STRUCTURAL ATTACHMENTS FOR PIPE AND DUCT RESTRAINTS

I5.1 – Introduction:

This section will present several basic arrangements for attaching seismic cable restraints to the building structure. The figures and descriptions in this section will be based on the Kinetics Noise Control drawings SS-20070951, SS-20070952, and SS-20070953 titled Concrete/Masonry Attachment – Sheet B, Steel Attachment – Sheet C, and Wood Attachment – D respectively. There are several drawings in this specific series. They have been designed to aid the installing contractor with the installation of seismic cable restraints for pipe and duct. Each drawing has a number designation ranging from SS-20070950 through SS-20070959. Also each drawing is specified by a particular letter designation ranging from Sheet A though Sheet H. The drawing numbers are in no particular order. However, the letter designations are in strict alphabetical order. Each of the drawings in this series has several views on each sheet designated by a specific letter. Where the figures in this section correspond with those views on the Kinetics Noise Control drawings SS-20070950 through SS-20070959 they will be cross referenced by sheet letter and figure letter, for instance Sheet C – View M.

Kinetics Noise Control provides attachment kits for their seismic restraint cable kits for pipe and duct. Kinetics Noise Control will, when requested to do so, provide a certification for the products that they sell. This certification will state that the seismic restraint cable and attachment kits will meet the seismic design requirements for the project in question when properly installed at the correct spacing. It is important to keep in mind that this certification ***does not*** extend to the building structure. Kinetics Noise Control is a manufacturer of vibration isolation and seismic restraint devices for the HVAC industry, and as such has no control over the design of the building structure. It is the responsibility of the structural engineer of record, and in some cases the architect of record, to approve the structural connections for the seismic restraints for pipe and duct.

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I5.2 – KSUA Attachment Brackets:

I5.2.1 – KSUA Brackets – Basic Sizes & Installation:

Kinetics Noise Control provides several different attachment brackets that can be used for making the structural attachment for the seismic cable restraints. Figure I5-1 shows the two KSUA brackets.

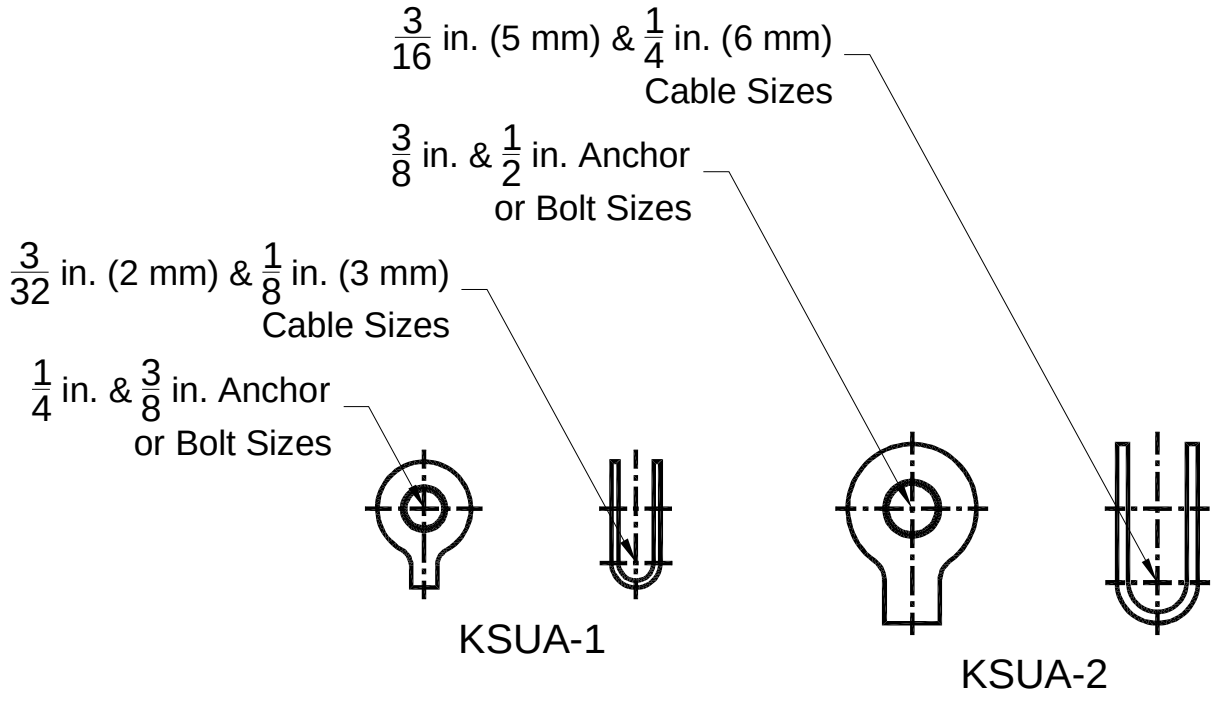

Figure I5-1; Kinetics Noise Control Model KSUA Seismic Restraint Cable Attachment Brackets

Primarily, the KSUA attachment brackets are used with the Kinetics Noise Control Model KSCU Seismic Restraint Cable Kits, which are described in Appendix A1.1. A KSCU seismic restraint cable kit consists of two restraint cables with a loop swaged on one end, two Kinetics provided end connectors, two Kinetics Model KSCA attachment brackets (which will be described in detail in the Section I5.3.1). ***For OSHPD applications thimbles are required for both ends of the restraint cables***.

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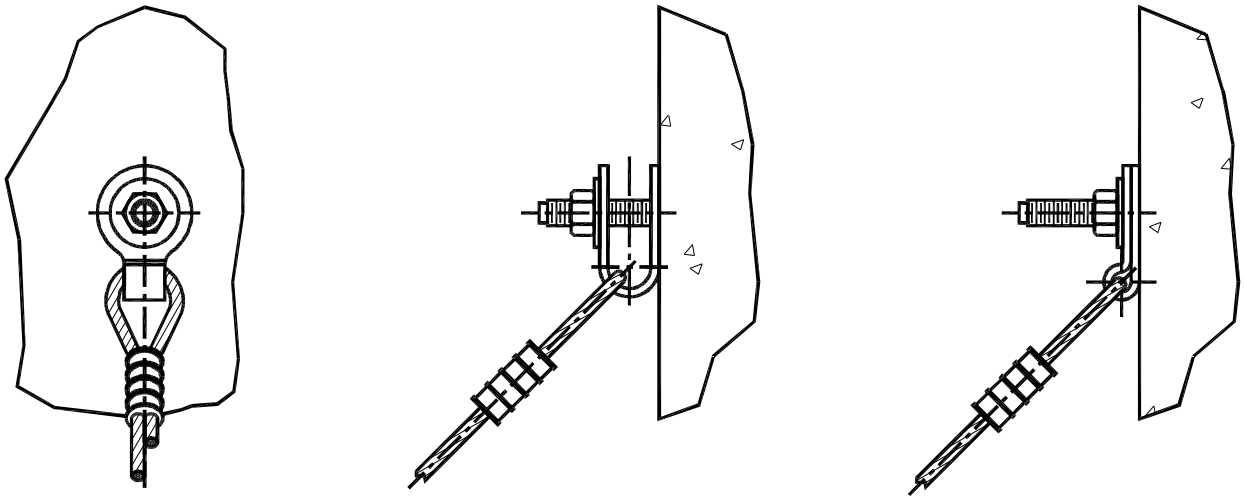

View #1
Front
KSUA - Installed

View #2
Side
KSUA - Open

View #3
Side
KSUA - Closed

Figure I5-2; Installation of Model KSUA Attachment Bracket

The KSUA attachment brackets were designed to be used with the pre-swaged end of the restraint cable, although they can be used on the end of the cable where the loop is made with the Kinetics provided end connector. Figure I5-2 shows the basic installation of the KSUA brackets. The particular installation shown is for attachment to the building structural concrete, although the basic procedure is the same regardless of whether the bracket is being attached to structural steel, concrete, or wood.

1. The pre-swaged end loop of the restraint cable is slipped over one of the legs of the open KSUA bracket; see View #2 Side KSUA – Open in Figure I5-2.
2. The open KSUA bracket is placed over the fastener, with or without a flat washer, and the nut is run down finger tight on the bracket. See View #2 Side KSUA – Open in Figure I5-2 above.
3. Tighten the nut with a wrench to the proper torque specified for the fastener being used. The two legs of the KSUA bracket should be squeezed completely shut as shown in View # 3 Side KSUA – Closed as shown in Figure I5-2. Squeezing the legs of the KSUA bracket shut

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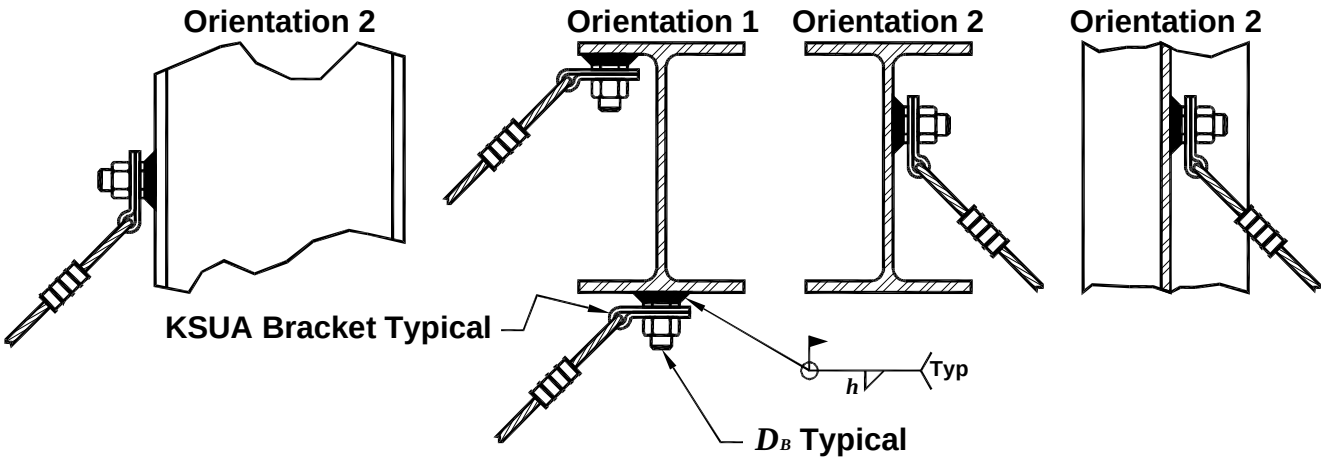
will form a loop for the restraint cable. The cable should be loose and free to move inside the loop of the KSUA bracket.

I5.2.2 – KSUA Brackets – Attachment to Steel:

In general, attaching the KSCU seismic restraint cable kits to structural steel will maximize the capacity of the KSCU restraint installation. Figure I5-3 and Table I5-1 illustrate how the KSUA bracket may be welded to structural steel. A rolled structural W shape is shown; however, this scheme may be applied to any structural shape with the ***approval of the building structural engineer***. An ASTM A307, SAE Grade 2, bolt of the proper size is located on the structural steel and welded as shown in Figure I5-3. Then the cable and KSUA bracket are installed a described in Section I5.2.1.



Sheet C - Views F, K, M, and N

Figure I5-3; Welding KSUA Brackets to Structural Steel

Table I5-1; Bolt and Weld Size for KSUA Bracket Weld Attachment to Structural Steel

KSUA Bracket	Bolt Size D_B	Weld Size h (in)
KSUA-1	3/8-16 UNC	3/16
KSUA-2	1/2-13 UNC	1/4

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Kinetics Noise Control supplies Models KSBC-1 and -2 Seismic Beam Clamps that may be used to attach the KSUA brackets to structural steel AISC W, M, S, or HP shapes without welding. This method of attachment to structural steel is shown in Figure I5.4. Here also, the use of the seismic beam clamps to attach the KSUA brackets to the structural steel ***must be approved by the building structural engineer***.

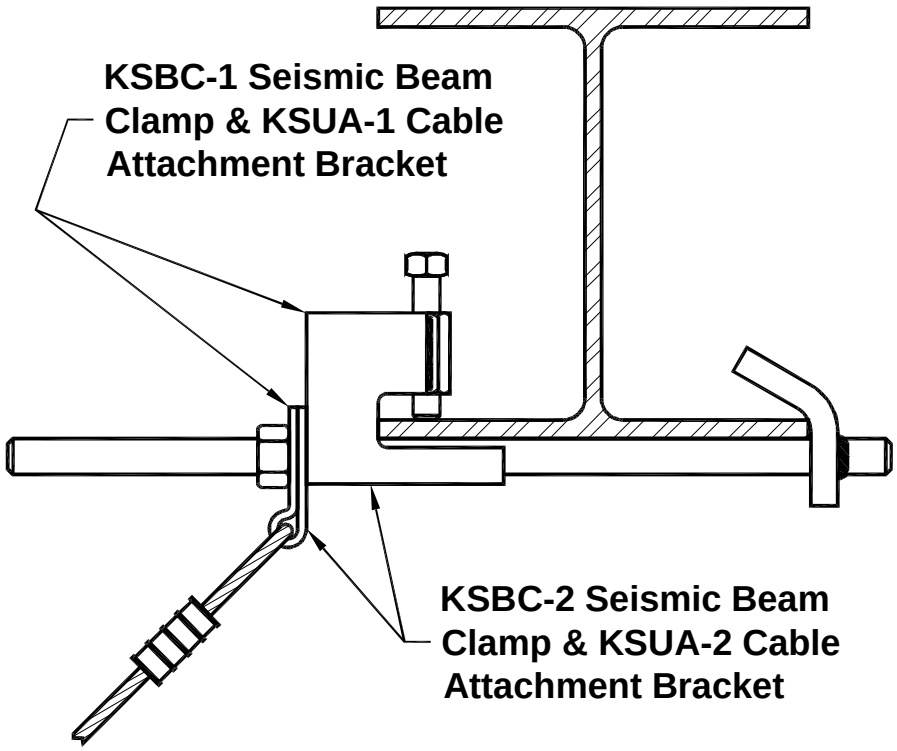

Figure I5-4; Using Model KSBC Seismic Beam Clamps to Attach KSUA Brackets to Structural Steel

KSUA Brackets may be attached to steel open web joists as shown in Figures I5-5, I5-6, and I5-7. These structural elements are normally designed to be as efficient as possible which means that they are designed to carry primarily vertical loads, and are sized to carry just the code mandated loads. If seismic restraints for pipe and duct are to be attached to these open web steel joists as shown in Figures I5-5, I5-6, and I5-7 below, ***it is absolutely necessary for the building structural engineer to approve each attachment point***.

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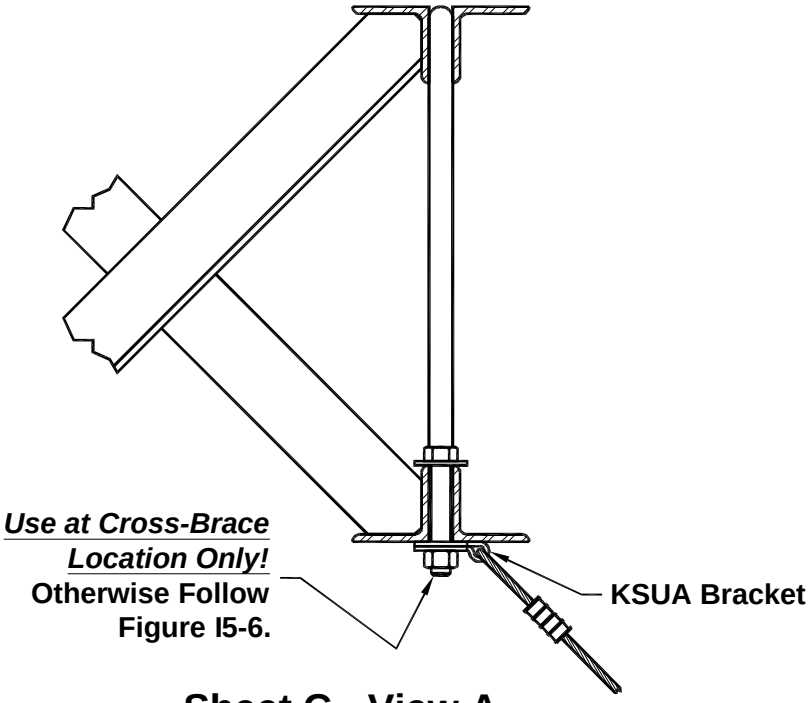
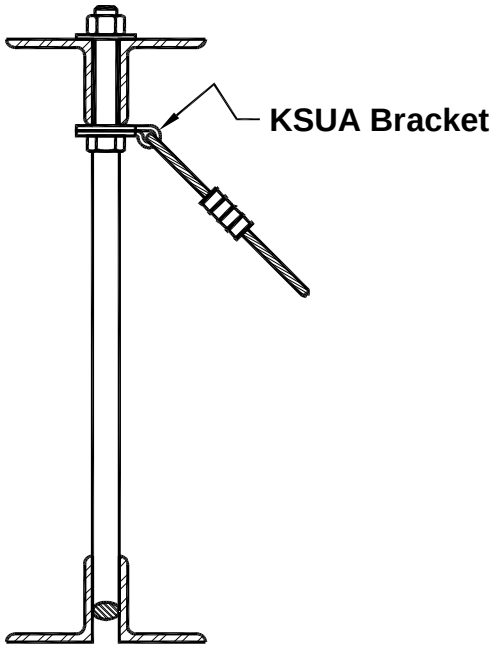


Sheet C - View A

Figure I5-5; Attaching KSUA Brackets to Cross-Braced Open Web Steel Joists



Sheet C - View G

Figure I5-6; Attaching KSUA Brackets to Un-Braced Open Web Steel Joists

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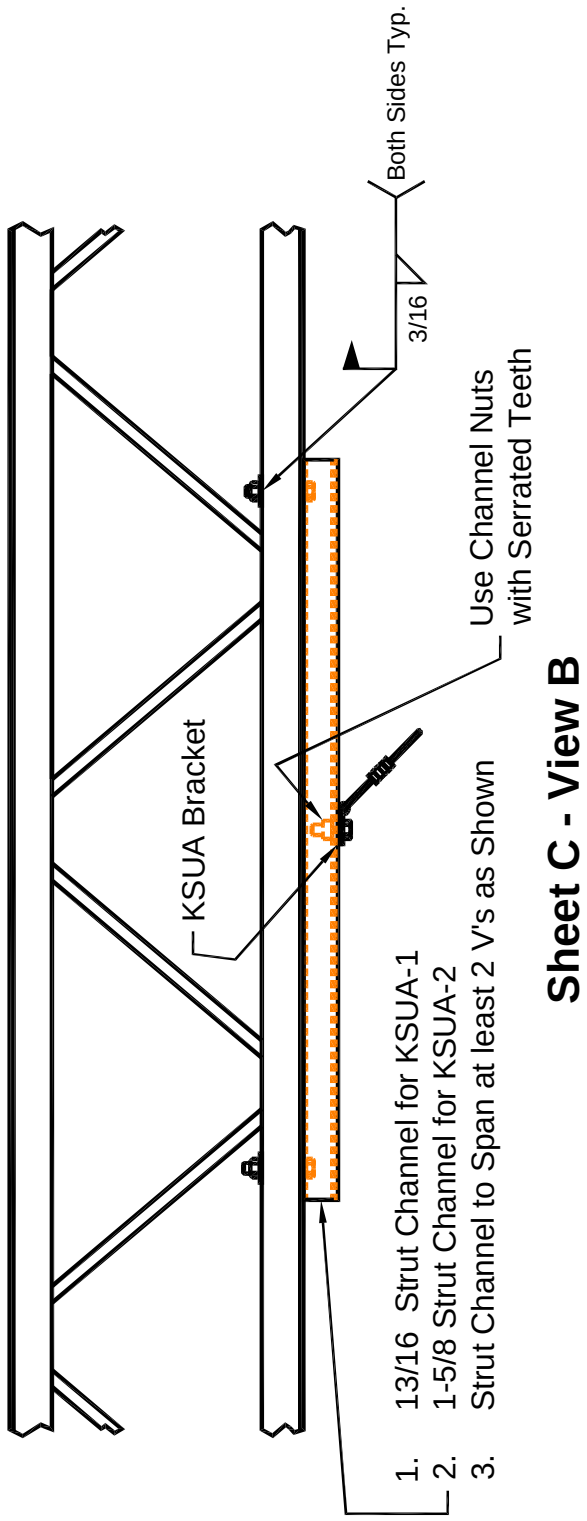

Figure I5-7; Attaching KSUA Brackets to Un-Braced Open Web Steel Joists – Aligned to Joists

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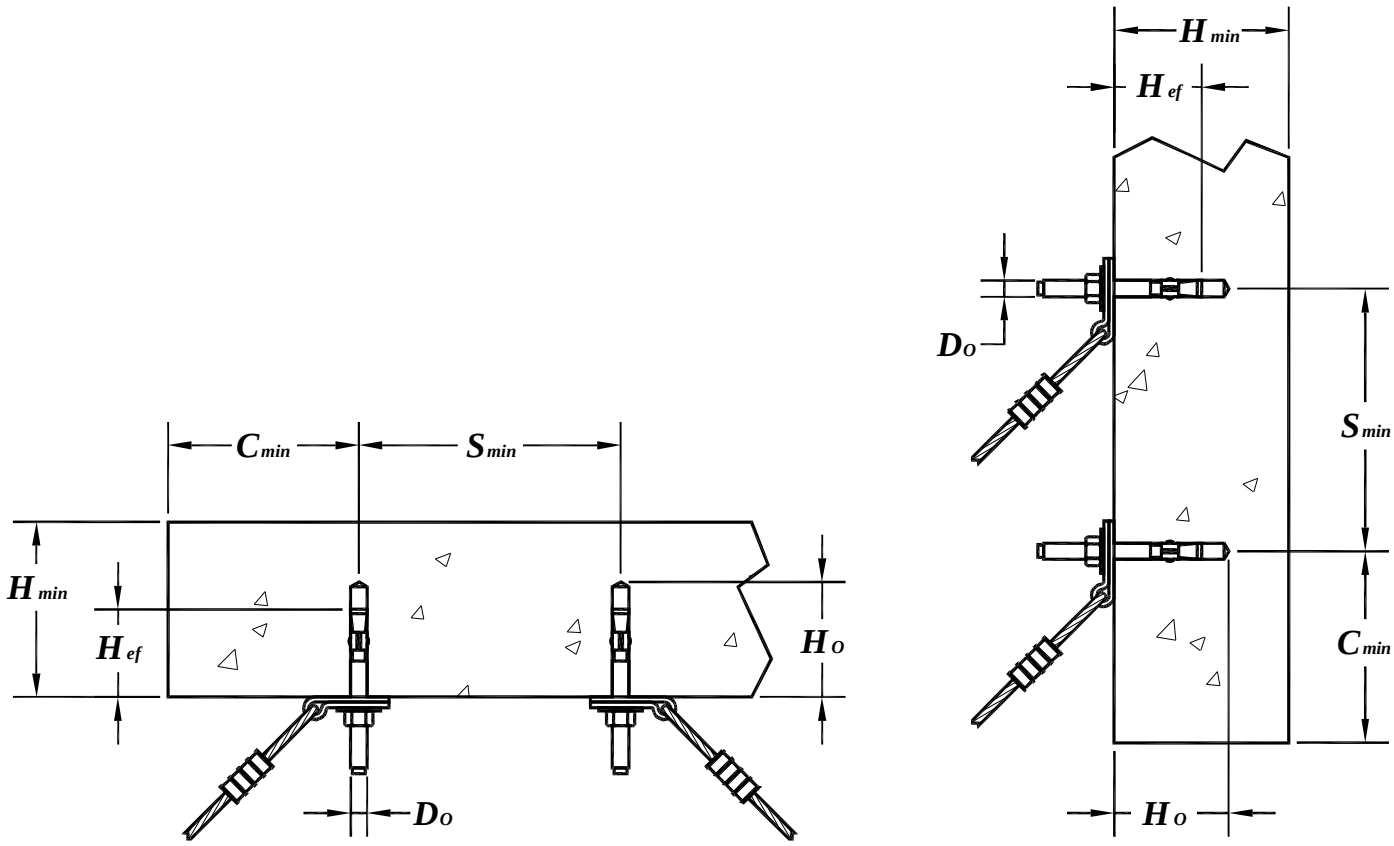
I5.2.3 – KSUA Brackets – Attachment to Concrete:

The typical attachment of seismic cable restraints to concrete using KSUA brackets is shown in Figure I5-8. The critical installation dimensions are listed in Table I5-2.



Orientation 1

Orientation 2

Sheet B - View A

Figure I5-8; Typical KSUA Bracket Installation in Concrete

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Table I5-2; Critical KCCAB Concrete Anchor Installation Dimensions for KSCU Restraint Cable Kits

Anchor & Pilot Hole Size D_O (in)	Pilot Hole Depth H_O (in)	Effective Anchor Embedment H_{ef} (in)	Minimum Concrete Thickness H_{min} (in)	Minimum Anchor Spacing S_{min} (in)	Minimum Anchor Edge Distance C_{min} (in)
3/8	2-5/8	2	4	6	4-3/8
1/2	4	3-1/4	6	9-3/4	7-1/2

The installation dimensions listed in Table I5-2 are the minimum required to achieve the listed capacities for the Model KSCU Seismic Restraint Cable Kits listed in Appendix A1.1, Tables A1.1-3 and A1.1-4.

Figure I5-9 shows a KSUA bracket attached to concrete which has been poured over a corrugated metal deck. Thickest concrete section at the ribs of the decking must meet the Minimum Concrete Thickness from Table I5-2 above. Figure I5-10 shows a KSUA bracket mounted to a strut channel which spans at least two ribs. This arrangement is used when there is not enough concrete thickness for a 1/2″ anchor to be used with a KSUA-2 bracket, or the concrete is a lightweight concrete that produces a lower anchor capacity that what would be expected with normal weight concrete, see Table I5-3 for anchor substitutions for lightweight concrete over metal decking.

Table I5-3; Anchor Substitution for Lightweight Concrete over Metal Decking for KSCU Cable Kits

KNC Anchor Kit Code	Standard Anchor Size (in)	Used With KNC Restraint Kit Code	Cable Size	For Lightweight Concrete over Metal Decking		
				Required Anchor Size (in)	Required Embedment Depth (in)	Required Quantity
X2	3/8	K2	2 mm	3/8	2	1
X2	3/8	K3	3 mm	3/8	2	2
X2	3/8	K4	4 mm	3/8	2	2
X3	1/2	K5[1]	5 mm	5/8	4	1

[1] For use in lightweight concrete poured over metal decking, the KSUA-2 bracket supplied with the K5 (KSCU-5) cable restraint kit will need to be replaced with the Kinetics Noise Control Model KSCC-1 bracket, order P/N 9036608.

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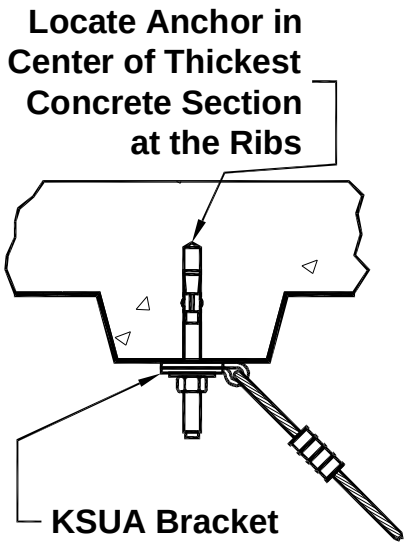
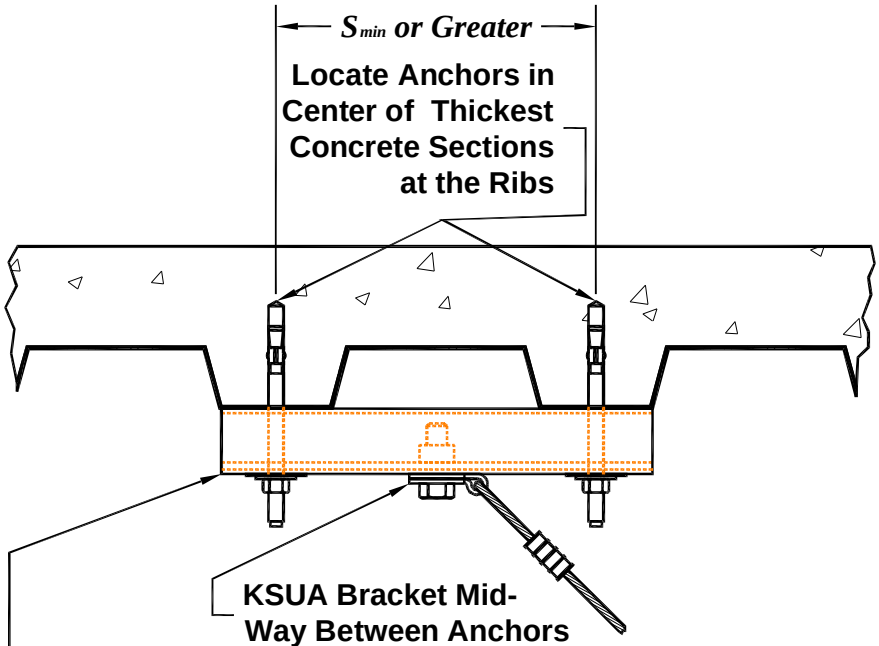


Sheet B - View C

Figure I5-9; KSUA Bracket Attached to Concrete Poured on Corrugated Metal Decking



1. 13/16 Strut Channel for KSUA-1
2. 1-5/8 Strut Channel for KSUA-2
3. Use Channel Nuts with Serrated Teeth

Sheet B - View G

Figure I5-10; KSUA Bracket Attached to Strut Channel Anchored to Concrete Poured on Corrugated Metal Decking

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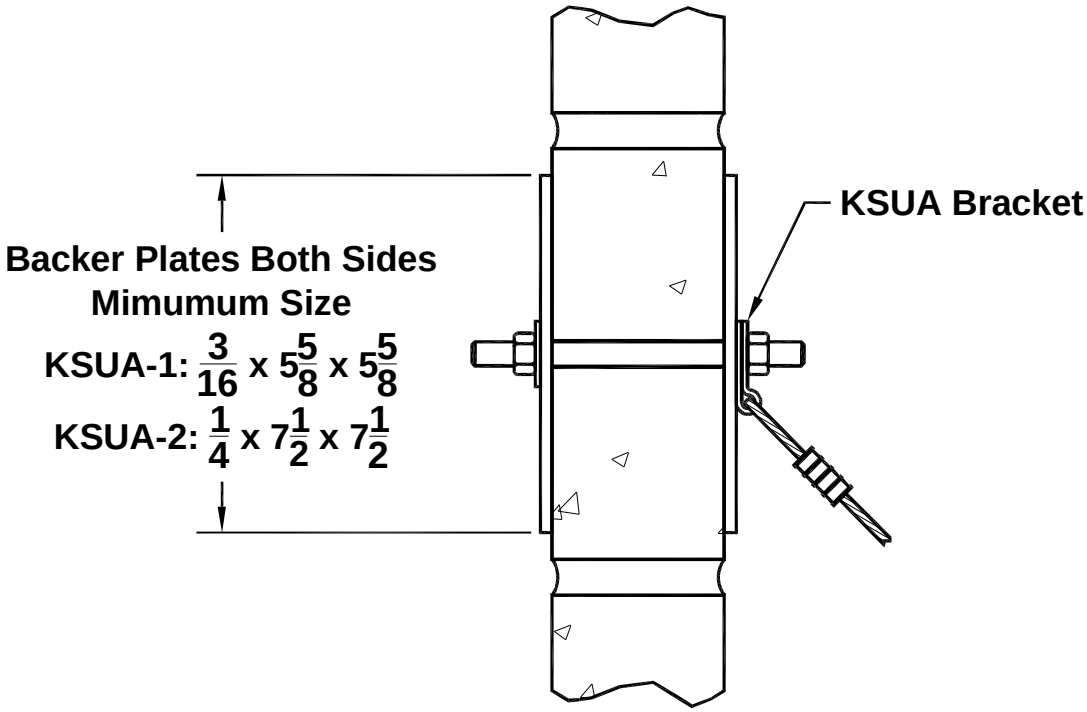
I5.2.4 – KSUA Brackets – Attachment to CMU Walls:

The concrete used for CMU components is usually a lightweight concrete, and often has fillers and aggregates such as fly ash and bottom ash. Therefore, the strength of this concrete does not match that of normal weight concrete, and may not match that of poured in place lightweight concrete. For this reason, ***attachments for seismic restraints made to CMU walls must be approved by the building structural engineer in advance of installation of the restraints***. When solid masonry blocks are used, the best way to make theses attachments is to use through bolts with load plates on both sides of the wall as shown in Figure I5-11. The capacity of the attachment will be what ever the building structural engineer says that the point load limit for the wall will be. (Up to but not exceeding the cable kit capacity as published by Kinetics Noise Control.)



Sheet B - View F

Figure I5-11; KSUA Through Bolt Attachment to a Solid CMU Wall

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Figures I5-12 and I5-13 show attachment methods for hollow CMU walls. ***Here again, the building structural engineer must approve the attachment prior to installation, and indicate the point load limit for the wall***. (Note: In the case of the umbrella type anchor, Figure I5-13, the peak capacity is limited to that of the 3/8" anchor.)

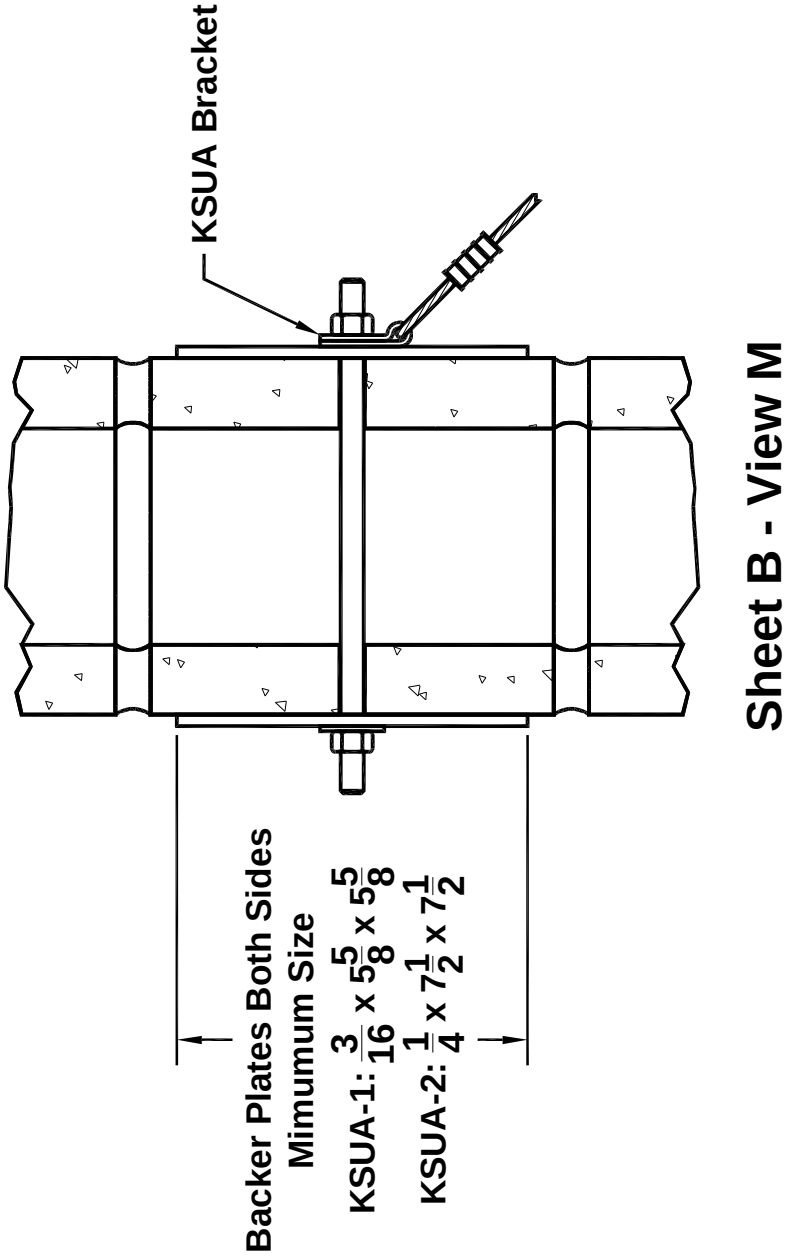

Figure I5-12; KSUA Through Bolt Attachment to a Hollow CMU Wall

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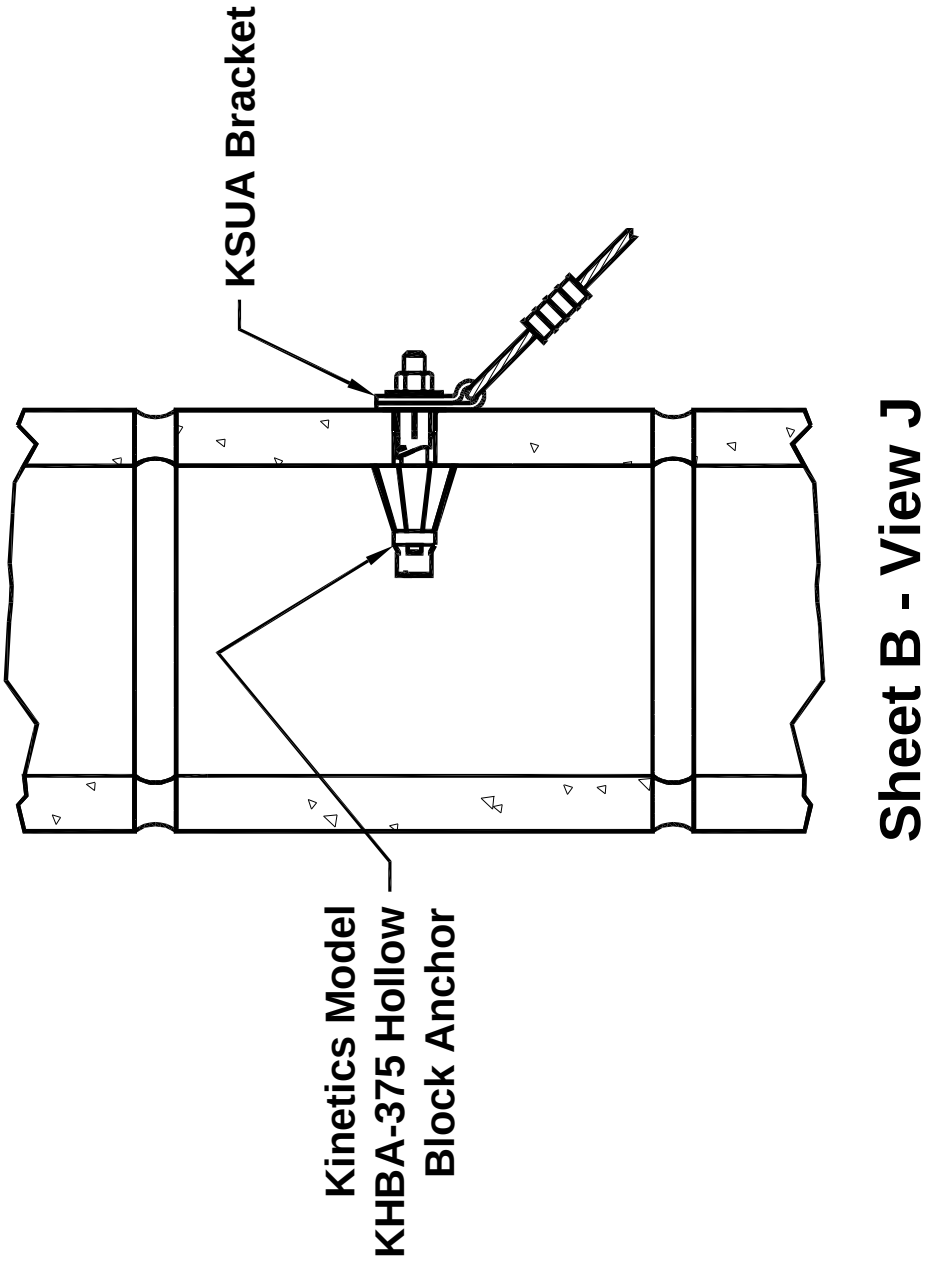

Figure I5-13; KSUA "Umbrella" Type Adhesive Anchor Attachment to a Hollow CMU Wall

Finally, for filled CMU walls, standard wedge type anchors can be used with reduced capacities as shown in Figure I5-14. ***Here also, the building structural engineer must approve the attachment prior to installation, and indicate the point load limit for the wall***.

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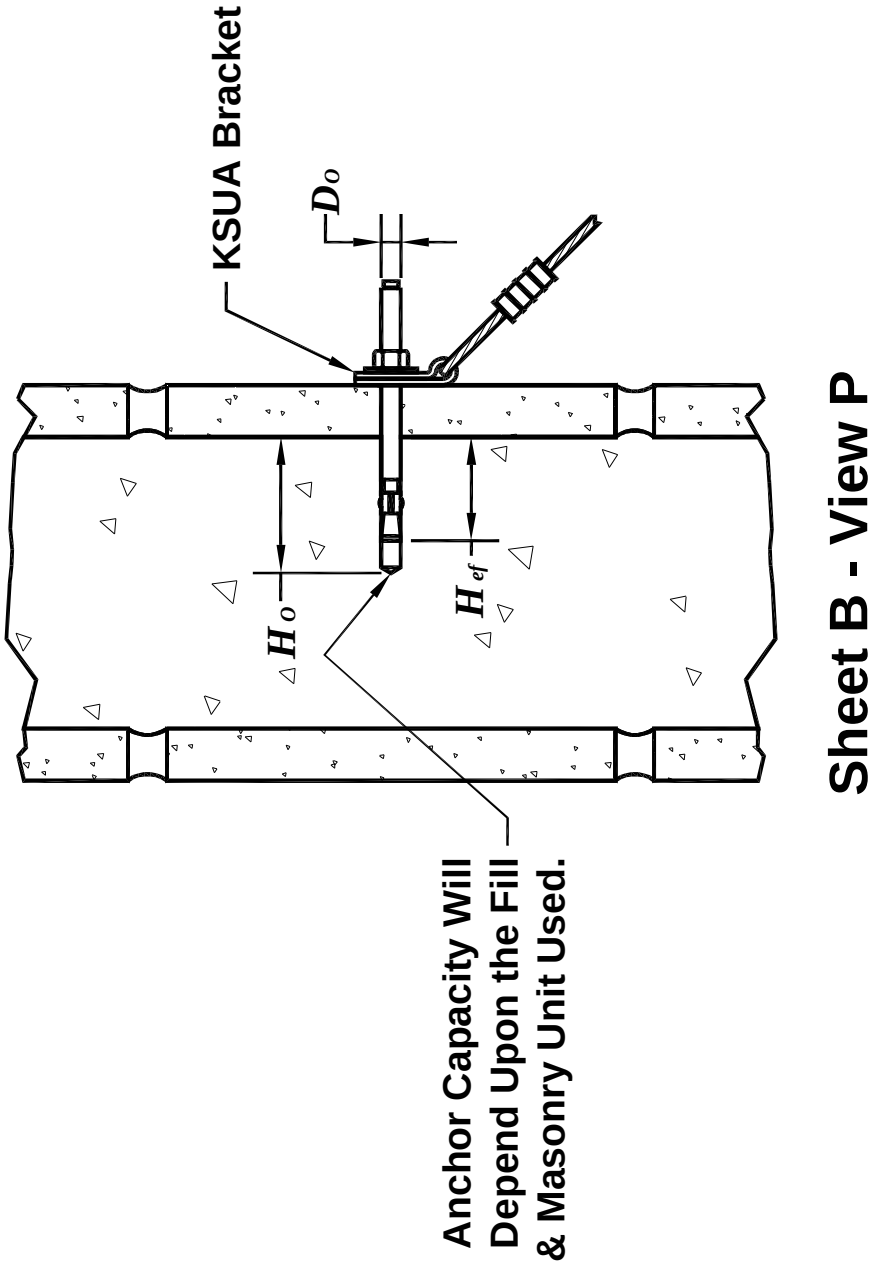

Figure I5-14; KSUA Wedge Type Anchor Attachment to a Filled CMU Wall

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I5.2.5 – KSUA Brackets – Attachment to Wooden Structures:

Attachment of seismic or wind restraints to a wooden structure requires careful coordination with the building structural engineer. While wooden structures tend to perform better during an earthquake than their concrete, masonry, or steel counterparts, individual restraint attachments and point loads can adversely affect the strength and performance of the building structure. This is because the location of grain irregularities, knots, splits and checks can not be controlled. The building structural engineer can indicate the proper locations and load capacity limits for each restraint attachment type and location.

Figure I5-15 and Table I5-4 show the typical installation dimensions that will apply to lag screw attachments. For more detailed lag screw data see Appendix A4.4.

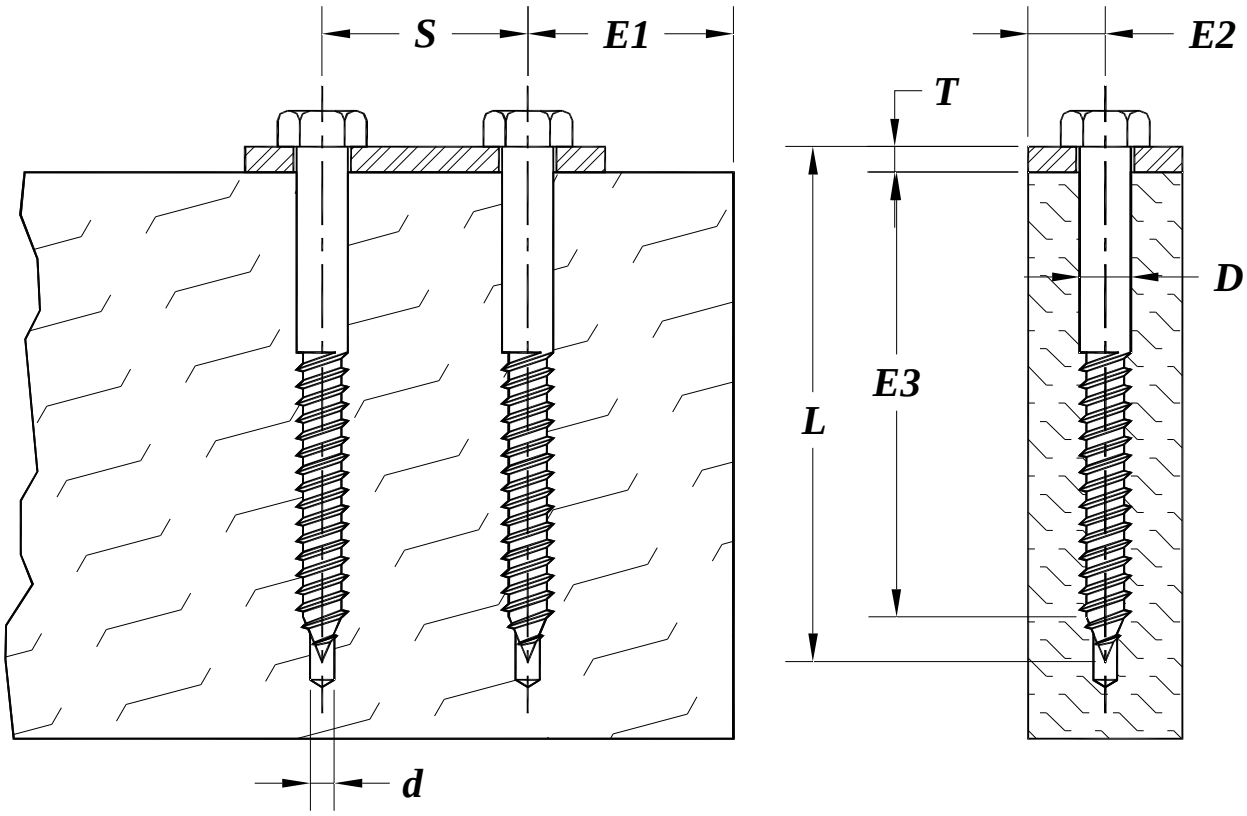

Figure I5-15; Typical Lag Screw Installation Dimensions

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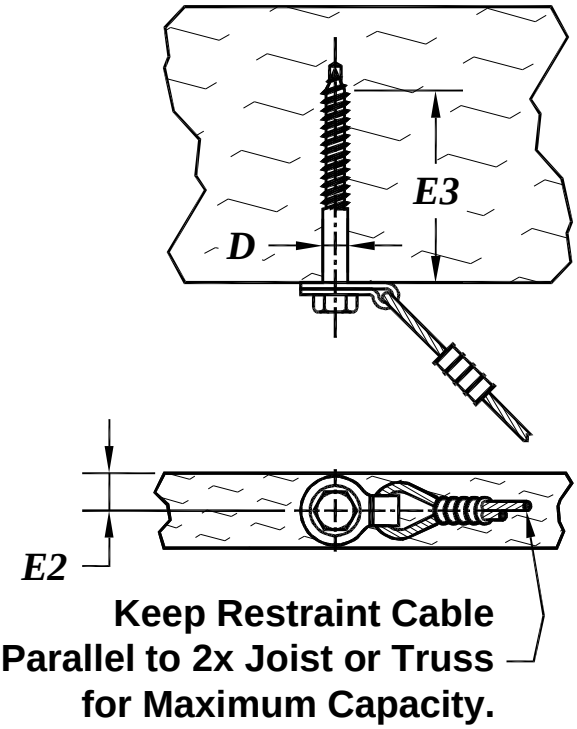
Table I5-4; Lag Screw and Through Bolt Installation Data for Model KSCU Restraint Cable Kits

Lag Screw & Through Bolt Size ***D*** (in)	Lag Screw Pilot Hole Size ***d*** (in)		Screw & Bolt Minimum Spacing ***S*** (in)	Screw & Bolt Minimum End Distance ***E1*** (in)	Screw & Bolt Minimum Edge Distance ***E2*** (in)	Lag Screw Embedment Does Not Include Screw Point ***E3*** (in)
	Soft Wood	Hard Wood				
1/4	1/8	5/32	1	1	3/8	2
3/8	3/16	1/4	1-1/2	1-1/2	9/16	3
1/2	15/64	21/64	2	2	3/4	4

KSUA brackets installed in Orientation 1 to structural wood are shown in Figure I5-16 for a lag screw attachment and Figure I5-17 for a through bolted attachment.



Sheet D - View A

Figure I5-16; KSUA Attached to Wood in Orientation 1 Using a Lag Screw

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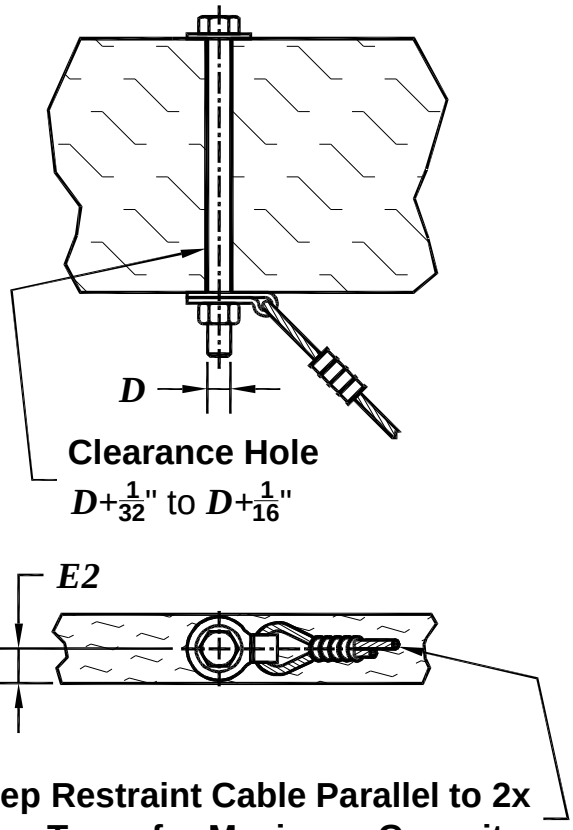

Sheet D - View A

Figure I5-17; KSUA Attached to Wood in Orientation 1 Using a Through Bolt

Special Note: Seismic and wind restraints are not to be attached to the end grain of structural wood!!

KSUA brackets installed in Orientation 2 to structural wood are shown in Figure I5-18 for a lag screw attachment and Figure I5-19 for a through bolted attachment.

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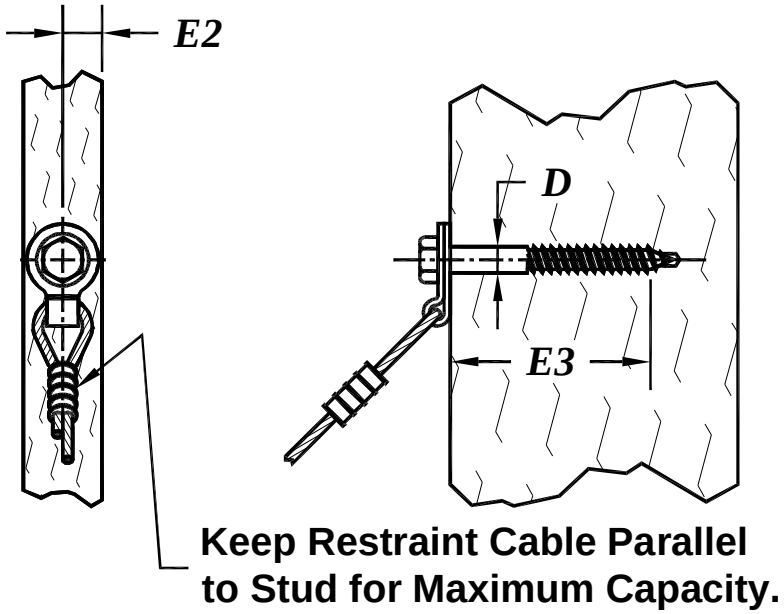
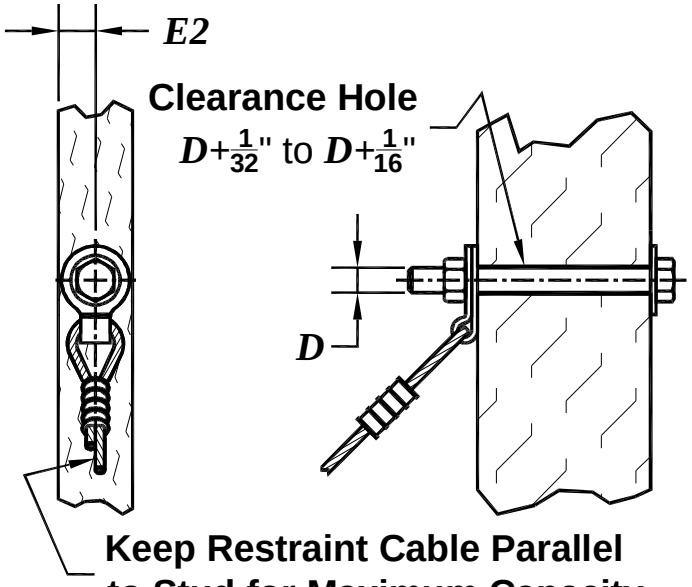


Sheet D - View K

Figure I5-18; KSUA Attached to Wood in Orientation 2 Using a Lag Screw



Sheet D - View K

Figure I5-19; KSUA Attached to Wood in Orientation 2 Using a Through Bolt

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The KSUA bracket may be attached to the sides of wooden joists and beams in Orientation 2 as shown in Figure I5-20 for lag screw attachment and Figure I5-21 for through bolt attachment.

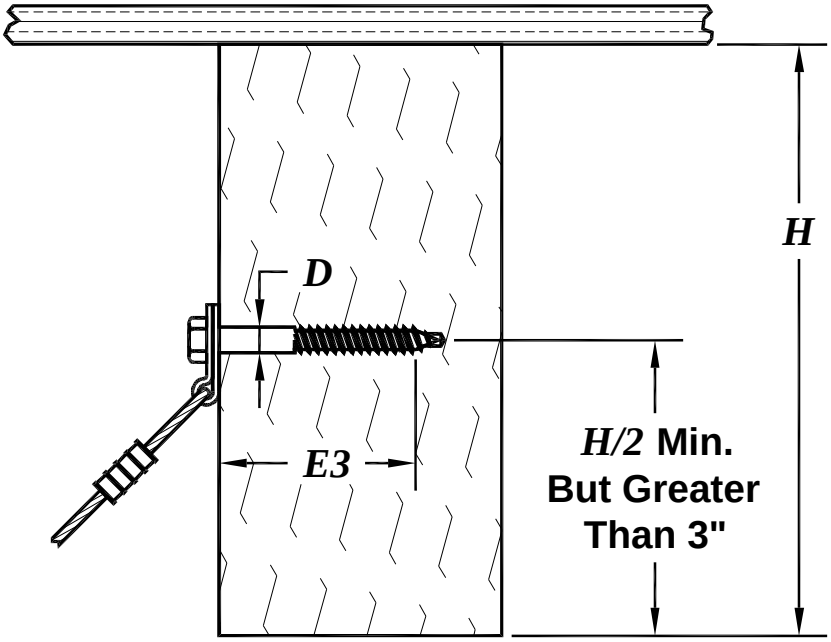

Figure I5-20; KSUA Attached to a Wooden Joist or Beam in Orientation 2 Using a Lag Screw

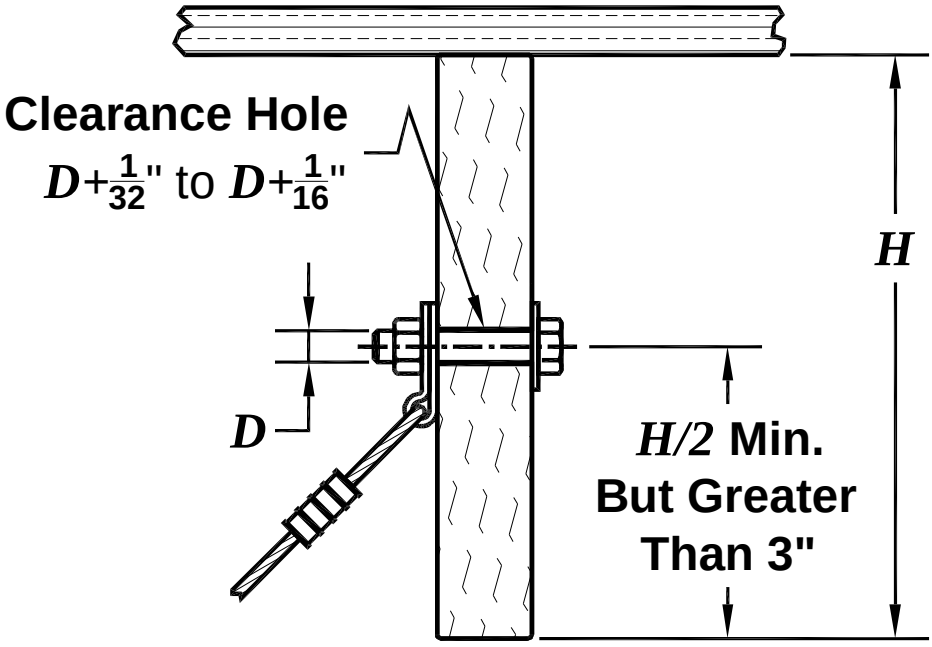

Figure I5-21; KSUA Attached to a Wooden Joist or Beam in Orientation 2 Using a Through Bolt

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I5.3 – KSCA Attachment Brackets:

I5.3.1 – KSCA Brackets – Basic Sizes & Installation:

The Kinetics Noise Control Model KSCA bracket was originally designed to be a part of a clamp assembly that would allow the restraint cables to be attached to hanger rods. More will be said about this application in Section I6.0 of this manual. However, over time, the KSCA bracket has proven to be useful for attaching the restraint cables to the building structure. The KSCA bracket as part of a bolted or anchored structural attachment is shown in Figures I5-22 and I5-23. Notice in Figure I5-22, that the single hole beyond the bend is used for attaching the cable to the bracket. Depending on the angle of the cable when installed, a thimble may be need in this loop to prevent damage to the cable. ***All OSHPD applications require the use of thimbles on both ends of the cable***.

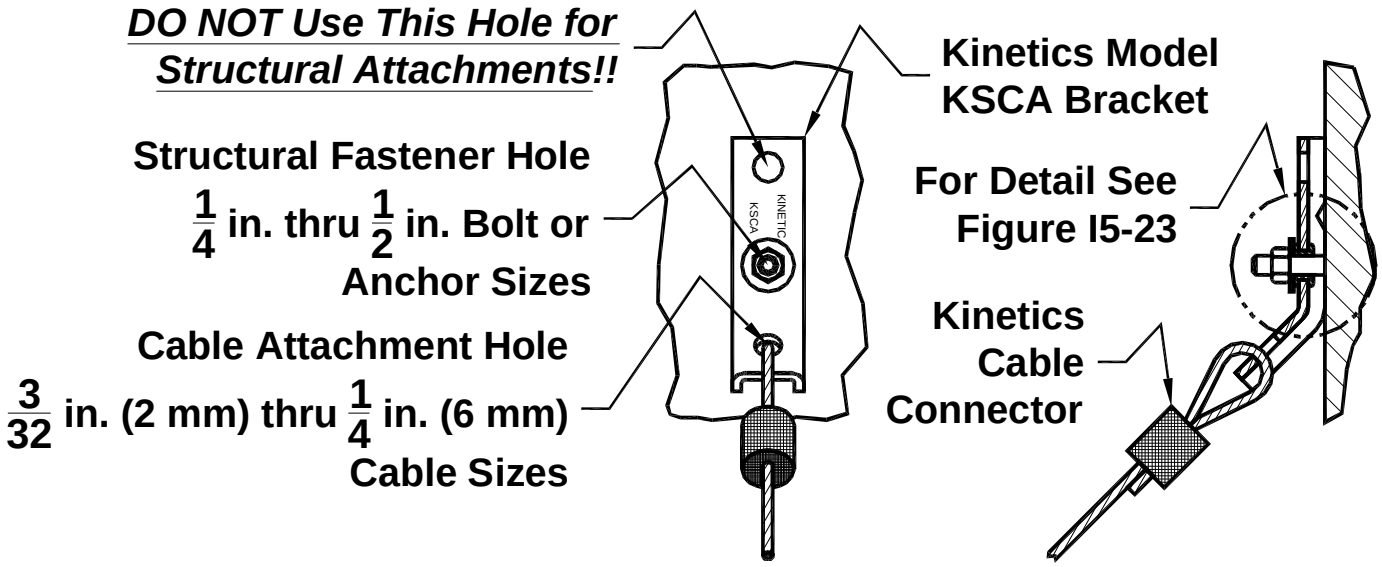

Figure I5-22; General Information for the KSCA Bracket Used for Structural Attachment

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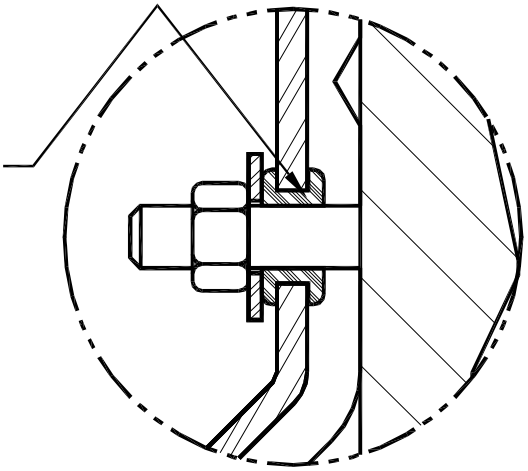

Figure I5-23; Detail of KSCA Bracket When Used with Smaller Bolts/Anchors

I5.3.2 – KSCA Brackets – Attachment to Steel:

KSCA brackets are most easily attached to structural steel by welding, see Figures I5-24 and I5-25. Most structural engineers do not want clearance holes drilled in the structural elements. Figure I5-26 shows the KSCA bracket attached to structural steel AISC W, M, S, or HP shapes without welding.

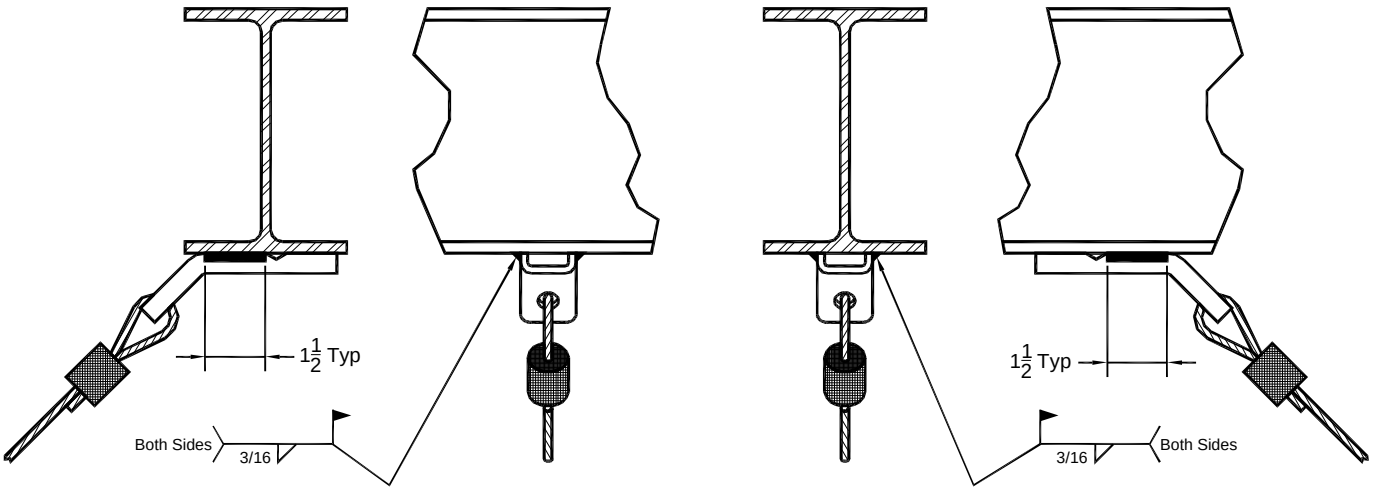

Figure I5-24; KSCA Bracket Welded to Structural Steel in Orientation 1

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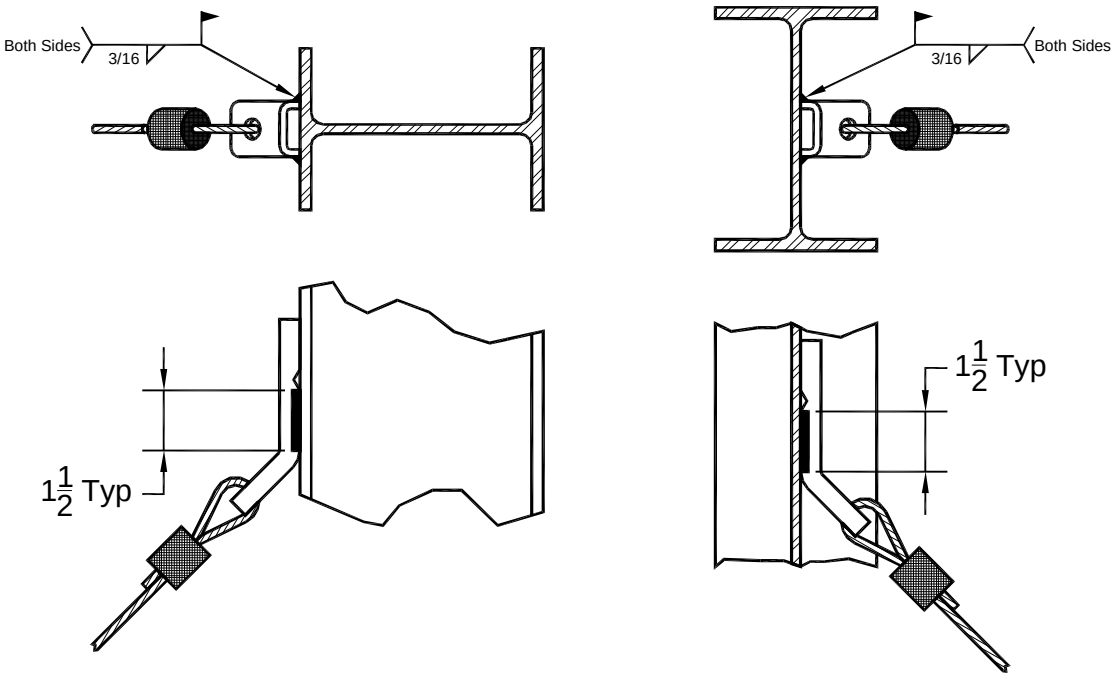

Figure I5-25; KSCA Bracket Welded to Structural Steel in Orientation 2

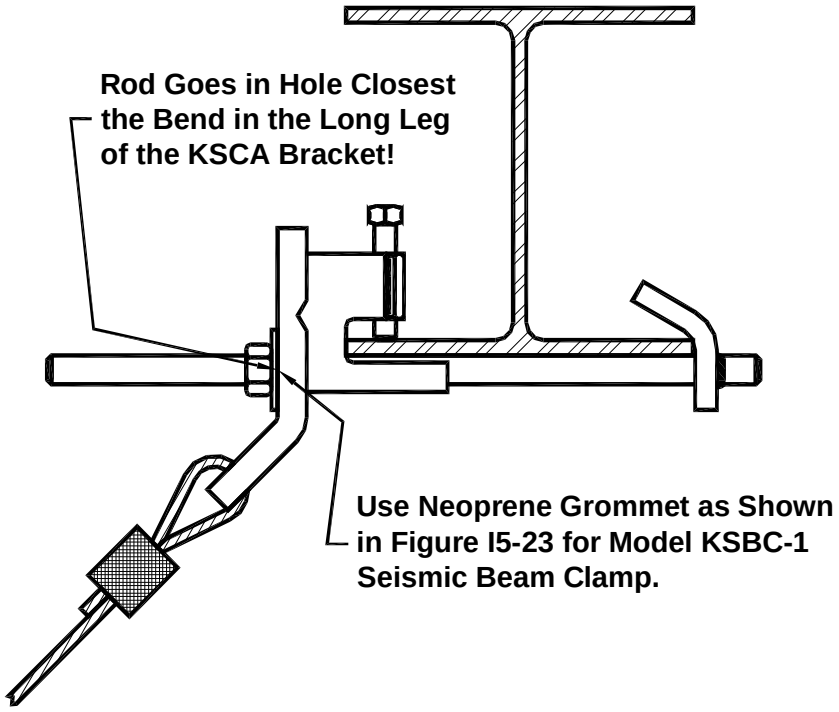

Figure I5-26; Using Model KSBC Seismic Beam Clamps to Attach KSCA Brackets to Structural Steel

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I5.3.3 – KSCA Brackets – Attachment to Concrete:

KSCA brackets should not be attached directly to light weight concrete. This is due to the fact that the contact area of a KSCA bracket is small enough that the light weight concrete may be crushed when tightening the fasteners. This will lead to the bracket being loose and increased shock loads during an earthquake. KSCA brackets may be attached directly to normal weight concrete as shown in Figure I5-27.

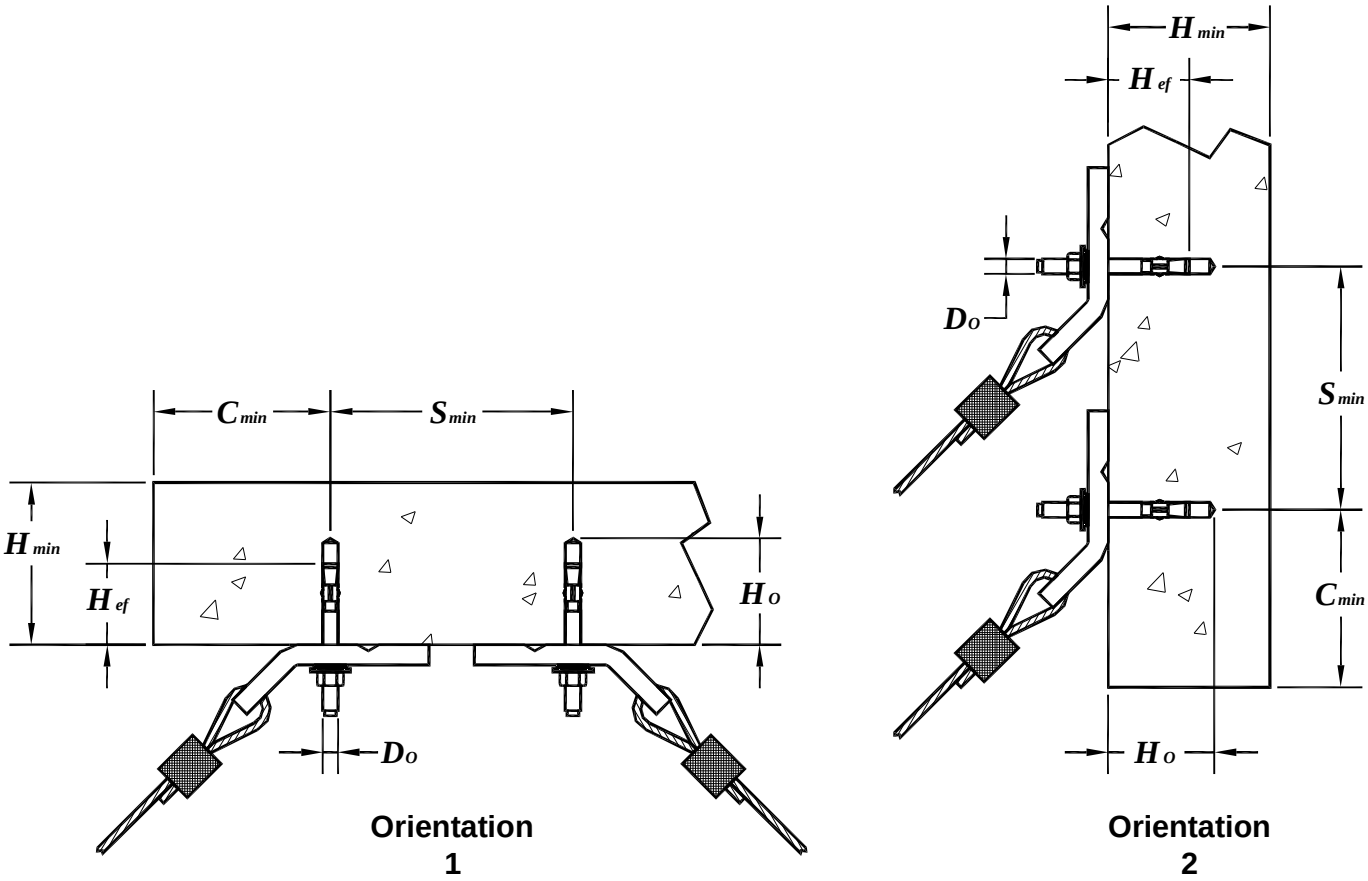

Figure I5-27; Typical KSCA Bracket Installation in Normal Weight Concrete

There may be certain instances where a single anchor with a KSUA bracket or a KSCA bracket will not have enough capacity. Then the KSCUZ2, two concrete anchor, and KSCUZ4, four concrete anchor, kits may be used, shown in Figures I5-28, I5-29, I5-30, and I5-31.

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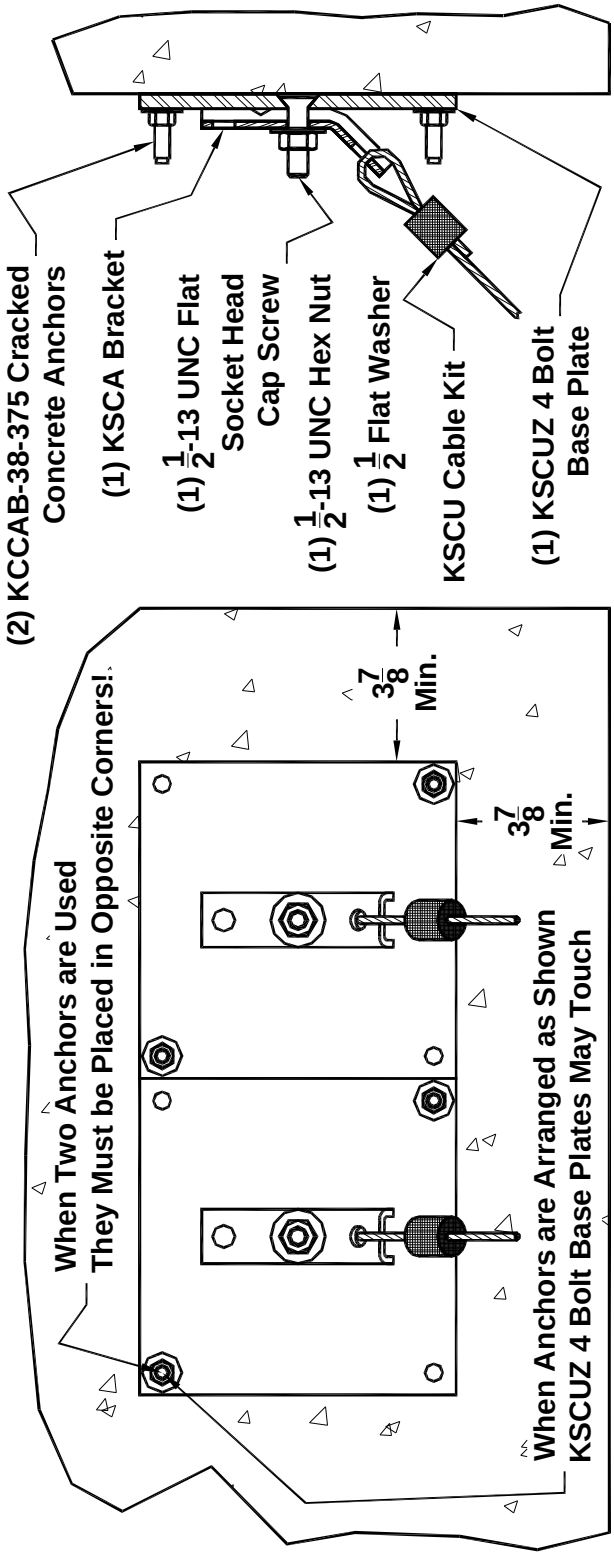

FigureI5-28; Model KSCUZ2 Attachment Kit to Concrete Using the KSCA Bracket – (2) 3/8 Anchors

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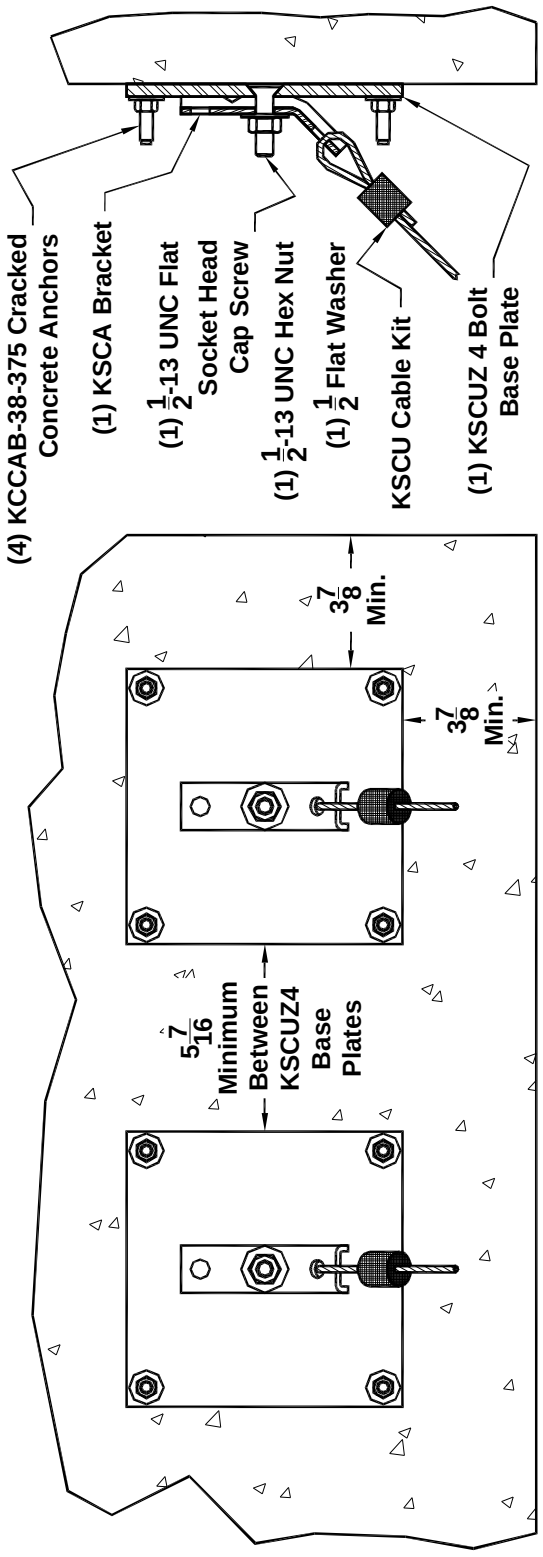

Figure I5-29; Model KSCUZ4 Attachment Kit to Concrete Using the KSCA Bracket – (4) 3/8 Anchors

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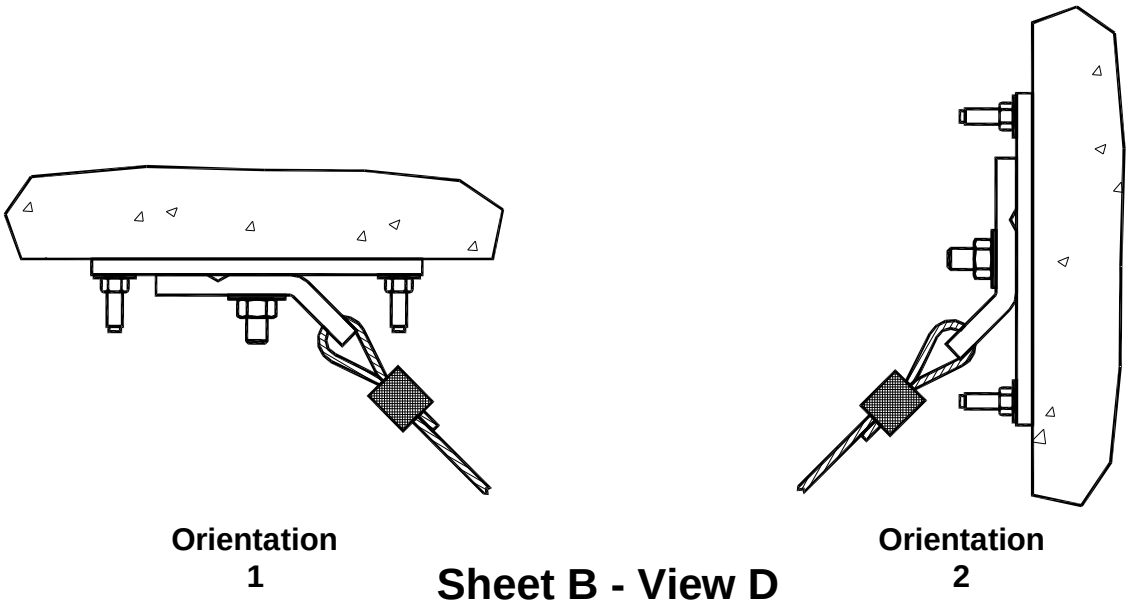

Figure I5-30: Models KSCUZ2 and KSCUZ4 Concrete Attachment Kits for KSCA Brackets in Orientation 1 and Orientation 2

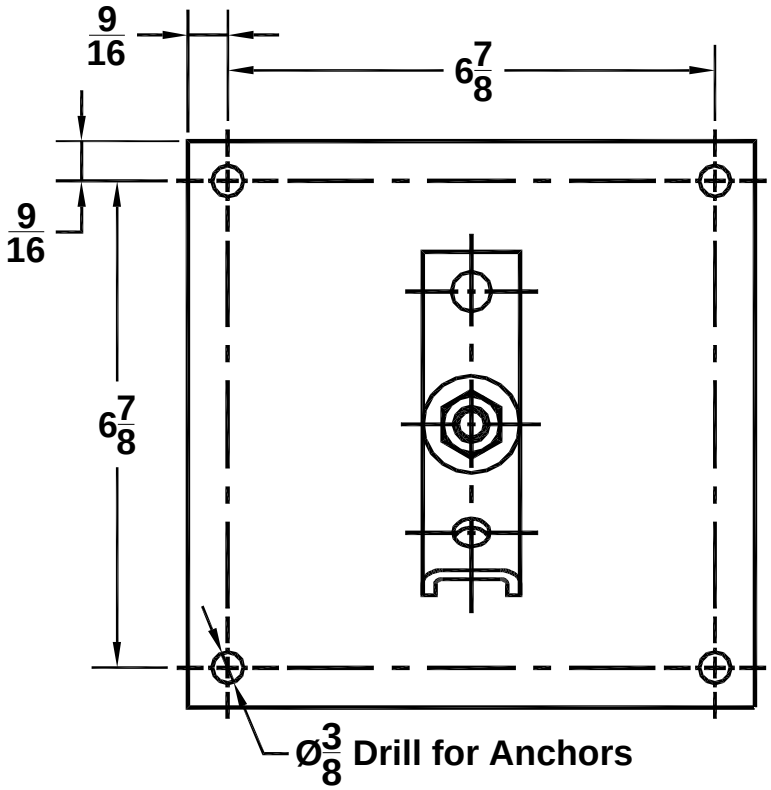

Figure I5-31; Anchor Hole Drill Template for Models KSCUZ2 and KSCUZ4

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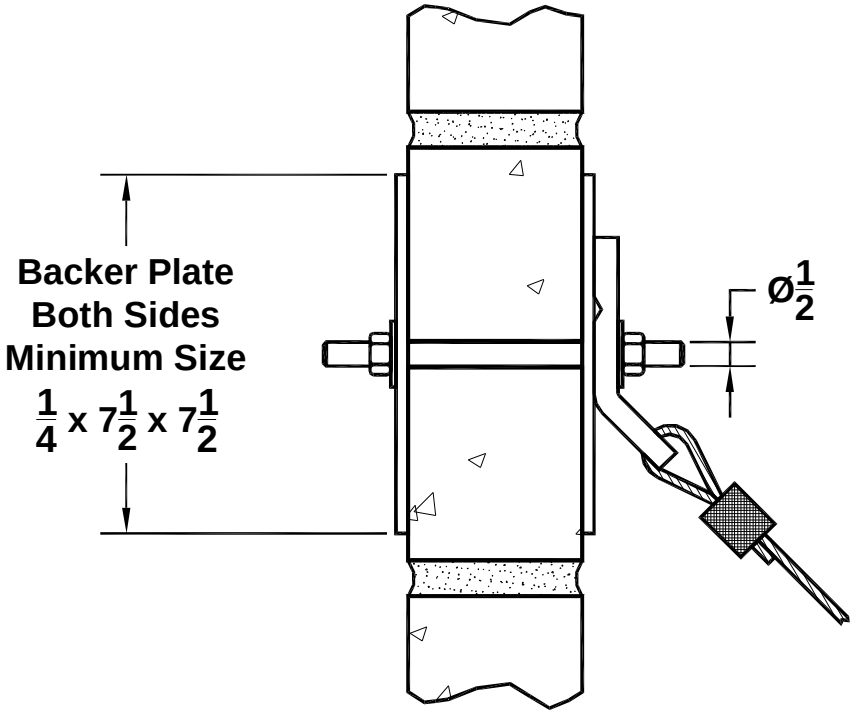
I5.3.4 – KSCA Brackets – Attachment to CMU Walls:

The concrete used for CMU components is usually a lightweight concrete, and often has fillers and aggregates such as fly ash and bottom ash. Therefore, the strength of this concrete does not match that of normal weight concrete, and may not match that of poured in place lightweight concrete. For this reason, ***attachments for seismic restraints made to CMU walls must be approved by the building structural engineer in advance of installation of the restraints***. All of the schemes for attaching the KSCA bracket to CMU walls will require the use of a backer plate beneath the KSCA bracket to protect the CMUs. When solid masonry blocks are used, the best way to make theses attachments is to use through bolts with load plates on both sides of the wall as shown in Figure I5-32. The capacity of the attachment will be what ever the building structural engineer says that the point load limit for the wall will be. (Up to but not exceeding the cable kit capacity as published by Kinetics Noise Control.)



Sheet B - View F

Figure I5-32; KSCA Through Bolt Attachment to a Solid CMU Wall

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Figures I5-33 and I5-34 show attachment methods for hollow CMU walls. ***Here again, the building structural engineer must approve the attachment prior to installation, and indicate the point load limit for the wall***. Also, backer plates beneath the KSCA bracket will be required to protect the CMU. (Note: In the case of the umbrella type anchor, Figure I5-13, the peak capacity is limited to that of the 3/8" anchor.)

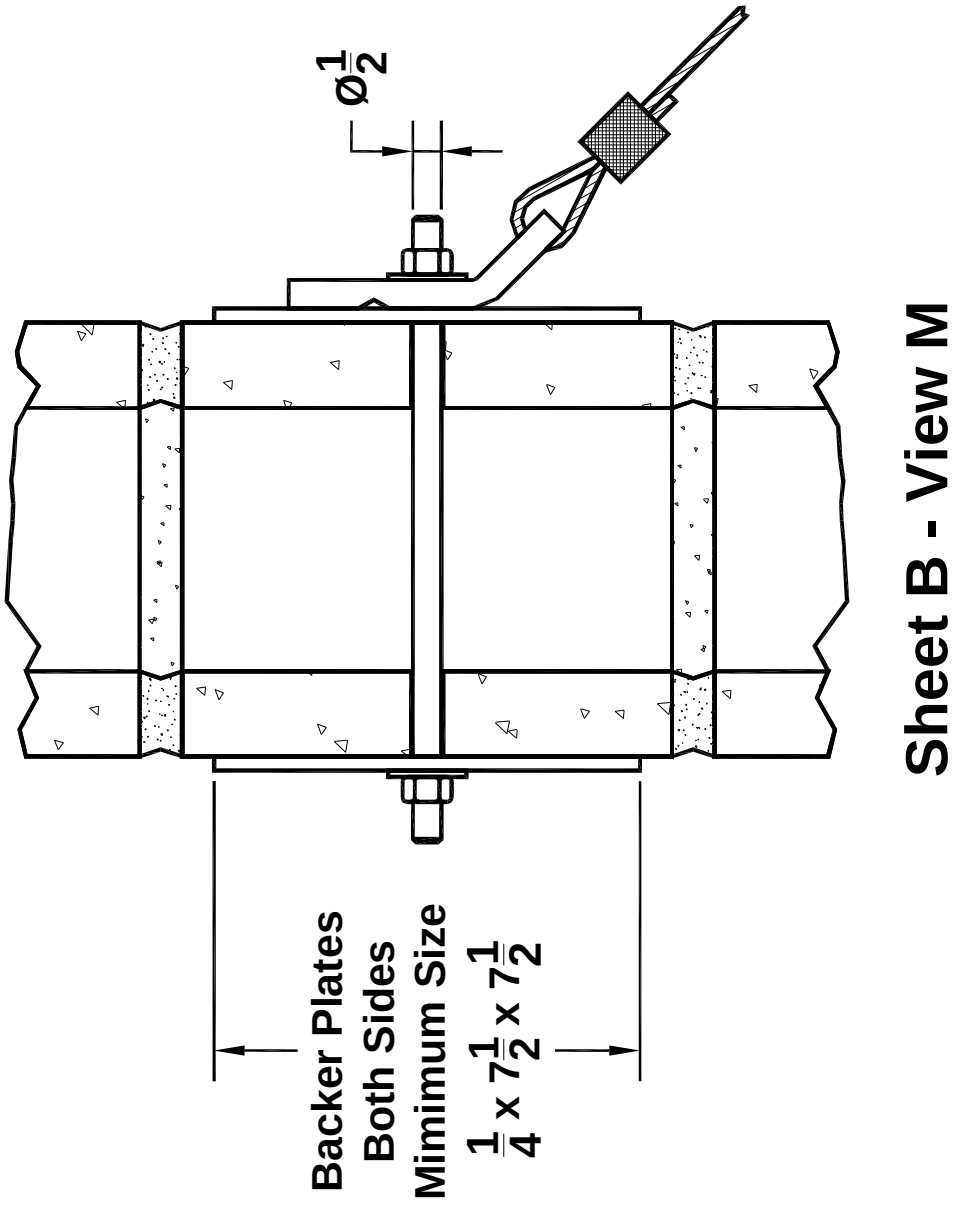

Figure I5-33; KSCA Through Bolt Attachment to a Hollow CMU Wall

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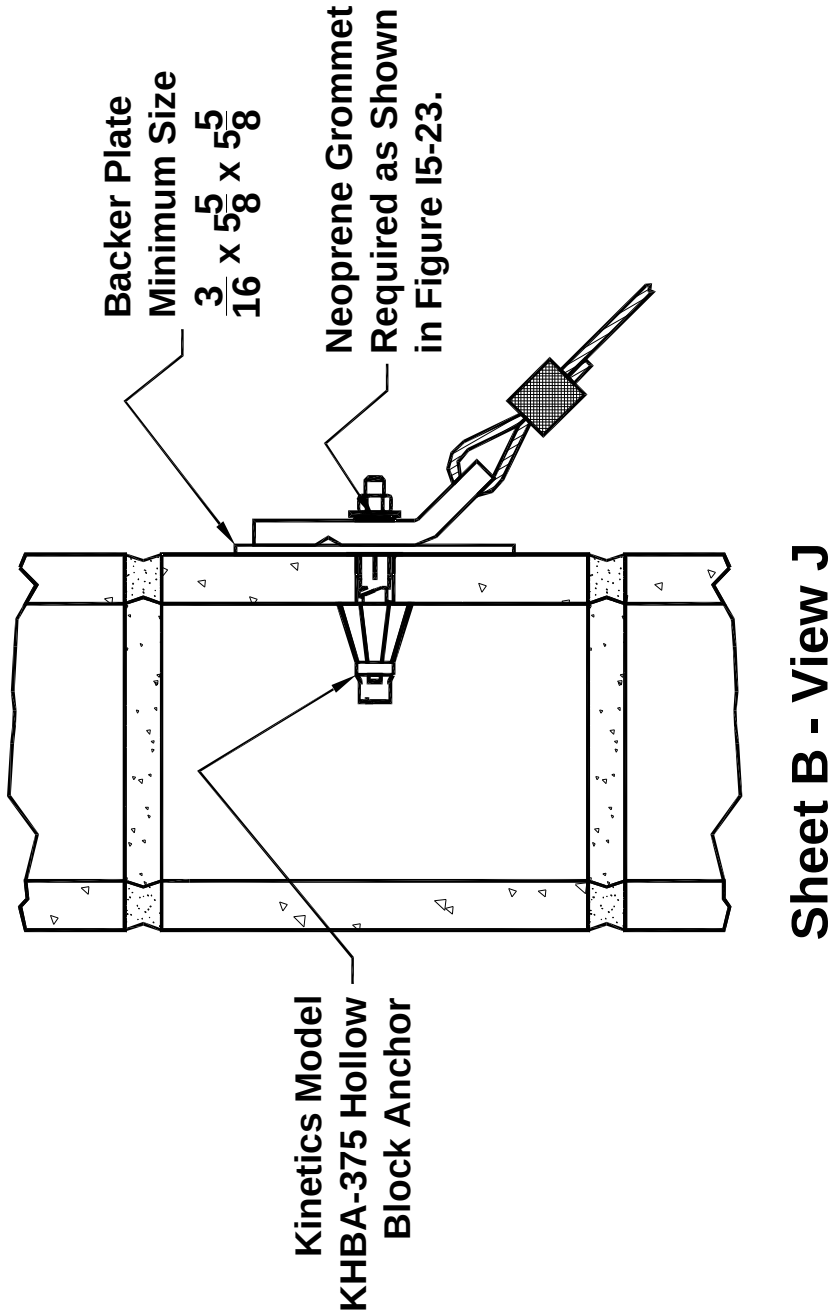

Figure I5-34; KSCA "Umbrella" Type Adhesive Anchor Attachment to a Hollow CMU Wall

Finally, for filled CMU walls, standard wedge type anchors can be used with reduced capacities as shown in Figure I5-35. ***Here also, the building structural engineer must approve the***

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attachment prior to installation, and indicate the point load limit for the wall. As with the other KSCA attachments to CMU walls, a backer plate beneath the KSCA bracket will be required.

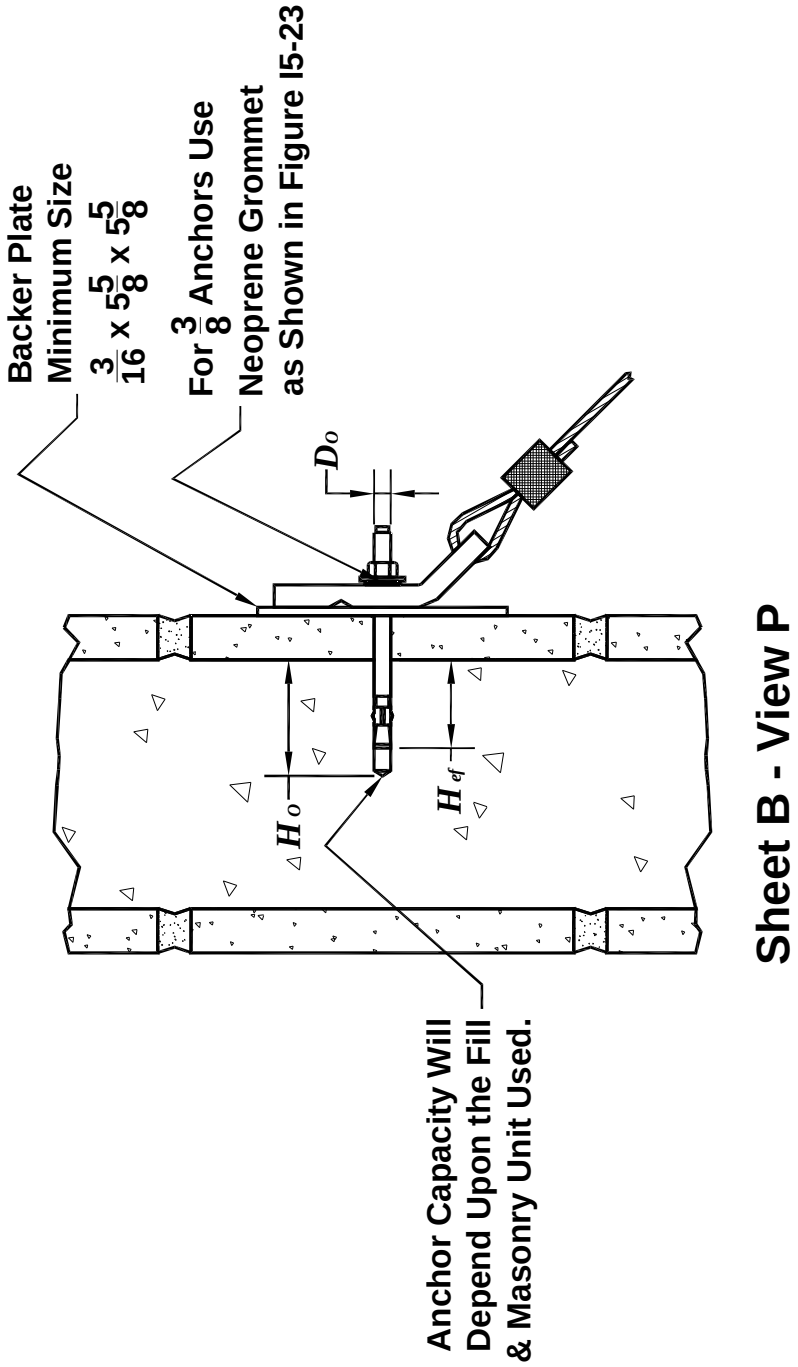

Figure I5-35; KSCA Wedge Type Anchor Attachment to a Filled CMU Wall

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I5.3.5 – KSCA Brackets – Attachment to Wooden Structures:

Attachment of seismic or wind restraints to a wooden structure requires careful coordination with the building structural engineer. While wooden structures tend to perform better during an earthquake than their concrete, masonry, or steel counterparts, individual restraint attachments and point loads can adversely affect the strength and performance of the building structure. This is because the location of grain irregularities, knots, splits and checks can not be controlled. The building structural engineer can indicate the proper locations and load capacity limits for each restraint attachment type and location. Figure I5-15 and Table I5-4 show the typical installation dimensions that will apply to lag screw attachments. For more detailed lag screw data see Appendix A4.4. ***KSCA brackets used fro attachment to wood applications will require steel backer plates beneath the KSCA bracket to prevent damage to the wood!*** KSCA brackets installed in Orientation 1 to structural wood are shown in Figure I5-36 for a lag screw attachment and Figure I5-37 for a through bolted attachment.

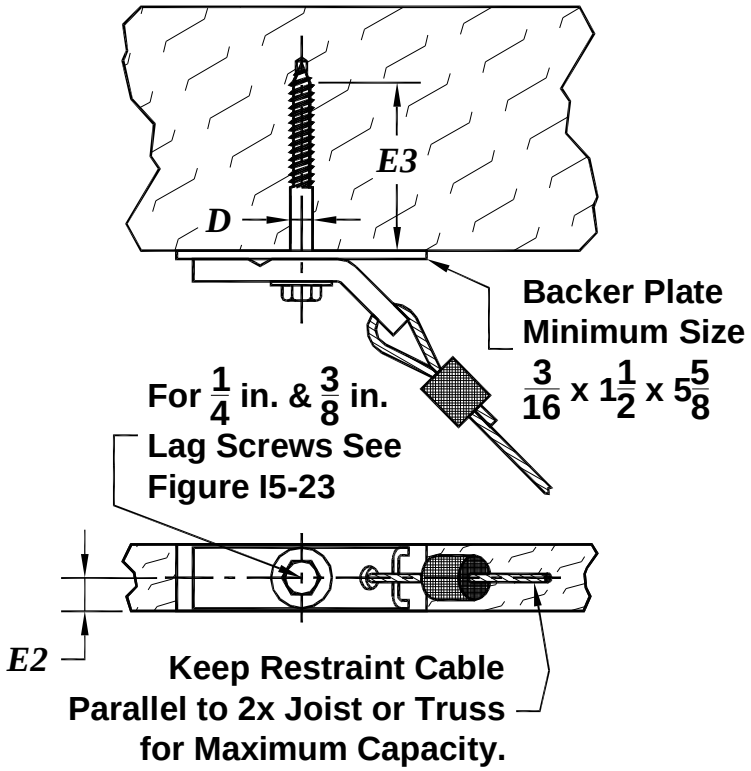

Figure I5-36; KSCA Attached to Wood in Orientation 1 Using a Lag Screw

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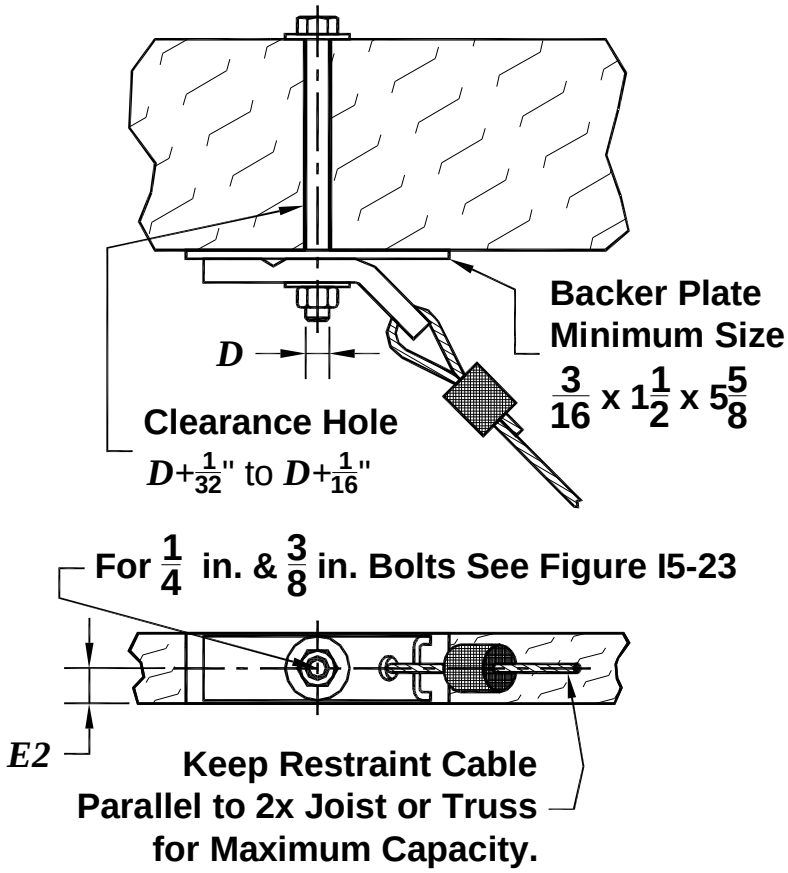

Figure I5-37; KSCA Attached to Wood in Orientation 1 Using a Through Bolt

Special Note: Seismic and wind restraints are not to be attached to the end grain of structural wood!!

KSCA brackets installed in Orientation 2 to structural wood are shown in Figure I5-38 for a lag screw attachment and Figure I5-39 for a through bolted attachment.

The KSCA bracket may be attached to the sides of wooden joists and beams in Orientation 2 as shown in Figure I5-40 for lag screw attachment and Figure I5-41 for through bolt attachment.

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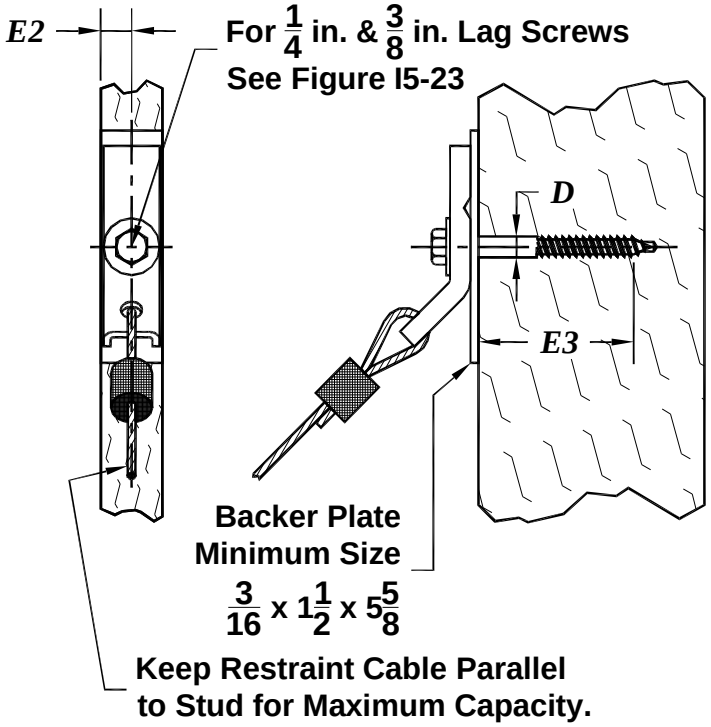

Figure I5-38; KSCA Attached to Wood in Orientation 2 Using a Lag Screw

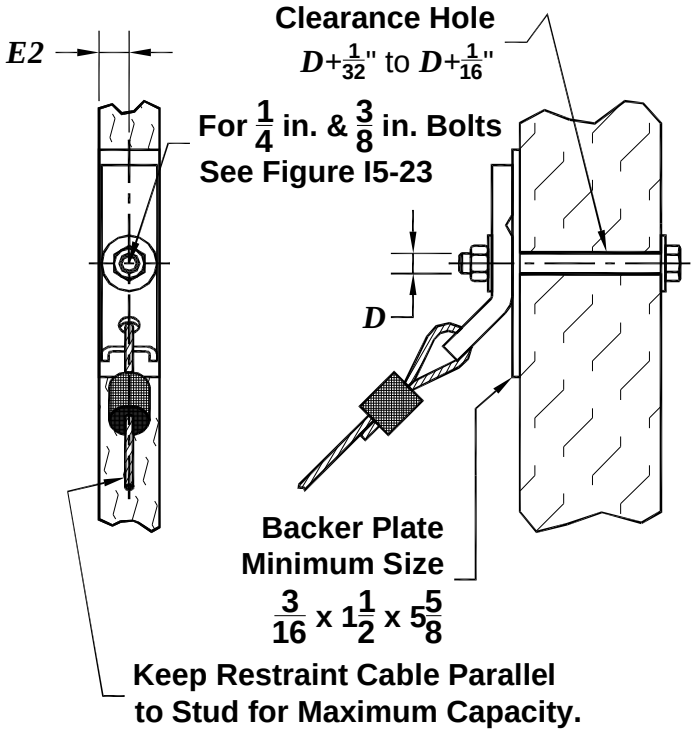

Figure I5-39; KSCA Attached to Wood in Orientation 2 Using a Through Bolt

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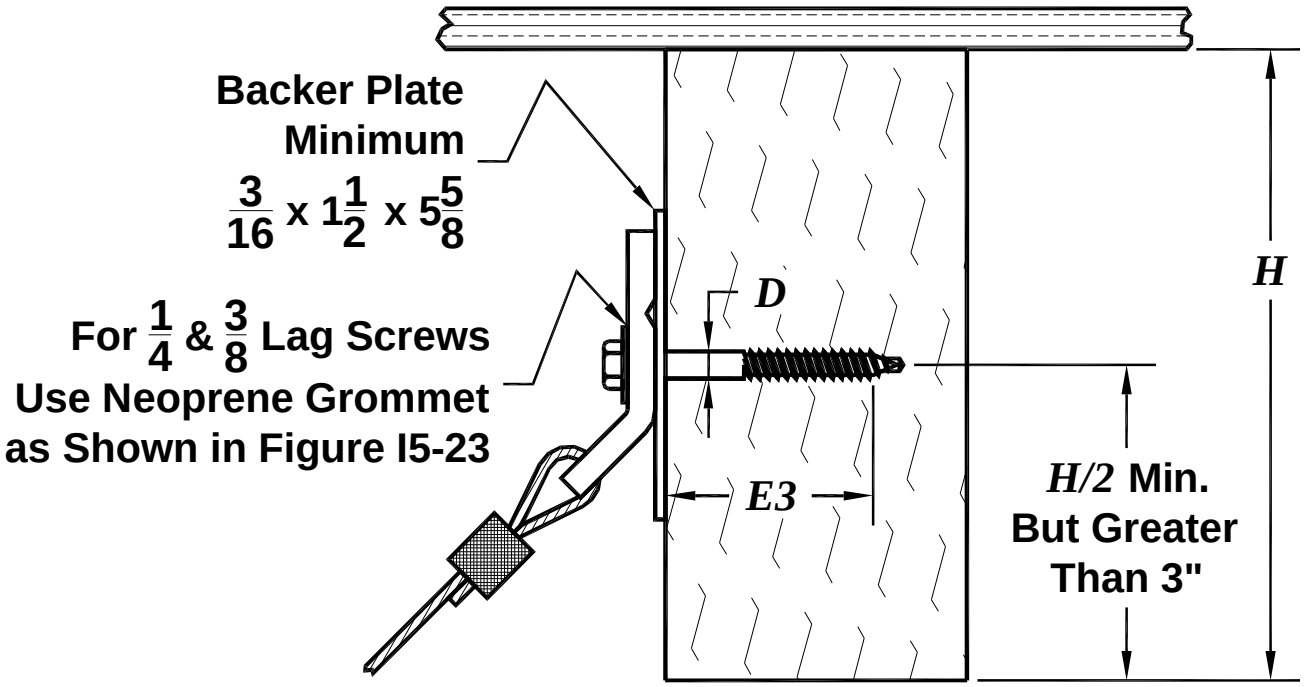

Figure I5-40; KSCA Attached to a Wooden Joist or Beam in Orientation 2 Using a Lag Screw

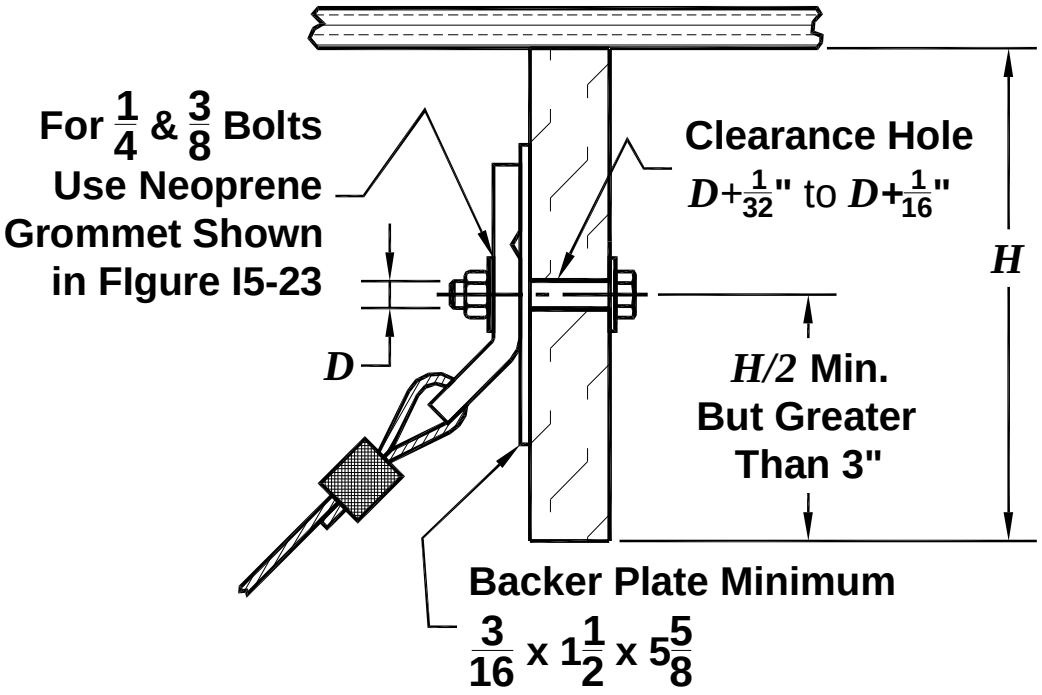

Figure I5-41; KSCA Attached to a Wooden Joist or Beam in Orientation 2 Using a Through Bolt

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The KSCUZ2 and KSCUZ4 attachment kits will allow the KSCA bracket to be mounted to a wooden structural member using two or four lag screws. Figures I5-42 and I5-43 show the KSCUZ2 and KSCUZ4, respectively, mounted to a wooden column.

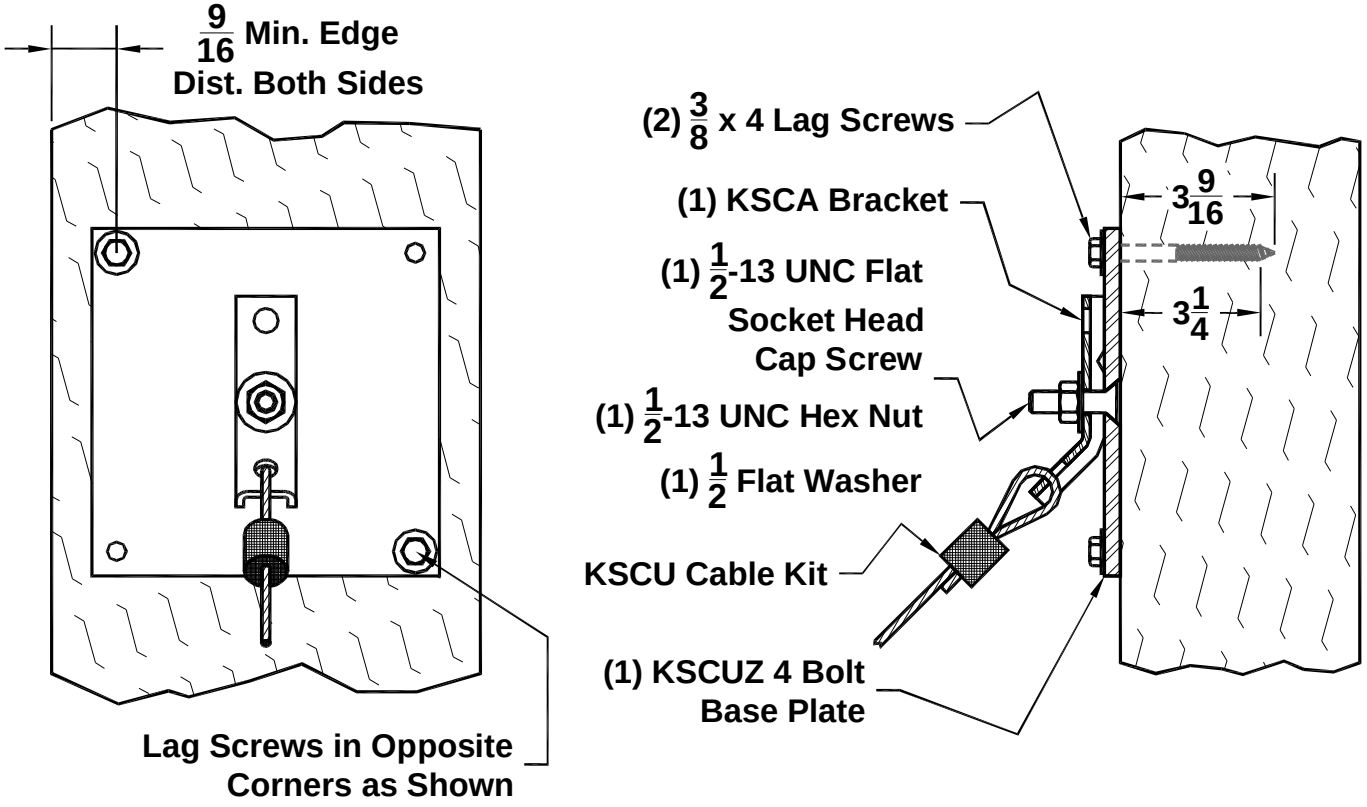

Figure I5-42; Model KSCUZ2 Attachment Kit to a Wooden Column Using the KSCA Bracket – (2) 3/8 Lag Screws

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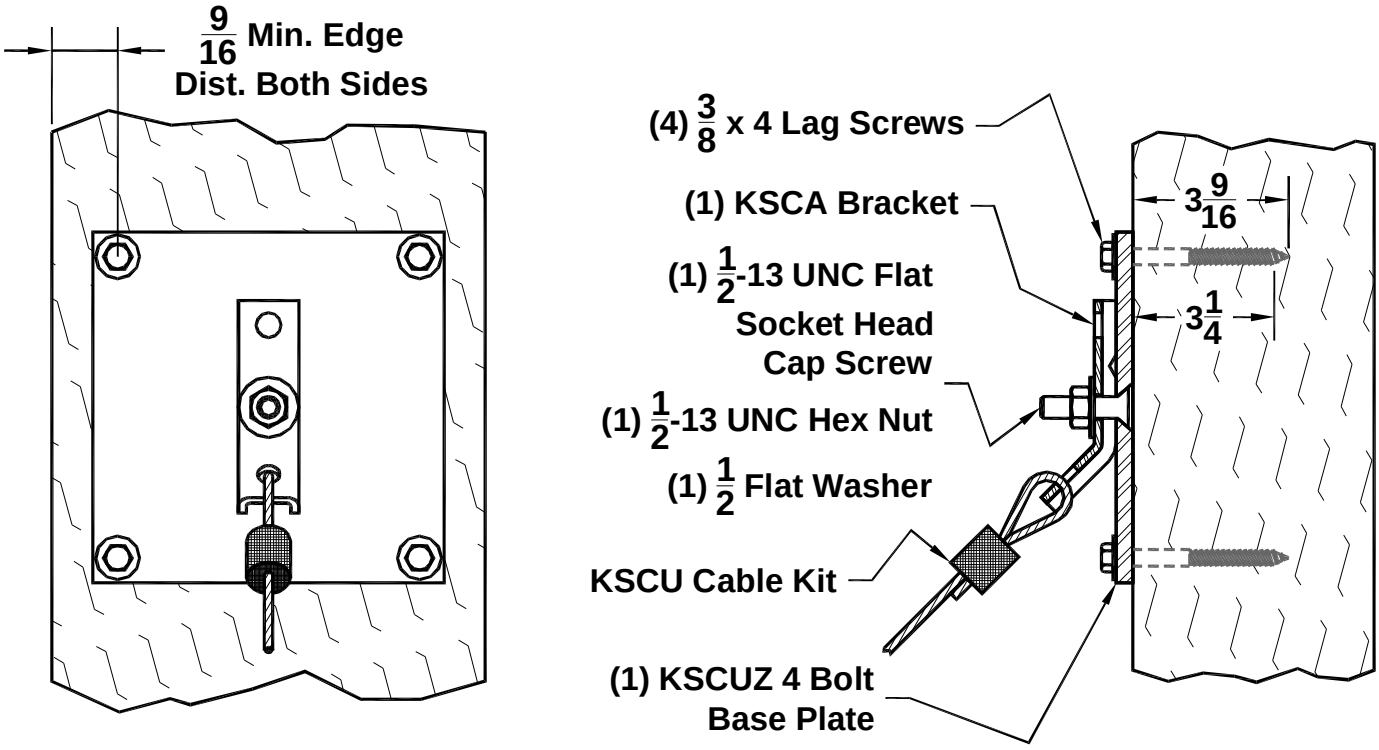

Figure I5-43; Model KSCUZ4 Attachment Kit to a Wooden Column Using the KSCA Bracket – (4) 3/8 Lag Screws

The KSCUZ2 and KSCUZ4 attachment kits will also allow the KSCA bracket to be mounted to a wooden structural beam using two or four lag screws. Figures I5-44 and I5-45 show the KSCUZ2 and KSCUZ4, respectively, mounted to a wooden beam. Figure I5-31 provides the dimensional information to layout the drill pattern for the pilot holes. The pilot drill size is given in Table I5-3 for both hard and soft woods.

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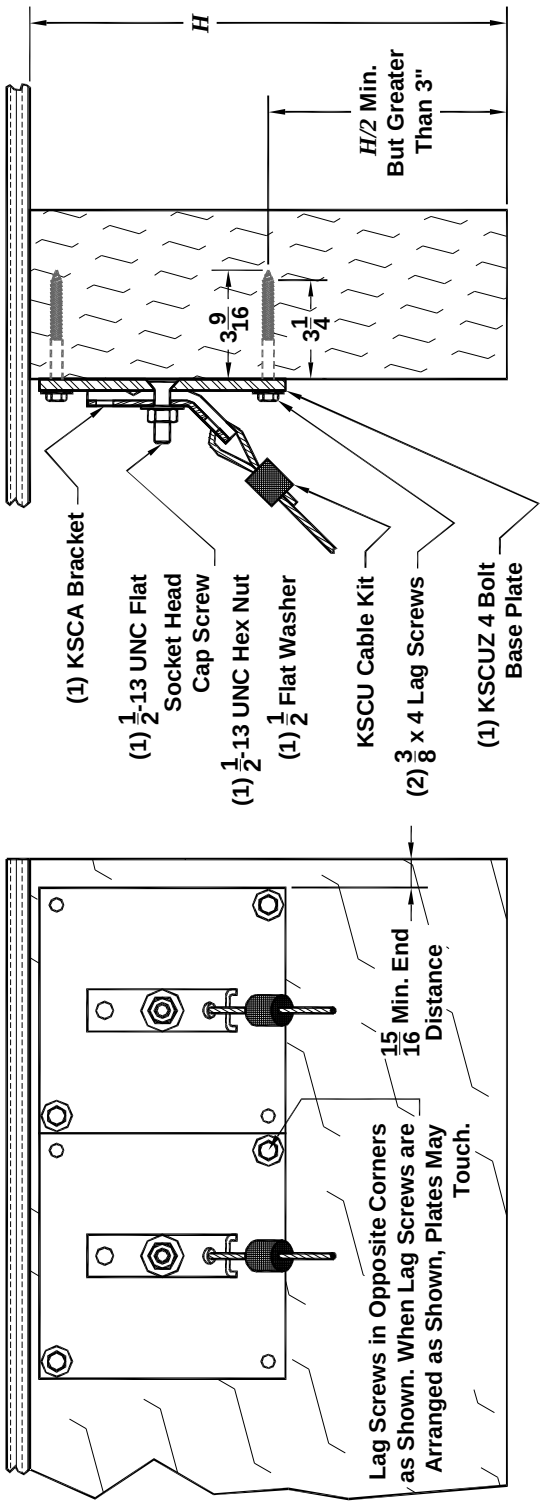

Figure I5-44; Model KSCUZ2 Attachment Kit to a Wooden Beam Using the KSCA Bracket – (2) 3/8 Lag Screws

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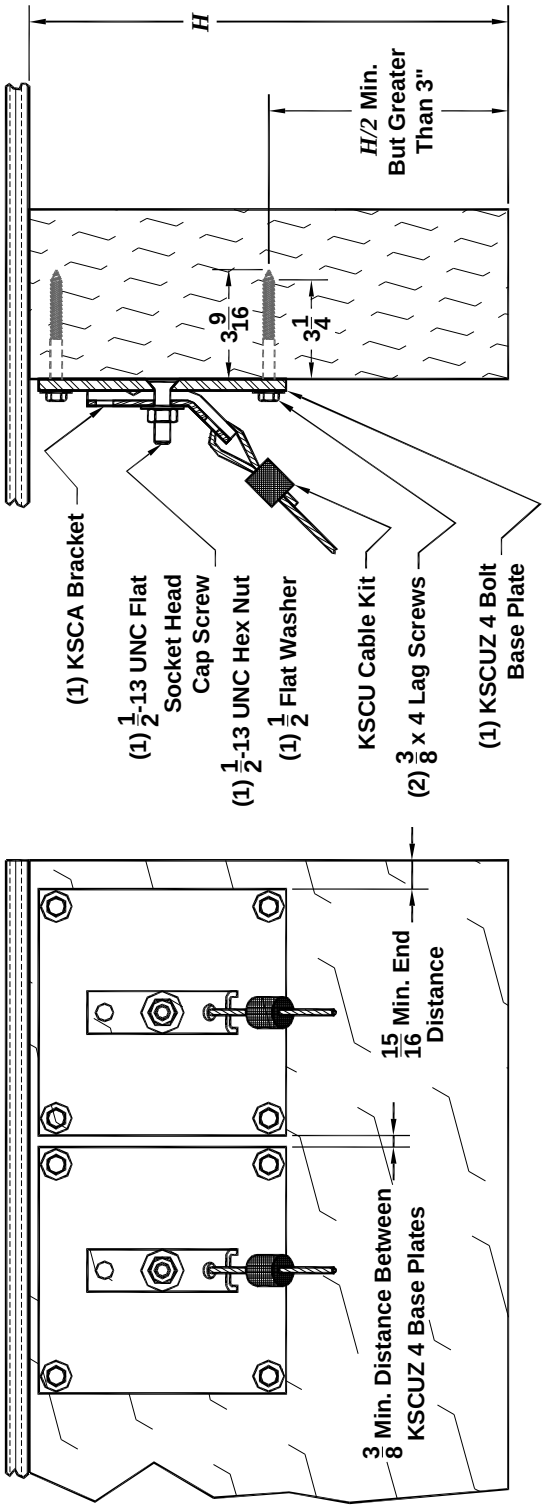

Figure I5-45; Model KSCUZ4 Attachment Kit to a Wooden Beam Using the KSCA Bracket – (4) 3/8 Lag Screws

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I5.4 – KSCC Attachment Brackets:

I5.4.1 – KSCC Brackets – Basic Sizes & Installation:

The Kinetics Noise Control Model KSCC brackets have been designed for use with the larger wire ropes and U-bolt, "Crosby®", type clips. There are currently two KSCC brackets which are described in Figure I5-46.

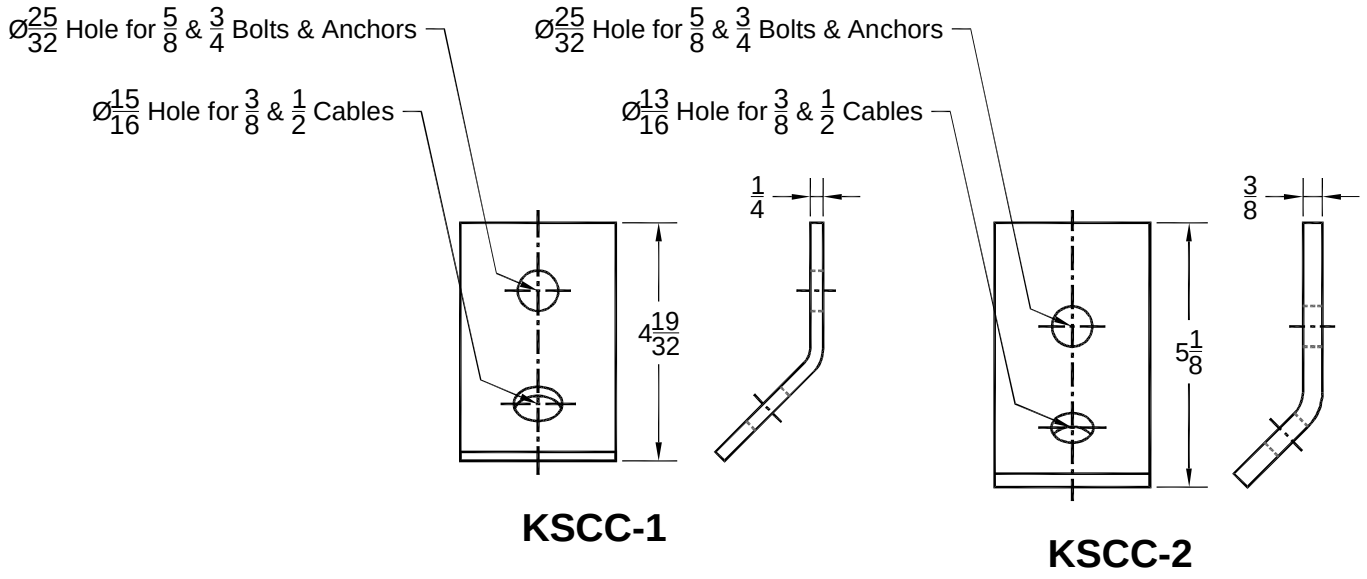

Figure I5-46; Kinetics Noise Control Model KSCC Brackets

A typical KSCC Restraint Cable using a KSCC bracket is shown in Figure I5-47. The details for the U-bolt clip installation may be found in the submittal package or in Appendix A1.1. ***All OSHPD applications require the use of thimbles on both ends of the cable***.

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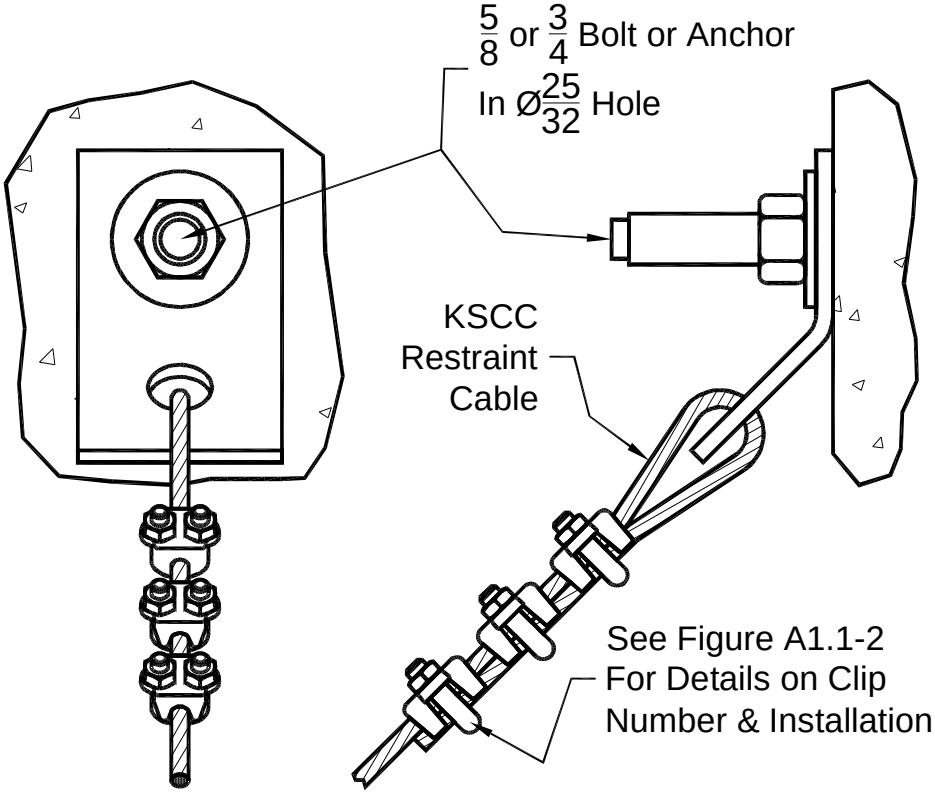

Figure I5-47; Typical Kinetics Noise Control Model KSCC Bracket Installation

I5.4.2 – KSCC Brackets – Attachment to Steel:

Typically, structural engineers do not want bolt clearance holes drilled in structural members that were not sized and selected for this application. So, the KSCC clips may be most readily attached to structural steel by welding as shown in Figures I5-48 and I5-49. Figure I5-50 shows the KSCC brackets attached to structural steel AISI W, M, S, or HP shapes without welding. The pertinent weld information is given in Table I5-5. Figures I5-51, I5-52, and I5-53 show the KSCC brackets attached to steel open web joists.

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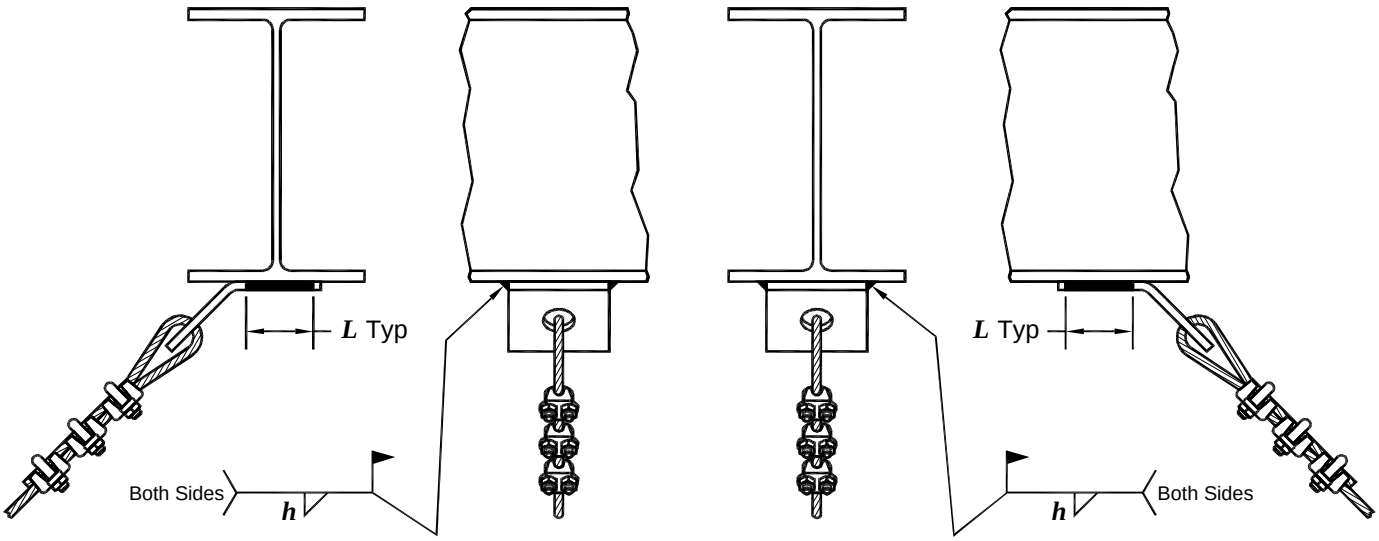
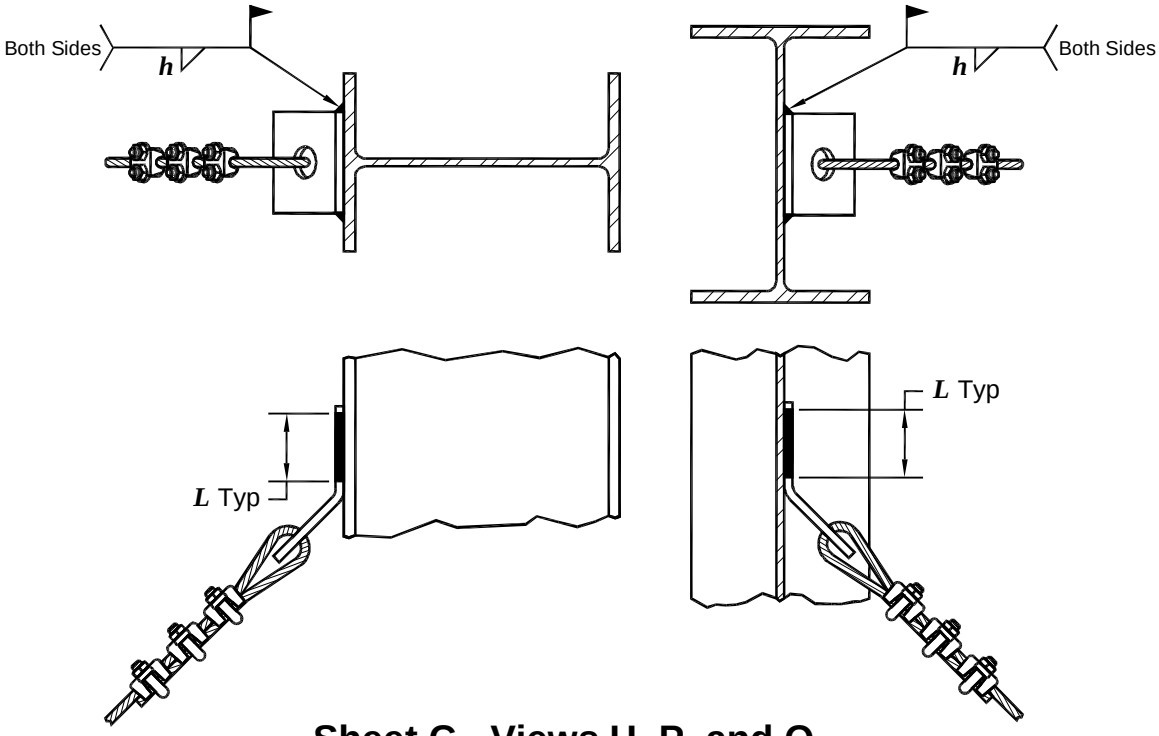


Sheet C - View E

Figure I5-48; KSCC Brackets Welded to Structural Steel in Orientation 1



Sheet C - Views H, P, and Q

Figure I5-49; KSCC Brackets Welded to Structural Steel in Orientation 2

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Table I5-5; Weld Size and Length for KSCC Bracket Weld Attachment to Structural Steel

KSCC Bracket	Weld Size ***h*** (in)	Weld Length Both Sides ***L*** (in)
KSCC-1	1/4	2
KSCC-2	5/16	3-1/4

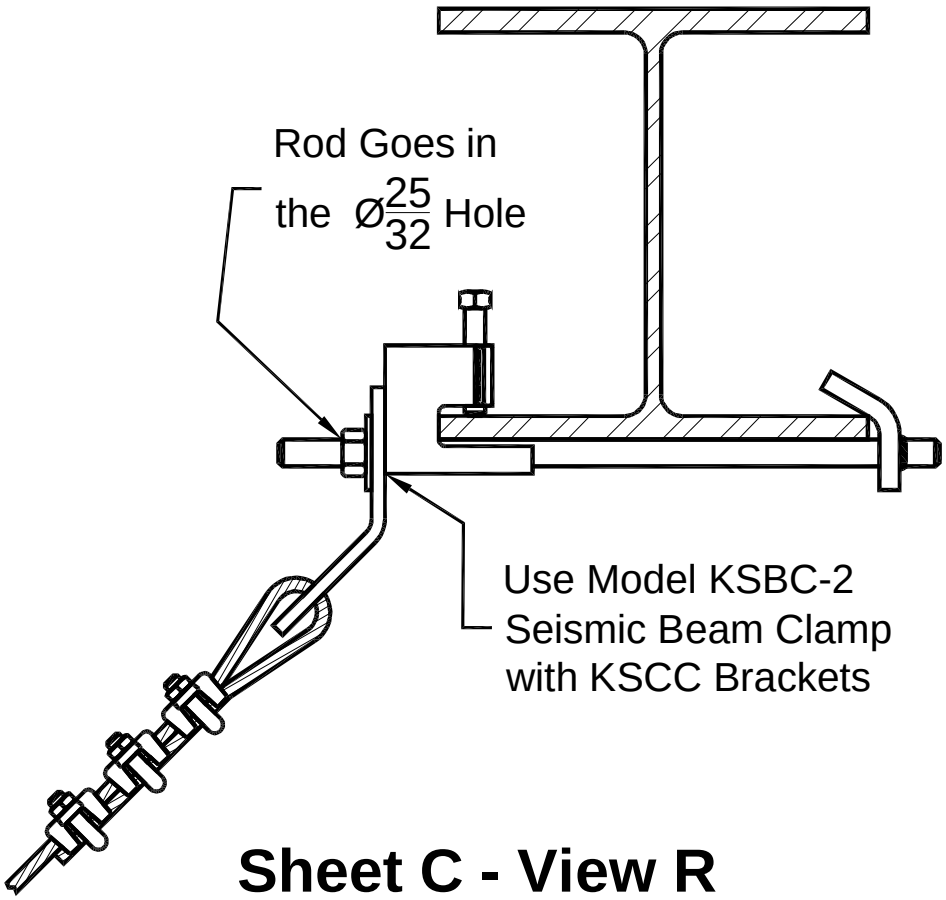

Figure I5-50; Using Model KSBC-2 Seismic Beam Clamps to Attach KSCC Brackets to Structural Steel

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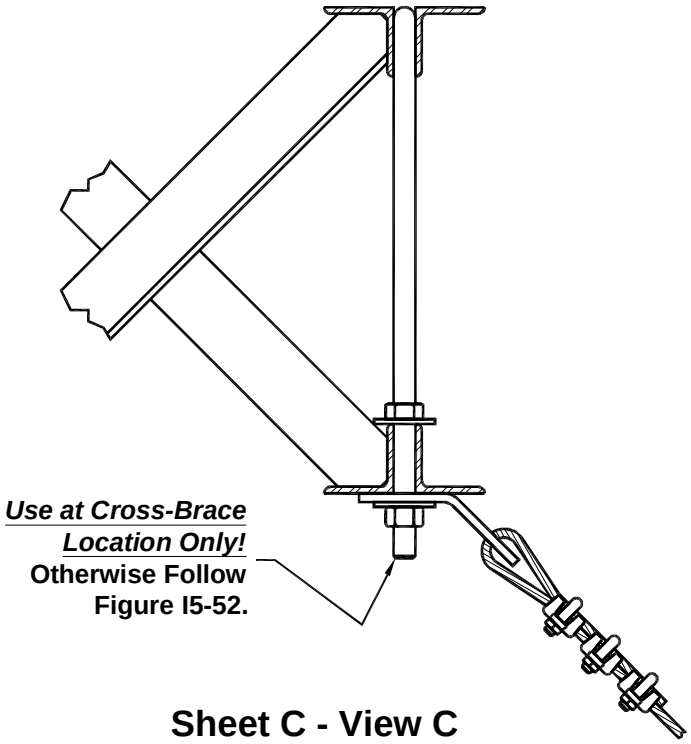
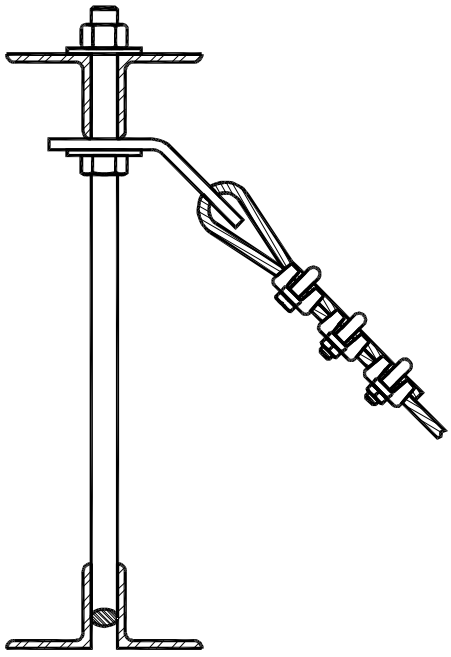


Sheet C - View C

Figure I5-51; Attaching KSCC Brackets to Cross-Braced Open Web Steel Joists



Sheet C - View D

Figure I5-52; Attaching KSUA Brackets to Un-Braced Open Web Steel Joists

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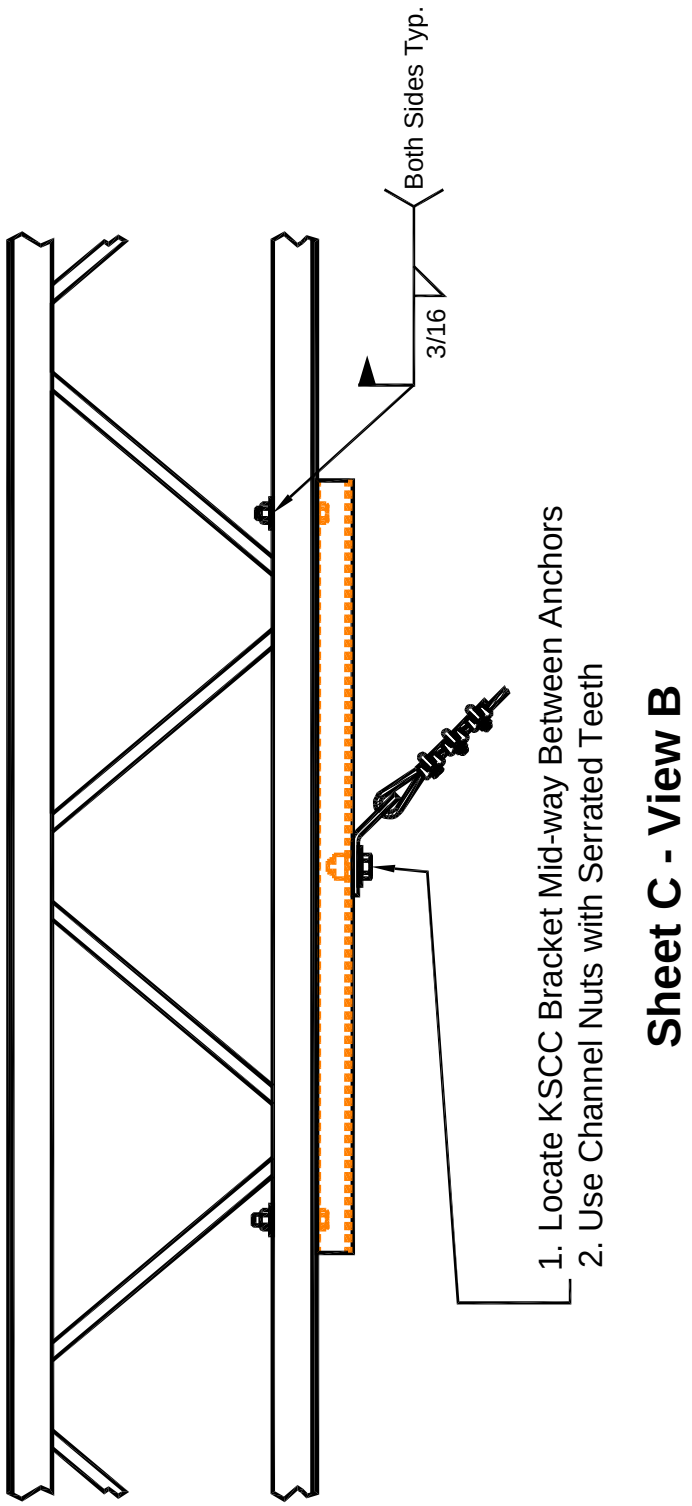

Figure I5-53; Attaching KSCC Brackets to Un-Braced Open Web Steel Joists – Aligned to Joists

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I5.4.3 – KSCC Brackets – Attachment to Concrete:

Model KSCC brackets may be attached to normal weight concrete as shown in Figure I5-54. The installation dimensions indicated in Figure I5-54 are listed in Table I5-6.

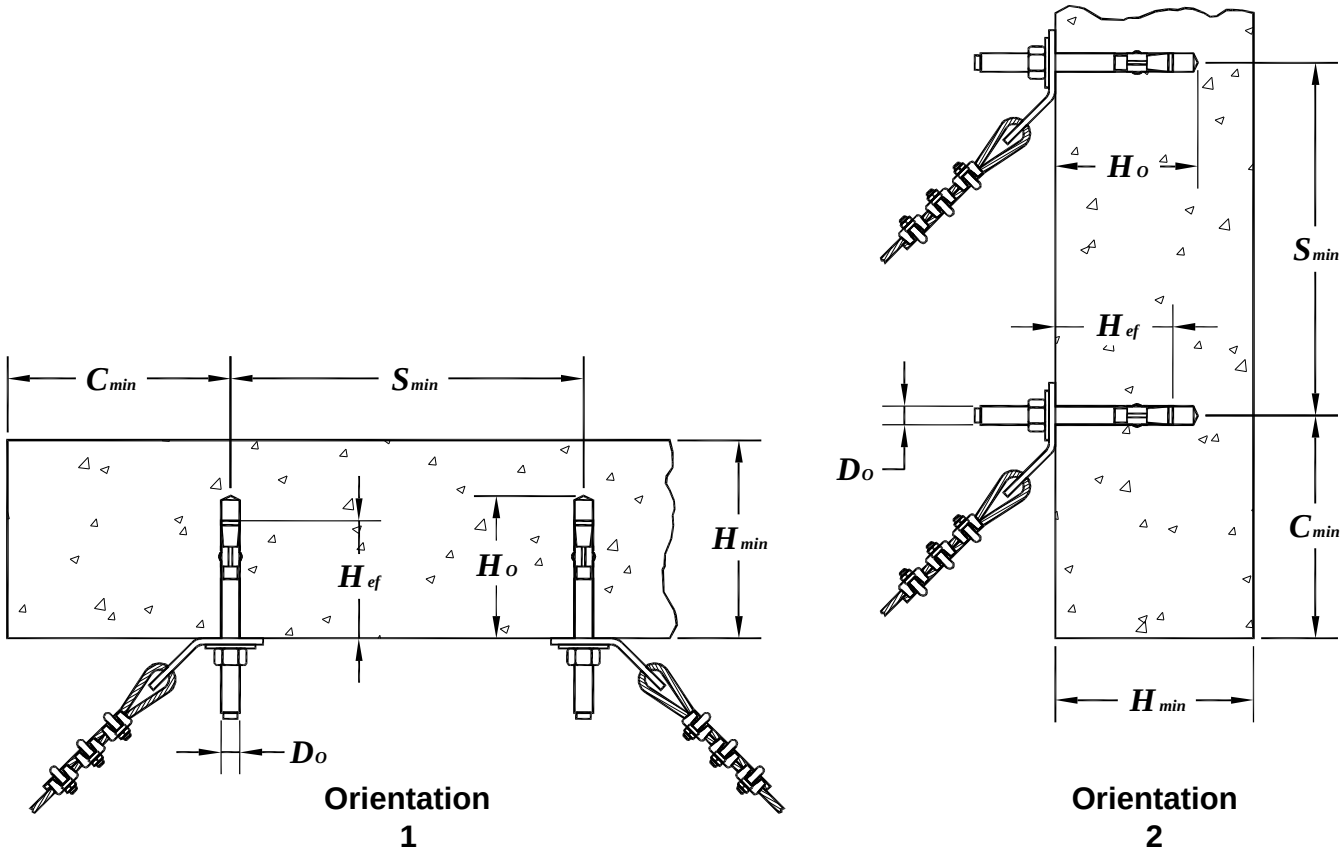

Figure I5-54; Typical KSCC Bracket Installation in Normal Weight Concrete

The installation dimensions listed in Table I5-6 are the minimum requirements to achieve the listed capacities the Model KSCC Seismic Restraint Cable Kits listed in Appendix A1.1, Tables A1.1-3 and A1.1-4 for normal weight concrete.

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Table I5-6; Critical KCCAB Concrete Anchor Installation Dimensions for KSCC Restraint Cable Kits

Anchor & Pilot Hole Size D_O (in)	Pilot Hole Depth H_O (in)	Effective Anchor Embedment H_{ef} (in)	Minimum Concrete Thickness H_{min} (in)	Minimum Anchor Spacing S_{min} (in)	Minimum Anchor Edge Distance C_{min} (in)
1/2	4	3-1/4	6	9-3/4	7-1/2
5/8	4-3/4	4	6	12	8-3/4
3/4	5-3/4	4-3/4	8	14-1/4	9

Figures I5-55 and I5-56 show schemes for attaching the KSCC brackets to concrete which has been poured over corrugated steel decking. The thickest section at the ribs of the decking must meet the Minimum Concrete Thickness from Table I5-6. In the arrangement shown in Figure I5-56, the strut channel must span at least two ribs as shown, see Table I5-7 for anchor substitutions for lightweight concrete over metal decking.

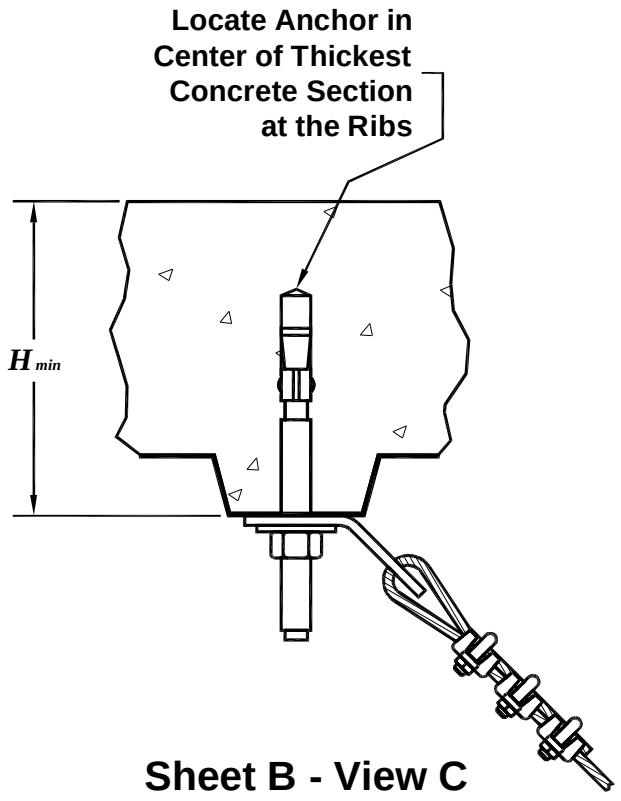

Figure I5-55; KSCC Bracket Attached to Concrete Poured on Corrugated Metal Decking

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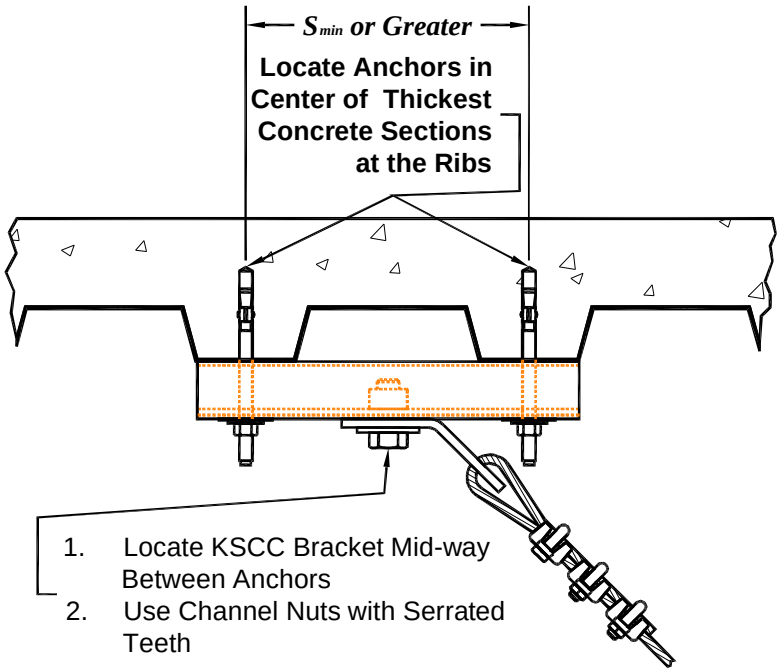
Table I5-7; Anchor Substitution for Lightweight Concrete over Metal Decking for KSCC Cable Kits

KNC Anchor Kit Code	Standard Anchor Size (in)	Used With KNC Restraint Kit Code	Cable Size	For Lightweight Concrete over Metal Decking		
				Required Anchor Size (in)	Required Embedment Depth (in)	Required Quantity
Y!	5/8	K2	1/4 in.	5/8	4	2
Y2	5/8	K3	1/4 in.	5/8	4	4
Y2	5/8	K5	3/8 in.	5/8	4	4



Sheet B - View G

Figure I5-56; KSCC Bracket Attached to Strut Channel Anchored to Concrete Poured on Corrugated Metal Decking

There may be certain instances where the KSCC bracket with a single anchor will not have the required capacity. In those cases, the KSCCZ2, two concrete anchors, or the KSCCZ4, four concrete anchor, kits may be used. These installations, orientations and required bolt template are shown in Figures I5-57, I5-58, I5-59, and I5-60 respectively. Minimum edge distances and spacings must be maintained to generate the full rated capacity of the attachment kits.

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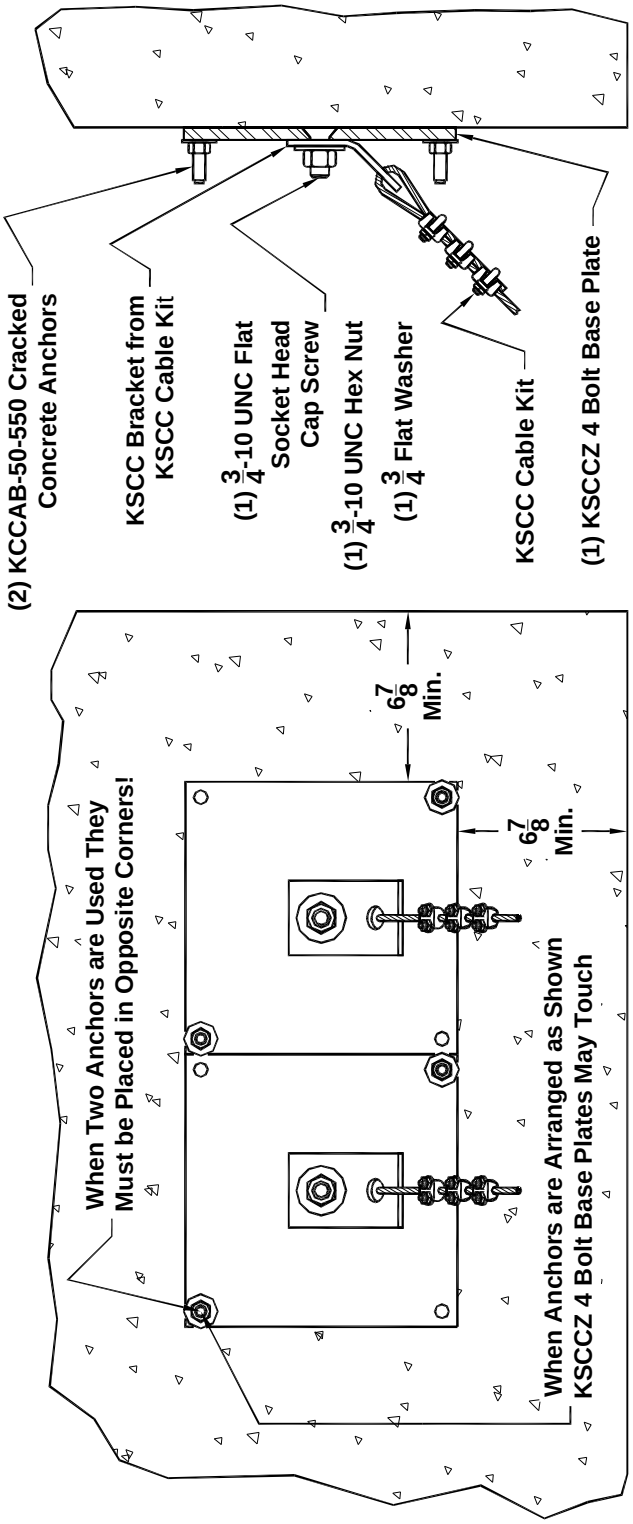

Figure I5-57; Model KSCCZ2 Attachment Kit to Concrete Using the KSCC Brackets – (2) 1/2 Anchors

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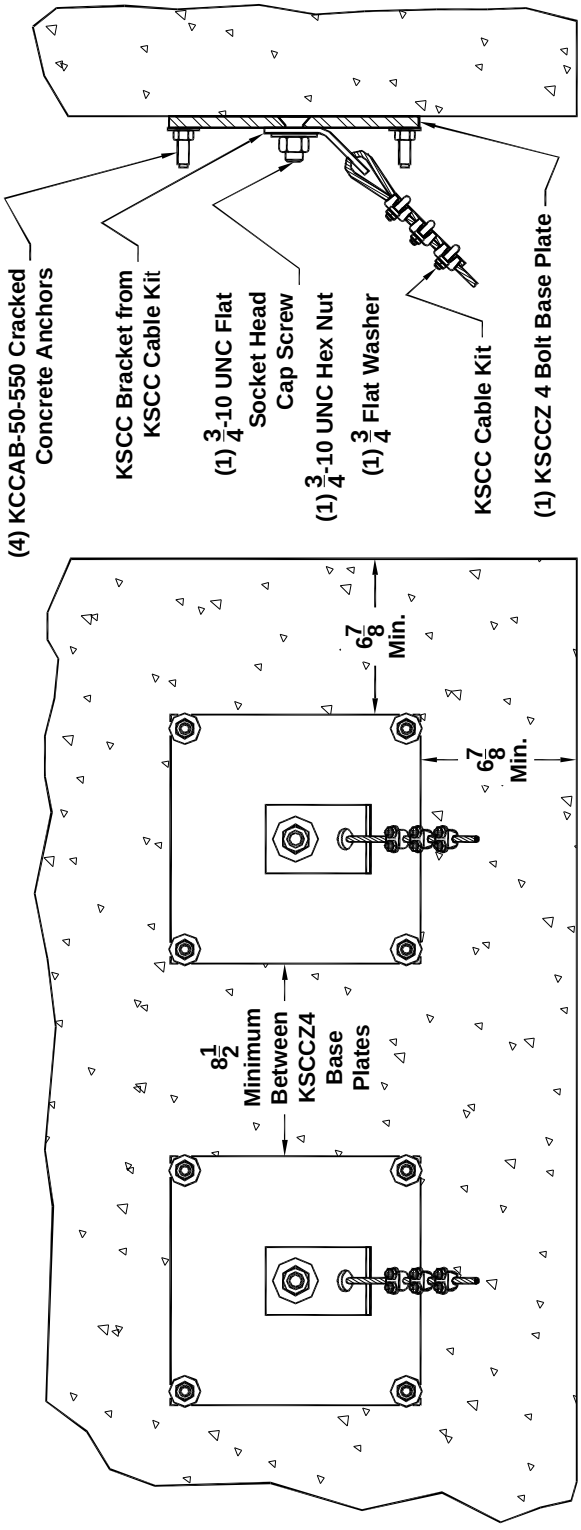

Figure I5-58; Model KSCCZ4 Attachment Kit to Concrete Using the KSCC Brackets – (4) 1/2 Anchors

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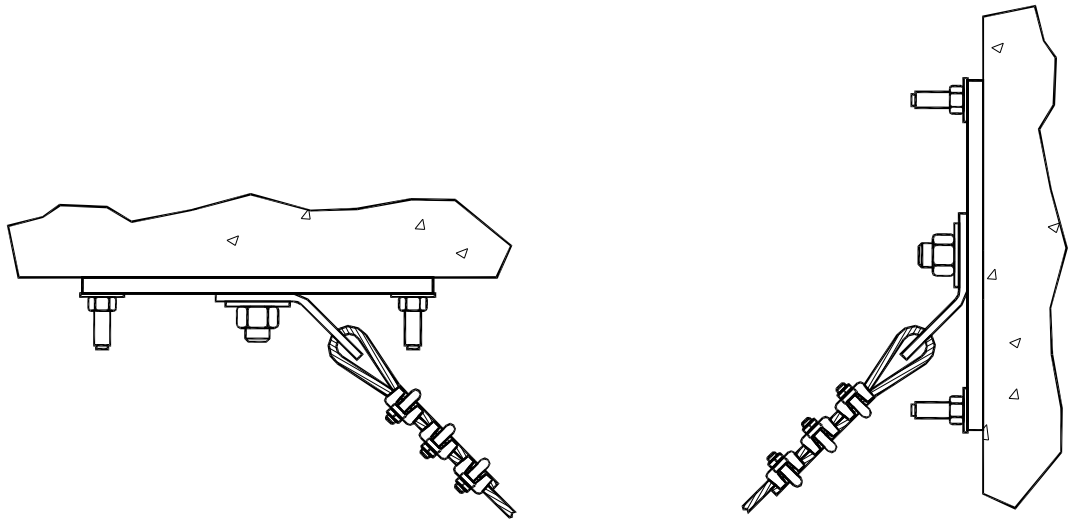

Orientation 1

Orientation 2

Sheet B - View D

Figure I5-59; Models KSCCZ2 and KSCCZ4 Concrete Attachment Kits for KSCC Brackets in Orientation 1 and Orientation 2

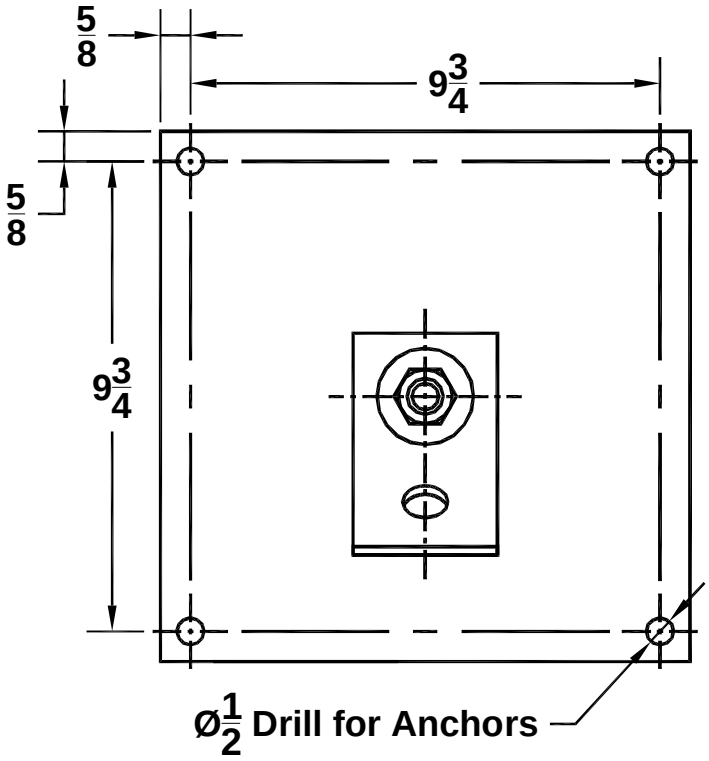

Figure I5-60; Anchor Hole Drill Template for Models KSCCZ2 and KSCCZ4

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I5.4.4 – KSCC Brackets – Attachment to CMU Walls:

The concrete used for CMU components is usually a lightweight concrete, and often has fillers and aggregates such as fly ash and bottom ash. Therefore, the strength of this concrete does not match that of normal weight concrete, and may not match that of poured in place lightweight concrete. For this reason, ***attachments for seismic restraints made to CMU walls must be approved by the building structural engineer in advance of installation of the restraints***. When solid masonry blocks are used, the best way to make theses attachments is to use through bolts with load plates on both sides of the wall as shown in Figure I5-61. The capacity of the attachment will be what ever the building structural engineer says that the point load limit for the wall will be. (Up to but not exceeding the cable kit capacity as published by Kinetics Noise Control.)

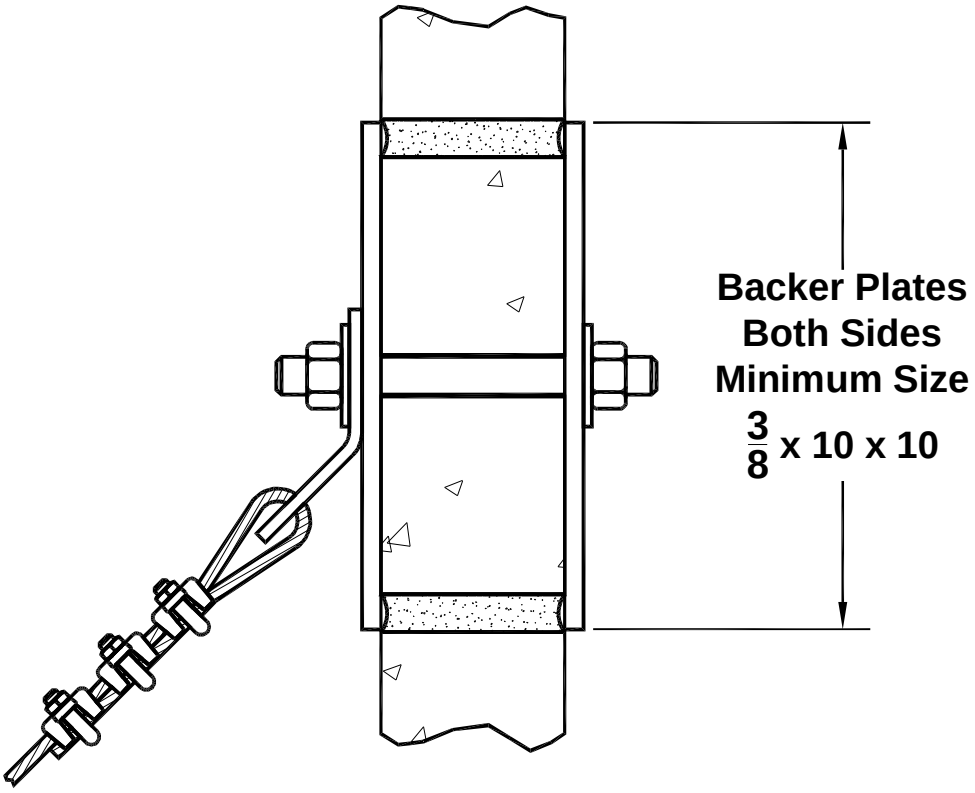

Figure I5-61; KSCC Through Bolt Attachment to a Solid CMU Wall

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Figures I5-62 and I5-63 show attachment methods for hollow CMU walls. ***Here again, the building structural engineer must approve the attachment prior to installation, and indicate the point load limit for the wall***. (Note: In the case of the umbrella type anchor, Figure I5-13, the peak capacity is limited to that of the 3/8" anchor.)

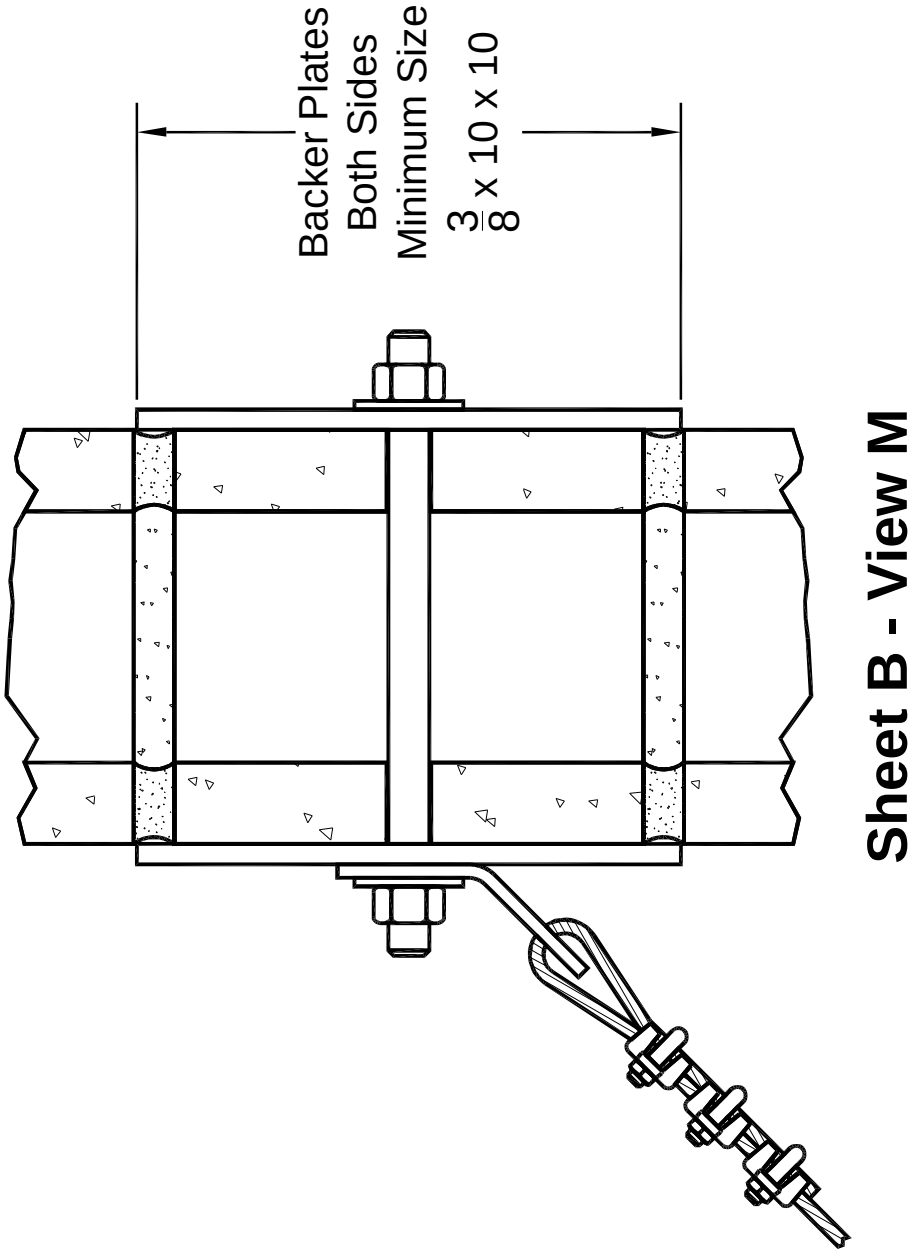

Figure I5-62; KSCC Through Bolt Attachment to a Hollow CMU Wall

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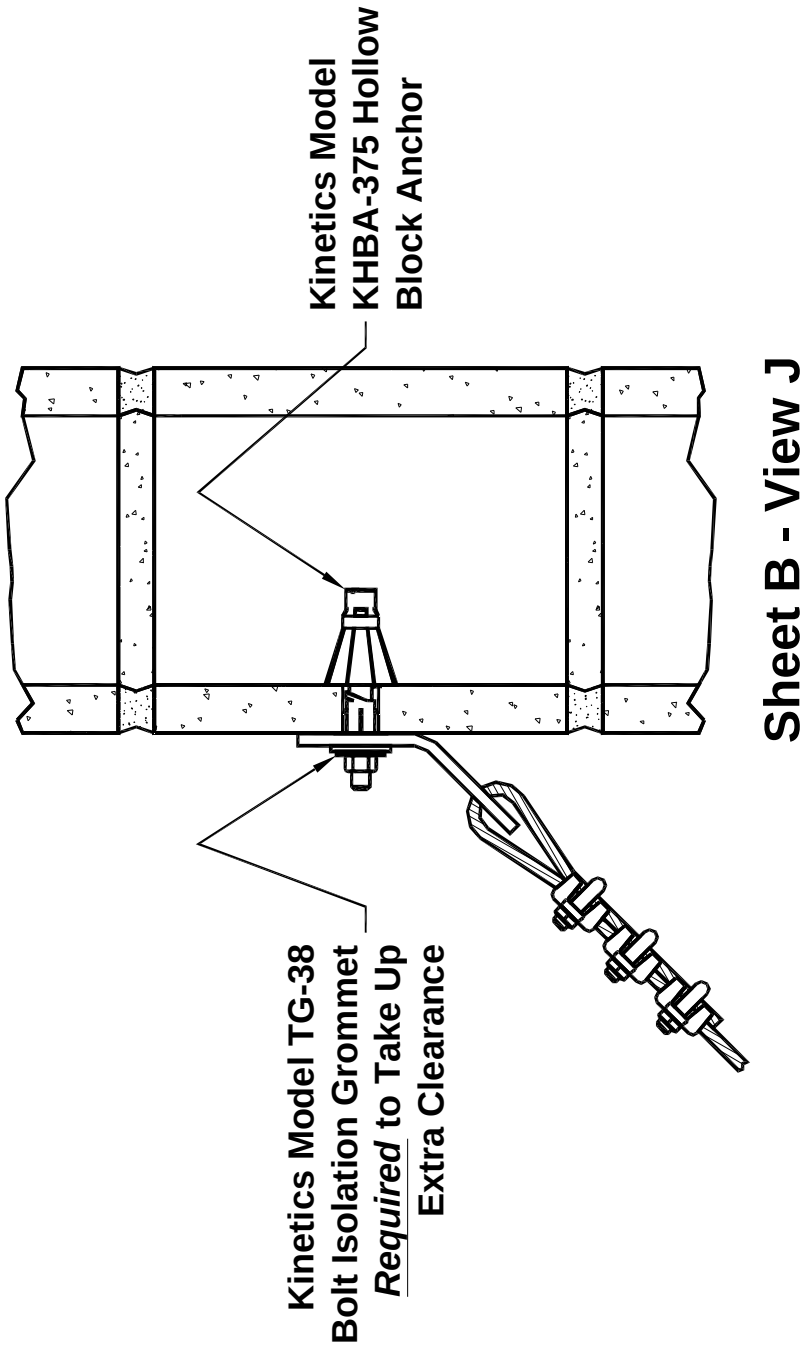

Figure I5-63; KSCC "Umbrella" Type Adhesive Anchor Attachment to a Hollow CMU Wall

Finally, for filled CMU walls, standard wedge type anchors can be used with reduced capacities as shown in Figure I5-64. ***Here also, the building structural engineer must approve the attachment prior to installation, and indicate the point load limit for the wall***.

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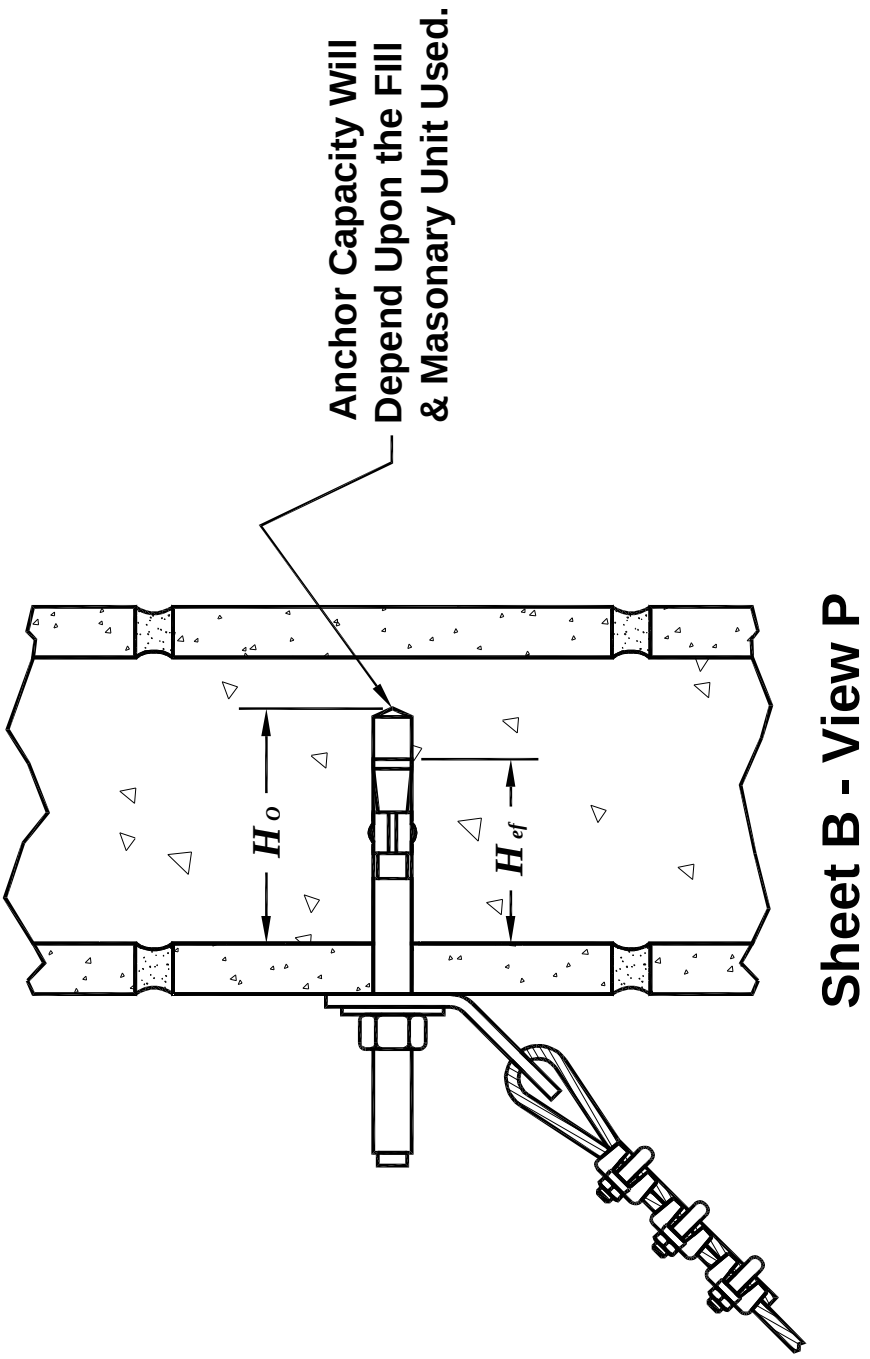

Figure I5-64; KSCC Wedge Type Anchor Attachment to a Filled CMU Wall

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I5.4.5 – KSCC Brackets – Attachment to Wooden Structures:

Attachment of seismic or wind restraints to a wooden structure requires careful coordination with the building structural engineer. While wooden structures tend to perform better during an earthquake than their concrete, masonry, or steel counterparts, individual restraint attachments and point loads can adversely affect the strength and performance of the building structure. This is because the location of grain irregularities, knots, splits and checks can not be controlled. The building structural engineer can indicate the proper locations and load capacity limits for each restraint attachment type and location. Figure I5-15 and Table I5-8 show the typical installation dimensions that will apply to lag screw attachments. For more detailed lag screw data see Appendix A4.4.

Table I5-8; Lag Screw and Through Bolt Installation Data for Model KSCC, Restraint Cable Kits

Lag Screw & Through Bolt Size ***D*** (in)	Lag Screw Pilot Hole Size ***d*** (in)		Screw & Bolt Minimum Spacing ***S*** (in)	Screw & Bolt Minimum End Distance ***E1*** (in)	Screw & Bolt Minimum Edge Distance ***E2*** (in)	Lag Screw Embedment Does Not Include Screw Point ***E3*** (in)
	Soft Wood	Hard Wood				
1/2	15/64	21/64	2	2	3/4	4
5/8	19/64	13/32	2-2/12	2-1/2	15/16	5
3/4	23/64	31/64	3	3	1-1/8	6

Model KSCC brackets installed in Orientation 1 to structural wood using lag screws and through bolts are shown in Figures I5-65 and I5-66 respectively. KSCC brackets attached to structural wood in Orientation 2 using lag screws and through bolts are shown, respectively, in Figures I5-67 and I5-68.

Special Note: Seismic and wind restraints are not to be attached to the end grain of structural wood!!

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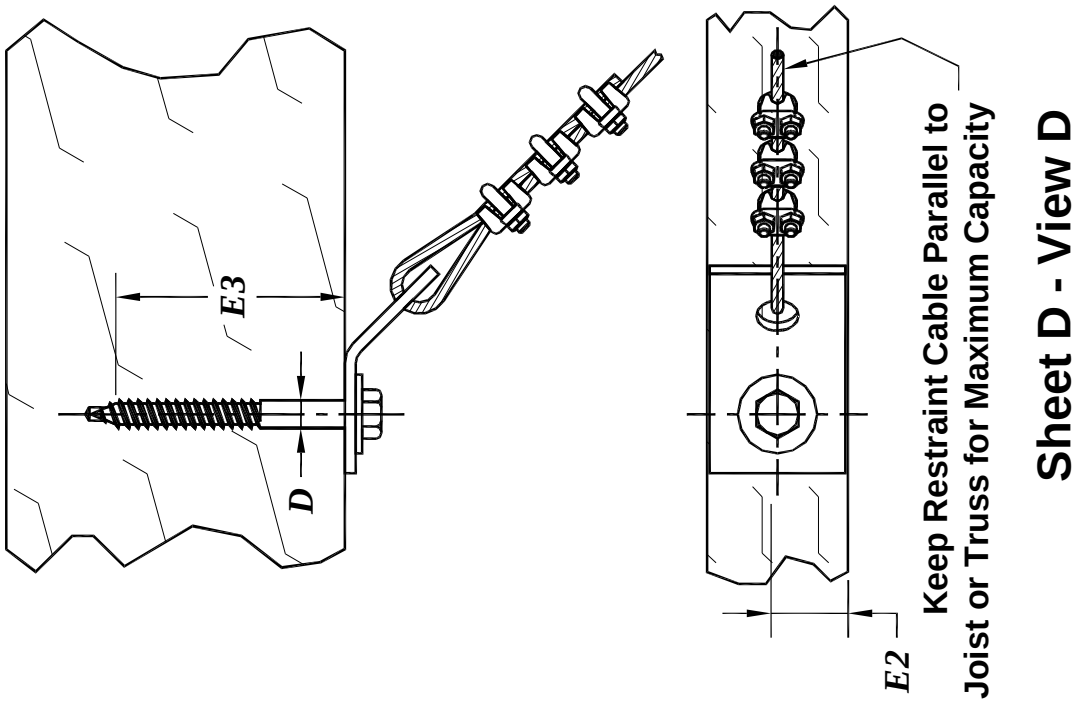

Figure I5-65; KSCC Attached to Wood in Orientation 1 Using a Lag Screw

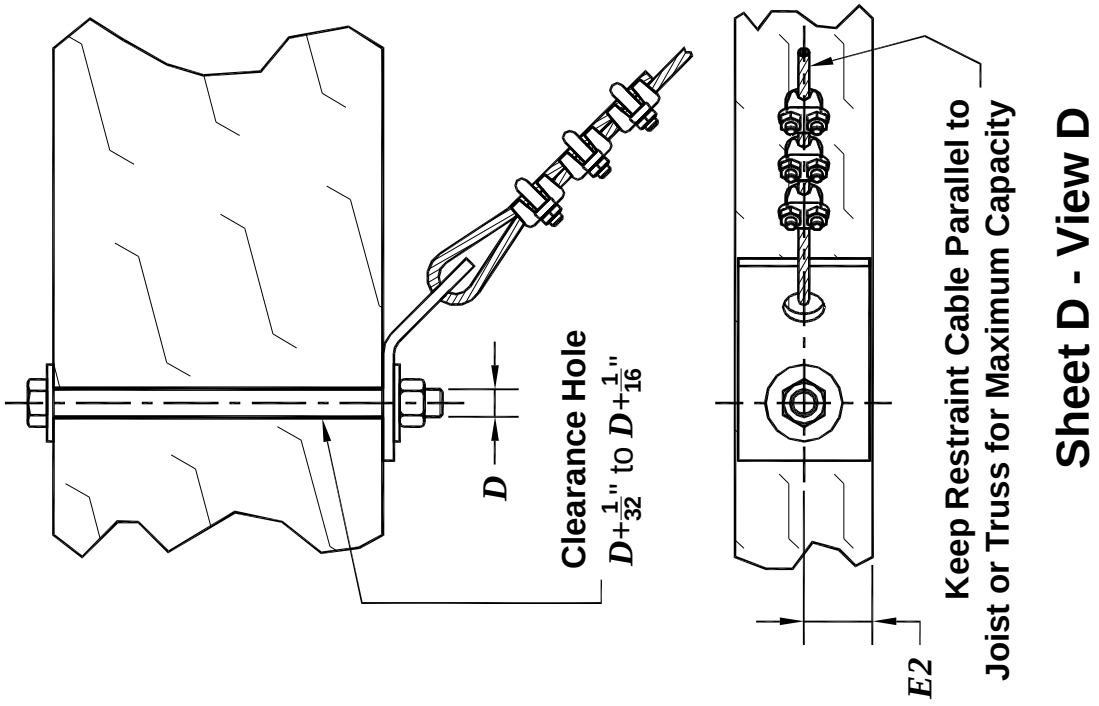

Figure I5-66; KSCC Attached to Wood in Orientation 1 Using a Through Bolt

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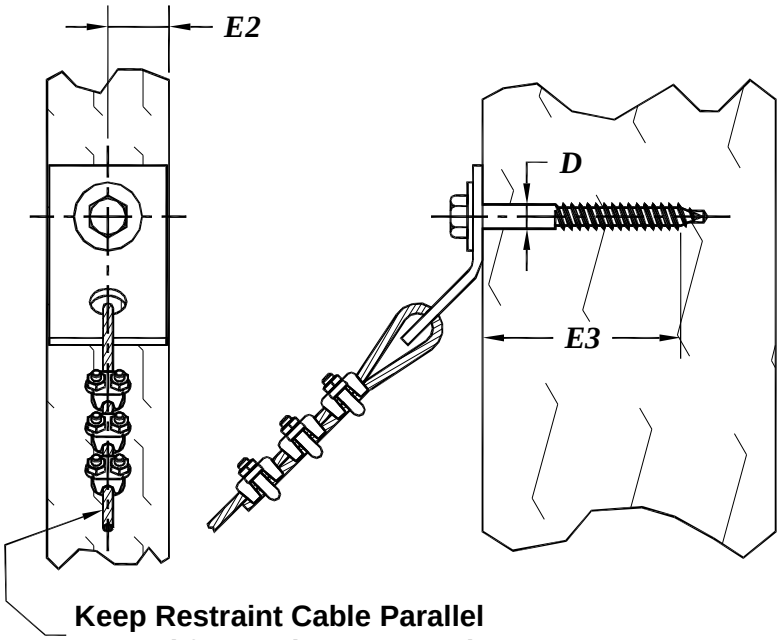
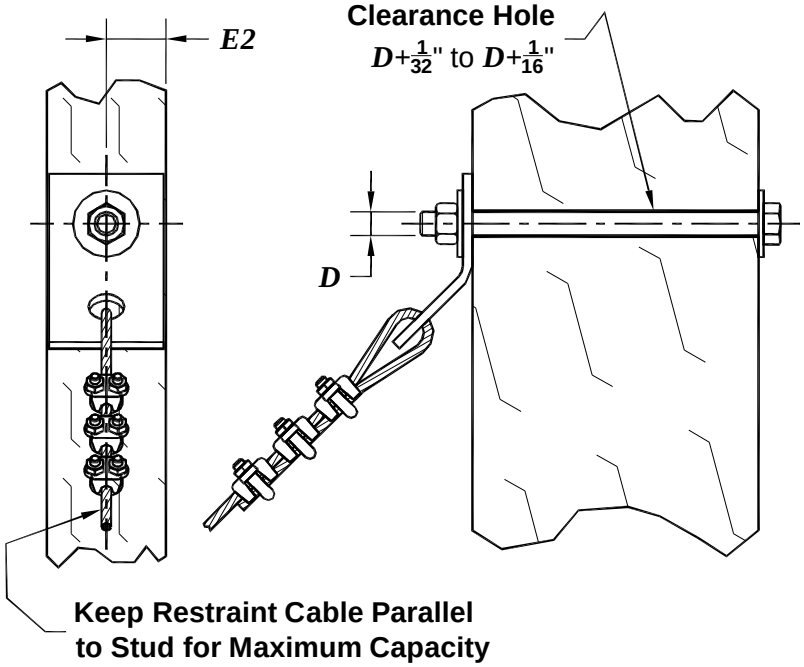


Sheet D - View J

Figure I5-67; KSCC Attached to Wood in Orientation 2 Using a Lag Screw



Sheet D - View J

Figure I5-68; KSCC Attached to Wood in Orientation 2 Using a Through Bolt

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The KSCC bracket may be attached to the sides of wooden joists and beams in Orientation 2 as shown in Figure I5-69 for lag screw attachment and Figure I5-70 for through bolt attachment.

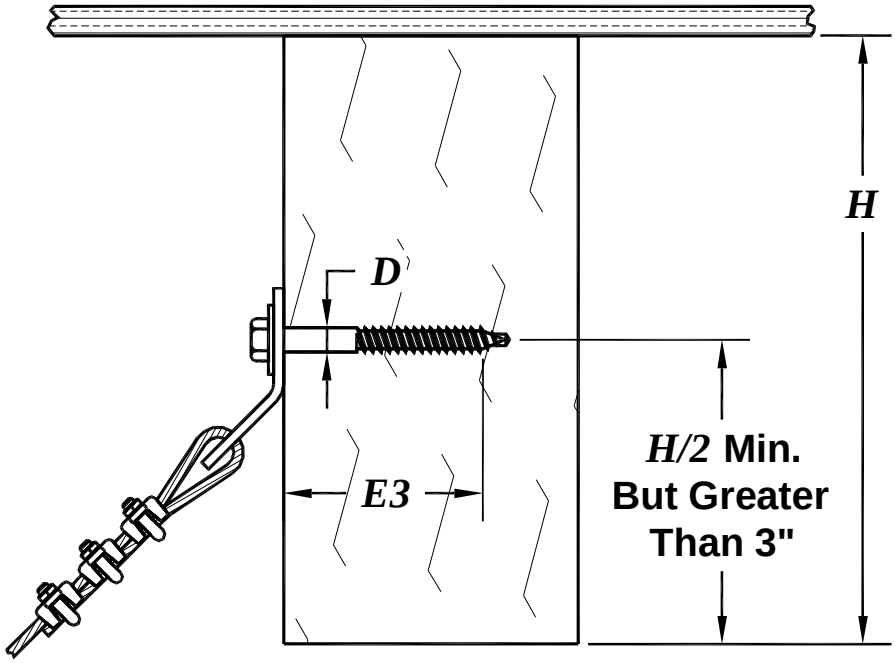
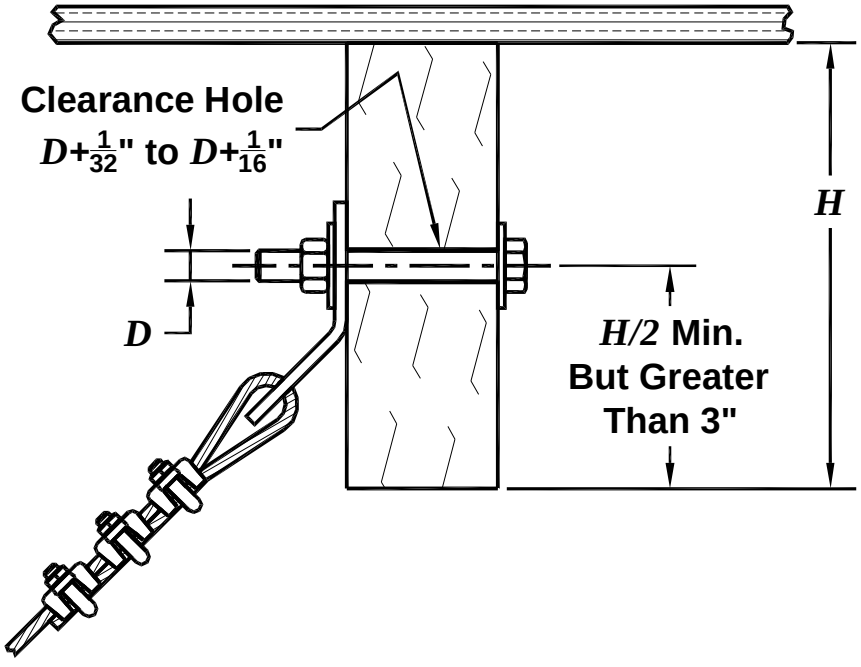


Figure I5-69; KSCC Attached to a Wooden Joist or Beam in Orientation 2 Using a Lag Screw



FigureI5-70; KSCC Attached to a Wooden Joist or Beam in Orientation 2 Using a Through Bolt

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The KSCCZ2 and KSCCZ4 attachment kits will allow the KSCC bracket to be mounted to a wooden structural member, such as a column, using two or four lag screws, as shown in Figures I5-71 and I5-72 respectively.

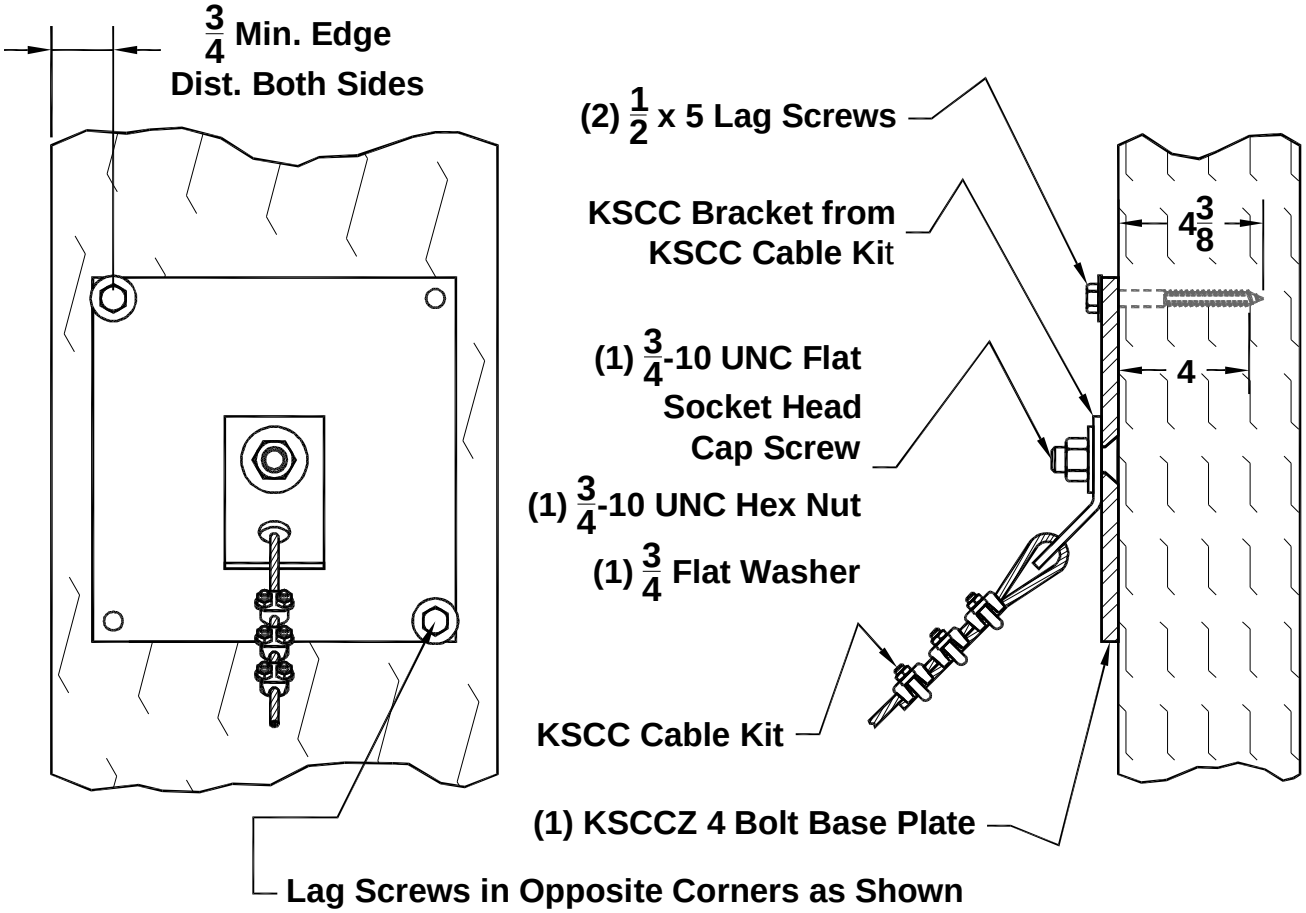

Figure I5-71; Model KSCCZ2 Attachment Kit to a Wooden Column Using KSCC Brackets – (2) 1/2 Lag Screws

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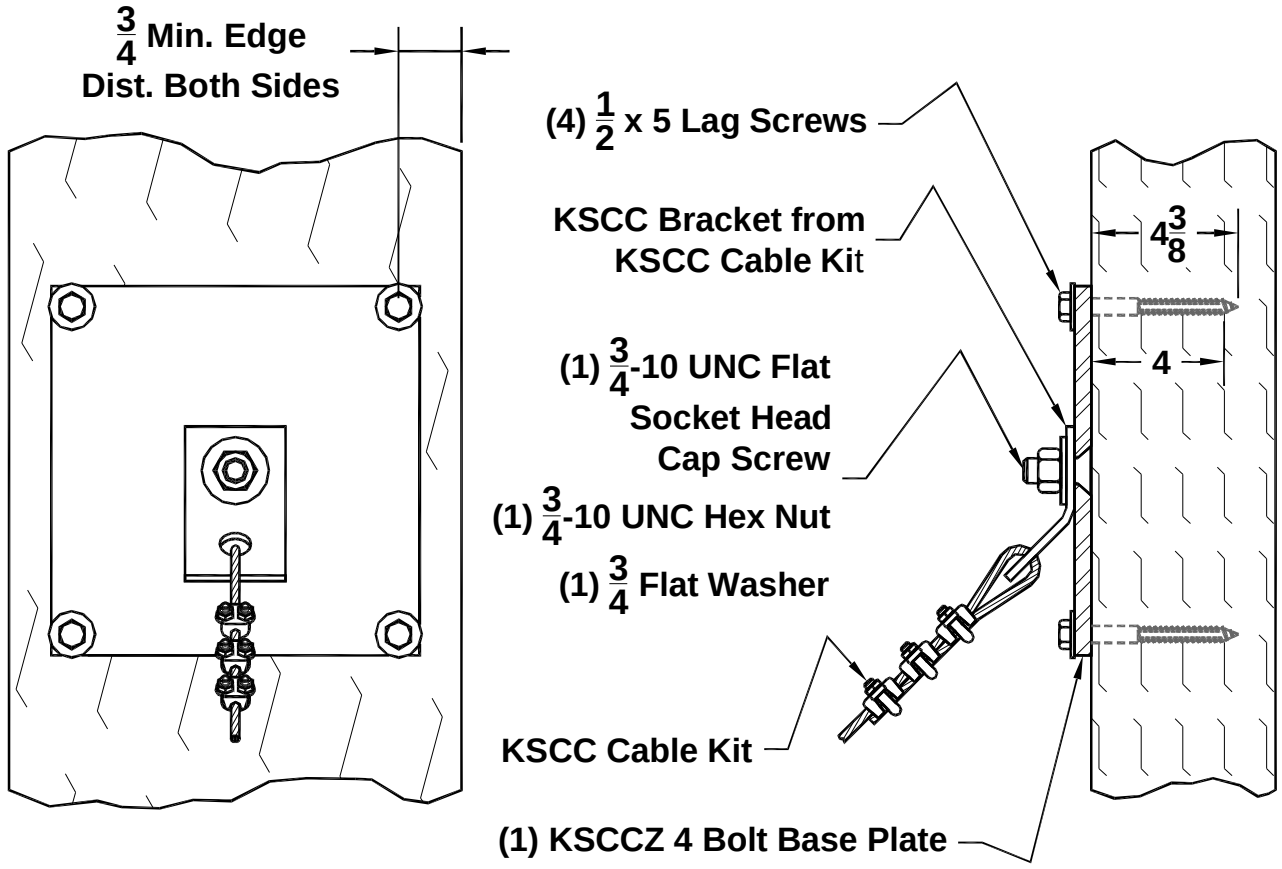

Sheet B - View G

FigureI5-72; Model KSCCZ4 Attachment Kit to a Wooden Column Using KSCC Brackets – (4) 1/2 Lag Screws

The KSCCZ2 and KSCCZ4 attachment kits will also allow the KSCC bracket to be mounted to a wooden structural beam using two or four lag screws. Figures I5-73 and I5-74 show the KSCCZ2 and KSCCZ4, respectively, mounted to a wooden beam. Figure I5-60 provides the dimensional information to layout the drill pattern for the pilot holes. The pilot drill size is given in Table I5-6 for both hard and soft woods.

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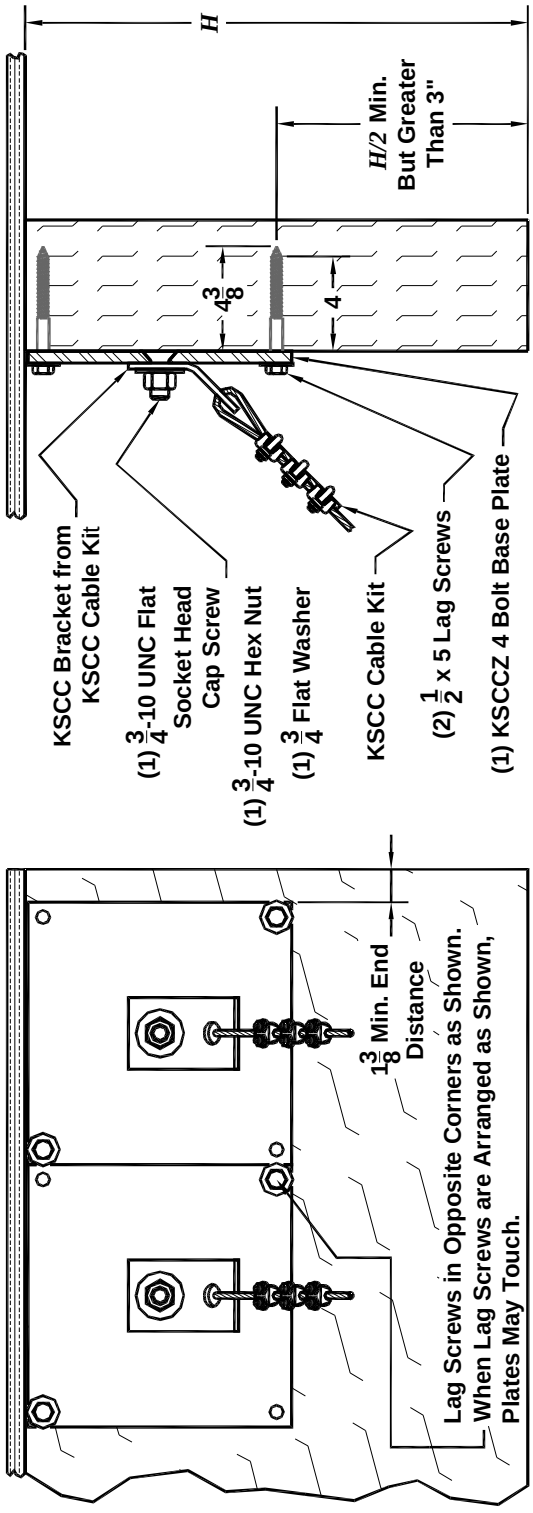

Figure I5-73; Model KSCCZ2 Attachment Kit to a Wooden Beam Using KSCC Brackets – (2) 1/2 Lag Screws

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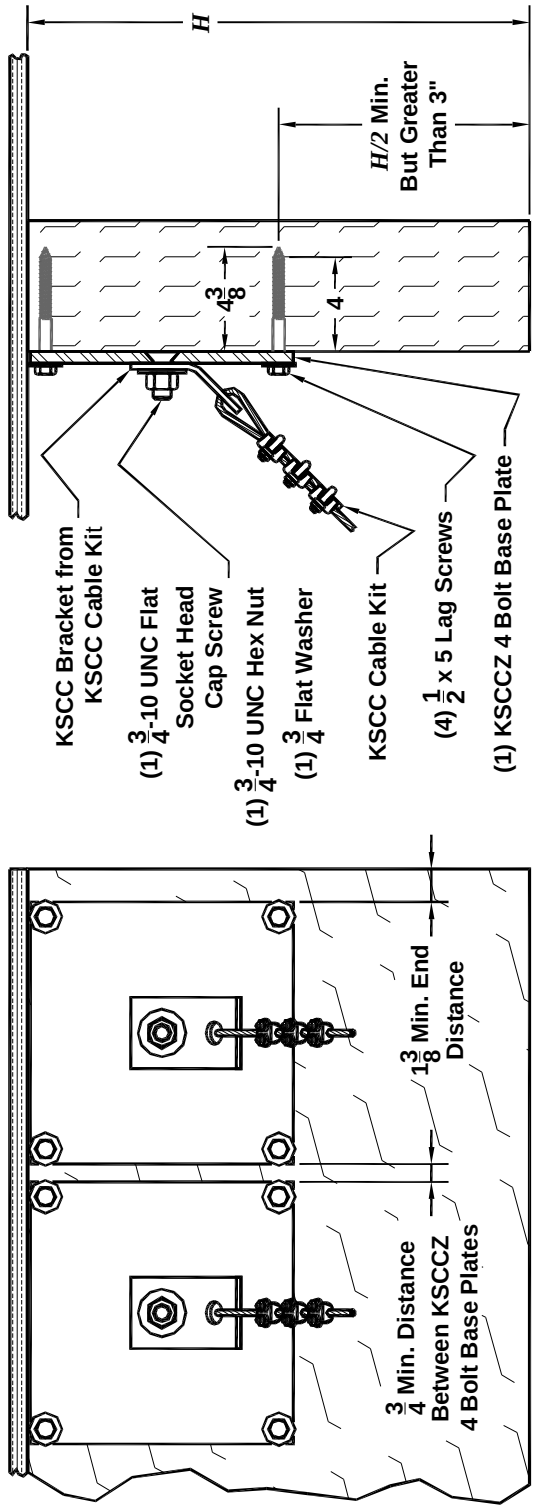

Figure I5-74; Model KSCCZ4 Attachment Kit to a Wooden Beam Using KSCC Brackets – (4) 1/2 Lag Screws

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I5.5 – Finishing Touches:

1. Make sure all restraints have two restraint cables 180° apart. Remember: ***You can't push a rope!***
2. Be sure all restraint locations have the proper restraints, transverse (**T**) and/or Longitudinal (**L**) and/or (**TL**), installed per the drawings provided by Kinetics Noise Control or the responsible engineer of record.
3. Make sure all longitudinal (**L**) restraints on trapeze supported pipe and duct are ***balanced***. Seismic forces acting through the longitudinal (**L**) restraints should not twist the pipe or duct through the trapeze bar.
4. All seismic restraints cable must be hand tight as shown in Figure I5-75, and the pipe(s) or duct must be centered.

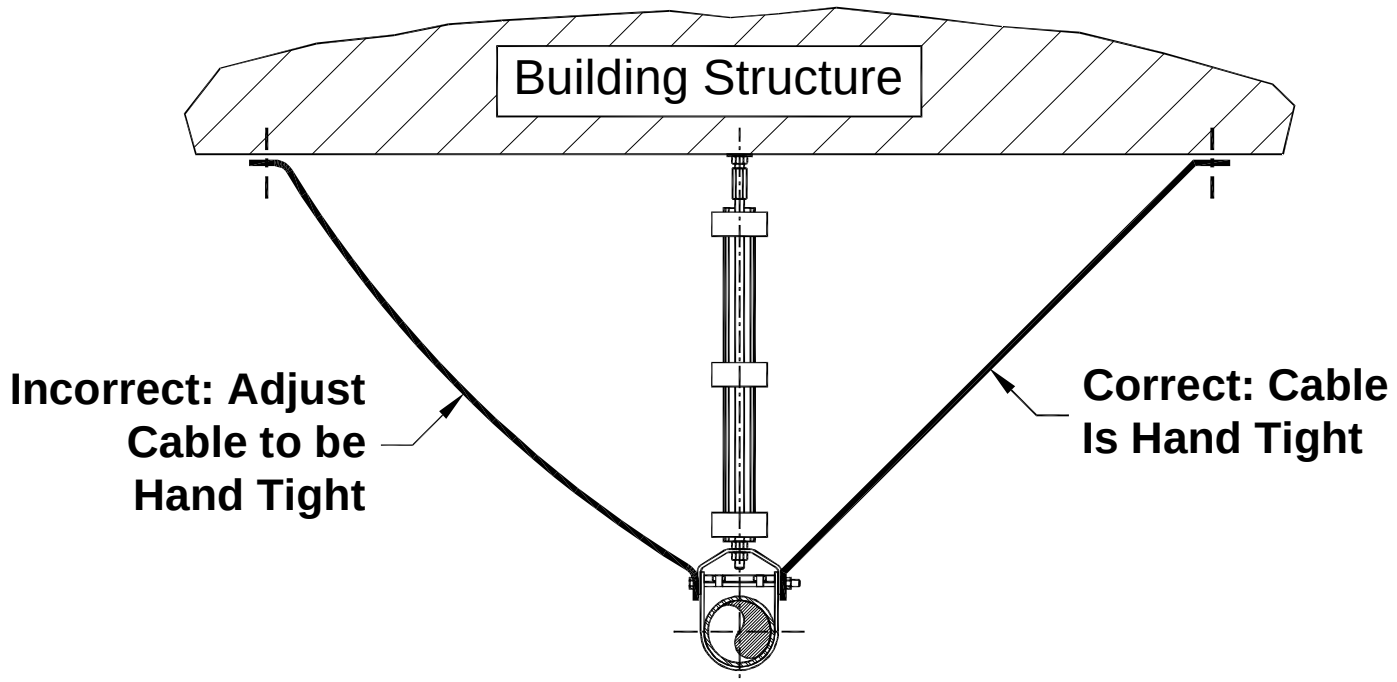

Figure I5-75; All Seismic Restraint Cables must be Hand Tight

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5. Excess seismic restraint cable may be coiled and tied off with tape, plastic or metal wire ties, or tie wire in a fashion that is compatible with the installed environment. For corrosive and damp environments use stainless steel wire ties and tie wire. Excess Cable may be coiled as shown in Figures I5-76 and I5-77 for KSCU and KSCC Seismic Restraint Cable Kits respectively.
6. Finally, if the excess cable is to be removed, ***do not cut off the excess until after the final inspection and approval of the system***.

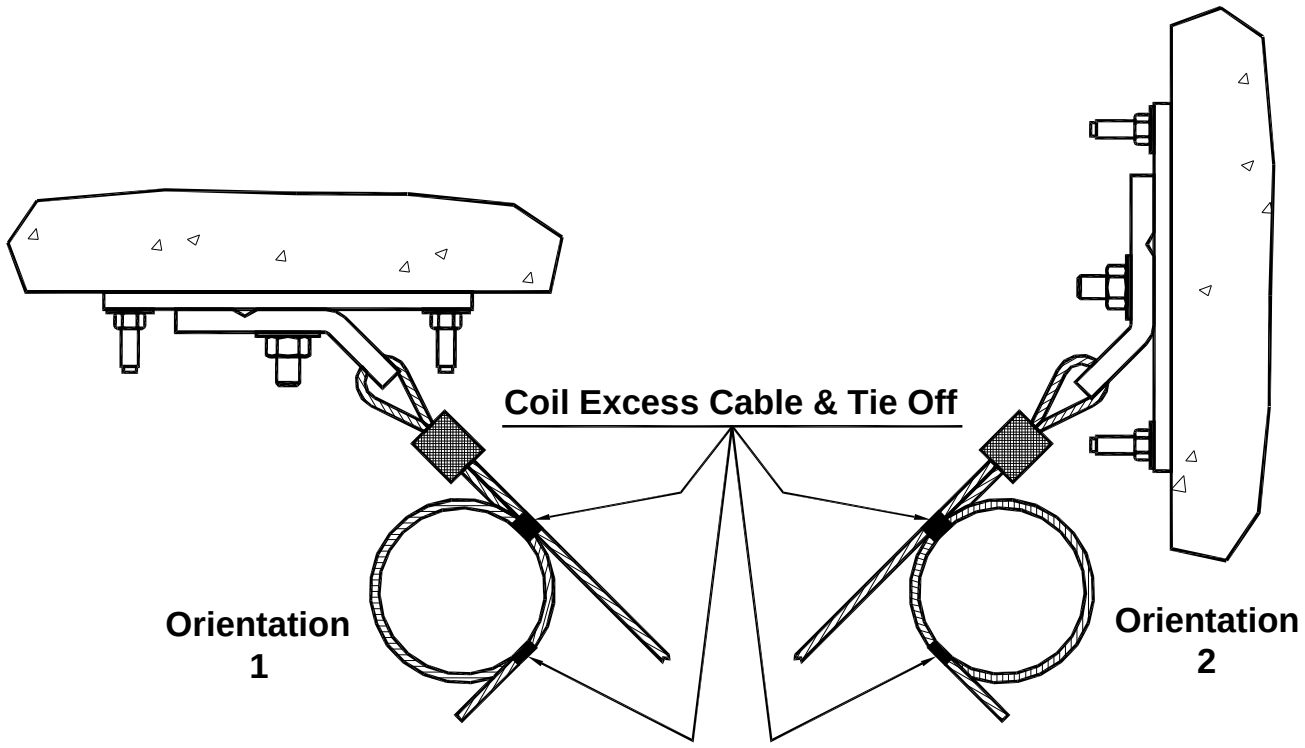

Figure I5-76; Coiling Excess Seismic Restraint Cables for KSCU Cable Kits

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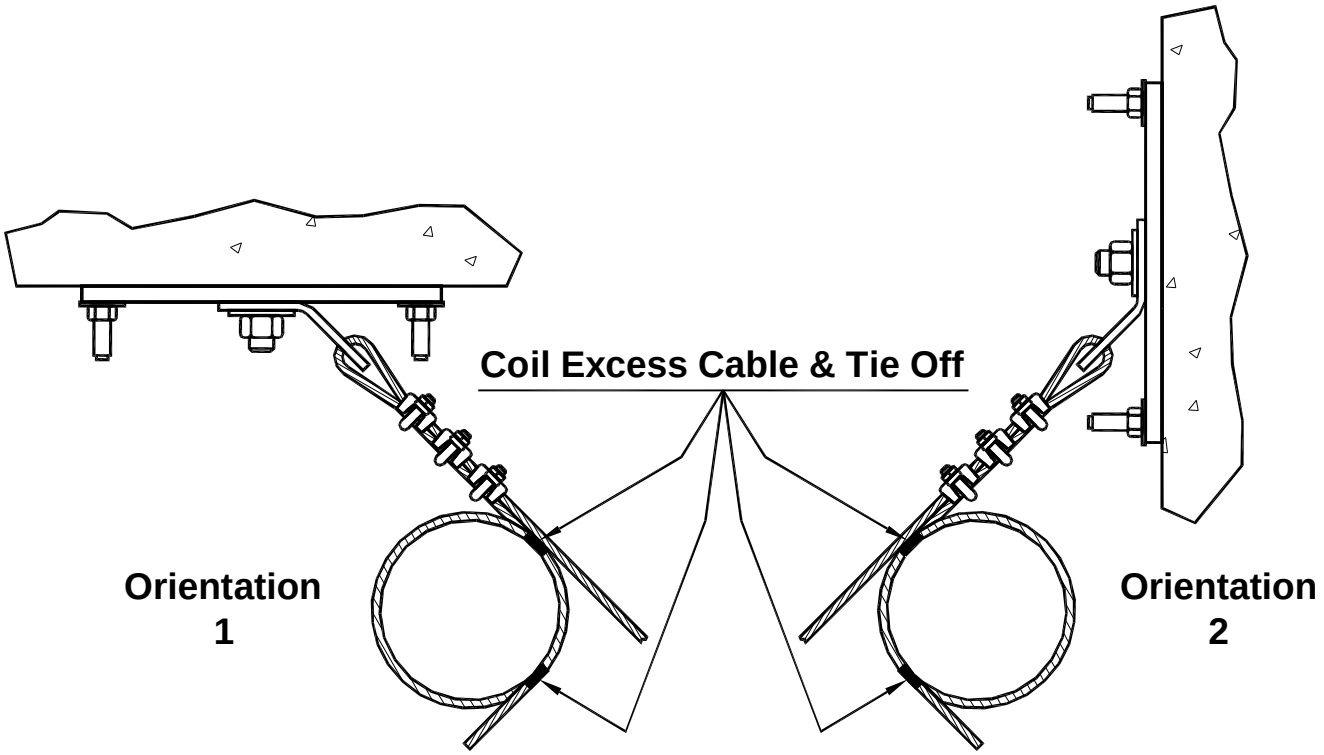

Figure I5-77; Coiling Excess Seismic Restraint Cables for KSCC Cable Kits

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