11	745.64
48	48.000	47.250	190.54	759.83	950.37

STANDARD STEEL PIPE DATA

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SECTION – A2.1

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KINETICS™ Pipe & Duct Seismic Application Manual

Table A2.1-2; Insulated Standard Steel Pipe – Water (85% Magnesia Insulation)

Nominal Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight (lb/ft)	Water Weight (lb/ft)	Insulation Thickness (in)	Insulation Weight (lb/ft)	Pipe + Water + Insulation Weight (lb/ft)
3/4	1.050	0.824	1.13	0.23	1.00	0.76	2.12
1	1.315	1.049	1.68	0.37	1.00	0.86	2.91
1 1/4	1.660	1.380	2.27	0.65	1.00	0.99	3.91
1 1/2	1.900	1.610	2.71	0.88	1.00	1.08	4.67
2	2.375	2.067	3.65	1.45	1.00	1.25	6.35
2 1/2	2.875	2.469	5.79	2.07	1.00	1.44	9.30
3	3.500	3.068	7.57	3.20	1.00	1.67	12.44
3 1/2	4.000	3.548	9.10	4.28	1.00	1.85	15.24
4	4.500	4.026	10.78	5.52	1.00	2.04	18.34
5	5.563	5.047	14.60	8.67	1.50	3.93	27.20
6	6.625	6.065	18.95	12.52	1.50	4.52	35.99
8	8.625	7.981	28.52	21.68	1.50	5.63	55.84
10	10.750	10.020	40.44	34.17	1.50	6.81	81.43
11	11.750	11.000	45.51	41.18	1.50	7.37	94.06
12	12.750	12.000	49.51	49.01	1.50	7.93	106.45
14	14.000	13.250	54.51	59.75	1.50	8.62	122.88
16	16.000	15.250	62.51	79.15	1.50	9.74	151.40
18	18.000	17.250	70.51	101.27	1.50	10.85	182.63
20	20.000	19.250	78.52	126.12	1.50	11.96	216.59
22	22.000	21.250	86.52	153.68	1.50	13.07	253.28
24	24.000	23.250	94.52	183.97	1.50	14.19	292.68
30	30.000	29.250	118.52	291.18	1.50	17.52	427.23
36	36.000	35.250	142.53	422.89	1.50	20.86	586.28
42	42.000	41.250	166.53	579.11	1.50	24.20	769.84
48	48.000	47.250	190.54	759.83	1.50	27.54	977.91

STANDARD STEEL PIPE DATA

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KINETICS™ Pipe & Duct Seismic Application Manual

Table A2.1-3; Insulated Standard Steel Pipe – Steam (85% Magnesia Insulation)

Nominal Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight (lb/ft)	Steam Weight (lb/ft)	Insulation Thickness (in)	Insulation Weight (lb/ft)	Pipe + Steam + Insulation Weight (lb/ft)
3/4	1.050	0.824	1.13	0.00014	1.50	1.42	2.55
1	1.315	1.049	1.68	0.00022	1.50	1.57	3.24
1 1/4	1.660	1.380	2.27	0.00039	1.50	1.76	4.03
1 1/2	1.900	1.610	2.71	0.00053	1.50	1.89	4.61
2	2.375	2.067	3.65	0.00087	1.50	2.16	5.81
2 1/2	2.875	2.469	5.79	0.00124	1.50	2.43	8.22
3	3.500	3.068	7.57	0.00191	1.50	2.78	10.35
3 1/2	4.000	3.548	9.10	0.00255	1.50	3.06	12.16
4	4.500	4.026	10.78	0.00329	1.50	3.34	14.12
5	5.563	5.047	14.60	0.00517	2.00	5.61	20.22
6	6.625	6.065	18.95	0.00746	2.00	6.40	25.36
8	8.625	7.981	28.52	0.01292	2.00	7.88	36.42
10	10.750	10.020	40.44	0.02037	2.00	9.46	49.92
11	11.750	11.000	45.51	0.02455	2.00	10.20	55.73
12	12.750	12.000	49.51	0.02922	2.00	10.94	60.48
14	14.000	13.250	54.51	0.03562	2.00	11.87	66.42
16	16.000	15.250	62.51	0.04719	2.00	13.35	75.91
18	18.000	17.250	70.51	0.06037	2.00	14.84	85.41
20	20.000	19.250	78.52	0.07519	2.00	16.32	94.91
22	22.000	21.250	86.52	0.09162	2.00	17.80	104.41
24	24.000	23.250	94.52	0.10968	2.00	19.29	113.91
30	30.000	29.250	118.52	0.17359	2.00	23.74	142.43
36	36.000	35.250	142.53	0.25211	2.00	28.19	170.97
42	42.000	41.250	166.53	0.34524	2.00	32.64	199.52
48	48.000	47.250	190.54	0.45297	2.00	37.09	228.08

STANDARD STEEL PIPE DATA

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SECTION – A2.1

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FIRE PROTECTION PIPE DATA

Table A2.2-1; Steel Pipe – Threaded or Cut Grooves
 {Includes 1.15 Factor Required by NFPA 13 Section 9.3.5.6.1}

Nominal Pipe Size (in)	Pipe Schedule	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight (lb/ft)	Water Weight (lb/ft)	Pipe + Water Weight (lb/ft)
1	40	1.315	1.049	1.93	0.43	2.36
1 1/4	40	1.660	1.380	2.61	0.75	3.36
1 1/2	40	1.900	1.610	3.12	1.01	4.14
2	40	2.375	2.067	4.20	1.67	5.87
2 1/2	40	2.875	2.469	6.65	2.39	9.04
3	40	3.500	3.068	8.70	3.68	12.39
3 1/2	40	4.000	3.548	10.46	4.93	15.39
4	40	4.500	4.026	12.40	6.34	18.74
5	40	5.563	5.047	16.79	9.97	26.76
6	40	6.625	6.065	21.80	14.40	36.19
8	30	8.625	8.071	28.37	25.50	53.87
10	30	10.750	10.136	39.33	40.21	79.55
12	Standard	12.750	12.000	56.94	56.36	113.30

FIRE PROTECTION PIPE DATA

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Table A2.2-2; Steel Pipe – Welded or Roll-Grooved
 {Includes 1.15 Factor Required by NFPA 13 Section 9.3.5.6.1}

Nominal Pipe Size (in)	Pipe Schedule	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight (lb/ft)	Water Weight (lb/ft)	Pipe + Water Weight (lb/ft)
1	10	1.315	1.097	1.61	0.47	2.08
1 1/4	10	1.660	1.442	2.07	0.81	2.89
1 1/2	10	1.900	1.682	2.40	1.11	3.50
2	10	2.375	2.157	3.03	1.82	4.85
2 1/2	10	2.875	2.635	4.06	2.72	6.77
3	10	3.500	3.260	4.98	4.16	9.14
3 1/2	10	4.000	3.760	5.71	5.53	11.25
4	10	4.500	4.260	6.45	7.10	13.55
5	10	5.563	5.295	8.93	10.97	19.90
6	10	6.625	6.357	10.67	15.82	26.49
8	-----	8.625	8.249	19.46	26.63	46.09
10	-----	10.750	10.374	24.36	42.12	66.48
12	30	12.750	12.090	50.29	57.21	107.50

FIRE PROTECTION PIPE DATA

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Table A2.2-3; TYPE K Copper Tubing – ASTM B88
 {Includes 1.15 Factor Required by NFPA 13 Section 9.3.5.6.1}

Tube Size (in)	Tube O. D. (in)	Wall Thickness (in)	Tube Weight (lb/ft)	Water Weight (lb/ft)	Tube + Water Weight (lb/ft)
1	1.125	0.065	0.96	0.39	1.35
1 1/4	1.375	0.065	1.19	0.61	1.80
1 1/2	1.625	0.072	1.56	0.86	2.42
2	2.125	0.083	2.37	1.50	3.87
2 1/2	2.625	0.095	3.36	2.32	5.68
3	3.125	0.109	4.59	3.31	7.90
3 1/2	3.625	0.120	5.87	4.48	10.36
4	4.125	0.134	7.47	5.82	13.29
5	5.125	0.160	11.09	9.04	20.13
6	6.125	0.192	15.90	12.90	28.80

FIRE PROTECTION PIPE DATA

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Table A2.2-4; TYPE L Copper Tubing – ASTM B88
 {Includes 1.15 Factor Required by NFPA 13 Section 9.3.5.6.1}

Tube Size (in)	Tube O. D. (in)	Wall Thickness (in)	Tube Weight (lb/ft)	Water Weight (lb/ft)	Tube + Water Weight (lb/ft)
1	1.125	0.050	0.75	0.41	1.16
1 1/4	1.375	0.055	1.01	0.63	1.64
1 1/2	1.625	0.060	1.31	0.89	2.20
2	2.125	0.070	2.01	1.54	3.55
2 1/2	2.625	0.080	2.84	2.38	5.22
3	3.125	0.090	3.81	3.39	7.21
3 1/2	3.625	0.100	4.92	4.59	9.51
4	4.125	0.114	6.38	5.94	12.33
5	5.125	0.125	8.72	9.30	18.03
6	6.125	0.140	11.70	13.37	25.07

FIRE PROTECTION PIPE DATA

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Table A2.2-5; TYPE M Copper Tubing – ASTM B88
 {Includes 1.15 Factor Required by NFPA 13 Section 9.3.5.6.1}

Tube Size (in)	Tube O. D. (in)	Wall Thickness (in)	Tube Weight (lb/ft)	Water Weight (lb/ft)	Tube + Water Weight (lb/ft)
1	1.125	0.035	0.53	0.44	0.97
1 1/4	1.375	0.042	0.78	0.65	1.43
1 1/2	1.625	0.049	1.08	0.91	1.99
2	2.125	0.058	1.67	1.58	3.25
2 1/2	2.625	0.065	2.32	2.44	4.76
3	3.125	0.072	3.07	3.48	6.55
3 1/2	3.625	0.083	4.10	4.68	8.79
4	4.125	0.095	5.34	6.06	11.40
5	5.125	0.109	7.63	9.42	17.06
6	6.125	0.122	10.22	13.54	23.76

FIRE PROTECTION PIPE DATA

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**Table A2.2-6; BlazeMaster® CPVC Sprinkler Pipe
Manufactured by HARVEL®
{Includes 1.15 Factor Required by NFPA 13 Section 9.3.5.6.1}**

Nominal Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight (lb/ft)	Water Weight (lb/ft)	Pipe + Water Weight (lb/ft)
3/4	1.125	0.874	0.30	0.30	0.60
1	1.375	1.101	0.40	0.47	0.88
1 1/4	1.625	1.394	0.42	0.76	1.18
1 1/2	2.125	1.598	1.17	1.00	2.17
2	2.625	2.003	1.71	1.57	3.28
2 1/2	3.125	2.423	2.32	2.30	4.62
3	6.125	2.950	17.15	3.41	20.56

FIRE PROTECTION PIPE DATA

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CAST IRON SOIL PIPE DATA

Table A2.3-1; Single Hub Service (SV) Weight Cast Iron Soil Pipe - 10' Length

Size (in)	Weight per Piece (lbs)	Barrel I. D. (in)	Average Pipe Weight (lb/ft)	Water Weight Full (lb/ft)	Pipe + Half Water Weight (lb/ft)	Pipe + Water Weight (lb/ft)
2	41	1.96	4.1	1.3	4.8	5.4
3	60	2.96	6.0	3.0	7.5	9.0
4	79	3.94	7.9	5.3	10.5	13.2
5	100	4.94	10.0	8.3	14.2	18.3
6	124	5.94	12.4	12.0	18.4	24.4
8	181	7.94	18.1	21.5	28.8	39.6
10	260	9.94	26.0	33.6	42.8	59.6
12	346	11.94	34.6	48.5	58.9	83.1
15	525	15.16	52.5	78.2	91.6	130.7

Table A2.3-2; Single Hub Extra Heavy (XH) Cast Iron Soil Pipe - 10' Length

Size (in)	Weight per Piece (lbs)	Barrel I. D. (in)	Average Pipe Weight (lb/ft)	Water Weight (lb/ft)	Pipe + Half Water Weight (lb/ft)	Pipe + Water Weight (lb/ft)
2	45	2.00	4.5	1.4	5.2	5.9
3	84	3.00	8.4	3.1	9.9	11.5
4	105	4.00	10.5	5.4	13.2	15.9
5	134	5.00	13.4	8.5	17.7	21.9
6	157	6.00	15.7	12.3	21.8	28.0
8	246	8.00	24.6	21.8	35.5	46.4
10	375	10.00	37.5	34.0	54.5	71.5
12	471	12.00	47.1	49.0	71.6	96.1
15	676	15.00	67.6	76.6	105.9	144.2

CAST IRON SOIL PIPE DATA

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SECTION – A2.3

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Table A2.3-3; Hubless Cast Iron Soil Pipe - 10' Length

Size (in)	Weight per Piece (lbs)	Barrel I. D. (in)	Average Pipe Weight (lb/ft)	Water Weight (lb/ft)	Pipe + Half Water Weight (lb/ft)	Pipe + Water Weight (lb/ft)
1 1/2	29	1.50	2.9	0.8	3.3	3.7
2	38	1.96	3.8	1.3	4.5	5.1
3	54	2.96	5.4	3.0	6.9	8.4
4	71	3.94	7.1	5.3	9.7	12.4
5	98	4.94	9.8	8.3	14.0	18.1
6	118	5.94	11.8	12.0	17.8	23.8
8	165	7.94	16.5	21.5	27.2	38.0
10	255	10.00	25.5	34.0	42.5	59.5
12	318	11.94	31.8	48.5	56.1	80.3
15	493	15.11	49.3	77.7	88.2	127.0

CAST IRON SOIL PIPE DATA

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SECTION – A2.3

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PVC & CPVC PIPE DATA

Table A2.4-1; PVC "Solid Wall" Schedule 40 Pipe

Nominal Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight (lb/ft)	Pipe + Half Water Weight (lb/ft)	Pipe + Water Weight (lb/ft)	Insulation Thickness (in)	Pipe + Water + Insulation Weight (lb/ft)
3/4	1.050	0.824	0.20	0.32	0.43	1.0	1.19
1	1.315	1.049	0.30	0.49	0.67	1.0	1.53
1 1/4	1.660	1.380	0.41	0.73	1.05	1.0	2.04
1 1/2	1.900	1.610	0.49	0.93	1.37	1.0	2.44
2	2.375	2.067	0.65	1.38	2.11	1.0	3.36
2 1/2	2.875	2.469	1.03	2.07	3.11	1.0	4.55
3	3.500	3.068	1.35	2.95	4.56	1.0	6.23
3 1/2	4.000	3.548	1.63	3.77	5.91	1.0	7.77
4	4.500	4.026	1.93	4.68	7.44	1.0	9.48
5	5.563	5.047	2.61	6.94	11.28	1.5	15.21
6	6.625	6.065	3.39	9.65	15.91	1.5	20.43
8	8.625	7.981	5.10	15.94	26.78	1.5	32.41
10	10.750	10.020	7.23	24.31	41.40	1.5	48.21
12	12.750	11.938	9.56	33.81	58.06	1.5	65.99
14	14.000	13.126	11.30	40.62	69.94	1.5	78.56
16	16.000	15.000	14.78	53.07	91.35	1.5	101.09
18	18.000	16.876	18.69	67.15	115.61	1.5	126.46
20	20.000	18.814	21.94	82.18	142.41	1.5	154.37
24	24.000	22.626	30.54	117.65	204.77	1.5	218.96

PVC & CPVC PIPE DATA

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SECTION – A2.4

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Table A2.4-2; PVC "Solid Wall" Schedule 80 Pipe

Nominal Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight (lb/ft)	Pipe + Half Water Weight (lb/ft)	Pipe + Water Weight (lb/ft)	Insulation Thickness (in)	Pipe + Water + Insulation Weight (lb/ft)
3/4	1.050	0.742	0.26	0.36	0.45	1.0	1.21
1	1.315	0.957	0.39	0.54	0.70	1.0	1.56
1 1/4	1.660	1.278	0.53	0.81	1.09	1.0	2.08
1 1/2	1.900	1.500	0.65	1.03	1.41	1.0	2.49
2	2.375	1.939	0.90	1.54	2.18	1.0	3.43
2 1/2	2.875	2.323	1.37	2.29	3.20	1.0	4.64
3	3.500	2.900	1.83	3.26	4.69	1.0	6.36
3 1/2	4.000	3.364	2.23	4.16	6.08	1.0	7.94
4	4.500	3.826	2.68	5.17	7.66	1.0	9.70
5	5.563	4.813	3.71	7.65	11.59	1.5	15.52
6	6.625	5.761	5.10	10.75	16.40	1.5	20.92
8	8.625	7.625	7.75	17.64	27.53	1.5	33.17
10	10.750	9.564	11.48	27.05	42.62	1.5	49.43
12	12.750	11.376	15.80	37.82	59.85	1.5	67.77
14	14.000	12.500	18.95	45.54	72.13	1.5	80.75
16	16.000	14.314	24.36	59.23	94.10	1.5	103.83
18	18.000	16.126	30.49	74.74	118.99	1.5	129.84
20	20.000	17.974	36.67	91.65	146.63	1.5	158.59
24	24.000	21.564	52.91	132.04	211.17	1.5	225.36

PVC & CPVC PIPE DATA

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SECTION – A2.4

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Table A2.4-3; CPVC "Solid Wall" Schedule 40 Pipe

Nominal Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight (lb/ft)	Pipe + Half Water Weight (lb/ft)	Pipe + Water Weight (lb/ft)	Insulation Thickness (in)	Pipe + Water + Insulation Weight (lb/ft)
3/4	1.050	0.824	0.22	0.33	0.45	1.0	1.21
1	1.315	1.049	0.33	0.51	0.70	1.0	1.56
1 1/4	1.660	1.380	0.44	0.76	1.09	1.0	2.08
1 1/2	1.900	1.610	0.53	0.97	1.41	1.0	2.48
2	2.375	2.067	0.71	1.44	2.16	1.0	3.41
2 1/2	2.875	2.469	1.12	2.16	3.20	1.0	4.63
3	3.500	3.068	1.47	3.07	4.67	1.0	6.34
3 1/2	4.000	3.548	1.77	3.91	6.05	1.0	7.90
4	4.500	4.026	2.09	4.85	7.61	1.0	9.65
5	5.563	5.047	2.83	7.17	11.50	1.5	15.43
6	6.625	6.065	3.68	9.94	16.20	1.5	20.72
8	8.625	7.981	5.53	16.37	27.21	1.5	32.85
10	10.750	10.020	7.85	24.93	42.02	1.5	48.83
12	12.750	11.938	10.38	34.63	58.88	1.5	66.81
14	14.000	13.126	12.27	41.59	70.91	1.5	79.53
16	16.000	15.000	16.04	54.33	92.62	1.5	102.36
18	18.000	16.876	20.29	68.75	117.22	1.5	128.06
20	20.000	18.814	23.82	84.06	144.29	1.5	156.25
24	24.000	22.626	33.16	120.27	207.39	1.5	221.57

PVC & CPVC PIPE DATA

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Table A2.4-4; CPVC "Solid Wall" Schedule 80 Pipe

Nominal Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight (lb/ft)	Pipe + Half Water Weight (lb/ft)	Pipe + Water Weight (lb/ft)	Insulation Thickness (in)	Pipe + Water + Insulation Weight (lb/ft)
3/4	1.050	0.742	0.29	0.38	0.47	1.0	1.23
1	1.315	0.957	0.42	0.58	0.73	1.0	1.59
1 1/4	1.660	1.278	0.58	0.86	1.14	1.0	2.12
1 1/2	1.900	1.500	0.70	1.09	1.47	1.0	2.55
2	2.375	1.939	0.97	1.61	2.25	1.0	3.50
2 1/2	2.875	2.323	1.48	2.40	3.32	1.0	4.76
3	3.500	2.900	1.99	3.42	4.85	1.0	6.52
3 1/2	4.000	3.364	2.42	4.35	6.28	1.0	8.13
4	4.500	3.826	2.90	5.40	7.89	1.0	9.93
5	5.563	4.813	4.03	7.97	11.91	1.5	15.84
6	6.625	5.761	5.54	11.19	16.83	1.5	21.35
8	8.625	7.625	8.41	18.30	28.20	1.5	33.83
10	10.750	9.564	12.47	28.03	43.60	1.5	50.41
12	12.750	11.376	17.16	39.18	61.20	1.5	69.13
14	14.000	12.500	20.57	47.16	73.75	1.5	82.37
16	16.000	14.314	26.45	61.32	96.18	1.5	105.92
18	18.000	16.126	33.10	77.35	121.60	1.5	132.45
20	20.000	17.974	39.82	94.79	149.77	1.5	161.73
24	24.000	21.564	57.44	136.57	215.70	1.5	229.89

PVC & CPVC PIPE DATA

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COPPER WATER PIPE DATA

Table A2.5-1; *TYPE K* Copper Tubing – ASTM B88

Tube Size (in)	Tube O. D. (in)	Wall Thickness (in)	Tube Weight (lb/ft)	Water Weight (lb/ft)	Tube + Water Weight (lb/ft)
1/2	0.625	0.049	0.34	0.09	0.44
3/4	0.875	0.065	0.64	0.19	0.83
1	1.125	0.065	0.84	0.34	1.17
1 1/4	1.375	0.065	1.03	0.53	1.56
1 1/2	1.625	0.072	1.36	0.75	2.10
2	2.125	0.083	2.06	1.31	3.36
2 1/2	2.625	0.095	2.92	2.02	4.94
3	3.125	0.109	3.99	2.88	6.87
3 1/2	3.625	0.120	5.11	3.90	9.01
4	4.125	0.134	6.49	5.06	11.55
5	5.125	0.160	9.64	7.86	17.50
6	6.125	0.192	13.83	11.22	25.05

Table A2.5-2; Insulated *TYPE K* Copper Tubing – ASTM B88 (85% Magnesia Insulation)

Tube Size (in)	Tube O. D. (in)	Wall Thickness (in)	Tube Weight (lb/ft)	Water Weight (lb/ft)	Insulation Thickness (in)	Insulation Weight (lb/ft)	Total Weight (lb/ft)
1/2	0.625	0.049	0.34	0.09	1.00	0.60	1.04
3/4	0.875	0.065	0.64	0.19	1.00	0.70	1.52
1	1.125	0.065	0.84	0.34	1.00	0.79	1.96
1 1/4	1.375	0.065	1.03	0.53	1.00	0.88	2.44
1 1/2	1.625	0.072	1.36	0.75	1.00	0.97	3.08
2	2.125	0.083	2.06	1.31	1.00	1.16	4.52
2 1/2	2.625	0.095	2.92	2.02	1.00	1.34	6.28
3	3.125	0.109	3.99	2.88	1.00	1.53	8.40
3 1/2	3.625	0.120	5.11	3.90	1.00	1.72	10.72
4	4.125	0.134	6.49	5.06	1.00	1.90	13.46
5	5.125	0.160	9.64	7.86	1.50	3.69	21.19
6	6.125	0.192	13.83	11.22	1.50	4.24	29.29

COPPER WATER PIPE DATA

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Table A2.5-3; *TYPE L* Copper Tubing – ASTM B88

Tube Size (in)	Tube O. D. (in)	Wall Thickness (in)	Tube Weight (lb/ft)	Water Weight (lb/ft)	Tube + Water Weight (lb/ft)
1/2	0.625	0.040	0.28	0.10	0.39
3/4	0.875	0.045	0.45	0.21	0.66
1	1.125	0.050	0.65	0.36	1.01
1 1/4	1.375	0.055	0.88	0.54	1.43
1 1/2	1.625	0.060	1.14	0.77	1.91
2	2.125	0.070	1.75	1.34	3.09
2 1/2	2.625	0.080	2.47	2.07	4.54
3	3.125	0.090	3.32	2.95	6.27
3 1/2	3.625	0.100	4.28	3.99	8.27
4	4.125	0.114	5.55	5.17	10.72
5	5.125	0.125	7.59	8.09	15.68
6	6.125	0.140	10.17	11.63	21.80

Table A2.5-4; Insulated *TYPE L* Copper Tubing – ASTM B88 (85% Magnesia Insulation)

Tube Size (in)	Tube O. D. (in)	Wall Thickness (in)	Tube Weight (lb/ft)	Water Weight (lb/ft)	Insulation Thickness (in)	Insulation Weight (lb/ft)	Total Weight (lb/ft)
1/2	0.625	0.040	0.28	0.10	1.00	0.60	0.99
3/4	0.875	0.045	0.45	0.21	1.00	0.70	1.36
1	1.125	0.050	0.65	0.36	1.00	0.79	1.80
1 1/4	1.375	0.055	0.88	0.54	1.00	0.88	2.31
1 1/2	1.625	0.060	1.14	0.77	1.00	0.97	2.88
2	2.125	0.070	1.75	1.34	1.00	1.16	4.25
2 1/2	2.625	0.080	2.47	2.07	1.00	1.34	5.88
3	3.125	0.090	3.32	2.95	1.00	1.53	7.80
3 1/2	3.625	0.100	4.28	3.99	1.00	1.72	9.99
4	4.125	0.114	5.55	5.17	1.00	1.90	12.62
5	5.125	0.125	7.59	8.09	1.50	3.69	19.36
6	6.125	0.140	10.17	11.63	1.50	4.24	26.04

COPPER WATER PIPE DATA
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Table A2.5-5; *TYPE M* Copper Tubing – ASTM B88

Tube Size (in)	Tube O. D. (in)	Wall Thickness (in)	Tube Weight (lb/ft)	Water Weight (lb/ft)	Tube + Water Weight (lb/ft)
1/2	0.625	0.028	0.20	0.11	0.31
3/4	0.875	0.032	0.33	0.22	0.55
1	1.125	0.035	0.46	0.38	0.84
1 1/4	1.375	0.042	0.68	0.57	1.25
1 1/2	1.625	0.049	0.94	0.79	1.73
2	2.125	0.058	1.46	1.37	2.83
2 1/2	2.625	0.065	2.02	2.12	4.14
3	3.125	0.072	2.67	3.02	5.69
3 1/2	3.625	0.083	3.57	4.07	7.64
4	4.125	0.095	4.65	5.27	9.92
5	5.125	0.109	6.64	8.19	14.83
6	6.125	0.122	8.89	11.77	20.66

Table A2.5-6; Insulated *TYPE M* Copper Tubing – ASTM B88 (85% Magnesia Insulation)

Tube Size (in)	Tube O. D. (in)	Wall Thickness (in)	Tube Weight (lb/ft)	Water Weight (lb/ft)	Insulation Thickness (in)	Insulation Weight (lb/ft)	Total Weight (lb/ft)
1/2	0.625	0.028	0.20	0.11	1.00	0.60	1.10
3/4	0.875	0.032	0.33	0.22	1.00	0.70	1.34
1	1.125	0.035	0.46	0.38	1.00	0.79	1.63
1 1/4	1.375	0.042	0.68	0.57	1.00	0.88	2.03
1 1/2	1.625	0.049	0.94	0.79	1.00	0.97	2.52
2	2.125	0.058	1.46	1.37	1.00	1.16	3.62
2 1/2	2.625	0.065	2.02	2.12	1.00	1.34	4.93
3	3.125	0.072	2.67	3.02	1.00	1.53	6.48
3 1/2	3.625	0.083	3.57	4.07	1.00	1.72	8.43
4	4.125	0.095	4.65	5.27	1.00	1.90	10.71
5	5.125	0.109	6.64	8.19	1.50	3.69	15.62
6	6.125	0.122	8.89	11.77	1.50	4.24	21.45

COPPER WATER PIPE DATA

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DOMESTIC HOT & CHILLED WATER PIPING CORNER DISTANCE DATA

Table A2.6-1; Corner Distance for Standard Steel Pipe – Domestic Hot & Chilled Water –
 $\Delta T = 80^{\circ}F$

Nominal Pipe Size (in)	Pipe O. D. (in)	Distance From Corner to Longitudinal Restraint (ft)			
		10	20	30	40
		Distance from Corner to First Transverse Restraint (ft)			
3/4	1.050	2	2	3	3
1	1.315	2	3	3	4
1 1/4	1.660	2	3	4	4
1 1/2	1.900	2	3	4	4
2	2.375	2	3	4	5
2 1/2	2.875	3	4	5	5
3	3.500	3	4	5	6
3 1/2	4.000	3	4	5	6
4	4.500	3	5	6	7
5	5.563	4	5	6	7
6	6.625	4	6	7	8
8	8.625	5	7	8	9
10	10.750	5	7	9	10
11	11.750	5	8	9	11
12	12.750	6	8	10	11
14	14.000	6	8	10	12
16	16.000	6	9	11	13
18	18.000	7	10	12	13
20	20.000	7	10	12	14
22	22.000	7	11	13	15
24	24.000	8	11	13	16
30	30.000	9	12	15	17
36	36.000	10	13	16	19
42	42.000	10	15	18	21
48	48.000	11	16	19	22

DOMESTIC HOT & CHILLED WATER PIPING CORNER DATA

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Table A2.6-2; Corner Distance for PVC 1120 & CPVC 4120 Pipe – Domestic Hot & Chilled Water – $\Delta T = 80^{\circ}F$

Nominal Pipe Size (in)	Pipe O. D. (in)	Distance From Corner to Longitudinal Restraint (ft)			
		10	20	30	40
		Distance from Corner to First Transverse Restraint (ft)			
3/4	1.050	1	1	1	2
1	1.315	1	1	2	2
1 1/4	1.660	1	1	2	2
1 1/2	1.900	1	2	2	2
2	2.375	1	2	2	2
2 1/2	2.875	1	2	2	3
3	3.500	1	2	3	3
3 1/2	4.000	2	2	3	3
4	4.500	2	2	3	3
5	5.563	2	3	3	4
6	6.625	2	3	4	4
8	8.625	2	3	4	5
10	10.750	3	4	5	5
11	11.750	3	4	5	5
12	12.750	3	4	5	6
14	14.000	3	4	5	6
16	16.000	3	4	5	6
18	18.000	3	5	6	7
20	20.000	4	5	6	7
24	24.000	4	5	7	8

DOMESTIC HOT & CHILLED WATER PIPING CORNER DATA

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Table A2.6-3; Corner Distance for Drawn Copper Tubing – Domestic Hot & Chilled Water –
 $\Delta T = 80^{\circ} F$

Nominal Pipe Size (in)	Pipe O. D. (in)	Distance from Corner to Longitudinal Restraint (ft)			
		10	20	30	40
		Distance from Corner to First Transverse Restraint (ft)			
1	1.125	2	3	3	4
1 1/4	1.375	2	3	4	4
1 1/2	1.625	2	3	4	5
2	2.125	3	4	5	6
2 1/2	2.625	3	4	5	6
3	3.125	3	5	6	7
3 1/2	3.625	4	5	6	7
4	4.125	4	5	7	8
5	5.125	4	6	7	9
6	6.125	5	7	8	9

DOMESTIC HOT & CHILLED WATER PIPING CORNER DATA

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RECTANGULAR DUCT DATA

Table A3.1-1; Maximum Recommended Rectangular Duct Weights for Sizing Seismic Restraints [Maximum Values of Tables A3.1.2 & A3.1.7]

Duct Width (in)	Duct Height (in)	Duct Area (ft ²)	Duct Weight (lb/ft)
28	28	5.4	24
30	30	6.3	26
42	42	12.3	36
54	54	20.3	47
60	60	25.0	54
84	84	49.0	103
96	96	64.0	129
40	20	5.6	26
54	28	10.5	35
60	30	12.5	39
84	42	24.5	74
96	48	32.0	97
108	54	40.5	110
120	60	50.0	121

RECTANGULAR DUCT DATA

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**Table A3.1-2; Non-Insulated Rectangular Duct: 16 Gage Steel
(Does Not Include Reinforcement Steel)**

Duct Width (in)	Duct Height (in)	Duct Area (ft ²)	Duct Weight (lb/ft)
28	28	5.4	24
30	30	6.3	26
42	42	12.3	36
54	54	20.3	47
60	60	25.0	52
84	84	49.0	72
96	96	64.0	83
40	20	5.6	26
54	28	10.5	35
60	30	12.5	39
84	42	24.5	54
96	48	32.0	62
108	54	40.5	70
120	60	50.0	78

RECTANGULAR DUCT DATA
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**Table A3.1-3; Insulated Rectangular Duct: 16 Gage Steel & 1.5 pcf Insulation
(Does Not Include Reinforcement Steel)**

Duct Width (in)	Duct Height (in)	Duct Area (ft ²)	Bare Duct + 1-1/4" Insulation Weight (lb/ft)	Bare Duct + 2" Insulation Weight (lb/ft)	Bare Duct + 3" Insulation Weight (lb/ft)	Bare Duct + 4" Insulation Weight (lb/ft)
28	28	5.4	25.6	26.5	27.7	28.8
30	30	6.3	27.4	28.4	29.6	30.9
42	42	12.3	38.4	39.7	41.5	43.2
54	54	20.3	49.4	51.1	53.3	55.6
60	60	25.0	54.9	56.8	59.3	61.8
84	84	49.0	76.8	79.5	83.0	86.5
96	96	64.0	87.8	90.8	94.8	98.8
40	20	5.6	27.4	28.4	29.6	30.9
54	28	10.5	37.5	38.8	40.5	42.2
60	30	12.5	41.2	42.6	44.4	46.3
84	42	24.5	57.6	59.6	62.2	64.8
96	48	32.0	65.9	68.1	71.1	74.1
108	54	40.5	74.1	76.6	80.0	83.4
120	60	50.0	82.3	85.1	88.9	92.6

RECTANGULAR DUCT DATA
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**Table A3.1-4; Insulated Rectangular Duct: 16 Gage Steel & 3 pcf Insulation
(Does Not Include Reinforcement Steel)**

Duct Width (in)	Duct Height (in)	Duct Area (ft ²)	Bare Duct + 1" Insulation Weight (lb/ft)	Bare Duct + 2" Insulation Weight (lb/ft)	Bare Duct + 3" Insulation Weight (lb/ft)	Bare Duct + 4" Insulation Weight (lb/ft)
28	28	5.4	26.5	28.8	31.2	33.5
30	30	6.3	28.4	30.9	33.4	35.9
42	42	12.3	39.7	43.2	46.7	50.2
54	54	20.3	51.1	55.6	60.1	64.6
60	60	25.0	56.8	61.8	66.8	71.8
84	84	49.0	79.5	86.5	93.5	100.5
96	96	64.0	90.8	98.8	106.8	114.8
40	20	5.6	28.4	30.9	33.4	35.9
54	28	10.5	38.8	42.2	45.6	49.0
60	30	12.5	42.6	46.3	50.1	53.8
84	42	24.5	59.6	64.8	70.1	75.3
96	48	32.0	68.1	74.1	80.1	86.1
108	54	40.5	76.6	83.4	90.1	96.9
120	60	50.0	85.1	92.6	100.1	107.6

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**Table A3.1-5; Insulated Rectangular Duct: 16 Gage Steel & 6 pcf Insulation
(Does Not Include Reinforcement Steel)**

Duct Width (in)	Duct Height (in)	Duct Area (ft ²)	Bare Duct + 1" Insulation Weight (lb/ft)	Bare Duct + 2" Insulation Weight (lb/ft)
28	28	5.4	28.8	33.5
30	30	6.3	30.9	35.9
42	42	12.3	43.2	50.2
54	54	20.3	55.6	64.6
60	60	25.0	61.8	71.8
84	84	49.0	86.5	100.5
96	96	64.0	98.8	114.8
40	20	5.6	30.9	35.9
54	28	10.5	42.2	49.0
60	30	12.5	46.3	53.8
84	42	24.5	64.8	75.3
96	48	32.0	74.1	86.1
108	54	40.5	83.4	96.9
120	60	50.0	92.6	107.6

RECTANGULAR DUCT DATA

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SECTION – A3.1

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**Table A3.1-6; Lagged Rectangular Duct: 16 Gage Steel & 5/8" Gypsum Board Lagging
(Does Not Include Reinforcement Steel)**

Duct Width (in)	Duct Height (in)	Duct Area (ft ²)	Bare Duct + 1 Layer Gypsum Board Weight (lb/ft)	Bare Duct + 2 Layers Gypsum Board Weight (lb/ft)	Bare Duct + 3 Layers Gypsum Board Weight (lb/ft)
28	28	5.4	42.4	60.6	78.8
30	30	6.3	45.4	64.9	84.5
42	42	12.3	63.6	90.9	118.3
54	54	20.3	81.7	116.9	152.0
60	60	25.0	90.8	129.9	168.9
84	84	49.0	127.1	181.8	236.5
96	96	64.0	145.3	207.8	270.3
40	20	5.6	45.4	64.9	84.5
54	28	10.5	62.1	88.7	115.4
60	30	12.5	68.1	97.4	126.7
84	42	24.5	95.4	136.4	177.4
96	48	32.0	109.0	155.9	202.7
108	54	40.5	122.6	175.3	228.1
120	60	50.0	136.2	194.8	253.4

RECTANGULAR DUCT DATA
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Table A3.1-7; SMACNA¹ – Maximum Weight for Rectangular Duct

Duct Width (in)	Duct Height (in)	Duct Area (ft ²)	Duct Weight (lb/ft)
30	30	6.3	17
42	42	12.3	29
54	54	20.3	46
60	60	25.0	54
84	84	49.0	103
96	96	64.0	129
54	28	10.5	34
60	30	12.5	39
84	42	24.5	74
96	48	32.0	97
108	54	40.5	110
120	60	50.0	121

¹ SMACNA, Seismic Restraint Manual – Guidelines for Mechanical Systems with Addendum No. 1 2nd Edition; Sheet Metal and Air Conditioning Contractors' National Association, Inc., 4201 Lafayette Center Drive, Chantilly, Virginia 20151-1209, 1998.

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ROUND DUCT DATA

Table A3.2-1; Maximum Recommended Round Duct Weights for Sizing Seismic Restraints
[Maximum Values of Tables A3.2.2 & A3.2.6]

Duct Diameter (in)	Duct Area (ft ²)	Duct Weight (lb/ft)
30	4.9	20
33	5.9	22
36	7.1	24
48	12.6	33
60	19.6	41
84	38.5	69

ROUND DUCT DATA

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SECTION – A3.2

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**Table A3.2-2; Non-Insulated Round Duct: 16 Gage Steel
(Does Not Include Reinforcement Steel)**

Duct Diameter (in)	Duct Area (ft ²)	Duct Weight (lb/ft)
30	4.9	20
36	7.1	24
42	9.6	28
48	12.6	33
54	15.9	37
60	19.6	41
66	23.8	45
72	28.3	49
78	33.2	53
84	38.5	57
90	44.2	61
96	50.3	65
102	56.7	69
108	63.6	73



**Table A3.2-3; Insulated Round Duct: 16 Gage Steel & 1.5 pcf Insulation
(Does Not Include Reinforcement Steel)**

Duct Diameter (in)	Duct Area (ft ²)	Bare Duct + 1-1/4" Insulation Weight (lb/ft)	Bare Duct + 2" Insulation Weight (lb/ft)	Bare Duct + 3" Insulation Weight (lb/ft)	Bare Duct + 4" Insulation Weight (lb/ft)
30	4.9	21.6	22.3	23.3	24.3
36	7.1	25.9	26.7	27.9	29.1
42	9.6	30.2	31.2	32.6	34.0
48	12.6	34.5	35.7	37.2	38.8
54	15.9	38.8	40.1	41.9	43.7
60	19.6	43.1	44.6	46.5	48.5
66	23.8	47.4	49.0	51.2	53.4
72	28.3	51.7	53.5	55.8	58.2
78	33.2	56.0	57.9	60.5	63.1
84	38.5	60.3	62.4	65.2	67.9
90	44.2	64.7	66.9	69.8	72.8
96	50.3	69.0	71.3	74.5	77.6
102	56.7	73.3	75.8	79.1	82.5
108	63.6	77.6	80.2	83.8	87.3

ROUND DUCT DATA

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**Table A3.2-4; Insulated Round Duct: 16 Gage Steel & 3 pcf Insulation
(Does Not Include Reinforcement Steel)**

Duct Diameter (in)	Duct Area (ft ²)	Bare Duct + 1" Insulation Weight (lb/ft)	Bare Duct + 2" Insulation Weight (lb/ft)	Bare Duct + 3" Insulation Weight (lb/ft)	Bare Duct + 4" Insulation Weight (lb/ft)
30	4.9	22.3	24.3	26.2	28.2
36	7.1	26.7	29.1	31.5	33.8
42	9.6	31.2	34.0	36.7	39.4
48	12.6	35.7	38.8	41.9	45.1
54	15.9	40.1	43.7	47.2	50.7
60	19.6	44.6	48.5	52.4	56.4
66	23.8	49.0	53.4	57.7	62.0
72	28.3	53.5	58.2	62.9	67.6
78	33.2	57.9	63.1	68.2	73.3
84	38.5	62.4	67.9	73.4	78.9
90	44.2	66.9	72.8	78.6	84.5
96	50.3	71.3	77.6	83.9	90.2
102	56.7	75.8	82.5	89.1	95.8
108	63.6	80.2	87.3	94.4	101.4

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**Table A3.2-5; Insulated Round Duct: 16 Gage Steel & 6 pcf Insulation
(Does Not Include Reinforcement Steel)**

Duct Diameter (in)	Duct Area (ft ²)	Bare Duct + 1-1/4" Insulation Weight (lb/ft)	Bare Duct + 2" Insulation Weight (lb/ft)
30	4.9	25.2	28.2
36	7.1	30.3	33.8
42	9.6	35.3	39.4
48	12.6	40.4	45.1
54	15.9	45.4	50.7
60	19.6	50.5	56.4
66	23.8	55.5	62.0
72	28.3	60.6	67.6
78	33.2	65.6	73.3
84	38.5	70.7	78.9
90	44.2	75.7	84.5
96	50.3	80.7	90.2
102	56.7	85.8	95.8
108	63.6	90.8	101.4

ROUND DUCT DATA

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Table A3.2-6; SMACNA¹ – Maximum Weight for Round Duct

Duct Diameter (in)	Duct Area (ft ²)	Duct Weight (lb/ft)
33	5.9	14
36	7.1	16
48	12.6	21
60	19.6	34
84	38.5	69

¹ SMACNA, Seismic Restraint Manual – Guidelines for Mechanical Systems with Addendum No. 1 2nd Edition; Sheet Metal and Air Conditioning Contractors' National Association, Inc., 4201 Lafayette Center Drive, Chantilly, Virginia 20151-1209, 1998.

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FLAT OVAL DUCT DATA

Table A3.3-1; Non-Insulated Flat Oval Duct: 16 Gage Steel
(*Does Not* Include Reinforcement Steel)

Duct Height (in)	Duct Width (in)	Duct Flat Width (in)	Duct Area (ft ²)	Duct Weight (lb/ft)
14	60	46	5.5	29
14	66	52	6.1	32
14	72	58	6.7	34
14	78	64	7.3	37
14	84	70	7.9	40
16	48	32	5.0	25
16	54	38	5.6	27
16	60	44	6.3	30
20	36	16	4.4	20
20	48	28	6.1	26
20	60	40	7.7	31
20	72	52	9.4	36
20	84	64	11.1	41
22	36	14	4.8	21
22	48	26	6.6	26
22	60	38	8.4	31
22	72	50	10.3	36
30	72	42	13.7	38
30	78	48	14.9	41
30	84	54	16.2	44

FLAT OVAL DUCT DATA

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SECTION – A3.3

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Table A3.3-2; Insulated Flat Oval Duct: 16 Gage Steel & 1.5 pcf Insulation
(Does Not Include Reinforcement Steel)

Duct Height (in)	Duct Width (in)	Duct Area (ft ²)	Bare Duct + 1-1/4" Insulation Weight (lb/ft)	Bare Duct + 2" Insulation Weight (lb/ft)	Bare Duct + 3" Insulation Weight (lb/ft)	Bare Duct + 4" Insulation Weight (lb/ft)
14	60	5.5	31.1	32.2	33.6	35.0
14	66	6.1	33.8	35.0	36.5	38.1
14	72	6.7	36.6	37.8	39.5	41.2
14	78	7.3	39.3	40.7	42.5	44.3
14	84	7.9	42.1	43.5	45.4	47.3
16	48	5.0	26.1	27.0	28.2	29.4
16	54	5.6	28.9	29.9	31.2	32.5
16	60	6.3	31.6	32.7	34.1	35.6
20	36	4.4	21.7	22.4	23.4	24.4
20	48	6.1	27.2	28.1	29.3	30.6
20	60	7.7	32.7	33.8	35.3	36.8
20	72	9.4	38.1	39.5	41.2	42.9
20	84	11.1	43.6	45.1	47.1	49.1
22	36	4.8	22.2	23.0	24.0	25.0
22	48	6.6	27.7	28.6	29.9	31.2
22	60	8.4	33.2	34.3	35.8	37.3
22	72	10.3	38.7	40.0	41.8	43.5
30	72	13.7	40.8	42.2	44.0	45.9
30	78	14.9	43.5	45.0	47.0	49.0
30	84	16.2	46.2	47.8	49.9	52.0

FLAT OVAL DUCT DATA
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**Table A3.3-3; Insulated Flat Oval Duct: 16 Gage Steel & 3 pcf Insulation
(Does Not Include Reinforcement Steel)**

Duct Height (in)	Duct Width (in)	Duct Area (ft ²)	Bare Duct + 1" Insulation Weight (lb/ft)	Bare Duct + 2" Insulation Weight (lb/ft)	Bare Duct + 3" Insulation Weight (lb/ft)	Bare Duct + 4" Insulation Weight (lb/ft)
14	60	5.5	32.2	35.0	37.8	40.7
14	66	6.1	35.0	38.1	41.2	44.2
14	72	6.7	37.8	41.2	44.5	47.8
14	78	7.3	40.7	44.3	47.8	51.4
14	84	7.9	43.5	47.3	51.2	55.0
16	48	5.0	27.0	29.4	31.8	34.2
16	54	5.6	29.9	32.5	35.1	37.8
16	60	6.3	32.7	35.6	38.5	41.3
20	36	4.4	22.4	24.4	26.4	28.4
20	48	6.1	28.1	30.6	33.1	35.5
20	60	7.7	33.8	36.8	39.7	42.7
20	72	9.4	39.5	42.9	46.4	49.9
20	84	11.1	45.1	49.1	53.1	57.1
22	36	4.8	23.0	25.0	27.0	29.0
22	48	6.6	28.6	31.2	33.7	36.2
22	60	8.4	34.3	37.3	40.4	43.4
22	72	10.3	40.0	43.5	47.0	50.6
30	72	13.7	42.2	45.9	49.6	53.3
30	78	14.9	45.0	49.0	52.9	56.9
30	84	16.2	47.8	52.0	56.3	60.5

FLAT OVAL DUCT DATA
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**Table A3.3-4; Insulated Flat Oval Duct: 16 Gage Steel & 6 pcf Insulation
(Does Not Include Reinforcement Steel)**

Duct Height (in)	Duct Width (in)	Duct Area (ft ²)	Bare Duct + 1" Insulation Weight (lb/ft)	Bare Duct + 2" Insulation Weight (lb/ft)
14	60	5.5	35.0	40.7
14	66	6.1	38.1	44.2
14	72	6.7	41.2	47.8
14	78	7.3	44.3	51.4
14	84	7.9	47.3	55.0
16	48	5.0	29.4	34.2
16	54	5.6	32.5	37.8
16	60	6.3	35.6	41.3
20	36	4.4	24.4	28.4
20	48	6.1	30.6	35.5
20	60	7.7	36.8	42.7
20	72	9.4	42.9	49.9
20	84	11.1	49.1	57.1
22	36	4.8	25.0	29.0
22	48	6.6	31.2	36.2
22	60	8.4	37.3	43.4
22	72	10.3	43.5	50.6
30	72	13.7	45.9	53.3
30	78	14.9	49.0	56.9
30	84	16.2	52.0	60.5

FLAT OVAL DUCT DATA

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SECTION – A3.3

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SHEET METAL SCREWS REQUIRED FOR DUCT RESTRAINT

Table A3.4-1; Horizontal Seismic Force Class System Designations

Horizontal Force Class	Horizontal Seismic Force Range per Force Class (lbs)
I	$0 \leq F_P \leq 250$
II	$250 < F_P \leq 500$
III	$500 < F_P \leq 1,000$
IV	$1,000 < F_P \leq 2,000$
V	$2,000 < F_P \leq 5,000$
VI	$5,000 < F_P \leq 10,000$

Table A3.4-2; Sheet Metal Screws Required for Seismic Attachment for 28 Gage Steel Ducts

Screw Size (Nom. Dia.)	#6 (0.138")		#8 (0.164")		#10 (0.190")		#12 (0.216")	
	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd
I	112	4	123	4	133	4	140	4
II		5		5		4		4
III		9		9		8		8
IV		18		17		16		15
V		45		41		38		36
VI		90		82		76		72

SHEET METAL SCREWS REQUIRED FOR DUCT RESTRAINT

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Table A3.4-3; Sheet Metal Screws Required for Seismic Attachment for 22 Gage Steel Ducts

Screw Size (Nom. Dia.)	#6 (0.138")		#8 (0.164")		#10 (0.190")		#12 (0.216")	
Horizontal Force Class	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd
I	207	4	225	4	245	4	259	4
II		4		4		4		
III		5		5		5		
IV		10		9		9		
V		25		23		21		
VI		49		45		41		

Table A3.4-4; Sheet Metal Screws Required for Seismic Attachment for 20 Gage Steel Ducts

Screw Size (Nom. Dia.)	#6 (0.138")		#8 (0.164")		#10 (0.190")		#12 (0.216")	
Horizontal Force Class	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd
I	281	4	307	4	330	4	351	4
II		4		4		4		
III		4		4		4		
IV		8		7		7		
V		18		17		16		
VI		36		33		31		

SHEET METAL SCREWS REQUIRED FOR DUCT RESTRAINT

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KINETICS™ Pipe & Duct Seismic Application Manual

Table A3.4-5; Sheet Metal Screws Required for Seismic Attachment for 18 Gage Steel Ducts

Screw Size (Nom. Dia.)	#6 (0.138")		#8 (0.164")		#10 (0.190")		#12 (0.216")	
Horizontal Force Class	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd
I	419	4	455	4	491	4	522	4
II		4		4		4		
III		4		4		4		
IV		5		5		5		
V		12		11		11		
VI		24		22		21		

Table A3.4-6; Sheet Metal Screws Required for Seismic Attachment for 16 Gage Steel Ducts

Screw Size (Nom. Dia.)	#6 (0.138")		#8 (0.164")		#10 (0.190")		#12 (0.216")	
Horizontal Force Class	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd
I	588	4	643	4	690	4	735	4
II		4		4		4		
III		4		4		4		
IV		4		4		4		
V		9		8		8		
VI		18		16		15		

SHEET METAL SCREWS REQUIRED FOR DUCT RESTRAINT

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FILLET WELD SIZE & LENGTH FOR DUCT RESTRAINT

Table A3.5-1; Horizontal Seismic Force Class System Designations

Horizontal Force Class	Horizontal Seismic Force Range per Force Class (lbs)
I	$0 \leq F_P \leq 250$
II	$250 < F_P \leq 500$
III	$500 < F_P \leq 1,000$
IV	$1,000 < F_P \leq 2,000$
V	$2,000 < F_P \leq 5,000$
VI	$5,000 < F_P \leq 10,000$

Table A3.5-2; Fillet Weld Size and Length Required for Seismic Attachment to Duct and Supports

Fillet Weld Leg Size (in)		1/32	1/16	3/32	1/8	3/16	1/4
Horizontal Force Class	Allow. Weld Shear (LRFD) (psi)	Total Weld Length Req'd (in)	Total Weld Length Req'd (in)	Total Weld Length Req'd (in)	Total Weld Length Req'd (in)	Total Weld Length Req'd (in)	Total Weld Length Req'd (in)
I	26,040	1.00	1.00	1.00	1.00	1.00	1.00
II		1.00	1.00	1.00	1.00	1.00	1.00
III		2.00	1.00	1.00	1.00	1.00	1.00
IV		4.00	2.00	2.00	1.00	1.00	1.00
V		9.00	5.00	3.00	3.00	2.00	2.00
VI		18.00	9.00	6.00	5.00	3.00	3.00

FILLET WELD SIZE & LENGTH FOR DUCT RESTRAINT

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Notes:

- 1.) The weld lengths shown in Table A3.5-2 are the minimum total length of weld required to resist the maximum horizontal seismic load for each Horizontal Force Class at each restraint location. The welds must be balance vertically around, and side-to-side across the duct at each restraint location to prevent twisting and warping of the duct. Use the total weld length from Table A3.5-2 for each restraint location plus enough extra weld to balance the amount of weld vertically around, and side-to-side across the duct.
- 2.) Select Weld leg size based on the thickness of the thinnest member in the weld joint.
- 3.) Make sure to use the lowest possible current setting that will produce a good weld joint to prevent “burn through” in the duct sheet metal.
- 4.) The allowable weld shear is based on E60XX weld material.

FILLET WELD SIZE & LENGTH FOR DUCT RESTRAINT

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ASTM A307 & A325 BOLTS REQUIRED FOR DUCT RESTRAINT

Table A3.4-1; Horizontal Seismic Force Class System Designations

Horizontal Force Class	Horizontal Seismic Force Range per Force Class (lbs)
I	$0 \leq F_P \leq 250$
II	$250 < F_P \leq 500$
III	$500 < F_P \leq 1,000$
IV	$1,000 < F_P \leq 2,000$
V	$2,000 < F_P \leq 5,000$
VI	$5,000 < F_P \leq 10,000$

Table A3.6-2; ASTM A307 Bolts Required for Seismic Attachment for Steel Ducts

Bolt Size	1/4-20 UNC		3/8-16 UNC		1/2-13 UNC		5/8-11 UNC	
	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd
I	426	2	1,063	2	1,966	2	3,152	2
II		2		2		2		
III		3		2		2		2
IV		5		2		2		2
V		12		5		3		2
VI		24		10		6		4

ASTM A307 & A325 BOLTS REQUIRED FOR DUCT RESTRAINT

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KINETICS™ Pipe & Duct Seismic Application Manual

Table A3.6-3; ASTM A325 Bolts Required for Seismic Attachment for Steel Ducts

Bolt Size	1/4-20 UNC		3/8-16 UNC		1/2-13 UNC		5/8-11 UNC	
Horizontal Force Class	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd	Allow. Shear (LRFD) (lbs)	Min. Screws Req'd
I	1,089	2	2,717	2	5,025	2	8,055	2
II		2		2		2		
III		2		2		2		
IV		2		2		2		
V		5		2		2		
VI		10		4		2		

ASTM A307 & A325 BOLTS REQUIRED FOR DUCT RESTRAINT

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SECTION – A3.6

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BOLT DATA

Table A4.1-1; ASTM A307 Bolt Capacities (Standard in Cable Kits)

Bolt Size (in)	Thread Minor Diameter (in)	Thread Minor Area (in ²)	Allowable Tensile Load (ASD) (lbs)	Allowable Combined Load (ASD) (lbs)	Allowable Shear Load (ASD) (lbs)	Installation Torque (ft-lbs)
1/4-20 UNC	0.1894	0.0282	609	287	304	4
3/8-16 UNC	0.2992	0.0703	1,519	717	759	13
1/2-13 UNC	0.4069	0.1300	2,809	1,326	1,404	32
5/8-11 UNC	0.5152	0.2085	4,503	2,126	2,251	64
3/4-10 UNC	0.6291	0.3108	6,714	3,170	3,357	113
7/8-9 UNC	0.7408	0.4310	9,310	4,396	4,655	166
1-8 UNC	0.8492	0.5664	12,234	5,776	6,117	250

Table A4.1-2; ASTM A325 Bolt Capacities (Special for Cable Kits When Required)

Bolt Size (in)	Thread Minor Diameter (in)	Thread Minor Area (in ²)	Allowable Tensile Load (ASD) (lbs)	Allowable Combined Load (ASD) (lbs)	Allowable Shear Load (ASD) (lbs)	Installation Torque (ft-lbs)
1/4-20 UNC	0.1894	0.0282	1,555	734	778	8
3/8-16 UNC	0.2992	0.0703	3,881	1,832	1,941	31
1/2-13 UNC	0.4069	0.1300	7,178	3,389	3,589	75
5/8-11 UNC	0.5152	0.2085	11,507	5,433	5,754	150
3/4-10 UNC	0.6291	0.3108	17,158	8,101	8,579	266
7/8-9 UNC	0.7408	0.4310	23,792	11,233	11,896	429
1-8 UNC	0.8492	0.5664	31,264	14,761	15,632	644

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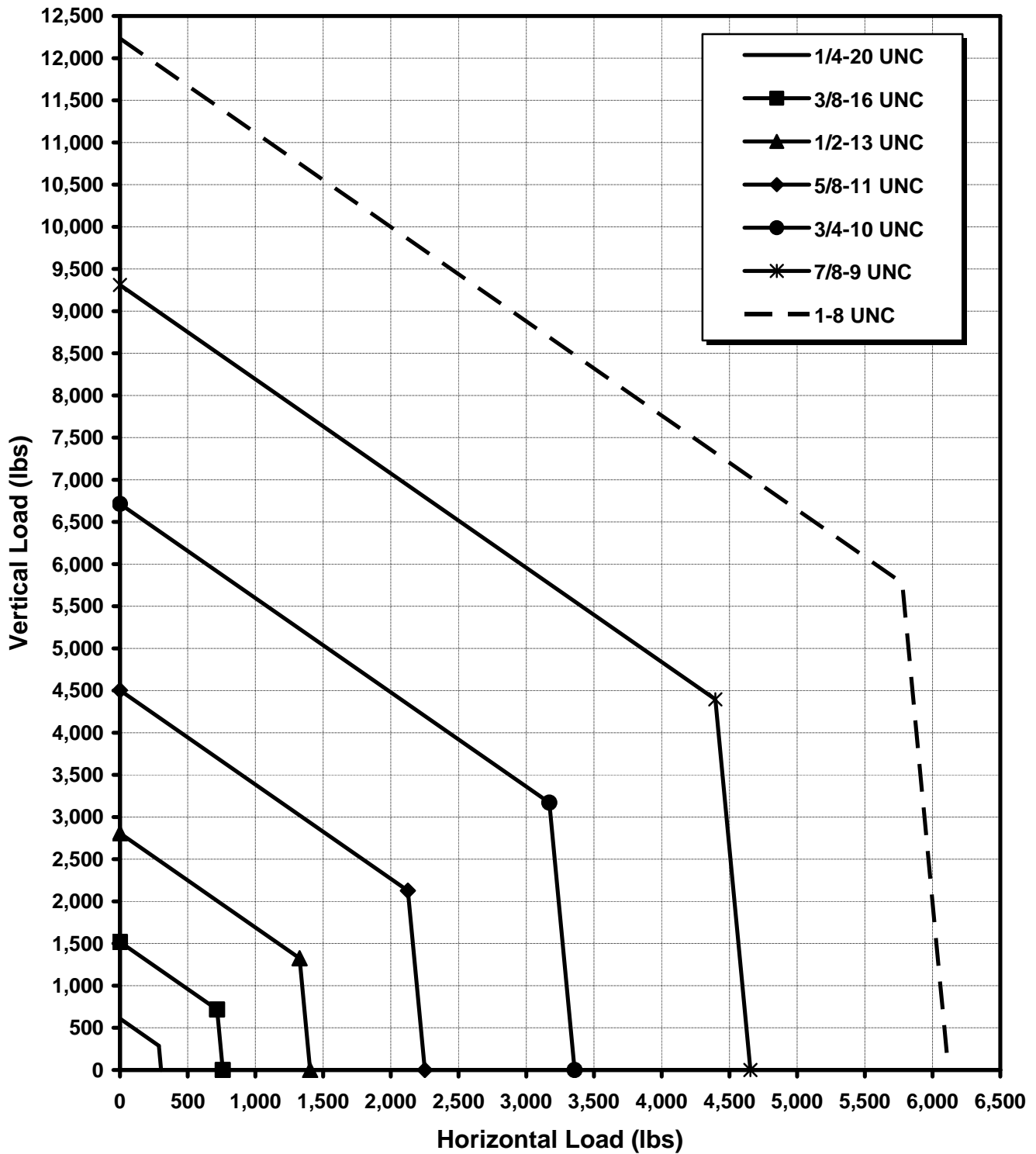


Figure A4.1-1; Seismic Capacity Envelopes for ASTM A307 Bolts

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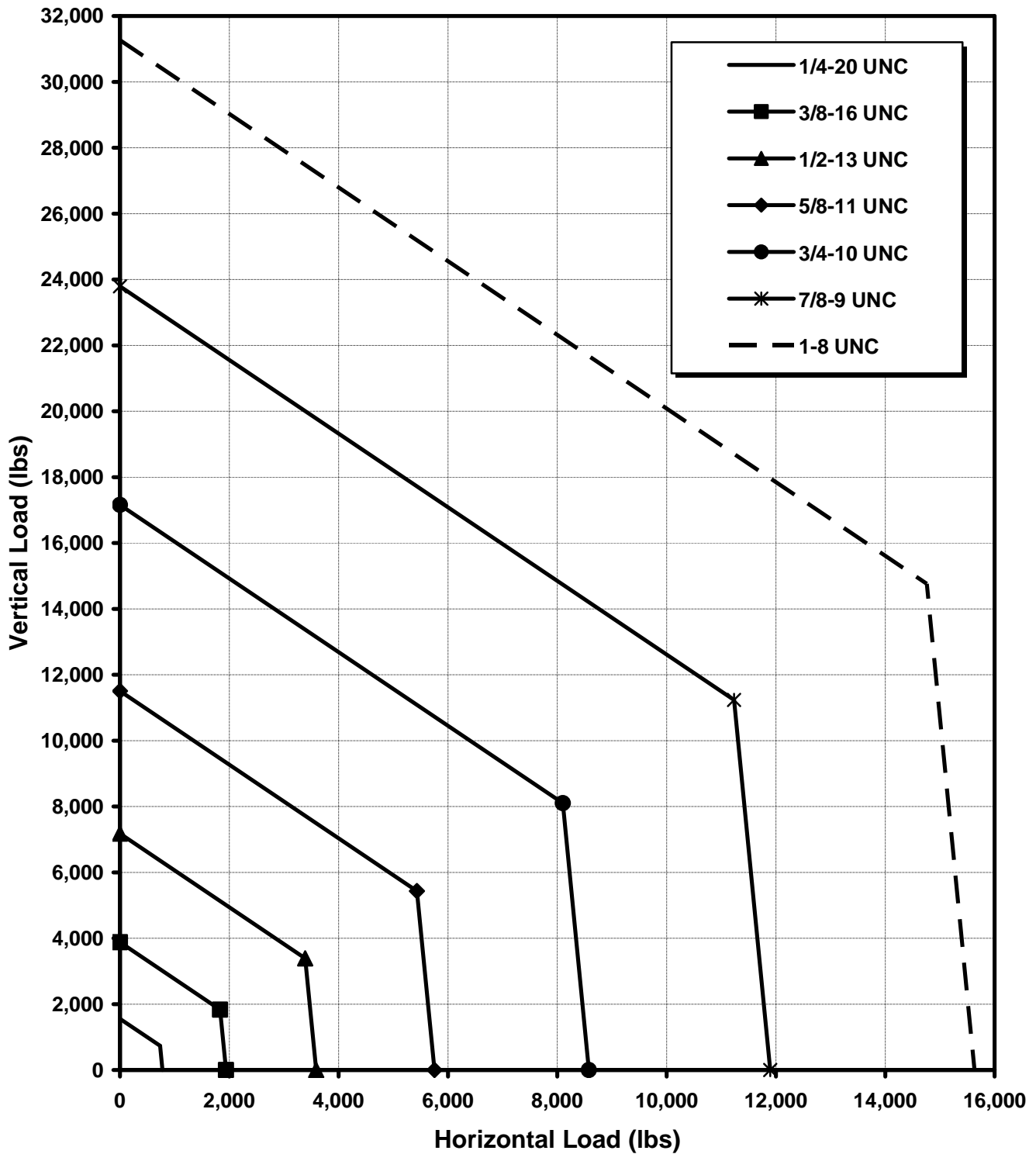


Figure A4.1-2; Seismic Capacity Envelopes for ASTM A325 Bolts

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MODEL KCCAB WEDGE TYPE CONCRETE ANCHOR DATA

Table A4.2-1; Model KCCAB Anchor Capacities – 3,000 psi Normal Weight Concrete – Standard Embedments

Anchor Size (in)	Pilot Hole Depth (in)	Anchor Embedment (in)	Allowable Tensile Load (ASD) (lbs)	Allowable Combined Load (ASD) (lbs)	Allowable Shear Load (ASD) (lbs)	Critical Anchor Spacing (in)	Critical Anchor Edge Distance (in)	Minimum Concrete Thickness (in)
3/8	2 5/8	2	808	567	922	6	4 3/8	4
1/2	4	3 1/4	1,750	1,251	2,082	9 3/4	7 1/2	6
5/8	4 3/4	4	2,079	1,675	3,430	12	9	6
3/4	5 3/4	4 3/4	3,133	2,525	5,177	14 1/4	11 3/4	8

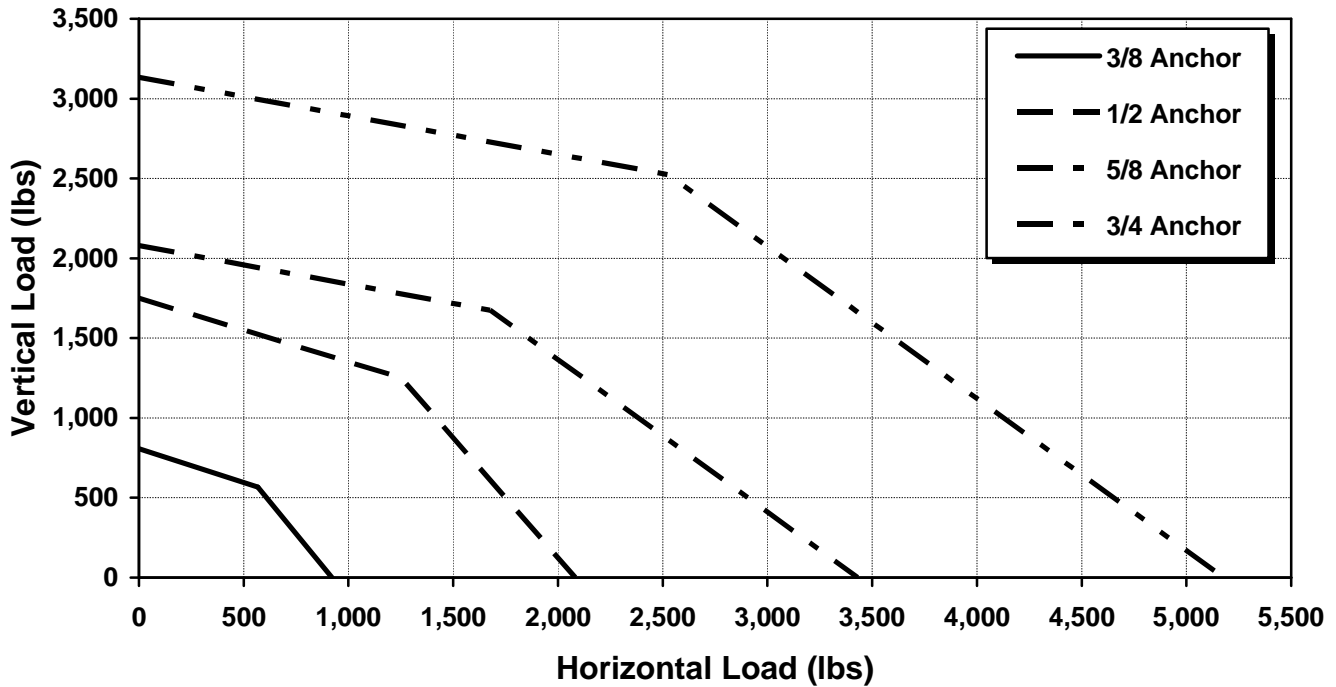


Figure A4.2-1; Seismic Capacity Envelopes for Model KCCAB Concrete Anchors – 3,000 psi Normal Weight Concrete – Standard Embedments

MODEL KCCAB WEDGE TYPE CONCRETE ANCHOR DATA

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SHEET METAL SCREW DATA

Table A4.3-1; Allowable Seismic and Wind Loads for Sheet Metal Screws vs. Sheet Metal Gage

Screw Size (Nom. Dia.)	#6 (0.138")		#8 (0.164")		#10 (0.190")		#12 (0.216")	
	Allow. Shear (ASD) (lbs)	Allow. Pullout (ASD) (lbs)	Allow. Shear (ASD) (lbs)	Allow. Pullout (ASD) (lbs)	Allow. Shear (ASD) (lbs)	Allow. Pullout (ASD) (lbs)	Allow. Shear (ASD) (lbs)	Allow. Pullout (ASD) (lbs)
28	80	44	88	52	95	61	100	69
22	148	67	161	79	175	92	185	104
20	201	81	219	96	236	112	251	127
18	299	105	325	125	351	145	373	165
16	420	133	459	157	493	183	525	208
14	531	167	632	199	697	231	743	261
12	757	239	900	284	1,044	328	1,187	373

Notes:

1. Minimum screw spacing is three (3) times the nominal screw diameter.
2. These values are based on sheet metal strength of 33,000 psi yield and 45,000 psi tensile.
3. These values have been increased by 33% for seismic and wind applications which produces a Factor of Safety equal to 2.25:1.
4. Use of these values requires a minimum penetration of three (3) clear exposed complete threads through the joined materials.
5. Screw strength must be verified by the supplier of the fasteners.
6. Table data is taken from, *SSMA – Product Technical Information ICBO ER-4943P*; Steel Stud Manufacturer’s Association, 2000; Pp 5 & 48.

SHEET METAL SCREW DATA

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LAG SCREW DATA

Notes:

1. ANSI/AF&PA NDS-1997 National Design Specification for Wood Construction; American Forest & Paper Association, 1997.
2. Data is for soft wood and engineered wood with a specific gravity of 0.35.
3. **Do not** install lag screws into the end grain of a piece of structural wood for seismic or wind applications!

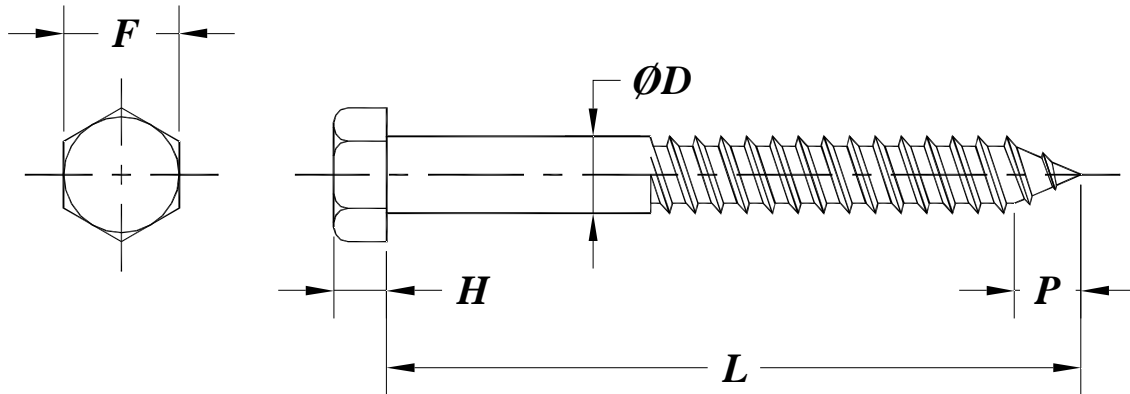


Figure A4.4-1; Typical Lag Screw

Table A4.4-1; Hex Head Lag Screw Dimensional Data – Figure A4.4-1

Lag Screw Size ϕD (in)	Width Across Flats F (in)	Head Height H (in)	Point Length P (in)
1/4	3/8	0.172	0.217
5/16	1/2	0.219	0.271
3/8	9/16	0.250	0.325
1/2	3/4	0.344	0.433
5/8	15/16	0.422	0.541
3/4	1-1/8	0.500	0.650

LAG SCREW DATA

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Table A4.4-2; Lag Screw Installation Data – Figure A4.4-2

Lag Screw Size ϕD (in)	Min. Spacing S (in)	Min. End Dist. $E1$ (in)	Min. Edge Dist. $E2$ (in)	Embed. Depth $E3$ (in)	Mtg. Plate Thick. T (in)	Screw Length L (in)	Soft Wood Pilot Drill ϕd (in)	Hard Wood Pilot Drill ϕd (in)
1/4	1	1	3/8	2	1/8	2-1/2	1/8	5/32
					1/4	2-1/2		
					3/8	3		
					1/2	3		
5/16	1-1/4	1-1/4	15/32	2-1/2	1/8	3	9/32	13/64
					1/4	3-1/2		
					3/8	3-1/2		
					1/2	3-1/2		
3/8	1-1/2	1-1/2	9/16	3	1/8	3-1/2	3/16	1/4
					1/4	4		
					3/8	4		
					1/2	4		
1/2	2	2	3/4	4	1/8	5	15/64	21/64
					1/4	5		
					3/8	5		
					1/2	5		
5/8	2-1/2	2-1/2	15/16	5	1/8	6	19/64	13/32
					1/4	6		
					3/8	6		
					1/2	7		
3/4	3	3	1-1/8	6	1/8	7	23/64	31/64
					1/4	7		
					3/8	8		
					1/5	8		

LAG SCREW DATA

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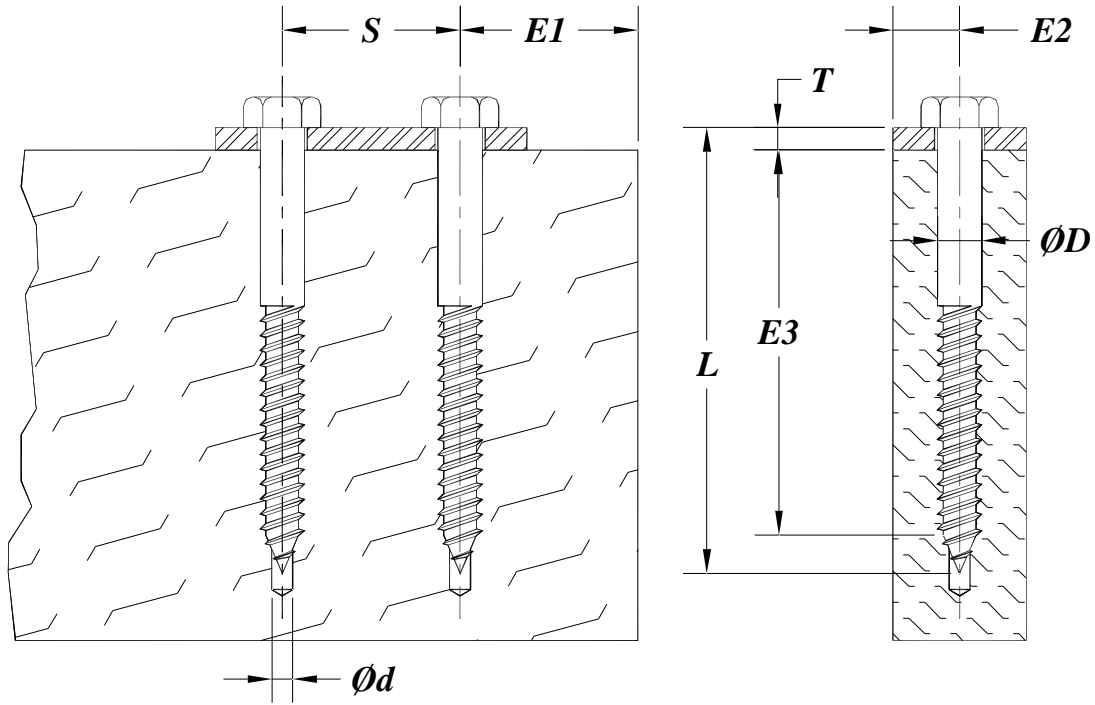


Figure A4.4-2; Typical Lag Screw Installation Dimensions

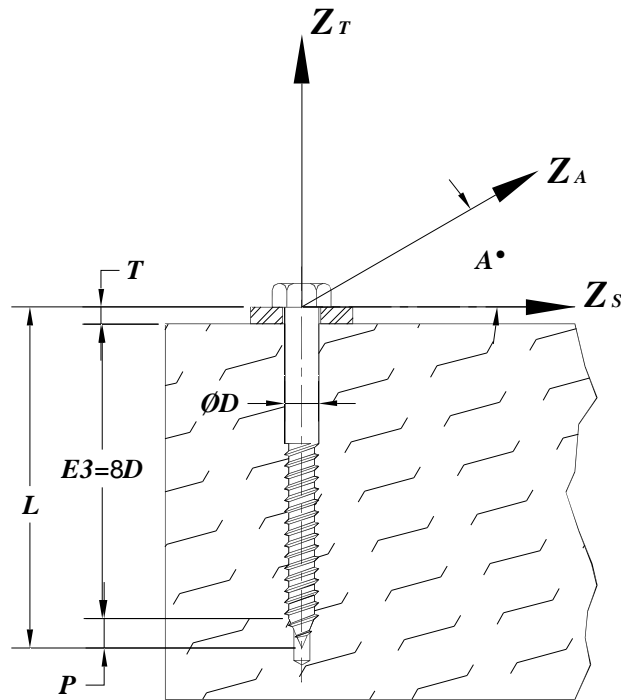


Figure A4.4-3; Lag Screw Loading Diagram

LAG SCREW DATA

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Table A4.4-3; Allowable Seismic and Wind Loads for Lag Screws – 1/4” Thick Side Plate

Lag Screw Size ΦD (in)	Embed. Depth $E3=8D$ (in)	Allow. Tensile Load Z_T (ASD) (lbs)	Allow. Shear Load Z_S (ASD) (lbs)	Load Angle A (deg)	Allow. Comb. Load Z_A (ASD) (lbs)
1/4	2	422	272	0	272
				30	299
				45	331
				60	371
5/16	2 1/2	624	352	0	352
				30	395
				45	450
				60	523
3/8	3	859	416	0	416
				30	478
				45	561
				60	678
1/2	4	1,421	624	0	624
				30	726
				45	867
				60	1,077
5/8	5	2,096	864	0	864
				30	1,013
				45	1,224
				60	1,545
3/4	6	2,880	1,152	0	1,152
				30	1,355
				45	1,646
				60	2,095

LAG SCREW DATA

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ESTIMATING HANGER ROD STIFFENER REQUIREMENTS

Introduction:

Determining the actual rod stiffener requirements for a specific hanger location on a specific project is beyond the scope of this manual. However, the intent of this appendix is to demonstrate how the rod stiffener requirements may be estimated in a general way for planning and cost estimating purposes.

The need for hanger rod stiffeners, the size of the rod stiffener angle, and the number of clamps used to attach the rod stiffener angle to the hanger rod is dependent on several variables.

1. The horizontal seismic force that is being restrained. This value depends on the design spectral acceleration seismic acceleration, the component importance factor, component amplification and response factors, the weight of the pipe or duct being restrained, the restraint spacing, and the elevation of the hanger rod attachment point in the building with respect to the roof line as measured from grade. In this appendix, the horizontal seismic force will be expressed as a Horizontal Force Class value, see Table A5.1-1. The numerical value assigned to the Horizontal Force Class will be the maximum force value in the range for each Force Class. The Horizontal Force Class number is the force that is applied at each restraint location. It may be computed from the information given in Sections S5.0 and S7.0, or obtained from the online tools provided by Kinetics Noise Control.
2. The hanger rod size. The buckling strength of the hanger rods in this appendix has been determined using the minor thread diameter and assuming that the rods are carbon steel and meet the minimum strength requirements of ASTM A307. The various hanger rod sizes are assigned a numerical code to streamline the data tables in the following sections of this appendix. The hanger rod size code and other hanger rod data are presented in Table A5.1-2.

ESTIMATING HANGER ROD STIFFENER REQUIREMENTS

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SECTION – A5.1

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Table A5.1-1; Horizontal Seismic Force Class System Designations

Horizontal Force Class	Horizontal Seismic Force Range per Force Class (lbs)
I	$0 \leq F_p \leq 250$
II	$250 < F_p \leq 500$
III	$500 < F_p \leq 1,000$
IV	$1,000 < F_p \leq 2,000$
V	$2,000 < F_p \leq 5,000$
VI	$5,000 < F_p \leq 10,000$

Table S5.1-2; Hanger Rod Size Code, Size, and Allowable Load Data

Hanger Rod Code	Hanger Rod Size UNC	Minor Thread Diameter (in)	Area Moment of Inertia (in ⁴)	Hanger Rod Allowable Load ASD (kips)
3	3/8 - 16	0.2992	0.000393	0.73
4	1/2 - 13	0.4069	0.001346	1.35
5	5/8 - 11	0.5152	0.003458	2.16
6	3/4 - 10	0.6291	0.007689	3.23
7	7/8 - 9	0.7408	0.014783	4.48
8	1 - 8	0.8492	0.025528	5.90
10	1 1/4 - 7	1.0777	0.066216	9.50

3. The supported weight of the pipe or duct. This is expressed as a weight per foot. Data for the weight per foot of various pipe and duct may be found in Appendix A2.0 and Appendix A3.0 of this manual respectively.
4. The hanger rod spacing. A 10 ft spacing of the hanger rods was assumed for the tables and analysis in this manual. This is a standard spacing that corresponds well with the usual recommended seismic restraint spacings, see Section S1.0.

ESTIMATING HANGER ROD STIFFENER REQUIREMENTS

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SECTION – A5.1

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5. Seismic restraint installation angle. In a run of pipe and duct, the restraint installation angle may vary widely from restraint location to restraint location. This appendix provides a set of tables for restraint installation angle ranging from 0° up to and including 45°, Sections A5.2 and A5.4, and a set of tables for restraint installation angles ranging from 45° up to and including 60°, Sections A5.3 and A5.5.
6. Single hanger rod or trapeze supported pipe or duct. This affects the dead weight load carried by each hanger rod which will affect the magnitude of the compressive load that is applied to the hanger rod. The effects of using a single hanger rod or a trapeze to support the pipe or duct is demonstrated in Tables S8-3 through S8-10.

Hanger rod stiffeners may be nearly any rigid structural shape. Some of the components that have historically been used are as follows.

1. AISI rolled structural angles
2. Pipe
3. Electrical conduit
4. UNISTRUT® channels, there are several different manufacturers of shapes similar to those provided by UNISTRUT®

Kinetics Noise Control has chosen to recommend the AISI rolled structural angles for use as hanger rod stiffeners because they give the hanger rod good lateral support, they are readily available, and they provide a great deal of flexibility for use with many hanger rod sizes. Kinetics Noise Control provides two basic models of rod stiffener clamps that cover a wide range of AISI rolled structural angles, and hanger rods. These clamps are shown in Figures A5.1-1 and A5.1-2. These two clamps will allow the use of hanger rods ranging from 3/8 – 16 UNC to 1-1/4 – 7 UNC, and AISI structural angles ranging from L1 x 1 x 1/8 to L2-1/2 x 2-1/2 x 1/4 for normal applications, and up to L2-1/2 x 2-1/2 x 1/2 for certain special applications. To make the tables and specifications easier, an alpha rod stiffener code has been assigned to the AISI structural angles recommended by Kinetics Noise Control. The AISI structural angles suitable for the Models

ESTIMATING HANGER ROD STIFFENER REQUIREMENTS

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KHRC-B and KHRC-C hanger rod stiffener clamps are list by rod stiffener code letter in Table A5.1-3.

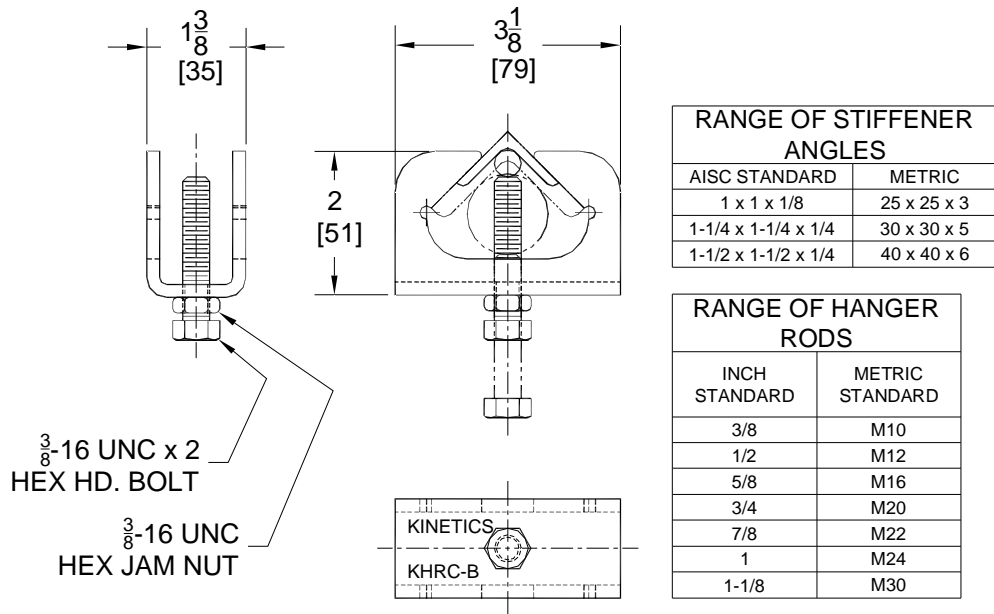


Figure A5.1-1; Kinetics Noise Control Model KHRC-B Small Hanger Rod Stiffener Clamp

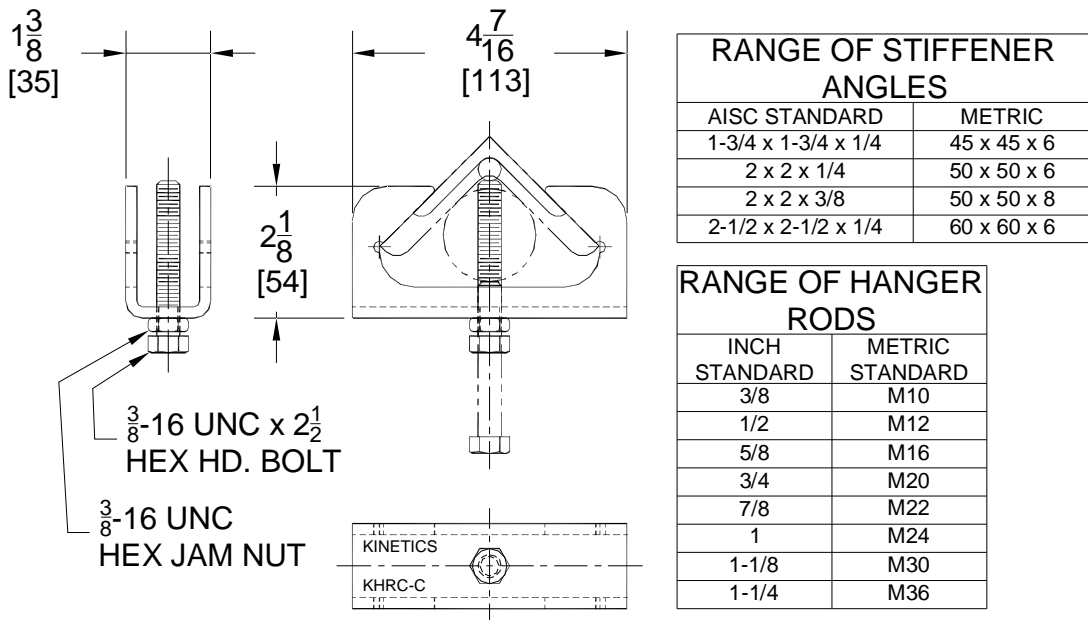


Figure A5.1-2; Kinetics Noise Control Model KHRC-C Large Hanger Rod Stiffener Clamp

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SECTION – A5.1

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Table A5.1-3; Rod Stiffener Angle Code Designation and Design Data

Rod Stiffener Code	AISI Angle Designation	Weight per Foot (lbs)	Section Area (in ²)	I_{X-X} or I_{Y-Y} (in ⁴)	Radius of Gyration Z-Z (in)	I_{Z-Z} (in ⁴)
A	L 1 x 1 x 1/8	0.80	0.234	0.022	0.196	0.0090
B	L 1-1/4 x 1-1/4 x 1/4	1.92	0.563	0.077	0.243	0.0332
C	L 1-1/2 x 1-1/2 x 1/4	2.34	0.688	0.139	0.292	0.0587
D	L 1-3/4 x 1-3/4 x 1/4	2.77	0.813	0.227	0.341	0.0945
E	L 2 x 2 x 1/4	3.19	0.938	0.348	0.391	0.1434
F	L 2 x 2 x 3/8	4.70	1.36	0.479	0.389	0.2058
G	L 2-1/2 x 2-1/2 x 1/4	4.10	1.19	0.703	0.491	0.2869
H ¹	L 2-1/2 x 2-1/2 x 3/8	5.90	1.73	0.984	0.487	0.4103
I ¹	L 2-1/2 x 2-1/2 x 1/2	7.70	2.25	1.230	0.487	0.5336

¹ These rod stiffener angles may be used with the Kinetics Noise Control Model KHRC-C rod stiffener clamp. Not all hanger rod sizes may work with these arrangements. Check with Kinetics Noise Control Engineering for your particular application.

Example No. 1:

1. CWS – Chilled Water Supply: 8" insulated schedule 40 steel pipe & a supported weight of 55.84 lbs/ft from Table A2.1-2.
2. Single Hanger Rod Supported: Hanger rod size = 1/2-13 UNC (Hanger Rod Code = 4 from Table A5.1-2).
3. Cable restraints installed @ 45°.
4. Assume 10 ft hanger rod spacing.
5. Horizontal Force Class III
6. Hanger rod length $L = 36$ in.

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- A. From Table A5.2-4 the maximum un-stiffened hanger rod length will be $L_{CR} = 11$ in. The actual supported weight falls just over the 50 lb/ft value in the table, therefore, to be safe, the hanger rod will require a stiffener.
- B. From Table A5.4-4 the rod stiffener code that will apply is A (L 1 x 1 x 1/8). The actual hanger rod length is less than the maximum allowable angle stiffener length for rod stiffener code A.
- C. From Table A5.6-4, the Maximum Rod Stiffener Clamp Spacing for 50 lbs/ft is 40 inches.
- D. The number of Model KHRC-B rod stiffener clamps that will be required for this hanger rod is 3. The hanger rod is shorter than the Maximum Rod Stiffener Clamp Spacing.

Example No. 2:

- 1. CWS & CWR – Chilled Water Supply and Chilled Water Return: 8" insulated schedule 40 steel pipe & a supported weight of 55.84 lbs/ft each from Table A2.1-2. Total supported weight is 111.68 lbs/ft.
 - 2. Trapeze Supported: Hanger rod size = 3/8-16 UNC (Hanger Rod Code = 3 from Table A5.1-2).
 - 3. Cable restraints installed @ 45°.
 - 4. Assume 10 ft hanger rod spacing.
 - 5. Horizontal Force Class II
 - 6. Hanger rod length $L = 36$ in.
- A. From Tables A5.2-9 and A5.4-9 hanger rod stiffeners are not required for:
 - a. 3/8-16 UNC hanger rods supporting over 100 lbs/ft in a trapeze arrangement.
 - b. Horizontal Force Class II.
 - c. Restraint installation angle of 45° or less.

Example No. 3:

- 1. 54 x 108 rectangular duct with a supported weight of 70 lbs/ft.

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2. Trapeze Supported: Hanger rod size = 3/8-16 UNC (Hanger Rod Code = 3 from Table A5.1-2).
 3. Cable restraints installed @ 60°.
 4. Assume 10 ft hanger rod spacing.
 5. Horizontal Force Class IV
 6. Hanger rod length $L = 60$ in.
- A. From Table A5.3-11 the 3/8-16 UNC hanger rod is not recommended for a trapeze application for any listed supported load when the Horizontal Force Class is IV and the installation angle is 60°. The first hanger rod that may be used is a #5 rod which is 5/8-11 UNC. The maximum un-stiffened hanger rod length is $L_{CR} = 7$ in.
- B. From Table A5.5-11 the rod stiffener code that will apply is C (L 1-1/2 x 1-1/2 x 1/4).
- C. From Table A5.7-11, the Maximum Rod Stiffener Clamp Spacing is 16 in.
- D. The number of Model KHRC-B rod stiffener clamps that will be required for this hanger rod

$$\text{is } N_{RC} = \left(\frac{L}{S_C} \right) + 1 = \left(\frac{60}{16} \right) = 3.75 = \underline{4}.$$

Example No. 4:

1. 44 x 44 square duct with a supported weight of 23.6 lbs/ft.
 2. Trapeze Supported: Hanger rod size = 3/8-16 UNC (Hanger Rod Code = 3 from Table A5.1-2).
 3. Cable restraints installed @ 60°.
 4. Assume 10 ft hanger rod spacing.
 5. Horizontal Seismic Design Force @ Restraint Point = 793 lbs (Horizontal Force Class III from Table A5.1-1).
 6. Hanger rod length $L = 120$ in.
- A. From Table A5.3-10 the 3/8-16 UNC hanger rod is not recommended for a trapeze application for any listed supported load when the Horizontal Force Class is III and the

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installation angle is 60°. The first hanger rod that may be used is a #5 rod which is 5/8-11 UNC. The maximum un-stiffened hanger rod length is $L_{CR} = 10$ in.

B. From Table A5.5-10 the rod stiffener code that will apply is E (L 2 x 2 x 1/4).

C. From Table A5.7-10, the Maximum Rod Stiffener Clamp Spacing is 22 in.

D. The number of Model KHRC-C rod stiffener clamps that will be required for this hanger rod

$$\text{is } N_{RC} = \left(\frac{L}{S_c} \right) + 1 = \left(\frac{120}{22} \right) = 3.75 = \underline{7}.$$

Example No. 5:

1. 114 x 50 rectangular duct with a supported weight of 92.4 lbs/ft.
 2. Trapeze Supported: Hanger rod size = 1/2-13 UNC (Hanger Rod Code = 4 from Table A5.1-2).
 3. Cable restraints installed @ 60°.
 4. Assume 10 ft hanger rod spacing.
 5. Horizontal Seismic Design Force @ Restraint Point = 3,105 lbs (Horizontal Force Class V from Table A5.1-1).
 6. Hanger rod length $L = 120$ in.
- A. From Table A5.3-12 the 1/2-13 UNC hanger rod is not recommended for a trapeze application for any listed supported load when the Horizontal Force Class is V and the installation angle is 60°. The first hanger rod that may be used is a #7 rod which is 7/8-9 UNC. The maximum un-stiffened hanger rod length is $L_{CR} = 9$ in.
- B. From Table A5.5-12 there is no available rod stiffener for this application and hanger rod length. Reduce restraint spacing to reduce the Horizontal Force Class, or consult with the Kinetics Noise Control for recommendations.

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Example No. 6:

1. Chilled Water Supply: 12" insulated schedule 40 steel pipe & a supported weight of 106.45 lbs/ft each from Table A2.1-2
 2. Single Clevis Supported: Hanger Rod Size = 3/4-10 UNC (Hanger Rod Code = 6 from Table A5.1-2).
 3. Cable restraints installed @ 60°.
 4. Assume 10 ft hanger rod spacing.
 5. Horizontal Seismic Design Force @ Restraint Point = 2,384 lbs (Horizontal Force Class V from Table A5.1-1).
 6. Hanger rod length $L = 60$ in.
- A. From Table A5.3-6 the 3/4-10 UNC the maximum un-stiffened hanger rod length is $L_{CR} = 7$ in.
- B. From Table A5.5-6 the rod stiffener code that will apply is F (L 2 x 2 x 3/8).
- C. From Table A5.7-6, the Maximum Rod Stiffener Clamp Spacing is 15 inches.
- D. The number of Model KHRC-B rod stiffener clamps that will be required for this hanger rod

$$\text{is } N_{RC} = \left(\frac{L}{S_C} \right) + 1 = \left(\frac{60}{15} \right) = 4.$$

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MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $0^\circ \leq A \leq 45^\circ$

Table S5.2-1; Hanger Rod Size Code, Size, and Allowable Load Data

Hanger Rod Code	Hanger Rod Size UNC	Minor Thread Diameter (in)	Area Moment of Inertia (in ⁴)	Hanger Rod Allowable Load ASD (kips)
3	3/8 - 16	0.2992	0.000393	0.73
4	1/2 - 13	0.4069	0.001346	1.35
5	5/8 - 11	0.5152	0.003458	2.16
6	3/4 - 10	0.6291	0.007689	3.23
7	7/8 - 9	0.7408	0.014783	4.48
8	1 - 8	0.8492	0.025528	5.90
10	1 1/4 - 7	1.0777	0.066216	9.50

Table A5.2-2; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class I, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	9	18	29	43	60	79	127
10	11	21	33	50	69	91	147
15	13	25	41	61	85	112	180
25	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
50	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.2-3; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class II, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	12	19	29	40	52	85
10	-----	12	20	30	42	56	90
15	7	13	22	32	45	59	96
25	8	16	26	38	54	70	114
50	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.2-4; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class III, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	8	13	19	27	36	58
10	-----	8	13	20	28	37	60
15	-----	8	14	21	29	38	62
25	-----	9	15	22	31	40	66
50	-----	11	18	27	38	50	80
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.2-5; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class **IV**, *Single Hanger Rod Supported Pipe & Duct*, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	9	13	19	25	40
10	-----	-----	9	14	19	25	41
15	-----	-----	9	14	19	26	42
25	-----	-----	9	14	20	26	43
50	-----	-----	10	15	22	28	46
100	-----	8	13	19	27	35	57
150	-----	11	18	27	38	50	80
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.2-6; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class **V**, *Single Hanger Rod Supported Pipe & Duct*, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	-----	8	12	15	25
10	-----	-----	-----	8	12	16	25
15	-----	-----	-----	8	12	16	25
25	-----	-----	-----	8	12	16	26
50	-----	-----	-----	9	12	16	26
100	-----	-----	-----	9	13	17	28
150	-----	-----	-----	10	14	18	30
200	-----	-----	7	11	15	20	33
250	-----	-----	8	12	17	22	36
300	-----	-----	9	13	19	25	40

MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.2-7; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class VI, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	-----	-----	8	11	18
10	-----	-----	-----	-----	8	11	18
15	-----	-----	-----	-----	8	11	18
25	-----	-----	-----	-----	8	11	18
50	-----	-----	-----	-----	8	11	18
100	-----	-----	-----	-----	9	11	19
150	-----	-----	-----	-----	9	12	19
200	-----	-----	-----	-----	9	12	20
250	-----	-----	-----	7	9	12	20
300	-----	-----	-----	7	10	13	21

Table A5.2-8; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class I, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	9	17	27	41	56	74	120
10	9	18	29	43	60	79	127
15	10	19	31	46	64	84	136
25	12	23	36	55	76	100	161
50	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.2-9; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class II, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	11	18	28	39	51	82
10	-----	12	19	29	40	52	85
15	-----	12	20	29	41	54	87
25	7	13	21	31	44	57	93
50	8	16	26	38	54	70	114
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.2-10; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class III, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	8	13	19	27	35	57
10	-----	8	13	19	27	36	58
15	-----	8	13	20	28	36	59
25	-----	8	13	20	28	37	61
50	-----	9	15	22	31	40	66
100	-----	11	18	27	38	50	80
150	8	16	26	38	54	70	114
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.2-11; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class IV, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	9	13	19	25	40
10	-----	-----	9	13	19	25	40
15	-----	-----	9	14	19	25	41
25	-----	-----	9	14	19	25	41
50	-----	-----	9	14	20	26	43
100	-----	-----	10	15	22	28	46
150	-----	7	11	17	24	31	51
200	-----	8	13	19	27	35	57
250	-----	9	15	22	31	40	66
300	-----	11	18	27	38	50	80

Table A5.2-12; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class V, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	-----	8	12	15	25
10	-----	-----	-----	8	12	15	25
15	-----	-----	-----	8	12	15	25
25	-----	-----	-----	8	12	16	25
50	-----	-----	-----	8	12	16	26
100	-----	-----	-----	9	12	16	26
150	-----	-----	-----	9	13	17	27
200	-----	-----	-----	9	13	17	28
250	-----	-----	-----	10	13	18	29
300	-----	-----	-----	10	14	18	30

MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.2-13; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class VI, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	-----	-----	8	11	18
10	-----	-----	-----	-----	8	11	18
15	-----	-----	-----	-----	8	11	18
25	-----	-----	-----	-----	8	11	18
50	-----	-----	-----	-----	8	11	18
100	-----	-----	-----	-----	8	11	18
150	-----	-----	-----	-----	8	11	18
200	-----	-----	-----	-----	9	11	19
250	-----	-----	-----	-----	9	11	19
300	-----	-----	-----	-----	9	12	19

MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $0^\circ \leq A \leq 45^\circ$

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MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $45^\circ < A \leq 60^\circ$

Table S5.3-1; Hanger Rod Size Code, Size, and Allowable Load Data

Hanger Rod Code	Hanger Rod Size UNC	Minor Thread Diameter (in)	Area Moment of Inertia (in ⁴)	Hanger Rod Allowable Load ASD (kips)
3	3/8 - 16	0.2992	0.000393	0.73
4	1/2 - 13	0.4069	0.001346	1.35
5	5/8 - 11	0.5152	0.003458	2.16
6	3/4 - 10	0.6291	0.007689	3.23
7	7/8 - 9	0.7408	0.014783	4.48
8	1 - 8	0.8492	0.025528	5.90
10	1 1/4 - 7	1.0777	0.066216	9.50

Table A5.3-2; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class I, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	7	13	21	31	43	57	92
10	7	14	22	33	46	61	99
15	8	15	24	36	50	66	107
25	10	19	30	45	63	82	133
50	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $45^\circ < A \leq 60^\circ$

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Table A5.3-3; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class II, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	9	14	21	29	39	63
10	-----	9	14	22	30	40	65
15	-----	9	15	23	31	41	67
25	-----	10	16	24	34	45	72
50	7	13	21	32	44	58	94
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.3-4; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class III, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	10	15	20	27	44
10	-----	-----	10	15	21	27	44
15	-----	-----	10	15	21	28	45
25	-----	-----	10	16	22	29	46
50	-----	7	11	17	24	31	51
100	-----	9	15	22	31	41	66
150	9	16	27	40	56	73	118
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $45^\circ < A \leq 60^\circ$

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Table A5.3-5; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class **IV**, *Single Hanger Rod Supported Pipe & Duct*, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	7	10	14	19	30
10	-----	-----	7	10	14	19	31
15	-----	-----	7	10	14	19	31
25	-----	-----	7	10	15	19	31
50	-----	-----	7	11	15	20	33
100	-----	-----	8	12	17	22	36
150	-----	-----	9	13	19	25	40
200	-----	-----	10	16	22	29	47
250	-----	8	13	19	27	36	58
300	-----	11	19	28	39	52	83

Table A5.3-6; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class **V**, *Single Hanger Rod Supported Pipe & Duct*, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	-----	-----	9	12	19
10	-----	-----	-----	-----	9	12	19
15	-----	-----	-----	-----	9	12	19
25	-----	-----	-----	-----	9	12	19
50	-----	-----	-----	-----	9	12	20
100	-----	-----	-----	7	9	12	20
150	-----	-----	-----	7	10	13	21
200	-----	-----	-----	7	10	13	22
250	-----	-----	-----	7	10	14	23
300	-----	-----	-----	8	11	14	24

MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $45^\circ < A \leq 60^\circ$

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Table A5.3-7; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class VI, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	-----	-----	-----	8	13
10	-----	-----	-----	-----	-----	8	13
15	-----	-----	-----	-----	-----	8	13
25	-----	-----	-----	-----	-----	8	13
50	-----	-----	-----	-----	-----	8	13
100	-----	-----	-----	-----	-----	8	14
150	-----	-----	-----	-----	-----	8	14
200	-----	-----	-----	-----	-----	9	14
250	-----	-----	-----	-----	7	9	14
300	-----	-----	-----	-----	7	9	15

Table A5.3-8; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class I, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	12	20	30	42	55	89
10	7	13	21	31	43	57	92
15	7	13	21	32	45	59	95
25	7	14	23	35	48	63	102
50	10	19	30	45	63	82	133
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $45^\circ < A \leq 60^\circ$

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Table A5.3-9; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class II, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	8	14	21	29	38	62
10	-----	9	14	21	29	39	63
15	-----	9	14	21	30	39	64
25	-----	9	15	22	31	41	66
50	-----	10	16	24	34	45	72
100	7	13	21	32	44	58	94
150	12	23	38	57	79	104	167
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.3-10; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class III, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	9	14	20	27	43
10	-----	-----	10	15	20	27	44
15	-----	-----	10	15	20	27	44
25	-----	-----	10	15	21	27	45
50	-----	-----	10	16	22	29	46
100	-----	7	11	17	24	31	51
150	-----	8	13	19	27	35	57
200	-----	9	15	22	31	41	66
250	-----	11	18	28	38	51	82
300	9	16	27	40	56	73	118

MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $45^\circ < A \leq 60^\circ$

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Table A5.3-11; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class **IV**, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	7	10	14	19	30
10	-----	-----	7	10	14	19	30
15	-----	-----	7	10	14	19	31
25	-----	-----	7	10	14	19	31
50	-----	-----	7	10	15	19	31
100	-----	-----	7	11	15	20	33
150	-----	-----	7	11	16	21	34
200	-----	-----	8	12	17	22	36
250	-----	-----	8	13	18	23	38
300	-----	-----	9	13	19	25	40

Table A5.3-12; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class **V**, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	-----	-----	9	12	19
10	-----	-----	-----	-----	9	12	19
15	-----	-----	-----	-----	9	12	19
25	-----	-----	-----	-----	9	12	19
50	-----	-----	-----	-----	9	12	19
100	-----	-----	-----	-----	9	12	20
150	-----	-----	-----	-----	9	12	20
200	-----	-----	-----	7	9	12	20
250	-----	-----	-----	7	9	13	20
300	-----	-----	-----	7	10	13	21

MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $45^\circ < A \leq 60^\circ$

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Table A5.3-13; Maximum Un-Stiffened Hanger Rod Length: Horizontal Force Class VI, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Un-Stiffened Hanger Rod Length (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	-----	-----	-----	8	13
10	-----	-----	-----	-----	-----	8	13
15	-----	-----	-----	-----	-----	8	13
25	-----	-----	-----	-----	-----	8	13
50	-----	-----	-----	-----	-----	8	13
100	-----	-----	-----	-----	-----	8	13
150	-----	-----	-----	-----	-----	8	14
200	-----	-----	-----	-----	-----	8	14
250	-----	-----	-----	-----	-----	8	14
300	-----	-----	-----	-----	-----	8	14

MAXIMUM UN-STIFFENED HANGER ROD LENGTH FOR $45^\circ < A \leq 60^\circ$

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AISI ANGLE STIFFENER DATA FOR $0^\circ \leq A \leq 45^\circ$

Table S5.4-1; Rod Stiffener Angle Code Designation and Design Data

Rod Stiffener Code	AISI Angle Designation	Weight per Foot (lbs)	Section Area (in ²)	I_{X-X} or I_{Y-Y} (in ⁴)	Radius of Gyration Z-Z (in)	I_{Z-Z} (in ⁴)
A	L 1 x 1 x 1/8	0.80	0.234	0.022	0.196	0.0090
B	L 1-1/4 x 1-1/4 x 1/4	1.92	0.563	0.077	0.243	0.0332
C	L 1-1/2 x 1-1/2 x 1/4	2.34	0.688	0.139	0.292	0.0587
D	L 1-3/4 x 1-3/4 x 1/4	2.77	0.813	0.227	0.341	0.0945
E	L 2 x 2 x 1/4	3.19	0.938	0.348	0.391	0.1434
F	L 2 x 2 x 3/8	4.70	1.36	0.479	0.389	0.2058
G	L 2-1/2 x 2-1/2 x 1/4	4.10	1.19	0.703	0.491	0.2869
H ¹	L 2-1/2 x 2-1/2 x 3/8	5.90	1.73	0.984	0.487	0.4103
I ¹	L 2-1/2 x 2-1/2 x 1/2	7.70	2.25	1.230	0.487	0.5336

¹ These rod stiffener angles may be used with the Kinetics Noise Control Model KHRC-C rod stiffener clamp. Not all hanger rod sizes may work with these arrangements. Check with Kinetics Noise Control Engineering for your particular application.

AISI ANGLE STIFFENER DATA FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.4-2; Maximum Allowable Rod Stiffener Length: Horizontal Force Class I, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	94	174	240	240	240	240	240	240	240
10	108	201	240	240	240	240	240	240	240
15	133	240	240	240	240	240	240	240	240
25	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
50	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.4-3; Maximum Allowable Rod Stiffener Length: Horizontal Force Class II, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	62	116	160	203	240	240	240	240	240
10	66	123	170	215	240	240	240	240	240
15	71	131	181	230	240	240	240	240	240
25	84	156	215	240	240	240	240	240	240
50	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

AISI ANGLE STIFFENER DATA FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.4-4; Maximum Allowable Rod Stiffener Length: Horizontal Force Class **III**, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	43	80	110	140	172	206	240	240	240
10	44	82	113	143	177	212	240	240	240
15	45	84	116	148	182	218	240	240	240
25	48	90	124	157	194	232	240	240	240
50	59	110	152	193	237	240	240	240	240
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.4-5; Maximum Allowable Rod Stiffener Length: Horizontal Force Class **IV**, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	30	55	77	97	120	144	170	203	232
10	30	56	78	99	122	146	172	206	235
15	30	57	79	100	123	148	174	209	238
25	31	58	81	103	127	152	179	215	240
50	34	63	87	111	137	164	194	232	240
100	42	78	107	136	168	201	237	240	240
150	59	110	152	193	237	240	240	240	240
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

AISI ANGLE STIFFENER DATA FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.4-6; Maximum Allowable Rod Stiffener Length: Horizontal Force Class V, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	18	35	48	61	75	90	106	127	145
10	19	35	48	61	76	91	107	128	146
15	19	35	48	62	76	91	108	129	147
25	19	35	49	62	77	92	109	130	148
50	19	36	50	64	79	95	112	134	152
100	21	39	53	68	84	100	118	142	162
150	22	41	57	73	89	107	127	152	173
200	24	45	62	78	97	116	137	164	187
250	26	49	68	86	106	127	150	179	205
300	29	55	76	96	118	142	168	201	229

Table A5.4-7; Maximum Allowable Rod Stiffener Length: Horizontal Force Class VI, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	13	24	34	43	53	63	75	90	102
10	13	24	34	43	53	64	75	90	103
15	13	24	34	43	53	64	75	90	103
25	13	24	34	43	53	64	76	91	103
50	13	25	34	44	54	65	77	92	105
100	14	26	35	45	56	67	79	94	108
150	14	26	36	46	57	69	81	97	111
200	14	27	38	48	59	71	84	100	114
250	15	28	39	49	61	73	86	103	118
300	15	29	40	51	63	76	89	107	122

AISI ANGLE STIFFENER DATA FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.4-8; Maximum Allowable Rod Stiffener Length: Horizontal Force Class **I**, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	88	164	226	240	240	240	240	240	240
10	94	174	240	240	240	240	240	240	240
15	100	186	240	240	240	240	240	240	240
25	119	220	240	240	240	240	240	240	240
50	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.4-9; Maximum Allowable Rod Stiffener Length: Horizontal Force Class **II**, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	61	113	156	198	240	240	240	240	240
10	62	116	160	203	240	240	240	240	240
15	64	119	165	209	240	240	240	240	240
25	68	127	175	223	240	240	240	240	240
50	84	156	215	240	240	240	240	240	240
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

AISI ANGLE STIFFENER DATA FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.4-10; Maximum Allowable Rod Stiffener Length: Horizontal Force Class III, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	42	79	108	138	170	204	240	240	240
10	43	80	110	140	172	206	240	240	240
15	43	81	111	142	174	209	240	240	240
25	45	83	115	146	179	215	240	240	240
50	48	90	124	157	194	232	240	240	240
100	59	110	152	193	237	240	240	240	240
150	84	156	215	240	240	240	240	240	240
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.4-11; Maximum Allowable Rod Stiffener Length: Horizontal Force Class IV, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	29	55	76	97	119	143	169	202	230
10	30	55	77	97	120	144	170	203	232
15	30	56	77	98	121	145	171	205	233
25	30	56	78	99	122	147	173	207	237
50	31	58	81	103	127	152	179	215	240
100	34	63	87	111	137	164	194	232	240
150	37	69	96	122	150	180	212	240	240
200	42	78	107	136	168	201	237	240	240
250	48	90	124	157	194	232	240	240	240
300	59	110	152	193	237	240	240	240	240

AISI ANGLE STIFFENER DATA FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.4-12; Maximum Allowable Rod Stiffener Length: Horizontal Force Class V, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	18	34	48	61	75	90	106	127	145
10	18	35	48	61	75	90	106	127	145
15	18	35	48	61	75	90	107	128	146
25	19	35	48	61	76	91	107	128	146
50	19	35	49	62	77	92	109	130	148
100	19	36	50	64	79	95	112	134	152
150	20	37	52	66	81	97	115	138	157
200	21	39	53	68	84	100	118	142	162
250	21	40	55	70	86	104	122	146	167
300	22	41	57	73	89	107	127	152	173

Table A5.4-13; Maximum Allowable Rod Stiffener Length: Horizontal Force Class VI, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	13	24	34	43	53	63	75	90	102
10	13	24	34	43	53	63	75	90	102
15	13	24	34	43	53	63	75	90	103
25	13	24	34	43	53	64	75	90	103
50	13	24	34	43	53	64	76	91	103
100	13	25	34	44	54	65	77	92	105
150	13	25	35	44	55	66	78	93	106
200	14	26	35	45	56	67	79	94	108
250	14	26	36	46	56	68	80	96	109
300	14	26	36	46	57	69	81	97	111

AISI ANGLE STIFFENER DATA FOR $0^\circ \leq A \leq 45^\circ$

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AISI ANGLE STIFFENER DATA FOR $45^\circ < A \leq 60^\circ$

Table S5.5-1; Rod Stiffener Angle Code Designation and Design Data

Rod Stiffener Code	AISI Angle Designation	Weight per Foot (lbs)	Section Area (in ²)	I_{X-X} or I_{Y-Y} (in ⁴)	Radius of Gyration Z-Z (in)	I_{Z-Z} (in ⁴)
A	L 1 x 1 x 1/8	0.80	0.234	0.022	0.196	0.0090
B	L 1-1/4 x 1-1/4 x 1/4	1.92	0.563	0.077	0.243	0.0332
C	L 1-1/2 x 1-1/2 x 1/4	2.34	0.688	0.139	0.292	0.0587
D	L 1-3/4 x 1-3/4 x 1/4	2.77	0.813	0.227	0.341	0.0945
E	L 2 x 2 x 1/4	3.19	0.938	0.348	0.391	0.1434
F	L 2 x 2 x 3/8	4.70	1.36	0.479	0.389	0.2058
G	L 2-1/2 x 2-1/2 x 1/4	4.10	1.19	0.703	0.491	0.2869
H ¹	L 2-1/2 x 2-1/2 x 3/8	5.90	1.73	0.984	0.487	0.4103
I ¹	L 2-1/2 x 2-1/2 x 1/2	7.70	2.25	1.230	0.487	0.5336

¹ These rod stiffener angles may be used with the Kinetics Noise Control Model KHRC-C rod stiffener clamp. Not all hanger rod sizes may work with these arrangements. Check with Kinetics Noise Control Engineering for your particular application.

AISI ANGLE STIFFENER DATA FOR $45^\circ < A \leq 60^\circ$

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Table A5.5-2; Maximum Allowable Rod Stiffener Length: Horizontal Force Class I, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	68	126	173	220	240	240	240	240	240
10	72	135	186	236	240	240	240	240	240
15	79	146	202	240	240	240	240	240	240
25	98	182	240	240	240	240	240	240	240
50	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.5-3; Maximum Allowable Rod Stiffener Length: Horizontal Force Class II, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	46	86	119	151	186	223	240	240	240
10	48	89	122	156	192	230	240	240	240
15	49	92	127	161	198	238	240	240	240
25	53	99	137	174	214	240	240	240	240
50	69	128	177	225	240	240	240	240	240
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

AISI ANGLE STIFFENER DATA FOR $45^\circ < A \leq 60^\circ$

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Table A5.5-4; Maximum Allowable Rod Stiffener Length: Horizontal Force Class III, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	32	60	82	105	129	155	183	219	240
10	32	61	84	106	131	157	186	222	240
15	33	62	85	108	133	160	189	226	240
25	34	64	88	112	138	165	195	233	240
50	37	70	96	123	151	181	214	240	240
100	49	91	125	159	196	235	240	240	240
150	87	161	223	240	240	240	240	240	240
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.5-5; Maximum Allowable Rod Stiffener Length: Horizontal Force Class IV, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	22	42	58	73	91	109	128	154	175
10	22	42	58	74	91	109	129	155	176
15	23	42	59	75	92	110	130	156	178
25	23	43	60	76	93	112	132	158	181
50	24	45	62	79	97	117	138	165	188
100	26	49	68	87	107	128	151	181	206
150	30	55	76	97	120	143	169	203	231
200	34	64	88	112	139	166	196	235	240
250	42	79	109	139	171	205	240	240	240
300	61	114	157	200	240	240	240	240	240

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Table A5.5-6; Maximum Allowable Rod Stiffener Length: Horizontal Force Class V, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	14	26	36	46	57	68	81	96	110
10	14	26	36	46	57	68	81	97	110
15	14	26	36	46	57	69	81	97	111
25	14	26	37	47	58	69	82	98	111
50	14	27	37	47	58	70	83	99	113
100	15	28	38	49	60	72	85	102	117
150	15	29	40	51	62	75	88	106	121
200	16	30	41	52	65	78	92	110	125
250	16	31	43	55	67	81	95	114	130
300	17	32	45	57	70	84	100	119	136

Table A5.5-7; Maximum Allowable Rod Stiffener Length: Horizontal Force Class VI, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	-----	18	25	32	40	48	57	68	78
10	-----	18	25	32	40	48	57	68	78
15	-----	18	25	32	40	48	57	68	78
25	-----	18	26	33	40	48	57	68	78
50	-----	19	26	33	41	49	58	69	79
100	-----	19	26	33	41	49	58	70	80
150	-----	19	27	34	42	50	59	71	81
200	-----	19	27	34	42	51	60	72	82
250	-----	20	27	35	43	52	61	73	84
300	-----	20	28	36	44	53	62	75	85

AISI ANGLE STIFFENER DATA FOR $45^\circ < A \leq 60^\circ$

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Table A5.5-8; Maximum Allowable Rod Stiffener Length: Horizontal Force Class **I**, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	65	122	168	213	240	240	240	240	240
10	68	126	173	220	240	240	240	240	240
15	70	130	179	228	240	240	240	240	240
25	75	140	193	240	240	240	240	240	240
50	98	182	240	240	240	240	240	240	240
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.5-9; Maximum Allowable Rod Stiffener Length: Horizontal Force Class **II**, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	45	85	117	148	183	219	240	240	240
10	46	86	119	151	186	223	240	240	240
15	47	87	120	153	189	226	240	240	240
25	48	90	125	158	195	234	240	240	240
50	53	99	137	174	214	240	240	240	240
100	69	128	177	225	240	240	240	240	240
150	123	229	240	240	240	240	240	240	240
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

AISI ANGLE STIFFENER DATA FOR $45^\circ < A \leq 60^\circ$

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Table A5.5-10; Maximum Allowable Rod Stiffener Length: Horizontal Force Class III, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	32	59	82	104	128	154	182	217	240
10	32	60	82	105	129	155	183	219	240
15	32	60	83	106	130	156	184	221	240
25	33	61	84	107	132	158	187	224	240
50	34	64	88	112	138	165	195	233	240
100	37	70	96	123	151	181	214	240	240
150	42	78	108	137	169	203	240	240	240
200	49	91	125	159	196	235	240	240	240
250	60	112	154	196	240	240	240	240	240
300	87	161	223	240	240	240	240	240	240

Table A5.5-11; Maximum Allowable Rod Stiffener Length: Horizontal Force Class IV, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	22	42	58	73	90	108	128	153	175
10	22	42	58	73	91	109	128	154	175
15	22	42	58	74	91	109	129	154	176
25	23	42	58	74	92	110	130	155	177
50	23	43	60	76	93	112	132	158	181
100	24	45	62	79	97	117	138	165	188
150	25	47	65	82	102	122	144	172	197
200	26	49	68	87	107	128	151	181	206
250	28	52	72	91	113	135	159	191	218
300	30	55	76	97	120	143	169	203	231

AISI ANGLE STIFFENER DATA FOR $45^\circ < A \leq 60^\circ$

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Table A5.5-12; Maximum Allowable Rod Stiffener Length: Horizontal Force Class V, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	14	26	36	46	57	68	80	96	110
10	14	26	36	46	57	68	81	96	110
15	14	26	36	46	57	68	81	97	110
25	14	26	36	46	57	68	81	97	111
50	14	26	37	47	58	69	82	98	111
100	14	27	37	47	58	70	83	99	113
150	14	27	38	48	59	71	84	101	115
200	15	28	38	49	60	72	85	102	117
250	15	28	39	50	61	74	87	104	119
300	15	29	40	51	62	75	88	106	121

Table A5.5-13; Maximum Allowable Rod Stiffener Length: Horizontal Force Class VI, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Length (in) Rod Stiffener Code for AISI Angles								
	A	B	C	D	E	F	G	H	I
5	-----	18	25	32	40	48	57	68	78
10	-----	18	25	32	40	48	57	68	78
15	-----	18	25	32	40	48	57	68	78
25	-----	18	25	32	40	48	57	68	78
50	-----	18	26	33	40	48	57	68	78
100	-----	19	26	33	41	49	58	69	79
150	-----	19	26	33	41	49	58	69	79
200	-----	19	26	33	41	49	58	70	80
250	-----	19	26	34	41	50	59	70	80
300	-----	19	27	34	42	50	59	71	81

AISI ANGLE STIFFENER DATA FOR $45^\circ < A \leq 60^\circ$
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MAXIMUM ROD STIFFENER CLAMP SPACING FOR $0^\circ \leq A \leq 45^\circ$

Table S5.6-1; Hanger Rod Size Code, Size, and Allowable Load Data

Hanger Rod Code	Hanger Rod Size UNC	Minor Thread Diameter (in)	Area Moment of Inertia (in ⁴)	Hanger Rod Allowable Load ASD (kips)
3	3/8 - 16	0.2992	0.000393	0.73
4	1/2 - 13	0.4069	0.001346	1.35
5	5/8 - 11	0.5152	0.003458	2.16
6	3/4 - 10	0.6291	0.007689	3.23
7	7/8 - 9	0.7408	0.014783	4.48
8	1 - 8	0.8492	0.025528	5.90
10	1 1/4 - 7	1.0777	0.066216	9.50

Table A5.6-2; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class I, *Single Hanger Rod* Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	21	39	63	95	117	117	117
10	24	46	73	110	117	117	117
15	30	56	90	117	117	117	117
25	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
50	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

MAXIMUM ROD STIFFENER CLAMP SPACING FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.6-3; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class II, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	14	26	42	63	88	115	117
10	15	28	45	67	93	117	117
15	16	30	48	72	100	117	117
25	19	35	57	85	117	117	117
50	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.6-4; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class III, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	9	18	29	43	60	79	117
10	10	18	30	44	62	81	117
15	10	19	31	46	64	84	117
25	11	20	33	49	68	89	117
50	13	25	40	60	83	109	117
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

MAXIMUM ROD STIFFENER CLAMP SPACING FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.6-5; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class IV, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	12	20	30	42	55	89
10	7	12	20	30	42	56	90
15	7	13	21	31	43	57	92
25	7	13	21	32	44	58	94
50	7	14	23	34	48	63	102
100	9	17	28	42	59	77	117
150	13	25	40	60	83	109	117
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.6-6; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class V, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	8	12	19	26	34	56
10	-----	8	12	19	26	35	56
15	-----	8	12	19	26	35	56
25	-----	8	13	19	27	35	57
50	-----	8	13	20	27	36	59
100	-----	8	14	21	29	38	62
150	-----	9	15	22	31	41	66
200	-----	10	16	24	34	44	72
250	-----	11	18	26	37	49	79
300	-----	12	20	30	41	54	88

MAXIMUM ROD STIFFENER CLAMP SPACING FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.6-7; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class VI, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	9	13	18	24	39
10	-----	-----	9	13	18	24	39
15	-----	-----	9	13	18	24	39
25	-----	-----	9	13	18	24	40
50	-----	-----	9	13	19	25	40
100	-----	-----	9	14	19	25	41
150	-----	-----	9	14	20	26	42
200	-----	-----	10	15	20	27	44
250	-----	-----	10	15	21	28	45
300	-----	-----	10	16	22	29	47

Table A5.6-8; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class I, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	20	37	60	89	117	117	117
10	21	39	63	95	117	117	117
15	23	42	68	102	117	117	117
25	27	50	80	117	117	117	117
50	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

MAXIMUM ROD STIFFENER CLAMP SPACING FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.6-9; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class II, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	14	25	41	61	85	112	117
10	14	26	42	63	88	115	117
15	14	27	43	65	90	117	117
25	15	29	46	69	96	117	117
50	19	35	57	85	117	117	117
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.6-10; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class III, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	9	18	28	43	59	78	117
10	9	18	29	43	60	79	117
15	10	18	29	44	61	80	117
25	10	19	30	45	63	83	117
50	11	20	33	49	68	89	117
100	13	25	40	60	83	109	117
150	19	35	57	85	117	117	117
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

MAXIMUM ROD STIFFENER CLAMP SPACING FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.6-11; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class IV, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	12	20	30	42	55	89
10	-----	12	20	30	42	55	89
15	-----	12	20	30	42	56	90
25	7	13	20	31	43	56	91
50	7	13	21	32	44	58	94
100	7	14	23	34	48	63	102
150	8	15	25	38	52	69	112
200	9	17	28	42	59	77	117
250	11	20	33	49	68	89	117
300	13	25	40	60	83	109	117

Table A5.6-12; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class V, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	8	12	19	26	34	56
10	-----	8	12	19	26	34	56
15	-----	8	12	19	26	35	56
25	-----	8	12	19	26	35	56
50	-----	8	13	19	27	35	57
100	-----	8	13	20	27	36	59
150	-----	8	13	20	28	37	60
200	-----	8	14	21	29	38	62
250	-----	9	14	22	30	40	64
300	-----	9	15	22	31	41	66

MAXIMUM ROD STIFFENER CLAMP SPACING FOR $0^\circ \leq A \leq 45^\circ$

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Table A5.6-13; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class VI, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 45°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	9	13	18	24	39
10	-----	-----	9	13	18	24	39
15	-----	-----	9	13	18	24	39
25	-----	-----	9	13	18	24	39
50	-----	-----	9	13	18	24	40
100	-----	-----	9	13	19	25	40
150	-----	-----	9	14	19	25	41
200	-----	-----	9	14	19	25	41
250	-----	-----	9	14	20	26	42
300	-----	-----	9	14	20	26	42

MAXIMUM ROD STIFFENER CLAMP SPACING FOR $0^\circ \leq A \leq 45^\circ$

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MAXIMUM ROD STIFFENER CLAMP SPACING FOR $45^\circ < A \leq 60^\circ$

Table S5.7-1; Hanger Rod Size Code, Size, and Allowable Load Data

Hanger Rod Code	Hanger Rod Size UNC	Minor Thread Diameter (in)	Area Moment of Inertia (in ⁴)	Hanger Rod Allowable Load ASD (kips)
3	3/8 - 16	0.2992	0.000393	0.73
4	1/2 - 13	0.4069	0.001346	1.35
5	5/8 - 11	0.5152	0.003458	2.16
6	3/4 - 10	0.6291	0.007689	3.23
7	7/8 - 9	0.7408	0.014783	4.48
8	1 - 8	0.8492	0.025528	5.90
10	1 1/4 - 7	1.0777	0.066216	9.50

Table A5.7-2; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class I, *Single Hanger Rod* Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	15	28	46	68	95	117	117
10	16	30	49	73	102	117	117
15	18	33	53	80	111	117	117
25	22	41	66	99	117	117	117
50	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

MAXIMUM ROD STIFFENER CLAMP SPACING FOR $45^\circ < A \leq 60^\circ$

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Table A5.7-3; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class **II**, *Single Hanger Rod Supported Pipe & Duct*, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	10	19	31	47	65	86	117
10	11	20	32	48	67	88	117
15	11	21	33	50	69	91	117
25	12	22	36	54	75	99	117
50	15	29	47	70	97	117	117
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.7-4; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class **III**, *Single Hanger Rod Supported Pipe & Duct*, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	7	13	22	32	45	59	96
10	7	13	22	33	46	60	98
15	7	14	22	33	47	61	99
25	7	14	23	35	48	63	102
50	8	16	25	38	53	70	112
100	11	20	33	49	69	90	117
150	20	37	59	88	117	117	117
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

MAXIMUM ROD STIFFENER CLAMP SPACING FOR $45^\circ < A \leq 60^\circ$

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Table A5.7-5; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class IV, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	9	15	23	32	42	67
10	-----	9	15	23	32	42	68
15	-----	9	15	23	32	42	68
25	-----	9	15	23	33	43	69
50	-----	10	16	24	34	45	72
100	-----	11	18	27	37	49	79
150	-----	12	20	30	42	55	89
200	7	14	23	35	48	64	103
250	9	18	29	43	60	79	117
300	14	26	42	62	86	114	117

Table A5.7-6; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class V, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	9	14	20	26	42
10	-----	-----	9	14	20	26	42
15	-----	-----	9	14	20	26	42
25	-----	-----	9	14	20	26	43
50	-----	-----	10	14	20	27	43
100	-----	-----	10	15	21	28	45
150	-----	-----	10	15	22	29	46
200	-----	-----	11	16	22	30	48
250	-----	7	11	17	23	31	50
300	-----	7	12	17	24	32	52

MAXIMUM ROD STIFFENER CLAMP SPACING FOR $45^\circ < A \leq 60^\circ$

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Table A5.7-7; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class VI, Single Hanger Rod Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	-----	10	14	18	30
10	-----	-----	-----	10	14	18	30
15	-----	-----	-----	10	14	18	30
25	-----	-----	-----	10	14	18	30
50	-----	-----	-----	10	14	18	30
100	-----	-----	7	10	14	19	31
150	-----	-----	7	10	14	19	31
200	-----	-----	7	10	15	19	31
250	-----	-----	7	11	15	20	32
300	-----	-----	7	11	15	20	33

Table A5.7-8; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class I, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	15	27	44	66	92	117	117
10	15	28	46	68	95	117	117
15	16	29	47	71	98	117	117
25	17	32	51	76	106	117	117
50	22	41	66	99	117	117	117
100	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
150	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

MAXIMUM ROD STIFFENER CLAMP SPACING FOR $45^\circ < A \leq 60^\circ$

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Table A5.7-9; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class II, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	10	19	31	46	64	84	117
10	10	19	31	47	65	86	117
15	10	20	32	47	66	87	117
25	11	20	33	49	68	90	117
50	12	22	36	54	75	99	117
100	15	29	47	70	97	117	117
150	28	52	84	117	117	117	117
200	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
250	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
300	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

Table A5.7-10; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class III, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	7	13	21	32	45	59	95
10	7	13	22	32	45	59	96
15	7	13	22	33	45	60	97
25	7	14	22	33	46	61	98
50	7	14	23	35	48	63	102
100	8	16	25	38	53	70	112
150	9	18	28	43	59	78	117
200	11	20	33	49	69	90	117
250	13	25	41	61	85	111	117
300	20	37	59	88	117	117	117

MAXIMUM ROD STIFFENER CLAMP SPACING FOR $45^\circ < A \leq 60^\circ$

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Table A5.7-11; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class IV, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	9	15	23	31	41	67
10	-----	9	15	23	32	42	67
15	-----	9	15	23	32	42	68
25	-----	9	15	23	32	42	68
50	-----	9	15	23	33	43	69
100	-----	10	16	24	34	45	72
150	-----	10	17	25	35	47	76
200	-----	11	18	27	37	49	79
250	-----	11	19	28	39	52	84
300	-----	12	20	30	42	55	89

Table A5.7-12; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class V, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	9	14	20	26	42
10	-----	-----	9	14	20	26	42
15	-----	-----	9	14	20	26	42
25	-----	-----	9	14	20	26	42
50	-----	-----	9	14	20	26	43
100	-----	-----	10	14	20	27	43
150	-----	-----	10	15	21	27	44
200	-----	-----	10	15	21	28	45
250	-----	-----	10	15	21	28	46
300	-----	-----	10	15	22	29	46

MAXIMUM ROD STIFFENER CLAMP SPACING FOR $45^\circ < A \leq 60^\circ$

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Table A5.7-13; Maximum Rod Stiffener Clamp Spacing: Horizontal Force Class VI, Trapeze Supported Pipe & Duct, 10 ft Hanger Spacing, and an Installation Angle = 60°

Supported Weight (lbs/ft)	Maximum Rod Stiffener Clamp Spacing (in) Hanger Rod Code for UNC Thread Hanger Rods						
	3	4	5	6	7	8	10
5	-----	-----	-----	10	14	18	30
10	-----	-----	-----	10	14	18	30
15	-----	-----	-----	10	14	18	30
25	-----	-----	-----	10	14	18	30
50	-----	-----	-----	10	14	18	30
100	-----	-----	-----	10	14	18	30
150	-----	-----	7	10	14	19	30
200	-----	-----	7	10	14	19	31
250	-----	-----	7	10	14	19	31
300	-----	-----	7	10	14	19	31

MAXIMUM ROD STIFFENER CLAMP SPACING FOR $45^\circ < A \leq 60^\circ$

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ROD STIFFENER EQUIVALENTS

Kinetics Noise Control provides clamps that may be used with the AISI rolled angles indicated in the tables below. The analysis and selection of rod stiffeners and clamps outlined in Section S8.0 and in Appendices A5.1 through A5.7 of this manual is intended to apply to rod stiffeners made from these rolled angles when used with the Models KHRC-B and KHRC-C Rod Stiffener Clamps. However, Kinetics Noise Control recognizes that other shapes and clamps may be used as hanger rod stiffeners, and that the analysis outlined in Section S8.0 and Appendices A5.1 through A5.7 may apply to these other shapes and clamps. It is the responsibility of the design professional of record to make this determination. As a convenience to other design professionals Kinetics Noise Control has included below Tables A5.8-1 through A5.8-3 to show the equivalencies between the AISI rolled angles used by Kinetics Noise Control and several other shapes commonly available to the various trades.

Table A5.8-1; Rod Stiffener Angle to Pipe Equivalents

Rod Stiffener Code	AISI Angle Designation	I_{z-z} (in ⁴)	Schedule 40 Nominal Pipe Size (in)	I (in ⁴)	Schedule 80 Nominal Pipe Size (in)	I (in ⁴)
A	L 1 x 1 x 1/8	0.009	1/2	0.017	1/2	0.020
B	L 1-1/4 x 1-1/4 x 1/4	0.033	3/4	0.037	3/4	0.045
C	L 1-1/2 x 1-1/2 x 1/4	0.059	1	0.087	1	0.106
D	L 1-3/4 x 1-3/4 x 1/4	0.095	1 1/4	0.195		
E	L 2 x 2 x 1/4	0.143	1 1/2	0.310	1 1/4	0.242
F	L 2 x 2 x 3/8	0.206			1 1/2	0.391
G	L 2-1/2 x 2-1/2 x 1/4	0.287	2	0.666	2	0.918
H	L 2-1/2 x 2-1/2 x 3/8	0.410			2	0.918
I	L 2-1/2 x 2-1/2 x 1/2	0.534			2	0.918

ROD STIFFENER EQUIVALENTS

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Table A5.8-2; Rod Stiffener Angle to Conduit Equivalents

Rod Stiffener Code	AISI Angle Designation	I_{z-z} (in ⁴)	EMT Steel Conduit	I (in ⁴)	IMC Steel Conduit	I (in ⁴)	Rigid Steel Conduit	I (in ⁴)
A	L 1 x 1 x 1/8	0.009	3/4	0.013	1/2	0.011	1/2	0.017
B	L 1-1/4 x 1-1/4 x 1/4	0.033	1 1/4	0.077	1	0.059	3/4	0.036
C	L 1-1/2 x 1-1/2 x 1/4	0.059					1	0.084
D	L 1-3/4 x 1-3/4 x 1/4	0.095	1 1/2	0.120	1 1/4	0.125	1 1/4	0.187
E	L 2 x 2 x 1/4	0.143	2	0.248	1 1/2	0.204		
F	L 2 x 2 x 3/8	0.206			2 1/2	0.623	2	0.434
G	L 2-1/2 x 2-1/2 x 1/4	0.287	2	0.638				
H	L 2-1/2 x 2-1/2 x 3/8	0.410			2 1/2	0.623	2 1/2	1.106
I	L 2-1/2 x 2-1/2 x 1/2	0.534	2 1/2	0.638				

Table A5.8-3; Rod Stiffener Angle to 1-5/8" UNISTRUT® Equivalents
Solid Channel: No Holes & No Slots

Rod Stiffener Code	AISI Angle Designation	I_{z-z} (in ⁴)	UNISTRUT Channel	Min. I (in ⁴)
A	L 1 x 1 x 1/8	0.009	P4100	0.026
B	L 1-1/4 x 1-1/4 x 1/4	0.033	P3300	0.037
C	L 1-1/2 x 1-1/2 x 1/4	0.059	P3000	0.120
D	L 1-3/4 x 1-3/4 x 1/4	0.095		
E	L 2 x 2 x 1/4	0.143	P1000	0.185
F	L 2 x 2 x 3/8	0.206	P5500	0.334
G	L 2-1/2 x 2-1/2 x 1/4	0.287		
H	L 2-1/2 x 2-1/2 x 3/8	0.410	P5000	0.433
I	L 2-1/2 x 2-1/2 x 1/2	0.534	P5501	0.669

ROD STIFFENER EQUIVALENTS

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MAXIMUM ALLOWABLE RESTRAINT SPACING – STANDARD STEEL PIPE

Table A6.1-1; Max Allowable Restraint Spacing for Non-Insulated Standard Steel Pipe – Empty

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.824	1.1	40	30	30	20	20	20
1	1.315	1.049	1.7	40	40	30	30	30	20
1 1/4	1.660	1.380	2.3	40	40	40	40	30	30
1 1/2	1.900	1.610	2.7	40	40	40	40	30	30
2	2.375	2.067	3.6	40	40	40	40	40	40
2 1/2	2.875	2.469	5.8	40	40	40	40	40	40
3	3.500	3.068	7.6	40	40	40	40	40	40
3 1/2	4.000	3.548	9.1	40	40	40	40	40	40
4	4.500	4.026	10.8	40	40	40	40	40	40
5	5.563	5.047	14.6	40	40	40	40	40	40
6	6.625	6.065	19.0	40	40	40	40	40	40
8	8.625	7.981	28.5	40	40	40	40	40	40
10	10.750	10.020	40.4	40	40	40	40	40	40
11	11.750	11.000	45.5	40	40	40	40	40	40
12	12.750	12.000	49.5	40	40	40	40	40	40
14	14.000	13.250	54.5	40	40	40	40	40	40
16	16.000	15.250	62.5	40	40	40	40	40	40
18	18.000	17.250	70.5	40	40	40	40	40	40
20	20.000	19.250	78.5	40	40	40	40	40	40
22	22.000	21.250	86.5	40	40	40	40	40	40
24	24.000	23.250	94.5	40	40	40	40	40	40

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Table A6.1-2; Max Allowable Restraint Spacing for Non-Insulated Standard Steel Pipe Filled – Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.824	1.4	40	30	30	20	20	20
1	1.315	1.049	2.1	40	40	30	30	20	20
1 1/4	1.660	1.380	2.9	40	40	40	30	30	30
1 1/2	1.900	1.610	3.6	40	40	40	40	30	30
2	2.375	2.067	5.1	40	40	40	40	40	30
2 1/2	2.875	2.469	7.9	40	40	40	40	40	40
3	3.500	3.068	10.8	40	40	40	40	40	40
3 1/2	4.000	3.548	13.4	40	40	40	40	40	40
4	4.500	4.026	16.3	40	40	40	40	40	40
5	5.563	5.047	23.3	40	40	40	40	40	40
6	6.625	6.065	31.5	40	40	40	40	40	40
8	8.625	7.981	50.2	40	40	40	40	40	40
10	10.750	10.020	74.6	40	40	40	40	40	40
11	11.750	11.000	86.7	40	40	40	40	40	40
12	12.750	12.000	98.5	40	40	40	40	40	40
14	14.000	13.250	114.3	40	40	40	40	40	40
16	16.000	15.250	141.7	40	40	40	40	40	40
18	18.000	17.250	171.8	40	40	40	40	40	40
20	20.000	19.250	204.6	40	40	40	40	40	40
22	22.000	21.250	240.2	40	40	40	40	40	40
24	24.000	23.250	278.5	40	40	40	40	40	40

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Table A6.1-3; Max Allowable Restraint Spacing for Insulated Standard Steel Pipe Filled – Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.824	2.1	30	30	20	20	20	15
1	1.315	1.049	2.1	40	40	30	30	20	20
1 1/4	1.660	1.380	2.9	40	40	40	30	30	30
1 1/2	1.900	1.610	3.6	40	40	40	40	30	30
2	2.375	2.067	5.1	40	40	40	40	40	30
2 1/2	2.875	2.469	7.9	40	40	40	40	40	40
3	3.500	3.068	10.8	40	40	40	40	40	40
3 1/2	4.000	3.548	13.4	40	40	40	40	40	40
4	4.500	4.026	16.3	40	40	40	40	40	40
5	5.563	5.047	23.3	40	40	40	40	40	40
6	6.625	6.065	31.5	40	40	40	40	40	40
8	8.625	7.981	50.2	40	40	40	40	40	40
10	10.750	10.020	74.6	40	40	40	40	40	40
11	11.750	11.000	86.7	40	40	40	40	40	40
12	12.750	12.000	98.5	40	40	40	40	40	40
14	14.000	13.250	114.3	40	40	40	40	40	40
16	16.000	15.250	141.7	40	40	40	40	40	40
18	18.000	17.250	171.8	40	40	40	40	40	40
20	20.000	19.250	204.6	40	40	40	40	40	40
22	22.000	21.250	240.2	40	40	40	40	40	40
24	24.000	23.250	278.5	40	40	40	40	40	40

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Table A6.1-4; Max Allowable Restraint Spacing for Insulated Standard Steel Pipe Filled – Steam

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.824	1.9	30	30	20	20	20	15
1	1.315	1.049	1.7	40	40	30	30	30	20
1 1/4	1.660	1.380	2.3	40	40	40	40	30	30
1 1/2	1.900	1.610	2.7	40	40	40	40	30	30
2	2.375	2.067	3.7	40	40	40	40	40	40
2 1/2	2.875	2.469	5.8	40	40	40	40	40	40
3	3.500	3.068	7.6	40	40	40	40	40	40
3 1/2	4.000	3.548	9.1	40	40	40	40	40	40
4	4.500	4.026	10.8	40	40	40	40	40	40
5	5.563	5.047	14.6	40	40	40	40	40	40
6	6.625	6.065	19.0	40	40	40	40	40	40
8	8.625	7.981	28.5	40	40	40	40	40	40
10	10.750	10.020	40.5	40	40	40	40	40	40
11	11.750	11.000	45.5	40	40	40	40	40	40
12	12.750	12.000	49.5	40	40	40	40	40	40
14	14.000	13.250	54.6	40	40	40	40	40	40
16	16.000	15.250	62.6	40	40	40	40	40	40
18	18.000	17.250	70.6	40	40	40	40	40	40
20	20.000	19.250	78.6	40	40	40	40	40	40
22	22.000	21.250	86.6	40	40	40	40	40	40
24	24.000	23.250	94.7	40	40	40	40	40	40

MAXIMUM ALLOWABLE RESTRAINT SPACING – STANDARD STEEL PIPE PAGE 4 of 4 SECTION – A6.1

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MAXIMUM ALLOWABLE RESTRAINT SPACING – FIRE PROTECTION PIPING

Table A6.2-1; Maximum Allowable Seismic Restraint Spacing for Steel Water-Filled Pipe – Threaded or Cut Grooves {Includes 1.15 Factor Required by NFPA 13 Section 9.3.5.6.1}

Seismic Coefficient C_p					0.43	0.60	0.73	0.99	1.33	2.00
Pipe Size (in)	Pipe Schedule	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
1	40	1.315	1.049	2.4	40	30	30	30	20	20
1 1/4	40	1.660	1.380	3.4	40	40	40	30	30	20
1 1/2	40	1.900	1.610	4.1	40	40	40	30	30	30
2	40	2.375	2.067	5.9	40	40	40	40	40	30
2 1/2	40	2.875	2.469	9.0	40	40	40	40	40	40
3	40	3.500	3.068	12.4	40	40	40	40	40	40
3 1/2	40	4.000	3.548	15.4	40	40	40	40	40	40
4	40	4.500	4.026	18.7	40	40	40	40	40	40
5	40	5.563	5.047	26.8	40	40	40	40	40	40
6	40	6.625	6.065	36.2	40	40	40	40	40	40
8	30	8.625	8.071	53.9	40	40	40	40	40	40
10	30	10.75	10.14	79.5	40	40	40	40	40	40
12	STD	12.75	12.00	113.3	40	40	40	40	40	40

MAXIMUM ALLOWABLE RESTRAINT SPACING – FIRE PROTECTION PIPE PAGE 1 of 6

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Table A6.2-2; Maximum Allowable Seismic Restraint Spacing for Steel Water-Filled Pipe – Welded or Rolled Grooves {Includes 1.15 Factor Required by NFPA 13 Section 9.3.5.6.1}

Seismic Coefficient C_p					0.43	0.60	0.73	0.99	1.33	2.00
Pipe Size (in)	Pipe Schedule	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
1	10	1.315	1.097	2.1	40	30	30	30	20	20
1 1/4	10	1.660	1.442	2.9	40	40	30	30	30	20
1 1/2	10	1.900	1.682	3.5	40	40	40	30	30	30
2	10	2.375	2.157	4.9	40	40	40	40	30	30
2 1/2	10	2.875	2.635	6.8	40	40	40	40	40	30
3	10	3.500	3.260	9.1	40	40	40	40	40	40
3 1/2	10	4.000	3.760	11.2	40	40	40	40	40	40
4	10	4.500	4.026	18.7	40	40	40	40	40	40
5	10	5.563	5.295	19.9	40	40	40	40	40	40
6	10	6.625	6.357	26.5	40	40	40	40	40	40
8	---	8.625	8.249	46.1	40	40	40	40	40	40
10	---	10.75	10.37	66.5	40	40	40	40	40	40
12	30	12.75	12.09	107.5	40	40	40	40	40	40

**MAXIMUM ALLOWABLE RESTRAINT SPACING – FIRE PROTECTION PIPE
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Table A6.2-3; Maximum Allowable Seismic Restraint Spacing for TYPE K Water-Filled Copper Tubing – ASTM B88 {Includes 1.15 Factor Required by NFPA 13 Section 9.3.5.6.1}

Seismic Coefficient C_p				0.43	0.60	0.73	0.99	1.33	2.00
Tube Size (in)	Tube O. D. (in)	Tube Wall Thickness (in)	Tube Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
1	1.125	0.065	1.3	20	20	20	20	15	15
1 1/4	1.375	0.065	1.8	30	20	20	20	20	15
1 1/2	1.625	0.072	2.4	30	30	30	20	20	20
2	2.125	0.083	3.9	40	30	30	30	20	20
2 1/2	2.625	0.095	5.7	40	40	40	30	30	20
3	3.125	0.109	7.9	40	40	40	40	30	30
3 1/2	3.625	0.120	10.4	40	40	40	40	40	30
4	4.125	0.134	13.3	40	40	40	40	40	30
5	5.125	0.160	20.1	40	40	40	40	40	40
6	6.125	0.192	28.8	40	40	40	40	40	40

MAXIMUM ALLOWABLE RESTRAINT SPACING – FIRE PROTECTION PIPE SECTION – A6.2

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Table A6.2-4; Maximum Allowable Seismic Restraint Spacing for TYPE L Water-Filled Copper Tubing – ASTM B88 {Includes 1.15 Factor Required by NFPA 13 Section 9.3.5.6.1}

Seismic Coefficient C_p				0.43	0.60	0.73	0.99	1.33	2.00
Tube Size (in)	Tube O. D. (in)	Tube Wall Thickness (in)	Tube Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
1	1.125	0.050	1.2	20	20	20	20	15	15
1 1/4	1.375	0.055	1.6	30	20	20	20	20	15
1 1/2	1.625	0.060	2.2	30	30	20	20	20	20
2	2.125	0.070	3.6	40	30	30	30	20	20
2 1/2	2.625	0.080	5.2	40	40	30	30	30	20
3	3.125	0.090	7.2	40	40	40	40	30	30
3 1/2	3.625	0.100	9.5	40	40	40	40	30	30
4	4.125	0.114	12.3	40	40	40	40	40	30
5	5.125	0.125	18.0	40	40	40	40	40	40
6	6.125	0.140	25.1	40	40	40	40	40	40

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Table A6.2-5; Maximum Allowable Seismic Restraint Spacing for TYPE M Water-Filled Copper Tubing – ASTM B88 {Includes 1.15 Factor Required by NFPA 13 Section 9.3.5.6.1}

Seismic Coefficient C_p				0.43	0.60	0.73	0.99	1.33	2.00
Tube Size (in)	Tube O. D. (in)	Tube Wall Thickness (in)	Tube Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
1	1.125	0.035	1.0	20	20	20	20	15	15
1 1/4	1.375	0.042	1.4	30	20	20	20	20	15
1 1/2	1.625	0.049	2.0	30	30	20	20	20	20
2	2.125	0.058	3.3	40	30	30	30	20	20
2 1/2	2.625	0.065	4.8	40	40	30	30	30	20
3	3.125	0.072	6.5	40	40	40	30	30	30
3 1/2	3.625	0.083	8.8	40	40	40	40	30	30
4	4.125	0.095	11.4	40	40	40	40	40	30
5	5.125	0.109	17.1	40	40	40	40	40	40
6	6.125	0.122	23.8	40	40	40	40	40	40

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Table A6.2-6; Maximum Allowable Seismic Restraint Spacing for BlazeMaster® CPVC Water-Filled Sprinkler Pipe Manufactured by HARVEL®
 {Includes 1.15 Factor Required by NFPA 13 Section 9.3.5.6.1}

Seismic Coefficient C_p				0.43	0.60	0.73	0.99	1.33	2.00
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.874	0.5	10	10	9	8	8	7
1	1.315	1.101	0.8	10	10	10	10	9	8
1 1/4	1.660	1.394	1.2	15	10	10	10	10	9
1 1/2	1.900	1.598	1.6	15	10	10	10	10	10
2	2.375	2.003	2.5	15	15	15	10	10	10
2 1/2	2.875	2.423	3.7	20	15	15	15	10	10
3	3.500	2.950	5.5	20	20	20	15	15	10

MAXIMUM ALLOWABLE RESTRAINT SPACING – FIRE PROTECTION PIPE
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MAXIMUM RESTRAINT SPACING – CAST IRON SOIL PIPE

Table A6.3-1; Maximum Seismic Restraint Spacing for Service (SV) Cast Iron Soil Pipe – Empty

Seismic Coefficient C_s					0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL					D	C	B	A	----	----
Pipe Size (in)	Pipe Weight per 10' Section (lbs)	Barrel O. D. (in)	Barrel I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
2	41	2.30	1.96	4.1	40	40	40	30	30	30
3	61	3.30	2.96	6.1	40	40	40	40	40	40
4	79	4.30	3.94	7.9	40	40	40	40	40	40
5	100	5.30	4.94	10.0	40	40	40	40	40	40
6	124	6.30	5.94	12.4	40	40	40	40	40	40
8	181	8.38	7.94	18.1	40	40	40	40	40	40
10	260	10.50	9.94	26.0	40	40	40	40	40	40
12	346	12.50	11.94	34.6	40	40	40	40	40	40
15	525	15.88	15.16	52.5	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – CAST IRON SOIL PIPE

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Table A6.3-2; Maximum Seismic Restraint Spacing for Service (SV) Cast Iron Soil Pipe – Half Empty

Seismic Coefficient C_s					0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL					D	C	B	A	----	----
Pipe Size (in)	Pipe Weight per 10' Section (lbs)	Barrel O. D. (in)	Barrel I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
2	41	2.30	1.96	4.8	40	40	40	30	30	20
3	61	3.30	2.96	7.6	40	40	40	40	40	30
4	79	4.30	3.94	10.5	40	40	40	40	40	40
5	100	5.30	4.94	14.2	40	40	40	40	40	40
6	124	6.30	5.94	18.4	40	40	40	40	40	40
8	181	8.38	7.94	28.8	40	40	40	40	40	40
10	260	10.50	9.94	42.8	40	40	40	40	40	40
12	346	12.50	11.94	58.9	40	40	40	40	40	40
15	525	15.88	15.16	91.6	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – CAST IRON SOIL PIPE

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Table A6.3-3; Maximum Seismic Restraint Spacing for Service (SV) Cast Iron Soil Pipe – Full

Seismic Coefficient C_s					0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL					D	C	B	A	----	----
Pipe Size (in)	Pipe Weight per 10' Section (lbs)	Barrel O. D. (in)	Barrel I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
2	41	2.30	1.96	5.4	40	40	30	30	30	20
3	61	3.30	2.96	9.1	40	40	40	40	30	30
4	79	4.30	3.94	13.2	40	40	40	40	40	40
5	100	5.30	4.94	18.3	40	40	40	40	40	40
6	124	6.30	5.94	24.4	40	40	40	40	40	40
8	181	8.38	7.94	39.6	40	40	40	40	40	40
10	260	10.50	9.94	59.6	40	40	40	40	40	40
12	346	12.50	11.94	83.1	40	40	40	40	40	40
15	525	15.88	15.16	130.7	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – CAST IRON SOIL PIPE

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Table A6.3-4; Maximum Seismic Restraint Spacing for Extra Heavy (XH) Cast Iron Soil Pipe – Empty

Seismic Coefficient C_s					0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL					D	C	B	A	----	----
Pipe Size (in)	Pipe Weight per 10' Section (lbs)	Barrel O. D. (in)	Barrel I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
2	45	2.38	2.00	4.5	40	40	40	40	30	30
3	84	3.50	3.00	8.4	40	40	40	40	40	40
4	105	4.50	4.00	10.5	40	40	40	40	40	40
5	134	5.50	5.00	13.4	40	40	40	40	40	40
6	157	6.50	6.00	15.7	40	40	40	40	40	40
8	246	8.62	8.00	24.6	40	40	40	40	40	40
10	375	10.75	10.00	37.5	40	40	40	40	40	40
12	471	12.75	12.00	47.1	40	40	40	40	40	40
15	676	15.88	15.00	67.6	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – CAST IRON SOIL PIPE

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Table A6.3-5; Maximum Seismic Restraint Spacing for Extra Heavy (XH) Cast Iron Soil Pipe – Half Empty

Seismic Coefficient C_s					0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL					D	C	B	A	----	----
Pipe Size (in)	Pipe Weight per 10' Section (lbs)	Barrel O. D. (in)	Barrel I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
2	45	2.38	2.00	5.2	40	40	40	30	30	30
3	84	3.50	3.00	9.9	40	40	40	40	40	40
4	105	4.50	4.00	13.2	40	40	40	40	40	40
5	134	5.50	5.00	17.7	40	40	40	40	40	40
6	157	6.50	6.00	21.8	40	40	40	40	40	40
8	246	8.62	8.00	35.5	40	40	40	40	40	40
10	375	10.75	10.00	54.5	40	40	40	40	40	40
12	471	12.75	12.00	71.6	40	40	40	40	40	40
15	676	15.88	15.00	105.9	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – CAST IRON SOIL PIPE

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Table A6.3-6; Maximum Seismic Restraint Spacing for Extra Heavy (XH) Cast Iron Soil Pipe – Full

Seismic Coefficient C_s					0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL					D	C	B	A	----	----
Pipe Size (in)	Pipe Weight per 10' Section (lbs)	Barrel O. D. (in)	Barrel I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
2	45	2.38	2.00	5.9	40	40	40	30	30	20
3	84	3.50	3.00	11.5	40	40	40	40	40	30
4	105	4.50	4.00	15.9	40	40	40	40	40	40
5	134	5.50	5.00	21.9	40	40	40	40	40	40
6	157	6.50	6.00	28.0	40	40	40	40	40	40
8	246	8.62	8.00	46.4	40	40	40	40	40	40
10	375	10.75	10.00	71.5	40	40	40	40	40	40
12	471	12.75	12.00	96.1	40	40	40	40	40	40
15	676	15.88	15.00	144.2	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – CAST IRON SOIL PIPE

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Table A6.3-7; Maximum Seismic Restraint Spacing for Hubless Cast Iron Soil Pipe – Empty

Seismic Coefficient C_s					0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL					D	C	B	A	----	----
Pipe Size (in)	Pipe Weight per 10' Section (lbs)	Barrel O. D. (in)	Barrel I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
1 1/2	29	1.90	1.50	2.9	40	40	40	30	30	20
2	38	2.35	1.96	3.8	40	40	40	40	30	30
3	54	3.35	2.96	5.4	40	40	40	40	40	40
4	71	4.38	3.94	7.1	40	40	40	40	40	40
5	98	5.30	4.94	9.8	40	40	40	40	40	40
6	118	6.30	5.94	11.8	40	40	40	40	40	40
8	165	8.38	7.94	16.5	40	40	40	40	40	40
10	255	10.56	10.00	25.5	40	40	40	40	40	40
12	318	12.50	11.94	31.8	40	40	40	40	40	40
15	493	15.83	15.11	49.3	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – CAST IRON SOIL PIPE

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Table A6.3-8; Maximum Seismic Restraint Spacing for Hubless Cast Iron Soil Pipe – Half Empty

Seismic Coefficient C_s					0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL					D	C	B	A	----	----
Pipe Size (in)	Pipe Weight per 10' Section (lbs)	Barrel O. D. (in)	Barrel I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
1 1/2	29	1.90	1.50	3.3	40	40	30	30	30	20
2	38	2.35	1.96	4.5	40	40	40	40	30	30
3	54	3.35	2.96	6.9	40	40	40	40	40	40
4	71	4.38	3.94	9.7	40	40	40	40	40	40
5	98	5.30	4.94	14.0	40	40	40	40	40	40
6	118	6.30	5.94	17.8	40	40	40	40	40	40
8	165	8.38	7.94	27.2	40	40	40	40	40	40
10	255	10.56	10.00	42.5	40	40	40	40	40	40
12	318	12.50	11.94	56.1	40	40	40	40	40	40
15	493	15.83	15.11	88.2	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – CAST IRON SOIL PIPE

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Table A6.3-9; Maximum Seismic Restraint Spacing for Hubless Cast Iron Soil Pipe – Full

Seismic Coefficient C_s					0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL					D	C	B	A	----	----
Pipe Size (in)	Pipe Weight per 10' Section (lbs)	Barrel O. D. (in)	Barrel I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
1 1/2	29	1.90	1.50	3.7	40	40	30	30	30	20
2	38	2.35	1.96	5.1	40	40	40	30	30	30
3	54	3.35	2.96	8.4	40	40	40	40	40	30
4	71	4.38	3.94	12.4	40	40	40	40	40	40
5	98	5.30	4.94	18.1	40	40	40	40	40	40
6	118	6.30	5.94	23.8	40	40	40	40	40	40
8	165	8.38	7.94	38.0	40	40	40	40	40	40
10	255	10.56	10.00	59.5	40	40	40	40	40	40
12	318	12.50	11.94	80.3	40	40	40	40	40	40
15	493	15.83	15.11	127.0	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – CAST IRON SOIL PIPE

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MAXIMUM RESTRAINT SPACING – PVC & CPVC PIPE

Table A6.4-1; Max Allowable Restraint Spacing for Sched 40 PVC Pipe - Empty

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.804	0.2	15	15	15	15	15	10
1	1.315	1.029	0.3	20	15	15	15	15	15
1 1/4	1.660	1.360	0.4	20	20	15	15	15	15
1 1/2	1.900	1.590	0.5	30	20	20	15	15	15
2	2.375	2.047	0.7	30	20	20	20	15	15
2 1/2	2.875	2.445	1.1	30	30	20	20	20	15
3	3.500	3.042	1.4	40	30	30	20	20	20
3 1/2	4.000	3.521	1.7	40	30	30	30	20	20
4	4.500	3.998	2.1	40	40	30	30	20	20
5	5.563	5.016	2.8	40	40	40	30	30	30
6	6.625	6.031	3.6	40	40	40	40	30	30
8	8.625	7.945	5.4	40	40	40	40	40	40
10	10.75	9.98	7.7	40	40	40	40	40	40
12	12.75	11.89	10.2	40	40	40	40	40	40
14	14.00	13.07	12.1	40	40	40	40	40	40
16	16.00	14.94	15.8	40	40	40	40	40	40
18	18.00	16.81	19.9	40	40	40	40	40	40
20	20.00	18.74	23.4	40	40	40	40	40	40
24	24.00	22.54	32.6	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – PVC & CPVC PIPE

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Table A6.4-2; Max Allowable Restraint Spacing for Sched 40 PVC Pipe – Half Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.804	0.3	15	10	10	10	10	9
1	1.315	1.029	0.5	15	15	10	10	10	10
1 1/4	1.660	1.360	0.8	20	15	15	10	10	10
1 1/2	1.900	1.590	1.0	20	15	15	15	10	10
2	2.375	2.047	1.4	20	20	15	15	15	10
2 1/2	2.875	2.445	2.1	30	20	20	20	15	15
3	3.500	3.042	3.0	30	20	20	20	15	15
3 1/2	4.000	3.521	3.8	30	30	20	20	20	15
4	4.500	3.998	4.8	40	30	20	20	20	20
5	5.563	5.016	7.1	40	30	30	20	20	20
6	6.625	6.031	9.8	40	40	30	30	20	20
8	8.625	7.945	16.2	40	40	40	30	30	20
10	10.75	9.98	24.6	40	40	40	40	30	30
12	12.75	11.89	34.3	40	40	40	40	40	30
14	14.00	13.07	41.1	40	40	40	40	40	30
16	16.00	14.94	53.7	40	40	40	40	40	40
18	18.00	16.81	68.0	40	40	40	40	40	40
20	20.00	18.74	83.2	40	40	40	40	40	40
24	24.00	22.54	119.1	40	40	40	40	40	40

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Table A6.4-3; Max Allowable Restraint Spacing for Sched 40 PVC Pipe – Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.804	0.4	15	10	10	10	9	8
1	1.315	1.029	0.7	15	10	10	10	10	9
1 1/4	1.660	1.360	1.1	20	15	10	10	10	10
1 1/2	1.900	1.590	1.4	20	15	15	10	10	10
2	2.375	2.047	2.1	20	15	15	15	10	10
2 1/2	2.875	2.445	3.1	20	20	15	15	15	10
3	3.500	3.042	4.6	30	20	20	15	15	15
3 1/2	4.000	3.521	6.0	30	20	20	20	15	15
4	4.500	3.998	7.5	30	20	20	20	15	15
5	5.563	5.016	11.3	30	30	20	20	20	15
6	6.625	6.031	16.0	40	30	20	20	20	20
8	8.625	7.945	26.9	40	30	30	30	20	20
10	10.75	9.98	41.6	40	40	30	30	30	20
12	12.75	11.89	58.3	40	40	40	30	30	30
14	14.00	13.07	70.2	40	40	40	40	30	30
16	16.00	14.94	91.7	40	40	40	40	30	30
18	18.00	16.81	116.1	40	40	40	40	40	30
20	20.00	18.74	143.0	40	40	40	40	40	40
24	24.00	22.54	205.5	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – PVC & CPVC PIPE

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Table A6.4-4; Max Allowable Restraint Spacing for Insulated Sched 40 PVC Pipe – Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.804	1.2	10	9	8	7	6	6
1	1.315	1.029	1.5	10	10	10	9	8	7
1 1/4	1.660	1.360	2.1	15	10	10	10	9	8
1 1/2	1.900	1.590	2.5	15	10	10	10	10	9
2	2.375	2.047	3.4	20	15	10	10	10	10
2 1/2	2.875	2.445	4.6	20	15	15	15	10	10
3	3.500	3.042	6.3	20	20	15	15	15	10
3 1/2	4.000	3.521	7.8	30	20	20	15	15	15
4	4.500	3.998	9.5	30	20	20	20	15	15
5	5.563	5.016	15.3	30	20	20	20	15	15
6	6.625	6.031	20.5	30	30	20	20	20	15
8	8.625	7.945	32.5	40	30	30	20	20	20
10	10.75	9.98	48.4	40	40	30	30	20	20
12	12.75	11.89	66.2	40	40	40	30	30	20
14	14.00	13.07	78.9	40	40	40	30	30	30
16	16.00	14.94	101.5	40	40	40	40	30	30
18	18.00	16.81	126.9	40	40	40	40	40	30
20	20.00	18.74	154.9	40	40	40	40	40	30
24	24.00	22.54	219.7	40	40	40	40	40	40

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Table A6.4-5; Max Allowable Restraint Spacing for Sched 80 PVC Pipe - Empty

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.722	0.3	15	15	10	10	10	10
1	1.315	0.936	0.4	20	15	15	10	10	10
1 1/4	1.660	1.255	0.6	20	20	15	15	10	10
1 1/2	1.900	1.476	0.7	20	20	20	15	15	10
2	2.375	1.913	1.0	30	20	20	20	15	15
2 1/2	2.875	2.290	1.5	30	30	20	20	20	15
3	3.500	2.864	1.9	40	30	30	20	20	20
3 1/2	4.000	3.326	2.4	40	30	30	30	20	20
4	4.500	3.786	2.8	40	40	30	30	20	20
5	5.563	4.768	3.9	40	40	40	30	30	30
6	6.625	5.709	5.4	40	40	40	40	30	30
8	8.625	7.565	8.2	40	40	40	40	40	40
10	10.75	9.49	12.2	40	40	40	40	40	40
12	12.75	11.29	16.8	40	40	40	40	40	40
14	14.00	12.41	20.2	40	40	40	40	40	40
16	16.00	14.21	26.0	40	40	40	40	40	40
18	18.00	16.01	32.5	40	40	40	40	40	40
20	20.00	17.81	39.7	40	40	40	40	40	40
24	24.00	21.42	56.4	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – PVC & CPVC PIPE

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Table A6.4-6; Max Allowable Restraint Spacing for Sched 80 PVC Pipe – Half Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.722	0.4	15	10	10	10	10	9
1	1.315	0.936	0.6	20	15	10	10	10	10
1 1/4	1.660	1.255	0.8	20	15	15	10	10	10
1 1/2	1.900	1.476	1.1	20	20	15	15	10	10
2	2.375	1.913	1.6	20	20	20	15	15	10
2 1/2	2.875	2.290	2.3	30	20	20	20	15	15
3	3.500	2.864	3.3	30	20	20	20	20	15
3 1/2	4.000	3.326	4.3	40	30	20	20	20	20
4	4.500	3.786	5.3	40	30	30	20	20	20
5	5.563	4.768	7.8	40	30	30	30	20	20
6	6.625	5.709	11.0	40	40	30	30	30	20
8	8.625	7.565	18.0	40	40	40	40	30	30
10	10.75	9.49	27.6	40	40	40	40	40	30
12	12.75	11.29	38.5	40	40	40	40	40	40
14	14.00	12.41	46.4	40	40	40	40	40	40
16	16.00	14.21	60.3	40	40	40	40	40	40
18	18.00	16.01	76.1	40	40	40	40	40	40
20	20.00	17.81	93.7	40	40	40	40	40	40
24	24.00	21.42	134.4	40	40	40	40	40	40

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Table A6.4-7; Max Allowable Restraint Spacing for Sched 80 PVC Pipe – Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.722	0.5	15	10	10	10	9	8
1	1.315	0.936	0.7	15	10	10	10	10	9
1 1/4	1.660	1.255	1.1	20	15	10	10	10	10
1 1/2	1.900	1.476	1.4	20	15	15	10	10	10
2	2.375	1.913	2.2	20	20	15	15	10	10
2 1/2	2.875	2.290	3.2	20	20	20	15	15	10
3	3.500	2.864	4.7	30	20	20	20	15	15
3 1/2	4.000	3.326	6.1	30	20	20	20	15	15
4	4.500	3.786	7.7	30	30	20	20	20	15
5	5.563	4.768	11.7	40	30	20	20	20	20
6	6.625	5.709	16.5	40	30	30	30	20	20
8	8.625	7.565	27.7	40	40	30	30	30	20
10	10.75	9.49	42.9	40	40	40	40	30	30
12	12.75	11.29	60.2	40	40	40	40	30	30
14	14.00	12.41	72.6	40	40	40	40	40	30
16	16.00	14.21	94.7	40	40	40	40	40	40
18	18.00	16.01	119.7	40	40	40	40	40	40
20	20.00	17.81	147.7	40	40	40	40	40	40
24	24.00	21.42	212.5	40	40	40	40	40	40

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Table A6.4-8; Max Allowable Restraint Spacing for Insulated Sched 80 PVC Pipe – Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.722	1.2	10	9	8	7	7	6
1	1.315	0.936	1.6	10	10	10	9	8	7
1 1/4	1.660	1.255	2.1	15	10	10	10	10	9
1 1/2	1.900	1.476	2.5	15	15	10	10	10	10
2	2.375	1.913	3.4	20	15	15	10	10	10
2 1/2	2.875	2.290	4.7	20	20	15	15	10	10
3	3.500	2.864	6.4	30	20	20	15	15	15
3 1/2	4.000	3.326	8.0	30	20	20	20	15	15
4	4.500	3.786	9.8	30	20	20	20	15	15
5	5.563	4.768	15.6	30	30	20	20	20	15
6	6.625	5.709	21.0	40	30	30	20	20	20
8	8.625	7.565	33.4	40	40	30	30	20	20
10	10.75	9.49	49.7	40	40	40	30	30	30
12	12.75	11.29	68.2	40	40	40	40	30	30
14	14.00	12.41	81.2	40	40	40	40	40	30
16	16.00	14.21	104.4	40	40	40	40	40	30
18	18.00	16.01	130.6	40	40	40	40	40	40
20	20.00	17.81	159.7	40	40	40	40	40	40
24	24.00	21.42	226.7	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – PVC & CPVC PIPE

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Table A6.4-9; Max Allowable Restraint Spacing for Sched 120 PVC Pipe - Empty

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.690	0.3	15	15	10	10	10	10
1	1.315	0.891	0.4	20	15	15	10	10	10
1 1/4	1.660	1.204	0.6	20	20	15	15	10	10
1 1/2	1.900	1.423	0.8	20	20	20	15	15	10
2	2.375	1.845	1.1	30	20	20	20	15	15
2 1/2	2.875	2.239	1.6	30	30	20	20	20	15
3	3.500	2.758	2.2	40	30	30	20	20	20
4	4.500	3.574	3.6	40	40	30	30	20	20
6	6.625	5.434	6.9	40	40	40	40	30	30
8	8.625	7.189	10.9	40	40	40	40	40	40

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Table A6.4-10; Max Allowable Restraint Spacing for Sched 120 PVC Pipe – Half Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.690	0.4	15	10	10	10	10	9
1	1.315	0.891	0.6	20	15	10	10	10	10
1 1/4	1.660	1.204	0.9	20	15	15	10	10	10
1 1/2	1.900	1.423	1.1	20	20	15	15	10	10
2	2.375	1.845	1.7	20	20	20	15	15	10
2 1/2	2.875	2.239	2.4	30	20	20	20	15	15
3	3.500	2.758	3.5	30	30	20	20	20	15
4	4.500	3.574	5.8	40	30	30	20	20	20
6	6.625	5.434	11.9	40	40	30	30	30	20
8	8.625	7.189	19.7	40	40	40	40	30	30

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Table A6.4-11; Max Allowable Restraint Spacing for Sched 120 PVC Pipe – Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.690	0.5	15	10	10	10	9	8
1	1.315	0.891	0.7	15	15	10	10	10	10
1 1/4	1.660	1.204	1.1	20	15	15	10	10	10
1 1/2	1.900	1.423	1.5	20	15	15	10	10	10
2	2.375	1.845	2.2	20	20	15	15	10	10
2 1/2	2.875	2.239	3.3	30	20	20	15	15	15
3	3.500	2.758	4.8	30	20	20	20	15	15
4	4.500	3.574	7.9	40	30	20	20	20	20
6	6.625	5.434	17.0	40	40	30	30	20	20
8	8.625	7.189	28.5	40	40	40	30	30	20

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Table A6.4-12; Max Allowable Restraint Spacing for Insulated Sched 120 PVC Pipe – Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.690	1.2	10	10	8	8	7	6
1	1.315	0.891	1.6	10	10	10	9	8	7
1 1/4	1.660	1.204	2.1	15	10	10	10	10	9
1 1/2	1.900	1.423	2.5	15	15	10	10	10	10
2	2.375	1.845	3.5	20	15	15	10	10	10
2 1/2	2.875	2.239	4.7	20	20	15	15	10	10
3	3.500	2.758	6.5	30	20	20	15	15	15
4	4.500	3.574	10.0	30	20	20	20	20	15
6	6.625	5.434	21.5	40	30	30	20	20	20
8	8.625	7.189	34.1	40	40	30	30	30	20

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Table A6.4-13; Max Allowable Restraint Spacing for Sched 40 CPVC Pipe – Empty

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.804	0.2	15	15	15	15	15	9
1	1.315	1.029	0.4	20	15	15	15	15	15
1 1/4	1.660	1.360	0.5	20	20	15	15	15	15
1 1/2	1.900	1.590	0.6	20	20	15	15	15	15
2	2.375	2.047	0.8	30	20	20	20	15	15
2 1/2	2.875	2.445	1.2	30	20	20	20	20	15
3	3.500	3.042	1.6	40	30	20	20	20	20
3 1/2	4.000	3.521	1.9	40	30	30	20	20	20
4	4.500	3.998	2.3	40	40	30	30	20	20
5	5.563	5.016	3.1	40	40	40	30	30	20
6	6.625	6.031	4.0	40	40	40	40	30	30
8	8.625	7.945	5.9	40	40	40	40	40	30
10	10.75	9.98	8.5	40	40	40	40	40	40
12	12.75	11.89	11.2	40	40	40	40	40	40
14	14.00	13.07	13.2	40	40	40	40	40	40
16	16.00	14.94	17.3	40	40	40	40	40	40
18	18.00	16.81	21.9	40	40	40	40	40	40
20	20.00	18.74	25.7	40	40	40	40	40	40
24	24.00	22.54	35.8	40	40	40	40	40	40

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Table A6.4-14; Max Allowable Restraint Spacing for Sched 40 CPVC Pipe – Half Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.804	0.4	15	10	10	10	9	8
1	1.315	1.029	0.5	15	10	10	10	10	9
1 1/4	1.660	1.360	0.8	20	15	10	10	10	10
1 1/2	1.900	1.590	1.0	20	15	15	10	10	10
2	2.375	2.047	1.5	20	20	15	15	10	10
2 1/2	2.875	2.445	2.2	30	20	20	15	15	15
3	3.500	3.042	3.2	30	20	20	20	15	15
3 1/2	4.000	3.521	4.0	30	20	20	20	20	15
4	4.500	3.998	5.0	30	30	20	20	20	15
5	5.563	5.016	7.3	40	30	30	20	20	20
6	6.625	6.031	10.2	40	30	30	30	20	20
8	8.625	7.945	16.7	40	40	30	30	30	20
10	10.75	9.98	25.4	40	40	40	40	30	30
12	12.75	11.89	35.2	40	40	40	40	30	30
14	14.00	13.07	42.3	40	40	40	40	40	30
16	16.00	14.94	55.3	40	40	40	40	40	40
18	18.00	16.81	70.0	40	40	40	40	40	40
20	20.00	18.74	85.5	40	40	40	40	40	40
24	24.00	22.54	122.3	40	40	40	40	40	40

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Table A6.4-15; Max Allowable Restraint Spacing for Sched 40 CPVC Pipe – Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.804	0.5	10	10	10	9	8	7
1	1.315	1.029	0.7	15	10	10	10	9	9
1 1/4	1.660	1.360	1.1	15	15	10	10	10	10
1 1/2	1.900	1.590	1.4	20	15	10	10	10	10
2	2.375	2.047	2.2	20	15	15	10	10	10
2 1/2	2.875	2.445	3.2	20	20	15	15	10	10
3	3.500	3.042	4.7	20	20	20	15	15	10
3 1/2	4.000	3.521	6.1	30	20	20	20	15	15
4	4.500	3.998	7.7	30	20	20	20	15	15
5	5.563	5.016	11.6	30	20	20	20	20	15
6	6.625	6.031	16.3	40	30	20	20	20	20
8	8.625	7.945	27.4	40	30	30	30	20	20
10	10.75	9.98	42.3	40	40	30	30	20	20
12	12.75	11.89	59.3	40	40	40	30	30	20
14	14.00	13.07	71.4	40	40	40	30	30	30
16	16.00	14.94	93.3	40	40	40	40	30	30
18	18.00	16.81	118.0	40	40	40	40	40	30
20	20.00	18.74	145.3	40	40	40	40	40	30
24	24.00	22.54	208.7	40	40	40	40	40	40

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Table A6.4-16; Max Allowable Restraint Spacing for Insulated Sched 40 CPVC Pipe – Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.804	1.2	10	9	7	7	6	5
1	1.315	1.029	1.6	10	10	9	8	7	7
1 1/4	1.660	1.360	2.1	15	10	10	10	9	8
1 1/2	1.900	1.590	2.5	15	10	10	10	9	9
2	2.375	2.047	3.4	15	15	10	10	10	10
2 1/2	2.875	2.445	4.7	20	15	15	10	10	10
3	3.500	3.042	6.4	20	20	15	15	10	10
3 1/2	4.000	3.521	8.0	20	20	20	15	15	10
4	4.500	3.998	9.7	30	20	20	15	15	15
5	5.563	5.016	15.5	30	20	20	20	15	15
6	6.625	6.031	20.9	30	30	20	20	20	15
8	8.625	7.945	33.1	40	30	30	20	20	20
10	10.75	9.98	49.2	40	40	30	30	20	20
12	12.75	11.89	67.2	40	40	30	30	30	20
14	14.00	13.07	80.0	40	40	40	30	30	30
16	16.00	14.94	103.0	40	40	40	40	30	30
18	18.00	16.81	128.9	40	40	40	40	30	30
20	20.00	18.74	157.2	40	40	40	40	40	30
24	24.00	22.54	222.9	40	40	40	40	40	40

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Table A6.4-17; Max Allowable Restraint Spacing for Sched 80 CPVC Pipe – Empty

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.722	0.3	15	10	10	10	10	9
1	1.315	0.936	0.5	20	15	10	10	10	10
1 1/4	1.660	1.255	0.6	20	15	15	15	10	10
1 1/2	1.900	1.476	0.8	20	20	15	15	15	10
2	2.375	1.913	1.0	30	20	20	20	15	15
2 1/2	2.875	2.290	1.6	30	20	20	20	20	15
3	3.500	2.864	2.1	40	30	20	20	20	20
3 1/2	4.000	3.326	2.6	40	30	30	20	20	20
4	4.500	3.786	3.1	40	30	30	30	20	20
5	5.563	4.768	4.3	40	40	40	30	30	20
6	6.625	5.709	6.0	40	40	40	40	30	30
8	8.625	7.565	9.1	40	40	40	40	40	30
10	10.75	9.49	13.4	40	40	40	40	40	40
12	12.75	11.29	18.5	40	40	40	40	40	40
14	14.00	12.41	22.2	40	40	40	40	40	40
16	16.00	14.21	28.5	40	40	40	40	40	40
18	18.00	16.01	35.7	40	40	40	40	40	40
20	20.00	17.81	43.6	40	40	40	40	40	40
24	24.00	21.42	61.9	40	40	40	40	40	40

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Table A6.4-18; Max Allowable Restraint Spacing for Sched 80 CPVC Pipe – Half Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.722	0.4	15	10	10	10	9	8
1	1.315	0.936	0.6	15	15	10	10	10	10
1 1/4	1.660	1.255	0.9	20	15	15	10	10	10
1 1/2	1.900	1.476	1.1	20	15	15	15	10	10
2	2.375	1.913	1.7	20	20	15	15	15	10
2 1/2	2.875	2.290	2.5	30	20	20	15	15	15
3	3.500	2.864	3.5	30	20	20	20	15	15
3 1/2	4.000	3.326	4.5	30	30	20	20	20	15
4	4.500	3.786	5.6	40	30	20	20	20	20
5	5.563	4.768	8.2	40	30	30	20	20	20
6	6.625	5.709	11.5	40	40	30	30	20	20
8	8.625	7.565	18.8	40	40	40	30	30	30
10	10.75	9.49	28.8	40	40	40	40	30	30
12	12.75	11.29	40.2	40	40	40	40	40	30
14	14.00	12.41	48.4	40	40	40	40	40	40
16	16.00	14.21	62.9	40	40	40	40	40	40
18	18.00	16.01	79.3	40	40	40	40	40	40
20	20.00	17.81	97.6	40	40	40	40	40	40
24	24.00	21.42	140.0	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – PVC & CPVC PIPE

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Table A6.4-19; Max Allowable Restraint Spacing for Sched 80 CPVC Pipe – Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	---	---
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.722	0.5	15	10	10	10	9	8
1	1.315	0.936	0.7	15	10	10	10	10	9
1 1/4	1.660	1.255	1.2	20	15	10	10	10	10
1 1/2	1.900	1.476	1.5	20	15	15	10	10	10
2	2.375	1.913	2.3	20	15	15	15	10	10
2 1/2	2.875	2.290	3.4	20	20	15	15	15	10
3	3.500	2.864	4.9	30	20	20	20	15	15
3 1/2	4.000	3.326	6.4	30	20	20	20	15	15
4	4.500	3.786	8.0	30	20	20	20	20	15
5	5.563	4.768	12.1	40	30	20	20	20	20
6	6.625	5.709	17.1	40	30	30	20	20	20
8	8.625	7.565	28.5	40	40	30	30	20	20
10	10.75	9.49	44.1	40	40	40	30	30	30
12	12.75	11.29	61.9	40	40	40	40	30	30
14	14.00	12.41	74.6	40	40	40	40	30	30
16	16.00	14.21	97.2	40	40	40	40	40	30
18	18.00	16.01	122.9	40	40	40	40	40	40
20	20.00	17.81	151.6	40	40	40	40	40	40
24	24.00	21.42	218.0	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – PVC & CPVC PIPE

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Table A6.4-20; Max Allowable Restraint Spacing for Insulated Sched 80 CPVC Pipe – Full of Water

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Pipe Size (in)	Pipe O. D. (in)	Pipe I. D. (in)	Pipe Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
3/4	1.050	0.722	1.2	10	9	8	7	6	6
1	1.315	0.936	1.6	10	10	10	9	8	7
1 1/4	1.660	1.255	2.1	15	10	10	10	9	8
1 1/2	1.900	1.476	2.6	15	10	10	10	10	9
2	2.375	1.913	3.5	20	15	10	10	10	10
2 1/2	2.875	2.290	4.8	20	20	15	15	10	10
3	3.500	2.864	6.6	20	20	20	15	15	10
3 1/2	4.000	3.326	8.2	30	20	20	15	15	15
4	4.500	3.786	10.0	30	20	20	20	15	15
5	5.563	4.768	16.0	30	20	20	20	20	15
6	6.625	5.709	21.6	40	30	20	20	20	20
8	8.625	7.565	34.2	40	30	30	30	20	20
10	10.75	9.49	50.9	40	40	40	30	30	20
12	12.75	11.29	69.8	40	40	40	40	30	30
14	14.00	12.41	83.2	40	40	40	40	30	30
16	16.00	14.21	107.0	40	40	40	40	40	30
18	18.00	16.01	133.8	40	40	40	40	40	40
20	20.00	17.81	163.6	40	40	40	40	40	40
24	24.00	21.42	232.2	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – PVC & CPVC PIPE
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MAXIMUM RESTRAINT SPACING – COPPER WATER PIPE

Table A6.5-1; Maximum Allowable Seismic Restraint Spacing for *TYPE K* Water-Filled Copper Tubing – ASTM B88

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Tube Size (in)	Tube O. D. (in)	Tube Wall Thickness (in)	Tube Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
1	1.125	0.065	1.2	30	20	20	20	20	15
1 1/4	1.375	0.065	1.6	40	30	20	20	20	20
1 1/2	1.625	0.072	2.1	40	30	30	20	20	20
2	2.125	0.083	3.4	40	40	30	30	20	20
2 1/2	2.625	0.095	4.9	40	40	40	30	30	30
3	3.125	0.109	6.9	40	40	40	40	30	30
3 1/2	3.625	0.120	9.0	40	40	40	40	40	30
4	4.125	0.134	11.6	40	40	40	40	40	40
5	5.125	0.160	17.5	40	40	40	40	40	40
6	6.125	0.192	25.0	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – COPPER WATER PIPE

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Table A6.5-2; Maximum Allowable Seismic Restraint Spacing for TYPE L Water-Filled Copper Tubing – ASTM B88

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Tube Size (in)	Tube O. D. (in)	Tube Wall Thickness (in)	Tube Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
1	1.125	0.500	3.8	30	20	20	20	15	15
1 1/4	1.375	0.055	1.4	40	30	20	20	20	20
1 1/2	1.625	0.060	1.9	40	30	30	20	20	20
2	2.125	0.070	3.1	40	40	30	30	20	20
2 1/2	2.625	0.080	4.5	40	40	40	30	30	20
3	3.125	0.090	6.3	40	40	40	40	30	30
3 1/2	3.625	0.100	8.3	40	40	40	40	40	30
4	4.125	0.114	10.7	40	40	40	40	40	30
5	5.125	0.125	15.7	40	40	40	40	40	40
6	6.125	0.140	21.8	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – COPPER WATER PIPE

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Table A6.5-3; Maximum Allowable Seismic Restraint Spacing for *TYPE M* Water-Filled Copper Tubing – ASTM B88

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Tube Size (in)	Tube O. D. (in)	Tube Wall Thickness (in)	Tube Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
1	1.125	0.035	0.8	30	20	20	20	15	15
1 1/4	1.375	0.042	1.2	30	30	20	20	20	15
1 1/2	1.625	0.049	1.7	40	30	20	20	20	20
2	2.125	0.058	2.8	40	40	30	30	20	20
2 1/2	2.625	0.065	4.1	40	40	30	30	30	20
3	3.125	0.072	5.7	40	40	40	40	30	30
3 1/2	3.625	0.083	7.6	40	40	40	40	30	30
4	4.125	0.095	9.9	40	40	40	40	40	30
5	5.125	0.109	14.8	40	40	40	40	40	40
6	6.125	0.122	20.7	40	40	40	40	40	40

MAXIMUM RESTRAINT SPACING – COPPER WATER PIPE

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MAXIMUM ALLOWABLE RESTRAINT SPACING – DUCTS

Table A6.6-1; Maximum Allowable Seismic Restraint Spacing for Rectangular Duct
(Based on Gross Buckling of the Duct)

Seismic Coefficient C_s				0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL				D	C	B	A	----	----
Duct Width (in)	Duct Height (in)	Duct Area (ft ²)	Duct Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
28	28	5.4	24	40	40	40	40	40	40
30	30	6.3	26	40	40	40	40	40	40
42	42	12	36	40	40	40	40	40	40
54	54	20	47	40	40	40	40	40	40
60	60	25	54	40	40	40	40	40	40
84	84	49	103	40	40	40	40	40	40
96	96	64	129	40	40	40	40	40	40
40	20	6	26	40	40	40	40	40	40
54	28	11	35	40	40	40	40	40	40
60	30	13	39	40	40	40	40	40	40
84	42	25	74	40	40	40	40	40	40
96	48	32	97	40	40	40	40	40	40
108	54	41	110	40	40	40	40	40	40
120	60	50	121	40	40	40	40	40	40

MAXIMUM ALLOWABLE RESTRAINT SPACING – DUCTS

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**Table A6.6-2; Maximum Allowable Seismic Restraint Spacing for Round Duct
(Based on Gross Buckling of the Duct)**

Seismic Coefficient C_s			0.25	0.50	0.75	1.00	1.50	2.00
Seismic Hazard Level SHL			D	C	B	A	----	----
Duct Diameter (in)	Duct Area (ft ²)	Duct Weight w_p (lb/ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)	Actual Maximum Spacing S_T (ft)
30	4.9	20	40	40	40	40	40	40
33	5.9	22	40	40	40	40	40	40
36	7.1	24	40	40	40	40	40	40
48	13	33	40	40	40	40	40	40
60	20	41	40	40	40	40	40	40
84	38	69	40	40	40	40	40	40

MAXIMUM ALLOWABLE RESTRAINT SPACING – DUCTS

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SECTION – A6.6

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ELECTRICAL CONDUIT DATA

Table A8.1-1; EMT Electrical Conduit with 40% Copper Fill

Trade Size (in)	Conduit O. D. (in)	Wall Thickness (in)	Conduit Weight (lb/ft)	Copper Weight (lb/ft)	Conduit + Copper Weight (lb/ft)
1/2	0.706	0.042	0.30	0.47	0.77
3/4	0.922	0.049	0.45	0.82	1.28
1	1.163	0.057	0.67	1.34	2.01
1 1/4	1.510	0.065	1.00	2.31	3.31
1 1/2	1.740	0.065	1.16	3.15	4.30
2	2.197	0.065	1.47	5.19	6.66
2 1/2	2.875	0.072	2.15	9.05	11.20
3	3.500	0.072	2.62	13.67	16.30
3 1/2	4.000	0.083	3.46	17.84	21.30
4	4.500	0.083	3.90	22.80	26.70

ELECTRICAL CONDUIT DATA

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SECTION – A8.1

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Table A8.1-2; IMC Electrical Conduit with 40% Copper Fill

Trade Size (in)	Conduit O. D. (in)	Wall Thickness (in)	Conduit Weight (lb/ft)	Copper Weight (lb/ft)	Conduit + Copper Weight (lb/ft)
1/2	0.815	0.070	0.55	0.55	1.11
3/4	1.029	0.075	0.76	0.94	1.70
1	1.290	0.085	1.09	1.52	2.61
1 1/4	1.638	0.085	1.40	2.62	4.02
1 1/2	1.883	0.090	1.72	3.52	5.24
2	2.360	0.095	2.29	5.72	8.00
2 1/2	2.857	0.140	4.04	8.06	12.11
3	3.476	0.140	4.97	12.40	17.36
3 1/2	3.971	0.140	5.70	16.54	22.24
4	4.466	0.140	6.44	21.27	27.71

ELECTRICAL CONDUIT DATA

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SECTION – A8.1

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Table A8.1-3; Rigid Electrical Conduit with 40% Copper Fill

Trade Size (in)	Conduit O. D. (in)	Wall Thickness (in)	Conduit Weight (lb/ft)	Copper Weight (lb/ft)	Conduit + Copper Weight (lb/ft)
1/2	0.840	0.104	0.81	0.48	1.30
3/4	1.050	0.107	1.07	0.85	1.92
1	1.315	0.126	1.59	1.37	2.96
1 1/4	1.660	0.133	2.16	2.36	4.52
1 1/2	1.900	0.138	2.59	3.20	5.79
2	2.375	0.146	3.46	5.27	8.73
2 1/2	2.875	0.193	5.50	7.52	13.02
3	3.500	0.205	7.18	11.59	18.77
3 1/2	4.000	0.215	8.65	15.47	24.12
4	4.500	0.225	10.23	19.91	30.14
5	5.563	0.245	13.85	31.24	45.09
6	6.625	0.266	17.98	45.07	63.05

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