

## HANGER ROD STIFFENERS – WHY, WHEN, & HOW

### 18.1 – Why are Rod Stiffeners Needed?

Hanger rod stiffeners are used to prevent the buckling of the hanger rods under the compressive reaction loads during an earthquake. Buckling is very difficult to predict, and depends on many factors such as, hanger rod length, hanger rod size, the dead load carried by the hanger rod, the horizontal seismic forces applied to the pipe or duct, and the seismic restraint installation angle. Buckling is also a very dangerous type of failure. It occurs in long slender structural members under compressive load, and it occurs at loads far less than those required to yield the material in the structural member.

It is impractical for the installing contractor to be able to perform the calculations needed to determine if rod stiffeners are required, and to select the proper stiffener element. This section will provide the contractor with some basic tools that can be used to visually determine the need for rod stiffeners. Then the matter can be referred to the engineer of record for the system to have the proper calculations done using the on-line web tools provided by Kinetics Noise Control.

### 18.2 – When are Rod Stiffeners Needed?

1. For Seismic Design Categories A & B no seismic restraints, and thus, no rod stiffeners are required for pipe and duct.
2. For Seismic Design Categories C & D, and cable/strut installation angles no greater than 45° as measured from the horizontal, use Tables 18.1 through 18.12. In these tables, N.S.R. means that no rod stiffener is required for the specified hanger rod size and restraint spacing. For all other cases the maximum Unstiffened, or critical, hanger rod length is given for single hanger rod supported pipe & duct, and for trapeze bar supported pipe and duct.
3. For Seismic Design Categories C & D, seismic restraint installation angles greater than 45° as measured from the horizontal, and or Hanger spacings less than 10', assume that rod stiffeners will be required.

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4. For Seismic Design Categories E & F rod stiffeners will be required for almost all cases, consult with the engineer of record.

**Table I8-1; Maximum Unstiffened Hanger Rod Length for Pipe & Duct, Seismic Design Category C, Hanger Spacing is 10', Restraint Spacing is 10', and Restraint Installation Angle is 45°**

N.S.R. = No Stiffener Required

Hanger Rod Size (in)	Distributed Weight per Hanger Rod (lb/ft)	Critical Hanger Rod Length for Single Hanger Support (in)	Critical Hanger Rod Length for Trapeze Bar Support (in)
3/8	5	N.S.R.	N.S.R.
1/2	13	N.S.R.	N.S.R.
5/8	23	N.S.R.	N.S.R.
3/4	50	N.S.R.	N.S.R.
7/8	99	N.S.R.	N.S.R.
1	172	N.S.R.	N.S.R.
1 1/4	410	N.S.R.	N.S.R.

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**Table I8-2; Maximum Unstiffened Hanger Rod Length for Pipe & Duct – Seismic Design Category C, Hanger Spacing is 10', Restraint Spacing is 20', and Restraint Installation Angle is 45°**

N.S.R. = No Stiffener Required

Hanger Rod Size (in)	Distributed Weight per Hanger Rod (lb/ft)	Critical Hanger Rod Length for Single Hanger Support (in)	Critical Hanger Rod Length for Trapeze Bar Support (in)
3/8	5	N.S.R.	34
1/2	13	N.S.R.	39
5/8	23	N.S.R.	47
3/4	50	N.S.R.	48
7/8	99	N.S.R.	48
1	172	N.S.R.	47
1 1/4	410	N.S.R.	49

**Table I8-3; Maximum Unstiffened Hanger Rod Length for Pipe & Duct – Seismic Design Category C, Hanger Spacing is 10', Restraint Spacing is 30', and Restraint Installation Angle is 45°**

N.S.R. = No Stiffener Required

Hanger Rod Size (in)	Distributed Weight per Hanger Rod (lb/ft)	Critical Hanger Rod Length for Single Hanger Support (in)	Critical Hanger Rod Length for Trapeze Bar Support (in)
3/8	5	N.S.R.	19
1/2	13	N.S.R.	22
5/8	23	N.S.R.	27
3/4	50	N.S.R.	27
7/8	99	N.S.R.	27
1	172	N.S.R.	27
1 1/4	410	N.S.R.	28

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**Table I8-4; Maximum Unstiffened Hanger Rod Length for Pipe & Duct – Seismic Design Category C, Hanger Spacing is 10', Restraint Spacing is 40', and Restraint Installation Angle is 45°**

N.S.R. = No Stiffener Required

Hanger Rod Size (in)	Distributed Weight per Hanger Rod (lb/ft)	Critical Hanger Rod Length for Single Hanger Support (in)	Critical Hanger Rod Length for Trapeze Bar Support (in)
3/8	5	34	15
1/2	13	39	17
5/8	23	47	21
3/4	50	48	21
7/8	99	48	21
1	172	47	21
1 1/4	410	49	22

**Table I8-5; Maximum Unstiffened Hanger Rod Length for Pipe & Duct – Seismic Design Category C, Hanger Spacing is 10', Restraint Spacing is 60', and Restraint Installation Angle is 45°**

N.S.R. = No Stiffener Required

Hanger Rod Size (in)	Distributed Weight per Hanger Rod (lb/ft)	Critical Hanger Rod Length for Single Hanger Support (in)	Critical Hanger Rod Length for Trapeze Bar Support (in)
3/8	5	19	11
1/2	13	22	12
5/8	23	27	15
3/4	50	27	15
7/8	99	27	15
1	172	27	15
1 1/4	410	28	16

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**Table I8-6; Maximum Unstiffened Hanger Rod Length for Pipe & Duct – Seismic Design Category C, Hanger Spacing is 10', Restraint Spacing is 80', and Restraint Installation Angle is 45°**

N.S.R. = No Stiffener Required

Hanger Rod Size (in)	Distributed Weight per Hanger Rod (lb/ft)	Critical Hanger Rod Length for Single Hanger Support (in)	Critical Hanger Rod Length for Trapeze Bar Support (in)
3/8	5	15	9
1/2	13	17	10
5/8	23	21	13
3/4	50	21	13
7/8	99	21	13
1	172	21	13
1 1/4	410	22	13

**Table I8-7; Maximum Unstiffened Hanger Rod Length for Pipe & Duct – Seismic Design Category D, Hanger Spacing is 10', Restraint Spacing is 10', and Restraint Installation Angle is 45°**

N.S.R. = No Stiffener Required

Hanger Rod Size (in)	Distributed Weight per Hanger Rod (lb/ft)	Critical Hanger Rod Length for Single Hanger Support (in)	Critical Hanger Rod Length for Trapeze Bar Support (in)
3/8	5	N.S.R.	N.S.R.
1/2	13	N.S.R.	N.S.R.
5/8	23	N.S.R.	N.S.R.
3/4	50	N.S.R.	N.S.R.
7/8	99	N.S.R.	N.S.R.
1	172	N.S.R.	N.S.R.
1 1/4	410	N.S.R.	N.S.R.

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**Table I8-8; Maximum Unstiffened Hanger Rod Length for Pipe & Duct – Seismic Design Category D, Hanger Spacing is 10', Restraint Spacing is 20', and Restraint Installation Angle is 45°**

N.S.R. = No Stiffener Required

Hanger Rod Size (in)	Distributed Weight per Hanger Rod (lb/ft)	Critical Hanger Rod Length for Single Hanger Support (in)	Critical Hanger Rod Length for Trapeze Bar Support (in)
3/8	5	N.S.R.	19
1/2	13	N.S.R.	22
5/8	23	N.S.R.	27
3/4	50	N.S.R.	27
7/8	99	N.S.R.	27
1	172	N.S.R.	27
1 1/4	410	N.S.R.	28

**Table I8-9; Maximum Unstiffened Hanger Rod Length for Pipe & Duct – Seismic Design Category D, Hanger Spacing is 10', Restraint Spacing is 30', and Restraint Installation Angle is 45°**

N.S.R. = No Stiffener Required

Hanger Rod Size (in)	Distributed Weight per Hanger Rod (lb/ft)	Critical Hanger Rod Length for Single Hanger Support (in)	Critical Hanger Rod Length for Trapeze Bar Support (in)
3/8	5	27	13
1/2	13	31	15
5/8	23	38	19
3/4	50	38	19
7/8	99	38	19
1	172	38	19
1 1/4	410	39	19

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**Table I8-10; Max. Unstiffened Hanger Rod Length for Pipe & Duct – Seismic Design Category D, Hanger Spacing is 10', Restraint Spacing is 40', and Restraint Installation Angle is 45°**

N.S.R. = No Stiffener Required

Hanger Rod Size (in)	Distributed Weight per Hanger Rod (lb/ft)	Critical Hanger Rod Length for Single Hanger Support (in)	Critical Hanger Rod Length for Trapeze Bar Support (in)
3/8	5	19	11
1/2	13	22	12
5/8	23	27	15
3/4	50	27	15
7/8	99	27	15
1	172	27	15
1 1/4	410	28	16

**Table I8-11; Max. Unstiffened Hanger Rod Length for Pipe & Duct – Seismic Design Category D, Hanger Spacing is 10', Restraint Spacing is 60', and Restraint Installation Angle is 45°**

N.S.R. = No Stiffener Required

Hanger Rod Size (in)	Distributed Weight per Hanger Rod (lb/ft)	Critical Hanger Rod Length for Single Hanger Support (in)	Critical Hanger Rod Length for Trapeze Bar Support (in)
3/8	5	13	8
1/2	13	15	9
5/8	23	19	12
3/4	50	19	12
7/8	99	19	12
1	172	19	12
1 1/4	410	19	12

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**Table I8-12; Max. Unstiffened Hanger Rod Length for Pipe & Duct – Seismic Design Category D, Hanger Spacing is 10', Restraint Spacing is 80', and Restraint Installation Angle is 45°**

N.S.R. = No Stiffener Required

Hanger Rod Size (in)	Distributed Weight per Hanger Rod (lb/ft)	Critical Hanger Rod Length for Single Hanger Support (in)	Critical Hanger Rod Length for Trapeze Bar Support (in)
3/8	5	11	7
1/2	13	12	8
5/8	23	15	10
3/4	50	15	10
7/8	99	15	10
1	172	15	10
1 1/4	410	16	10

### 18.3 – How are Rod Stiffeners Selected and Installed?

The sizing of the rod stiffeners may be accomplished using the techniques outlined in Section S8.0 and Appendices A5.1 through A5.8 of this manual. Section S8.7 outlines the requirements and procedure for using the on-line web Rod Stiffener program provided by Kinetics Noise Control. Sizing rod stiffeners is not a task that should be attempted by the installing contractor in the field, and should be performed by a qualified design professional. The following basic rules will help to determine the need for rod stiffeners.

1. Rod stiffeners only need to be used on hanger rods that carry the reaction loads from seismic restraints.
2. When determining the requirements for rod stiffeners, consider both the transverse (T) and Longitudinal (L) restraints on the run of pipe or duct. Remember, the longitudinal (L) restraints are typically spaced further apart than the transverse (T) restraints and could

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require rod stiffeners when the transverse (T) restraints did not, or require larger rod stiffeners when the transverse (T) restraints also required rod stiffeners.

3. Where hanger rods carry the loads from both Transverse (T) and Longitudinal (L) seismic restraints, the rod stiffeners need to be sized to carry only the reaction loads from the more severe case.

Kinetics Noise Control has designed a series of clamps that are used with standard rolled structural angle to create a rod stiffener system, which are shown in Figure I8-1. The model KHRC-B clamp has been designed to work with hanger rods from 3/8" to 1-1/8" in diameter. The model KHRC-C clamp is for use with hanger rods from 3/8" to 1-1/8" in diameter. Table I8-13 shows the rolled structural angles recommended for use as rod stiffeners by Kinetics Noise Control, and the model KHRC stiffener clamps to be used with each angle size. The analysis outlined in Section S8.0, and Appendix A5.1, or the on-line web based Rod Stiffener program will indicate which angle and clamp are to be used and how many clamps will be required to properly stiffen the hanger rod.

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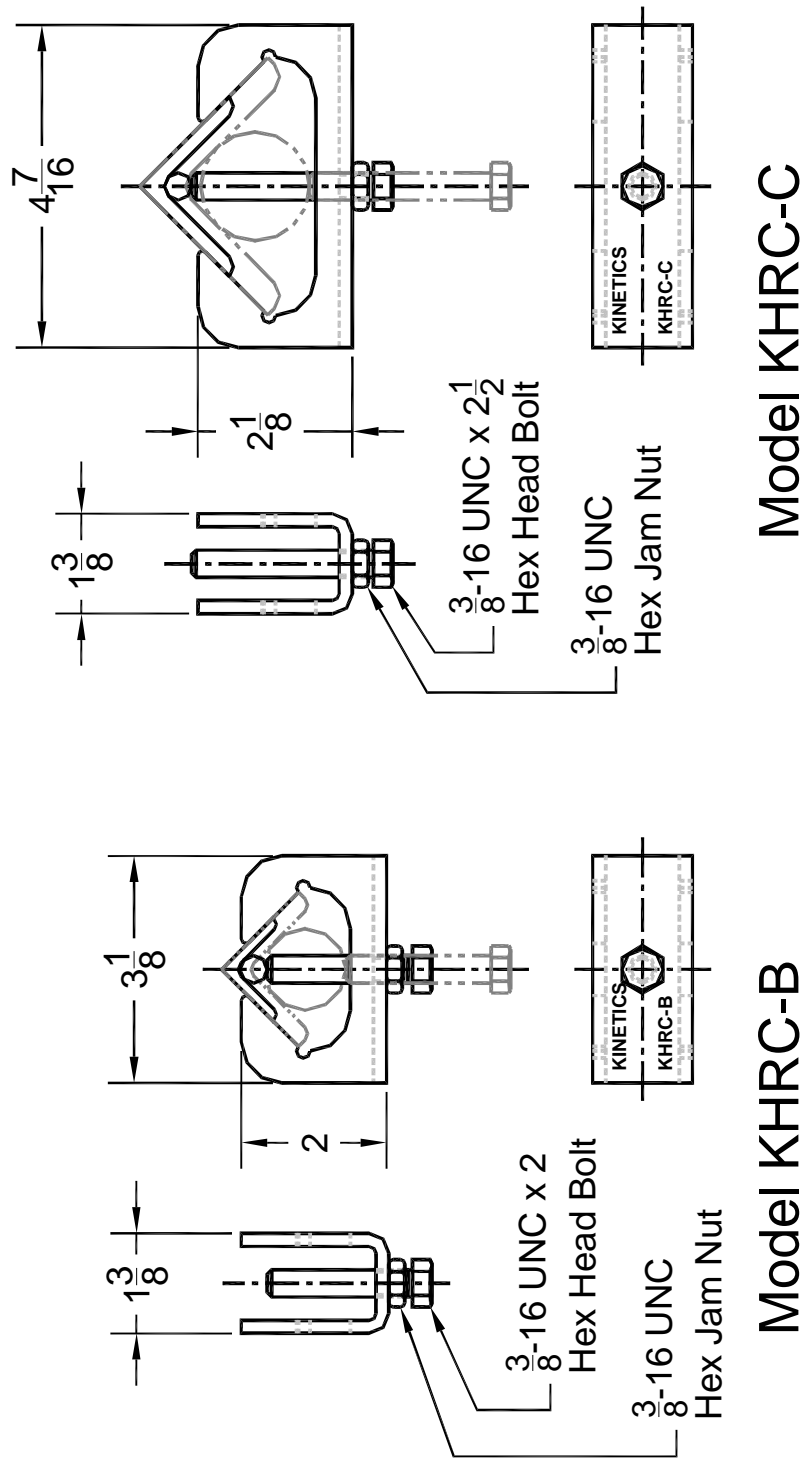


Figure I8-1; Kinetics Noise Control Model KHRC Rod Stiffener Clamps for Use with Rolled Structural Angle

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**Table I8-13; Rod Stiffener Angle Code Designation and Model KHRC Rod Stiffener Clamps**

Rod Stiffener Code	AISI Angle Designation	Rod Stiffener Clamp Model
A	L 1 x 1 x 1/8	KHRC-B
B	L 1-1/4 x 1-1/4 x 1/4	
C	L 1-1/2 x 1-1/2 x 1/4	
D	L 1-3/4 x 1-3/4 x 1/4	KHRC-C
E	L 2 x 2 x 1/4	
F	L 2 x 2 x 3/8	
G	L 2-1/2 x 2-1/2 x 1/4	
H <sup>2</sup>	L 2-1/2 x 2-1/2 x 3/8	
I <sup>2</sup>	L 2-1/2 x 2-1/2 x 1/2	

<sup>1</sup> The Rod Stiffener Code is used by the Kinetics Noise Control Rod Stiffener Program streamline the specification of the rod stiffener.

<sup>2</sup> 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.

The basic installation of the rod stiffener clamps is detailed in Figure I8-2, and typical rod stiffener installations are shown in Figures I8-3 through I8-6.



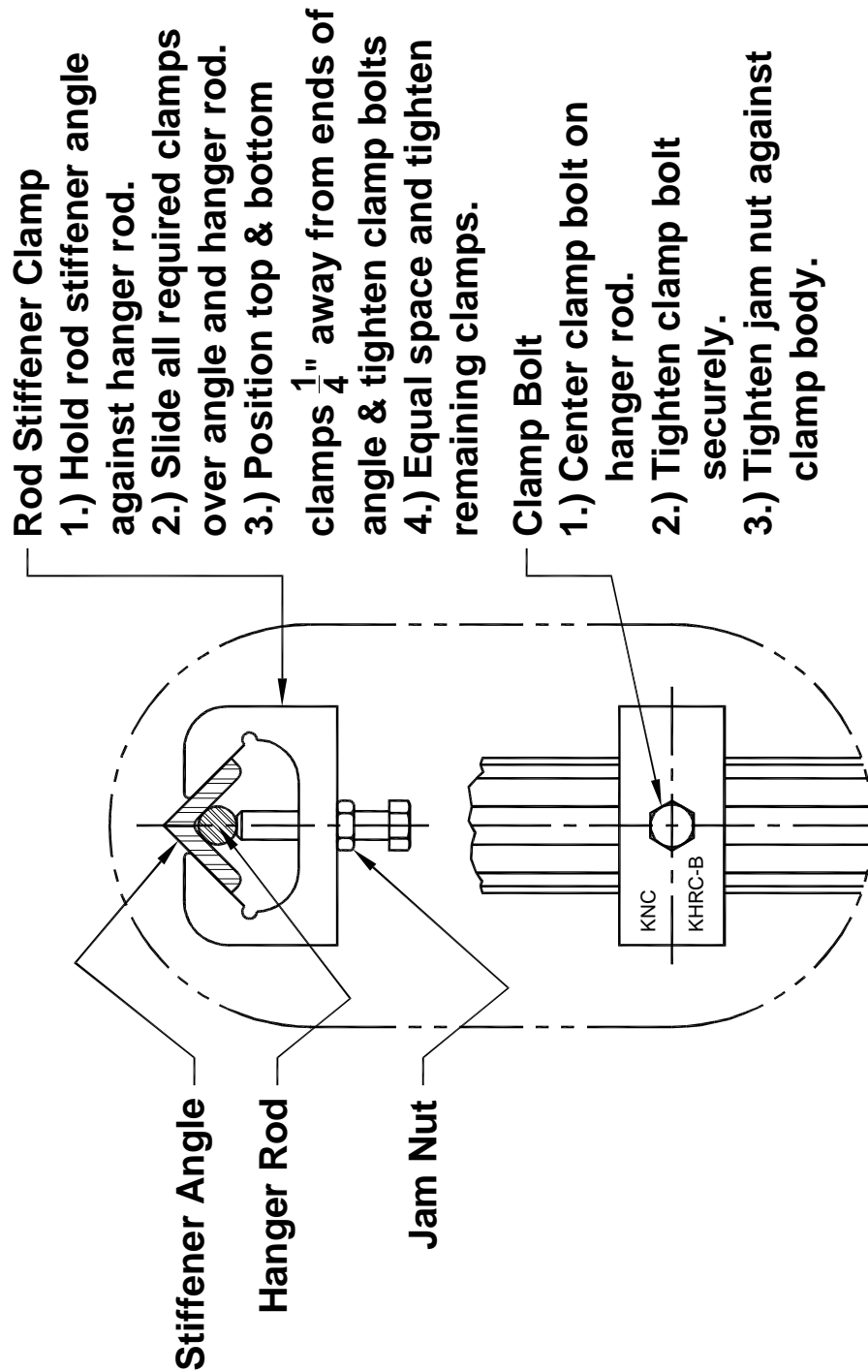


Figure I8-2; Basic Installation of Kinetics Noise Control Model KHRC Rod Stiffener Clamps

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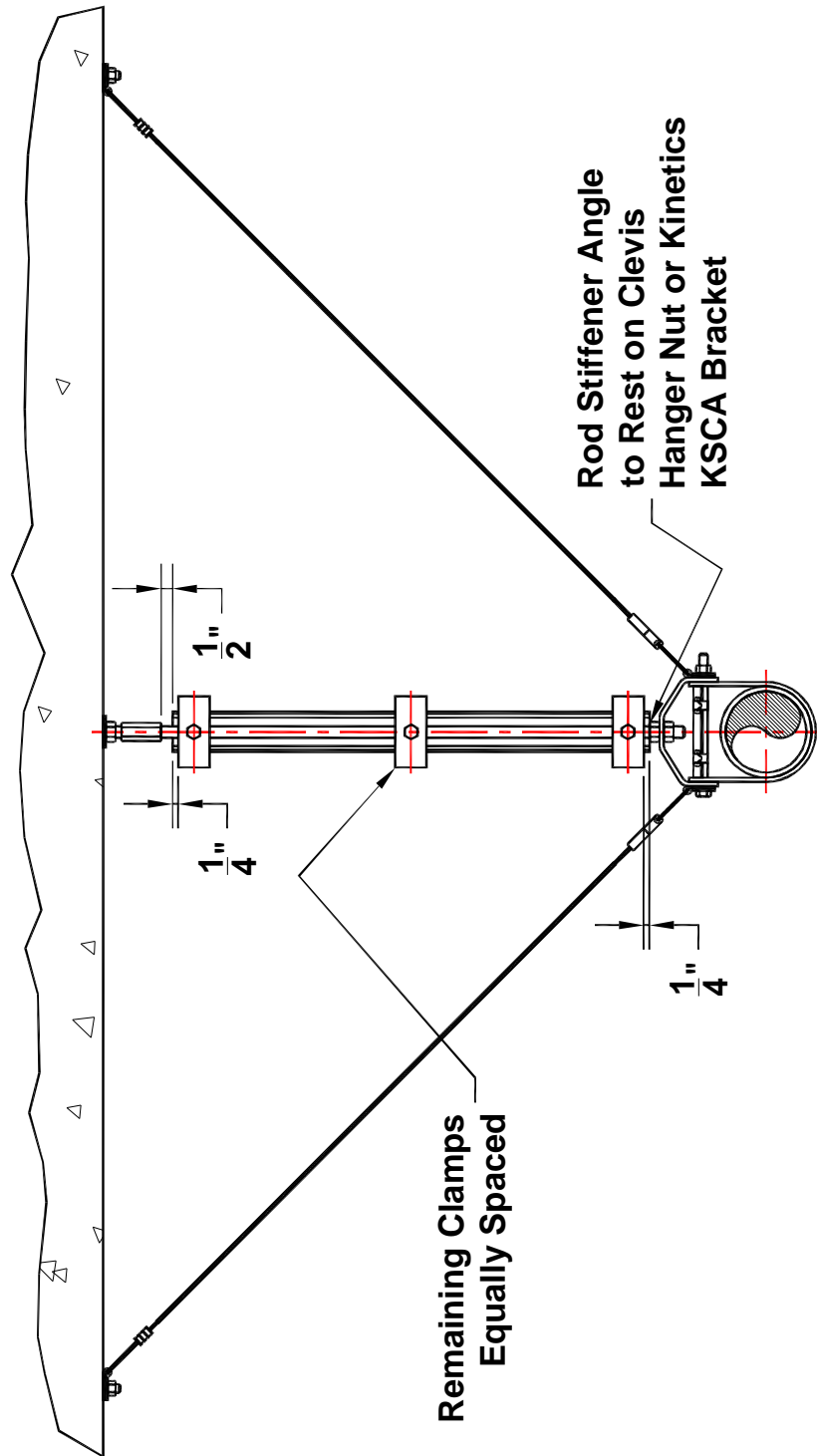


Figure I8-3; Typical Rod Stiffener Installation for Non-Isolated Single Clevis Hung Pipe

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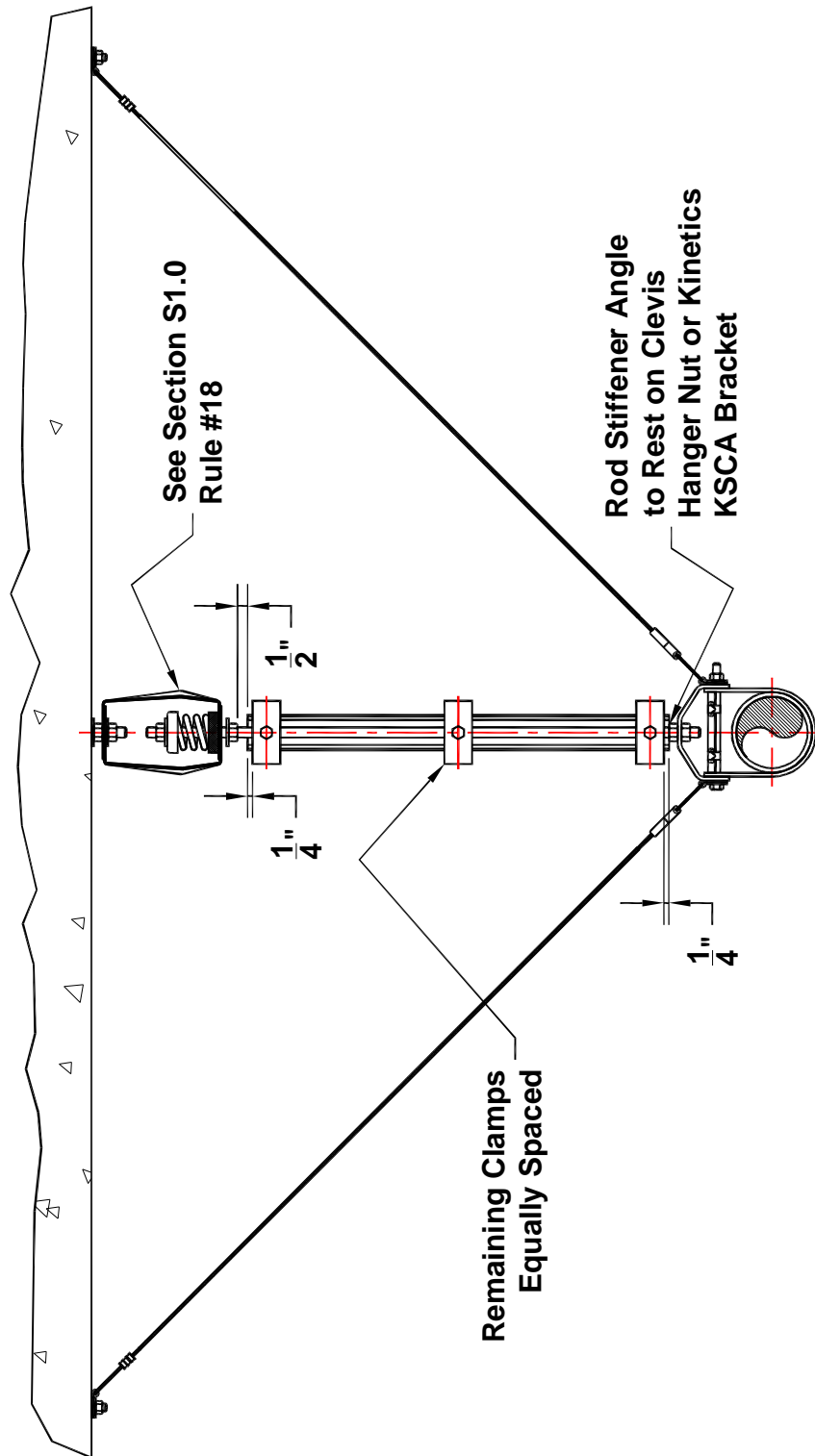


Figure I8-4; Typical Rod Stiffener Installation for Isolated Single Clevis Hung Pipe

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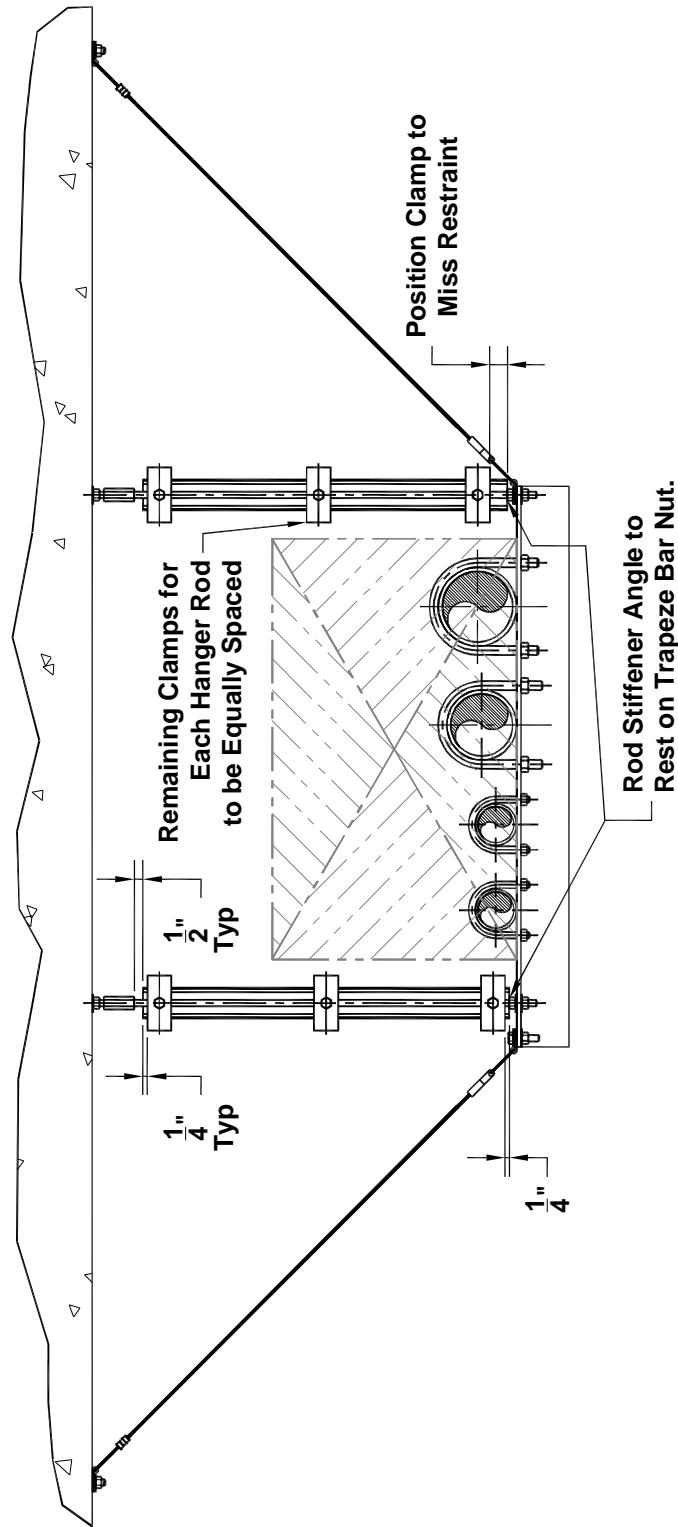


Figure 18-5; Typical Rod Stiffener Installation for Trapeze Supported Pipe & Duct – Two Rods

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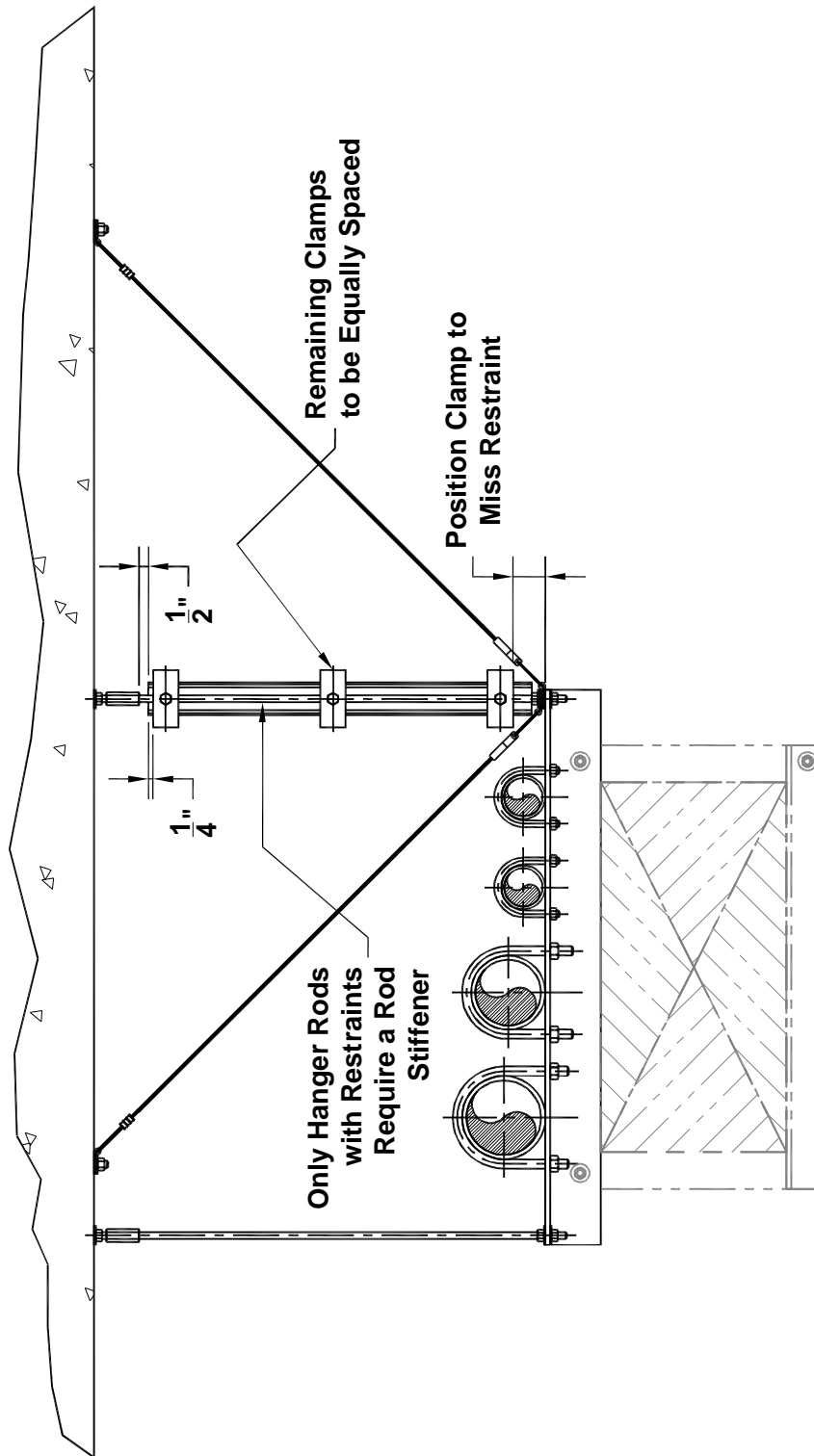


Figure I8-6; Typical Rod Stiffener Installation for Trapeze Supported Pipe & Duct – One Rod

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