

CABLE RESTRAINT SCHEMATICS FOR DUCT

14.1 – Introduction:

This section will present several basic schematics for the seismic cable restraints for duct. The figures and descriptions in this section will be based on the Kinetics Noise Control drawings SS-20070957 and SS-20070958 titled Cable Restraint Schematics for Duct – Sheets A1 and A2 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 A1 – View H.

The schematics in this section are intended to be a quick guide for planning and inspection purposes. The details on making structural connections and duct attachments for the seismic restraint cables and components are covered in Sections 15.0 and 16.0 respectively. Hanger rod stiffeners may be required at for hanger rods at seismic restraint locations to prevent buckling of the hanger rod under the seismic uplift conditions. They not addressed in this section, but are covered in Section 18.0. Also, duct supported on isolation hangers is not shown in this document. The seismic restraint schematics and attachments for isolated and non-isolated duct are identical. However, the isolation hangers must receive special treatments that are described in Section 11.7 of this manual.

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14.2 – Transverse (T) Cable Restraint Schematics for Rectangular and Square Duct:

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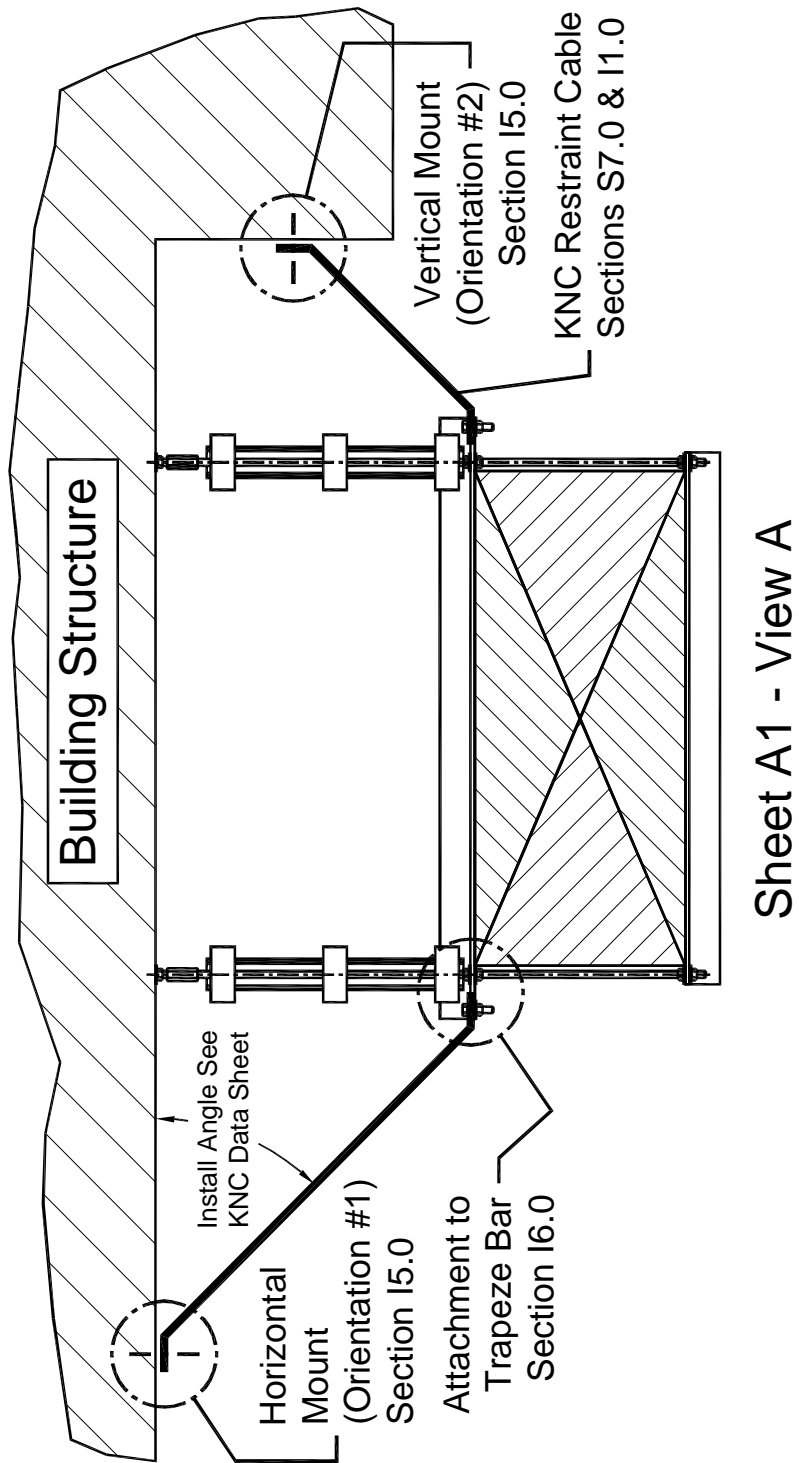


Figure I4-1; Transverse (T) Cable Restraint Schematic Arrangement for Trapped Rectangular Duct – One Restraint at Each Hanger Location Directed Outward from the Top Trapeze Bar

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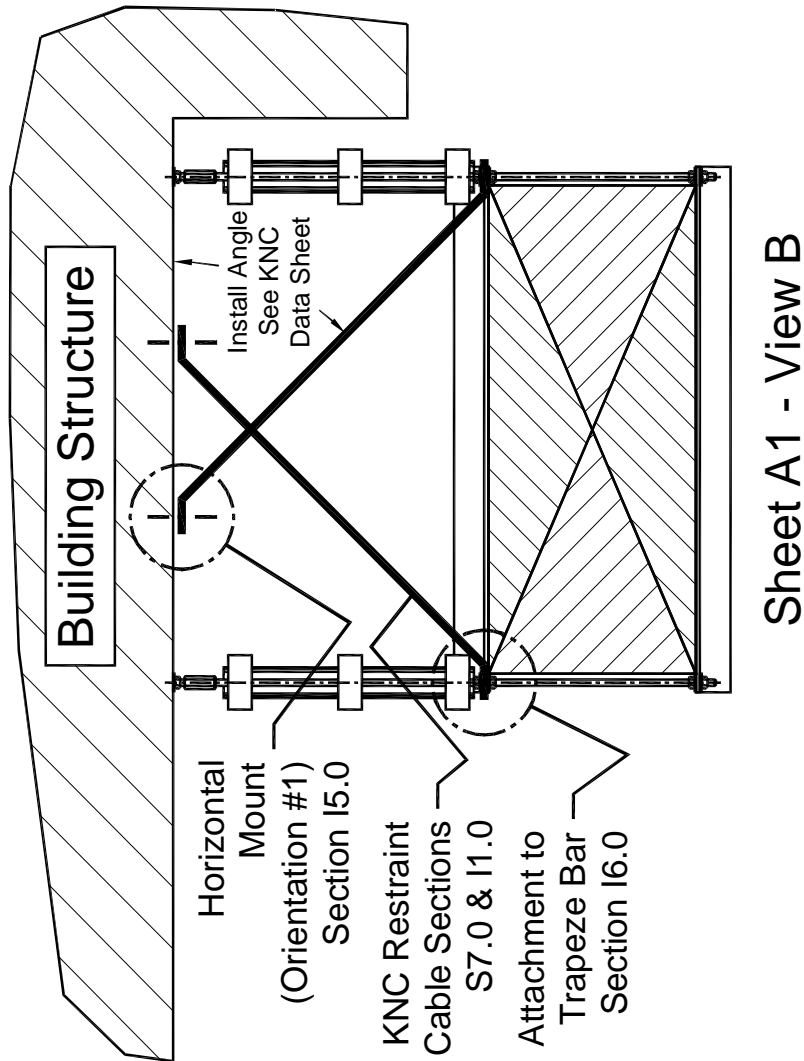


Figure I4-2; Transverse (T) Cable Restraint Schematic Arrangement for Trapped Rectangular Duct – One Restraint at Each Hanger Location Directed Inward & Crossing Over the Top of the Duct from the Top Trapeze Bar

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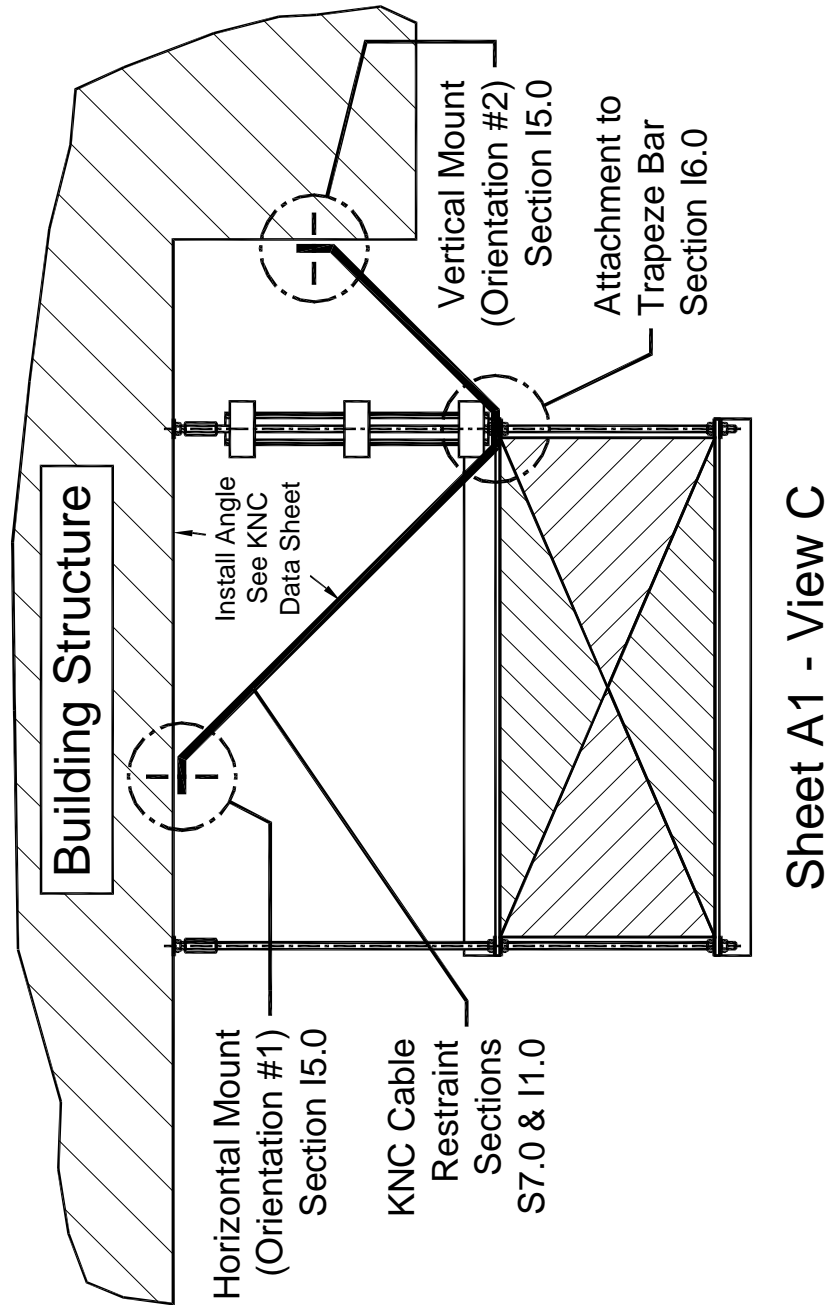


Figure I4-3; Transverse (T) Cable Restraint Schematic Arrangement for Trapped Rectangular Duct – Two Restraints at One Hanger Location with One Restraint Directed Inward & One Restraint Directed Outward from the Top Trapeze Bar

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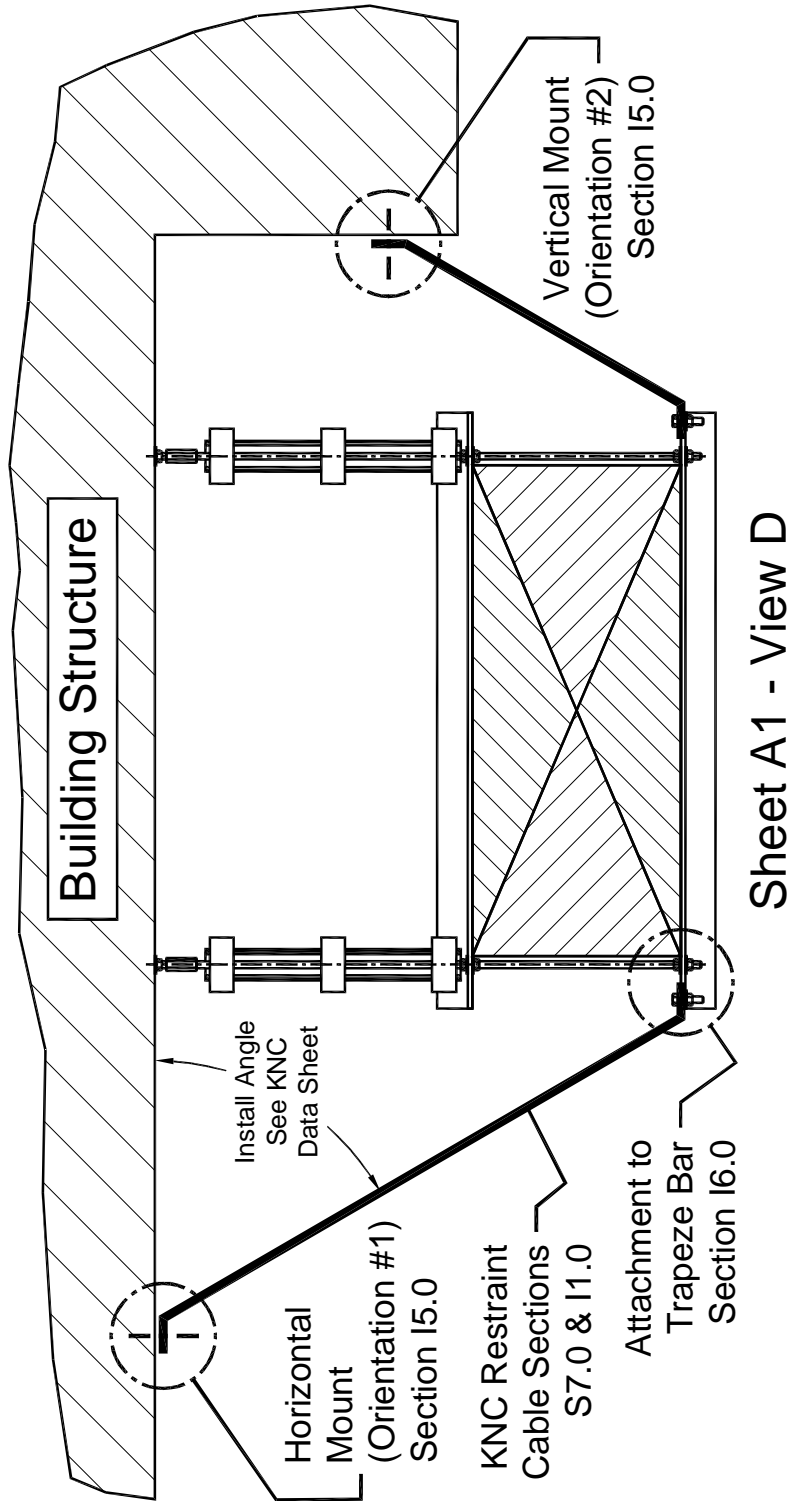


Figure I4-4; Transverse (T) Cable Restraint Schematic Arrangement for Trapped Rectangular Duct – One Restraint at Each Hanger Location Directed Outward from the Bottom Trapeze Bar

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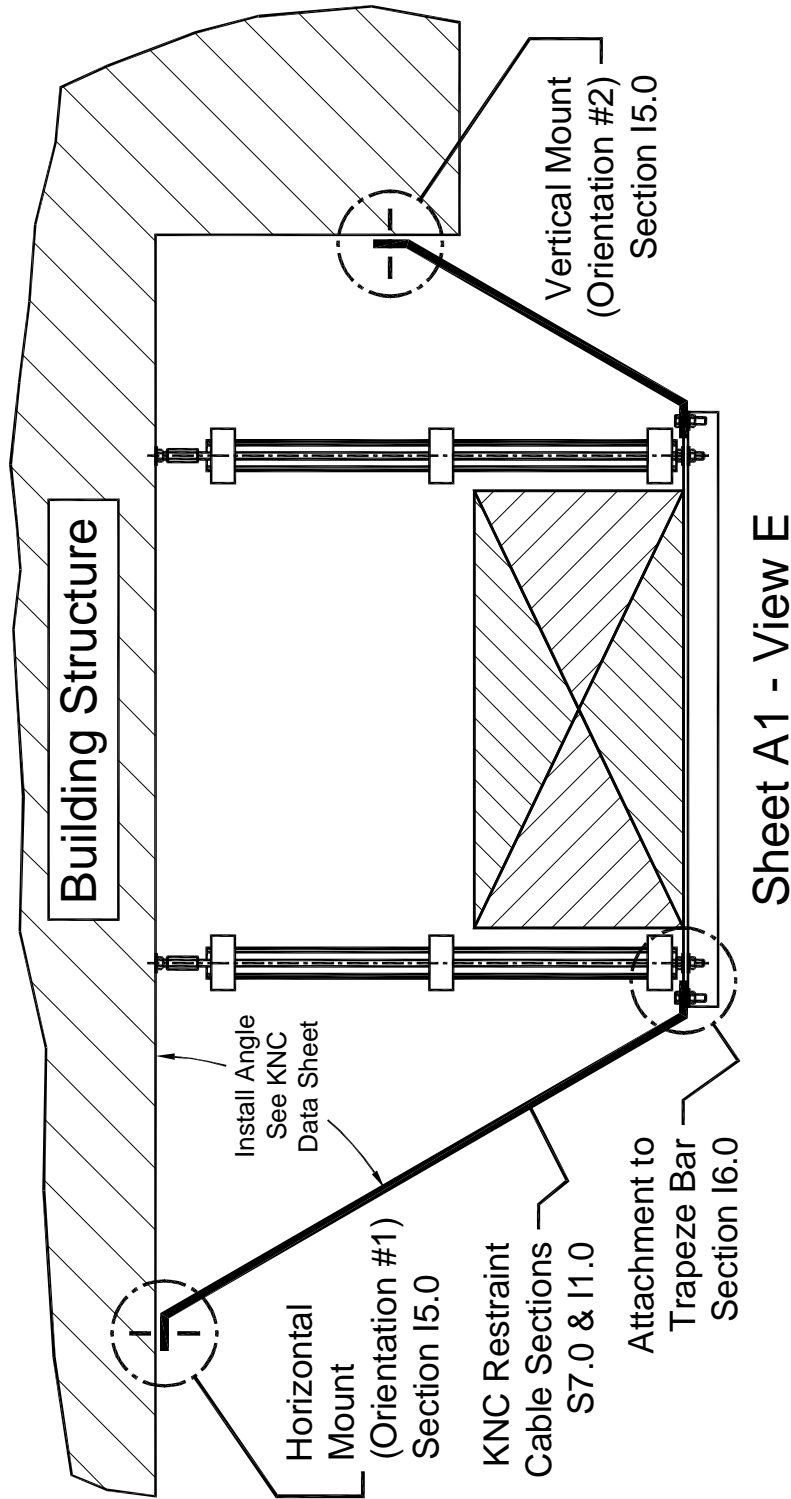


Figure I4-5; Transverse (T) Cable Restraint Schematic Arrangement for Supported Rectangular Duct – One Restraint at Each Hanger Location Directed Outward from the Trapeze Bar

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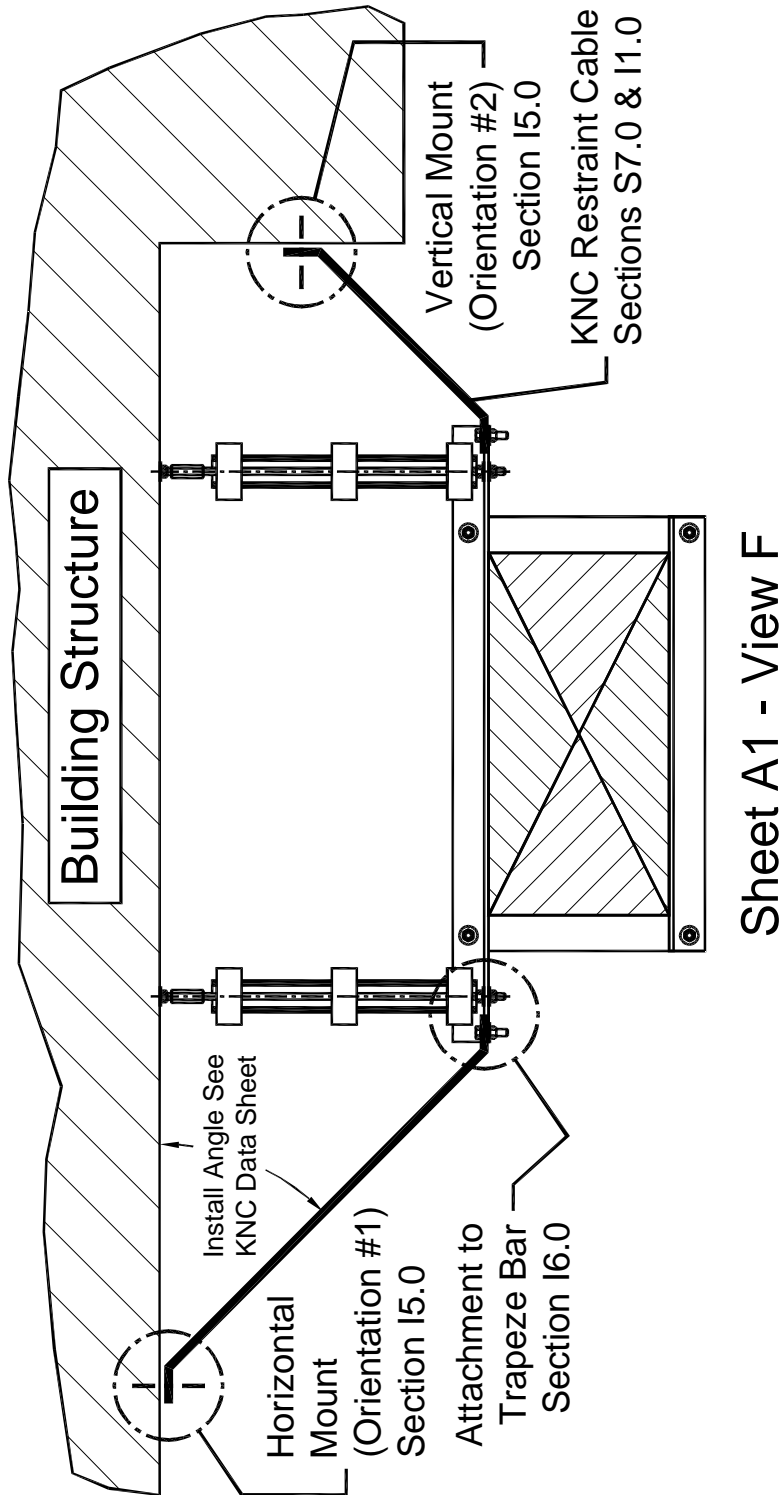
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Sheet A1 - View F

Figure I4-6; Transverse (T) Cable Restraint Schematic Arrangement for Suspended Rectangular Duct – One Restraint at Each Hanger Location Directed Outward from the Trapeze Bar

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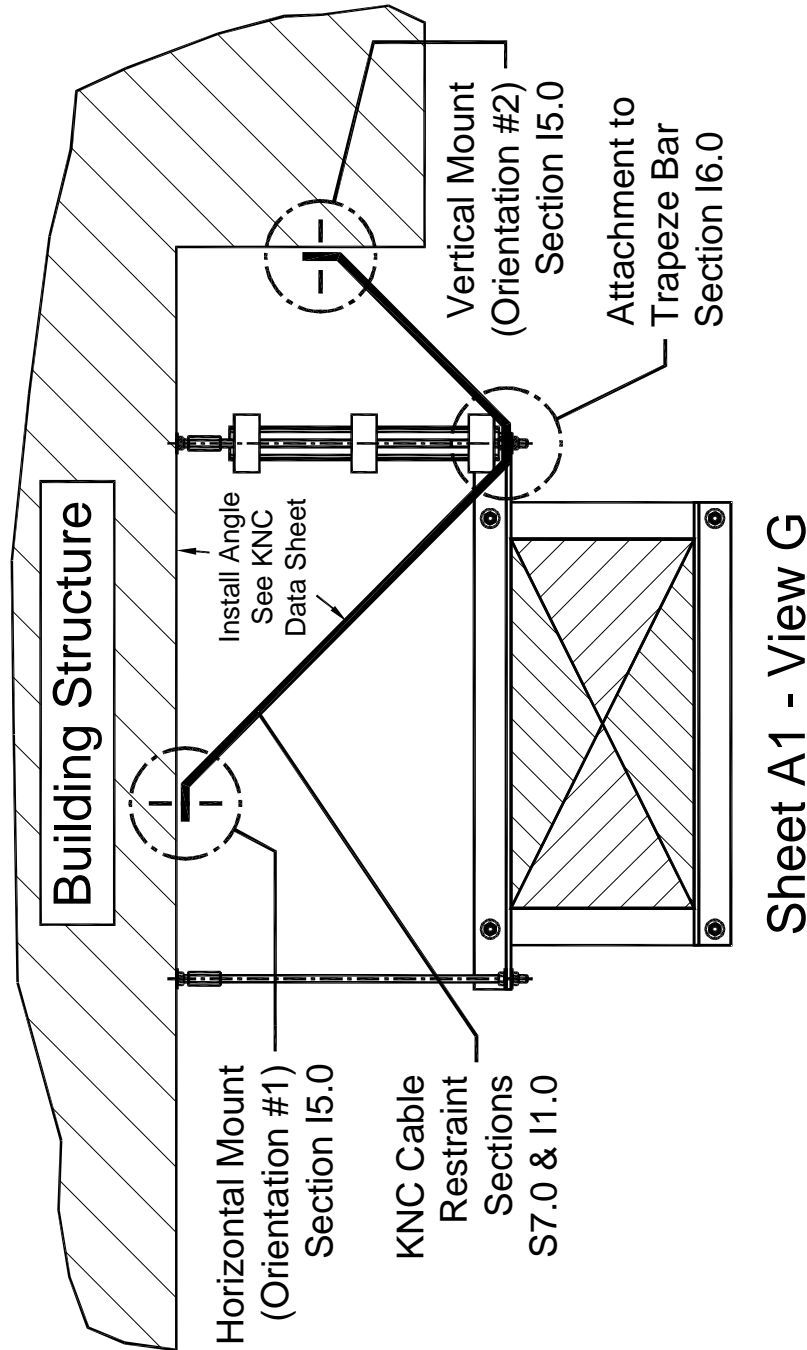


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Sheet A1 - View G

Figure I4-7; Transverse (T) Cable Restraint Schematic Arrangement for Suspended Rectangular Duct – Two Restraints at One Hanger Location with One Restraint Directed Inward & One Restraint Directed Outward from the Trapeze Bar

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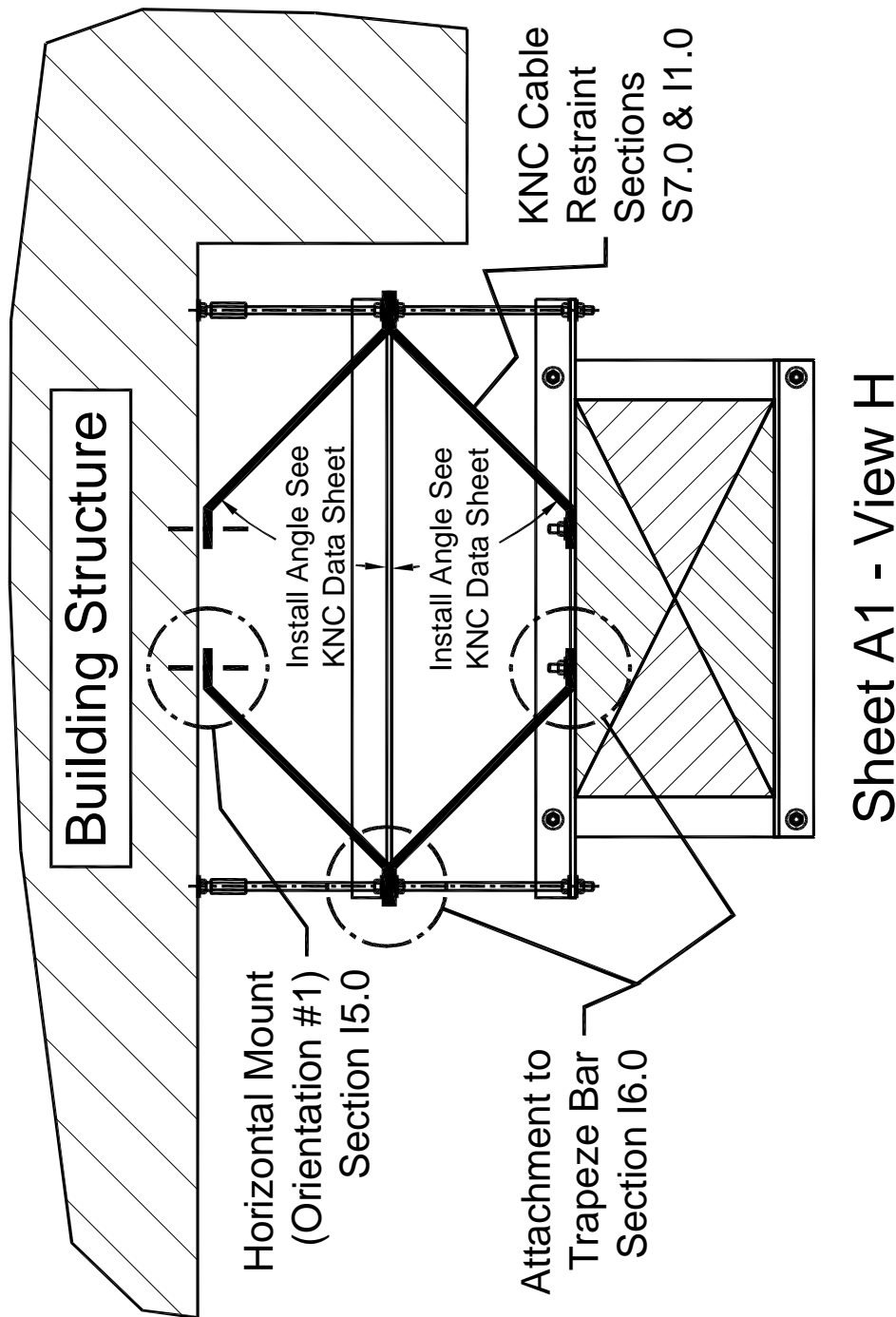


Figure I4-8; Transverse (T) Cable Restraint Schematic Arrangement for Suspended Rectangular Duct – Four Restraints Connected Through an Intermediate Trapeze Bar and Directed Inward from the Intermediate Trapeze Bar – An Extra Restraint Kit Is Required

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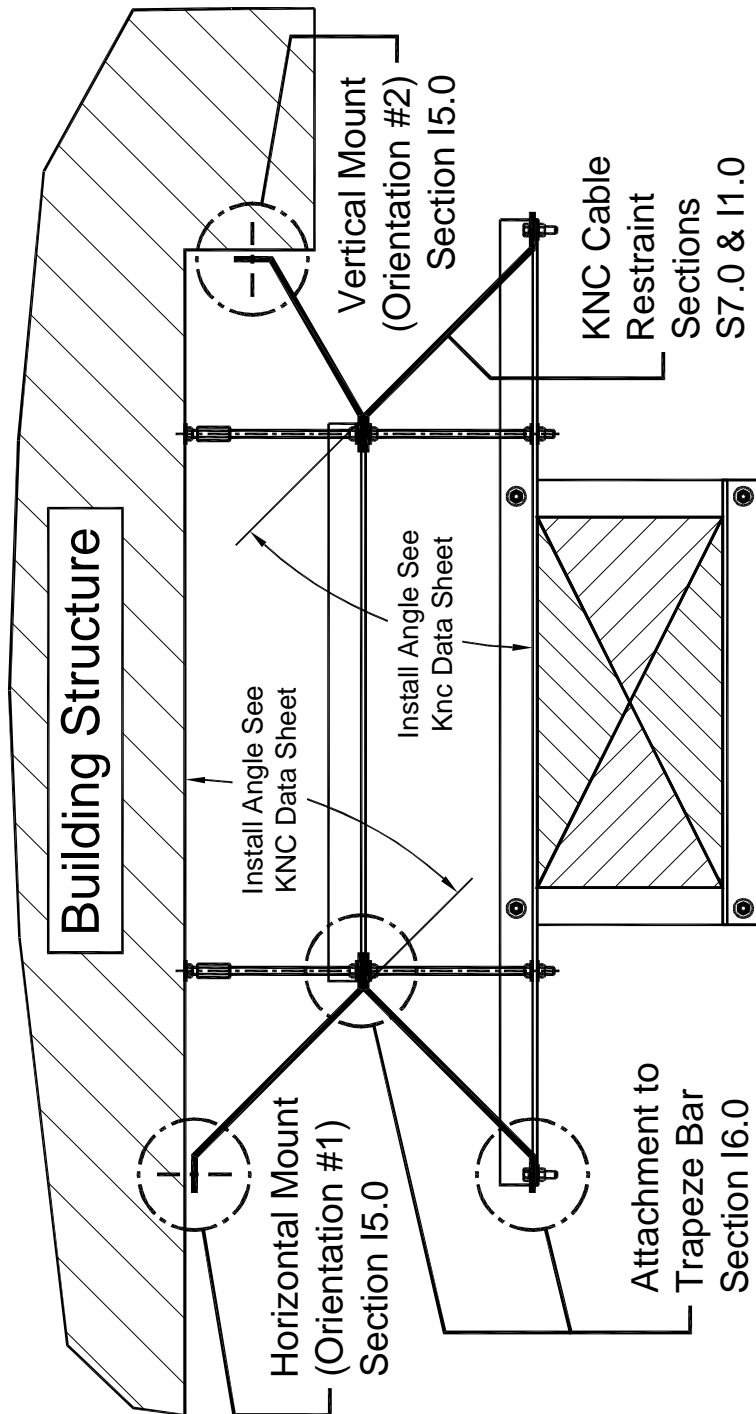
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Sheet A1 - View J

Figure I4-9: Transverse (T) Cable Restraint Schematic Arrangement for Suspended Rectangular Duct – Four Restraints Connected Through an Intermediate Trapeze Bar and Directed Outward from the Intermediate Trapeze Bar – An Extra Restraint Kit Is Required

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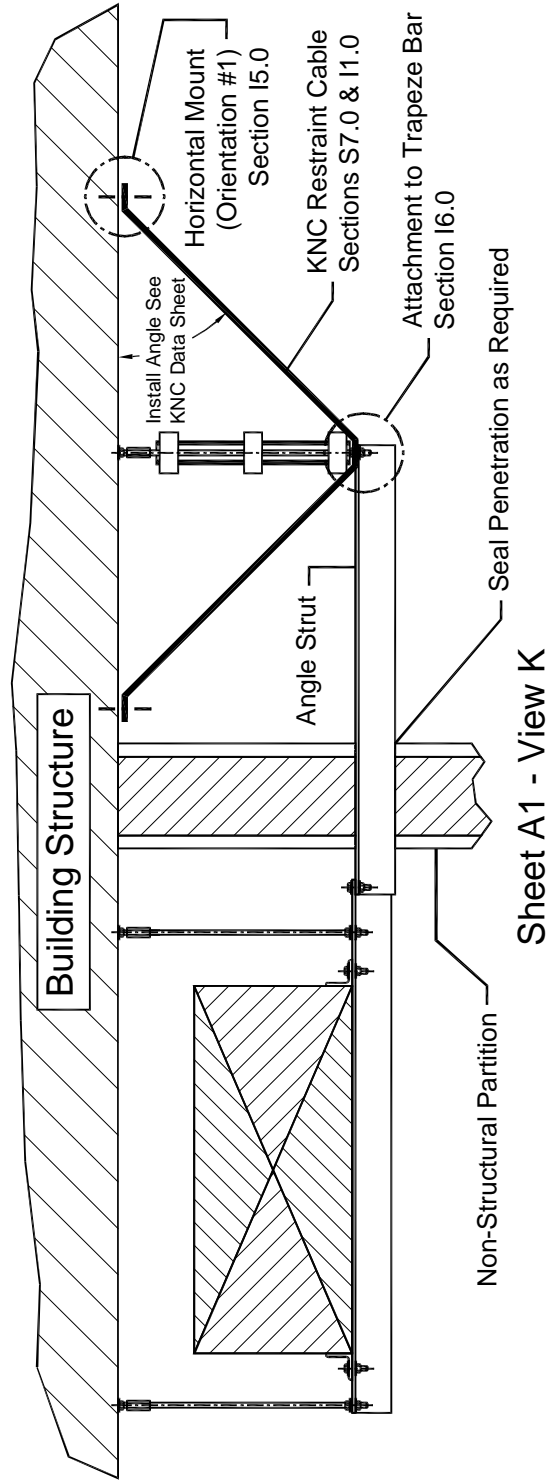


Figure I4-10; Transverse (T) Cable Restraint Schematic Arrangement for Supported Rectangular Duct – Restrained with an Angle Strut Passing Through a Non-Structural Wall Using One Pair of Restraint – Obtain Permission from the Structural Engineer & Architect before Penetrating the Wall

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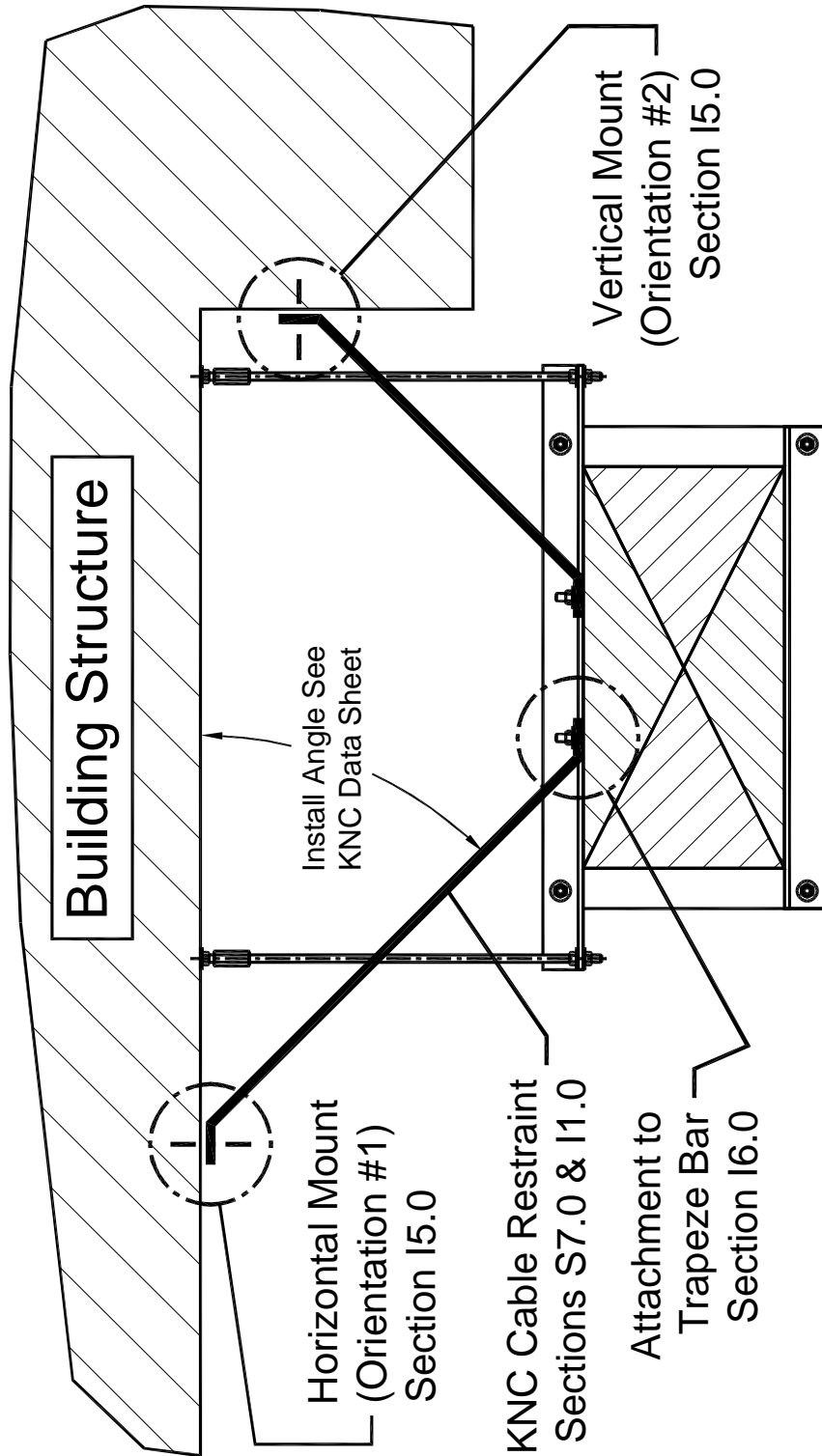


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Sheet A1 - View L

Figure I4-11; Transverse (T) Cable Restraint Schematic Arrangement for Suspended Rectangular Duct – Two Restraints Directed Outward and Attached At or Near the Center of the Trapeze Bar

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14.3 – Longitudinal (L) Cable Restraint Schematics for Rectangular and Square Duct:

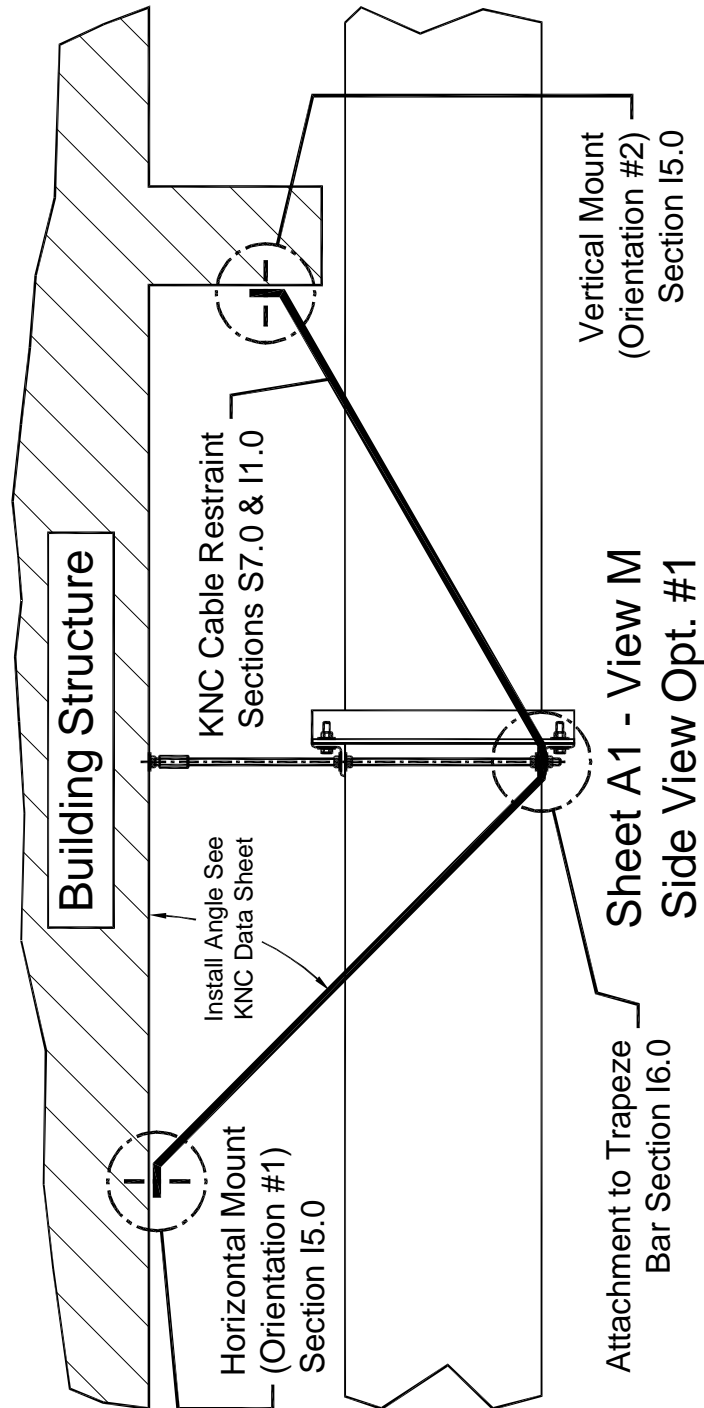


Figure I4-12: Longitudinal (L) Cable Restraint Schematic Arrangement for Rectangular Duct – Restraints Located on Each Side of the Bottom Trapeze Bar – An Extra Restraint Kit Is Required

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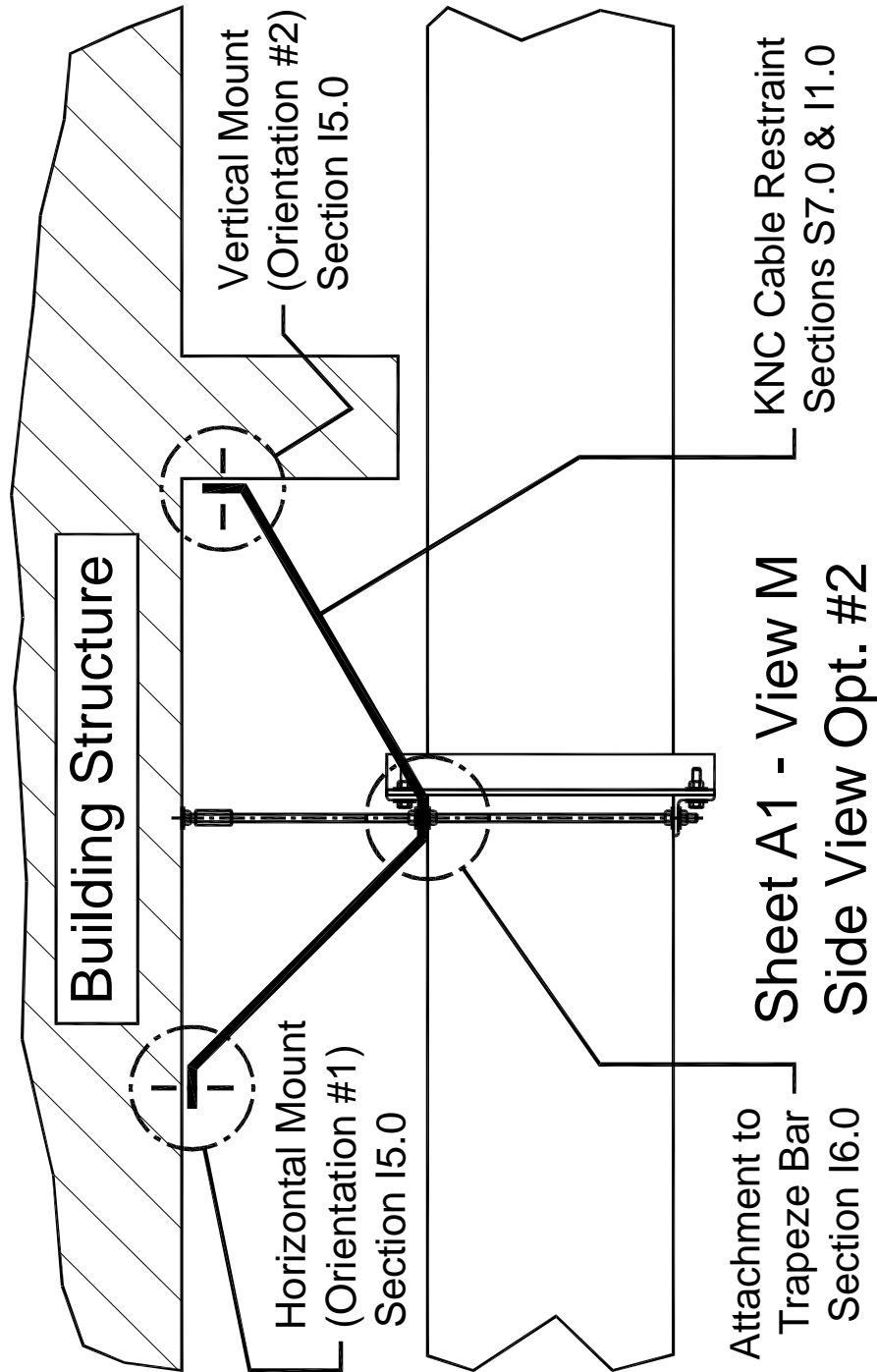


Figure I4-13; Longitudinal (L) Cable Restraint Schematic Arrangement for Trapped Rectangular Duct – 1.) Restraints Located in the Center of the Top Trapeze Bar or 2.) Restraints Located on Each Side of the Top Trapeze Bar – An Extra Restraint Kit Is Required

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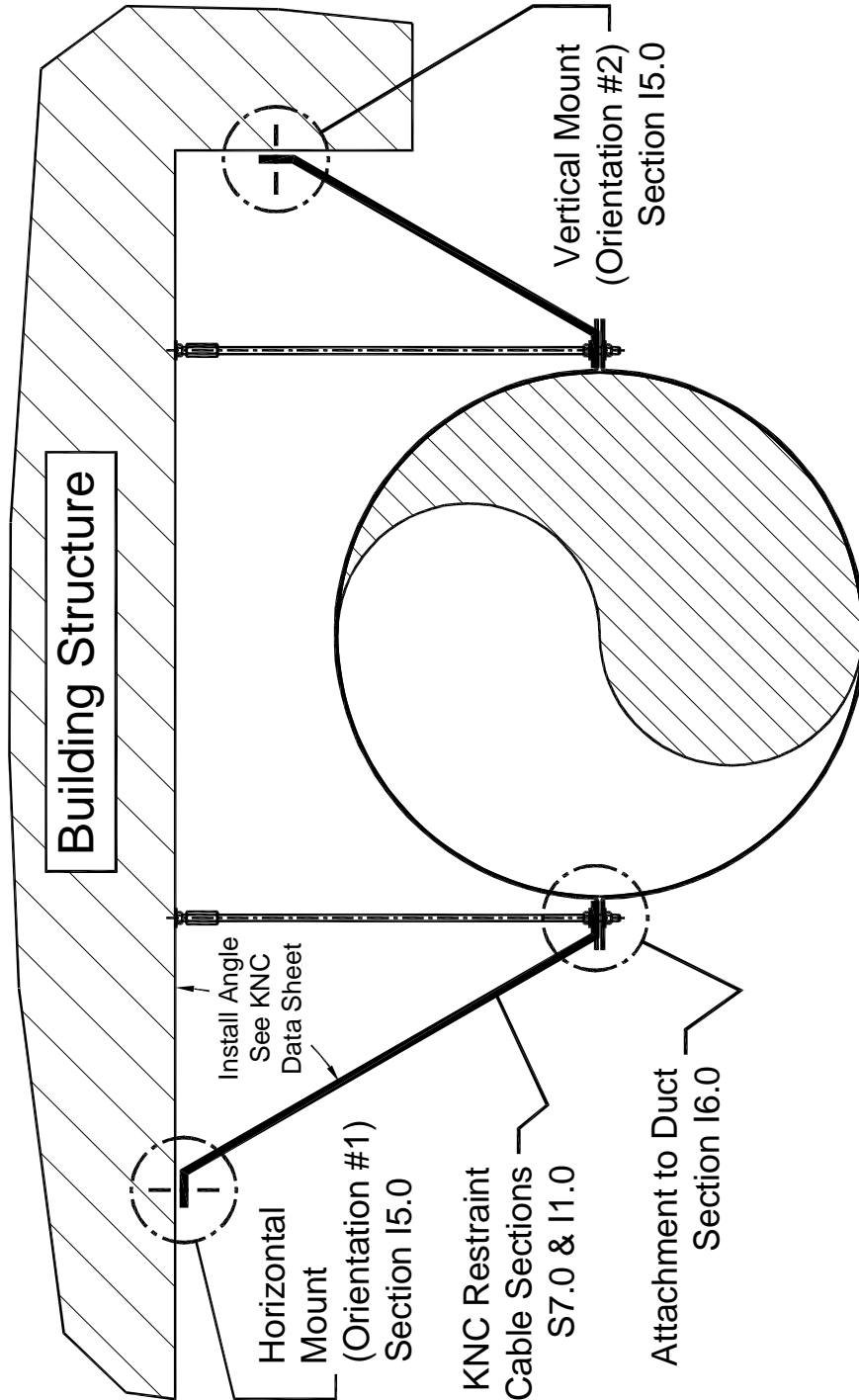
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14.4 – Transverse (T) Cable Restraint Schematics for Round Duct:



Sheet A1 - View N

Figure I4-14; Transverse (T) Cable Restraint Schematic Arrangement for Round Duct Supported by Two Hanger Rods – One Restraint at Each Hanger Location Directed Outward

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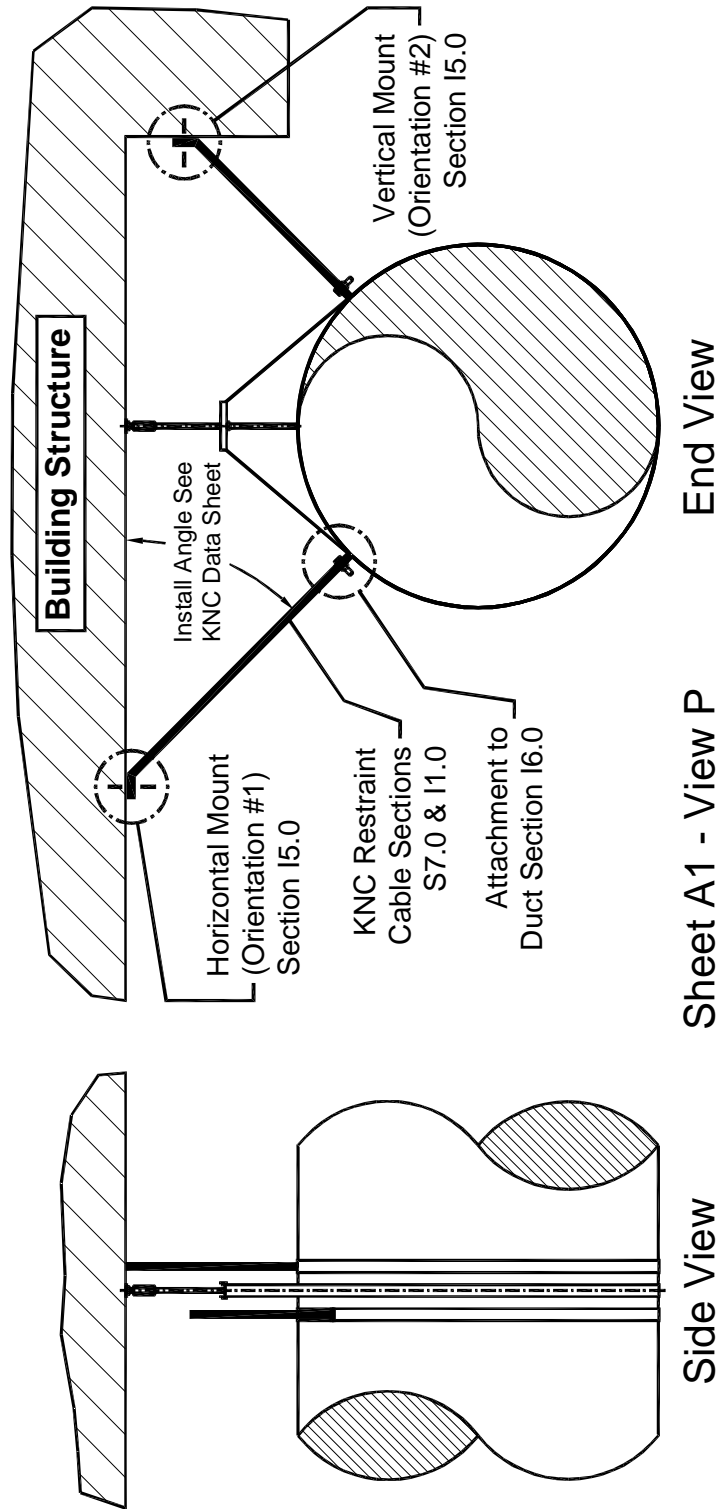
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End View

Sheet A1 - View P

Side View

Figure I4-15; Transverse (T) Cable Restraint Schematic Arrangement for Round Duct Supported by One Hanger Rod – Two Restraints Adjacent to Hanger Rod Attached to Band Clamps

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14.5 – Longitudinal (L) Cable Restraint Schematics for Round Duct:

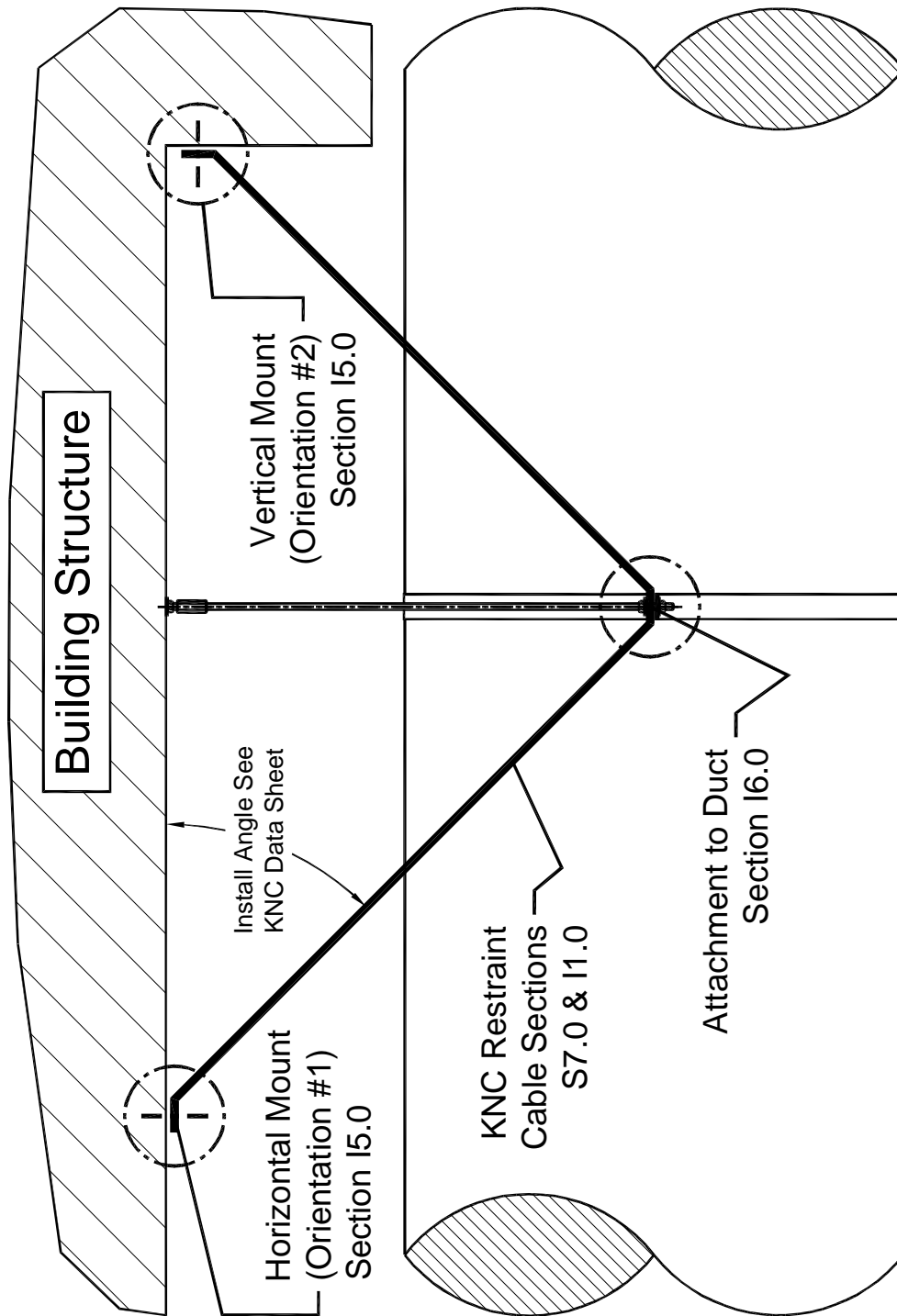


Figure 14-16; Longitudinal (L) Cable Restraint Schematic Arrangement for Round Duct Supported by Two Hanger Rods – Two Restraints at Each Hanger Location – An Extra Restraint Kit Is Required

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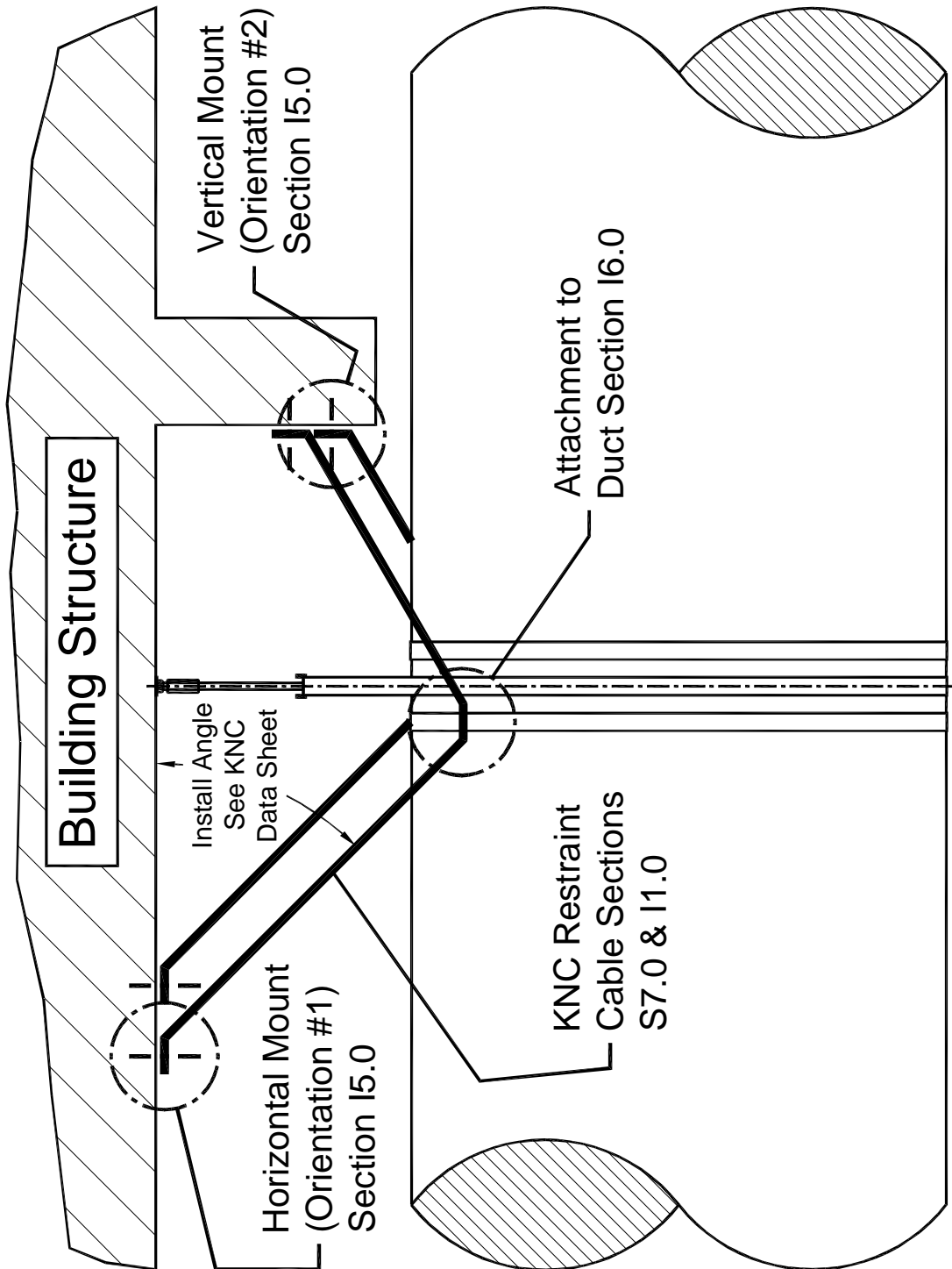


Figure I4-17; Longitudinal (L) Cable Restraint Schematic Arrangement for Round Duct Supported by One Hanger Rod – Two Restraints Adjacent to and on Each Side of the Hanger Rod Attached to Band Clamps – An Extra Restraint Kit Is Required

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14.6 – Transverse (T) Cable Restraint Schematics for Floor or Roof Mounted Duct:

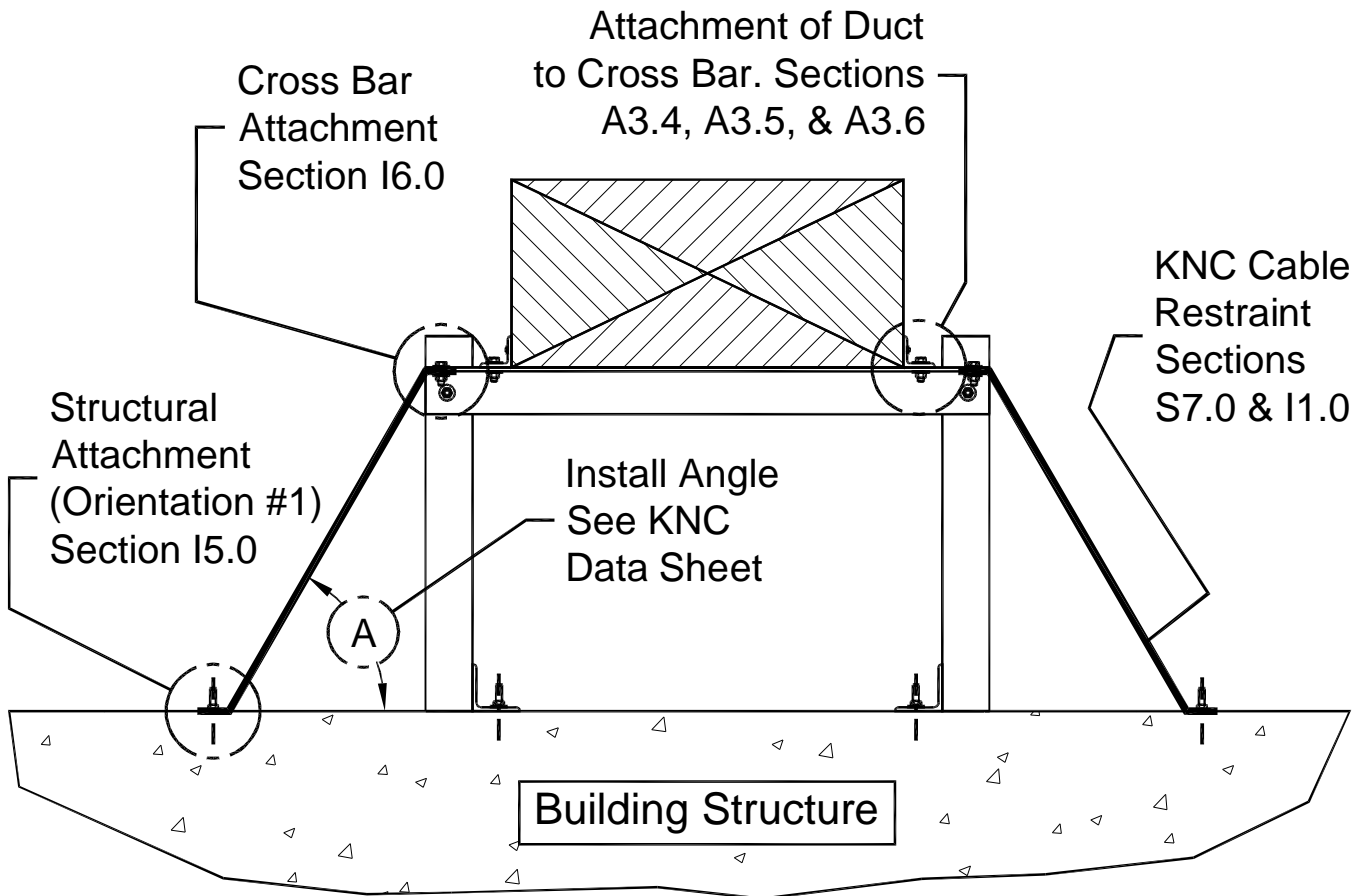


Figure 14-18; Transverse (T) Cable Restraint Schematic Arrangement for Floor or Roof Mounted Duct – One Restraint Attached to Each Side of the Cross Bar at the Vertical Legs and Directed Outward from the Floor Stand

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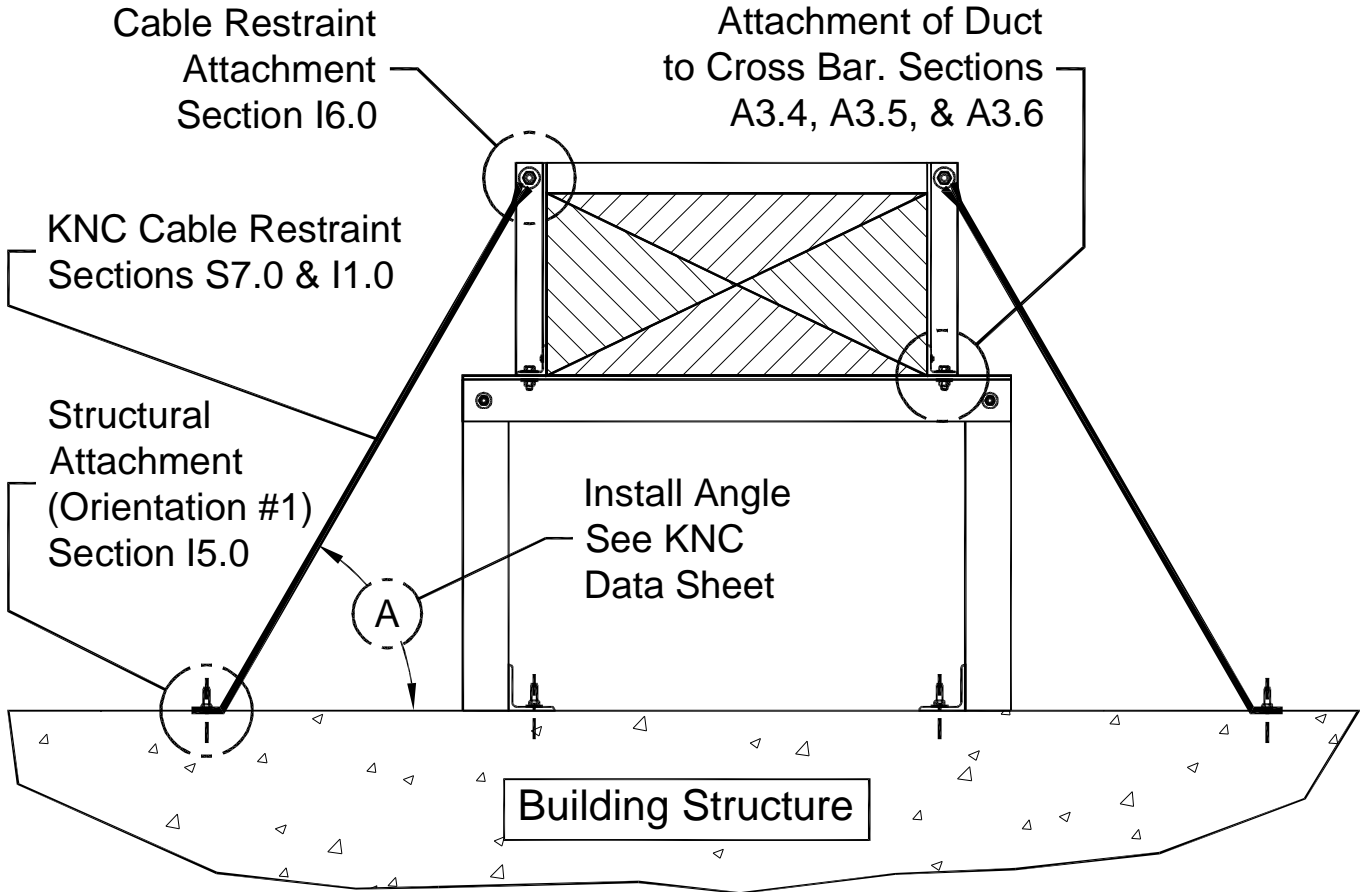


Figure I4- 19; Transverse (T) Cable Restraint Schematic Arrangement for Floor or Roof Mounted Duct – One Restraint Attached to Each Side of the Top of the Duct and Directed Outward from the Floor Stand

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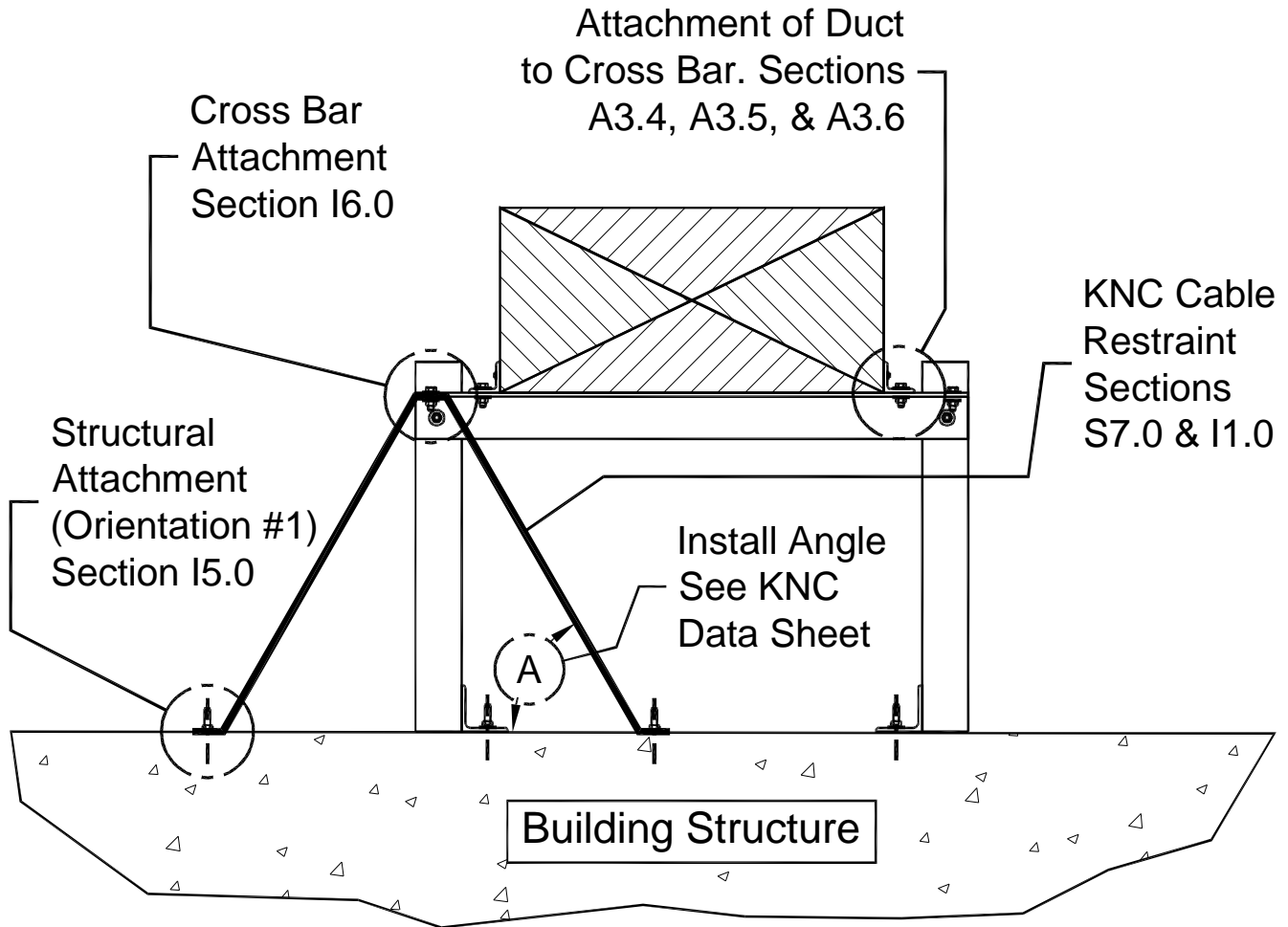


Figure I4-20; Transverse (T) Cable Restraint Schematic Arrangement for Floor or Roof Mounted Duct – Both Restraints Attached to One Side of the Cross Bar at the Vertical Leg

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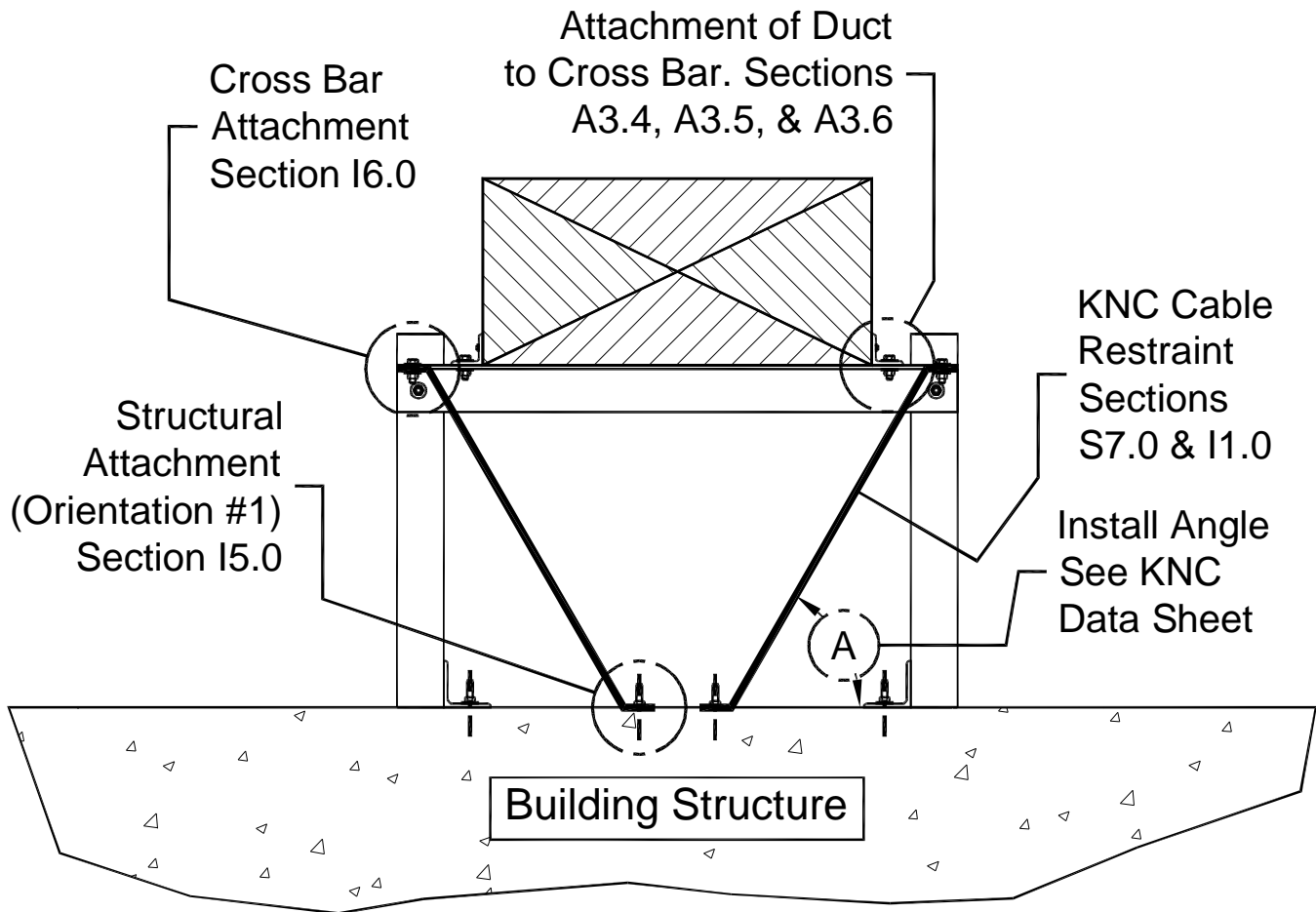


Figure I4-21; Transverse (T) Cable Restraint Schematic Arrangement for Floor or Roof Mounted Duct – One Restraint Attached to Each Side of the Cross Bar at the Vertical Legs and Directed Inward

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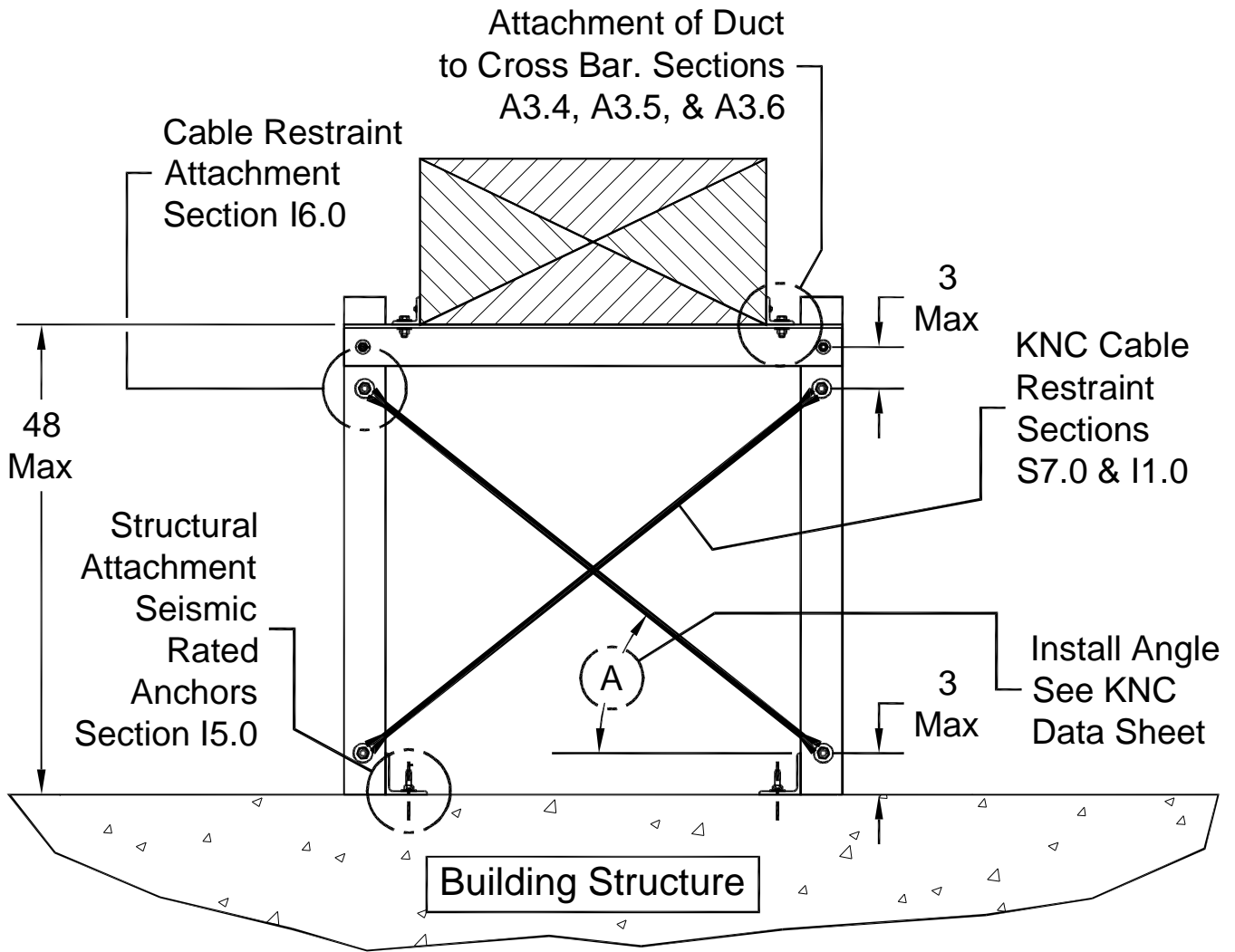


Figure 14-22; Transverse (T) Cable Restraint Schematic Arrangement for Floor or Roof Mounted Duct – Two Restraints Attached to the Vertical Legs Acting as Cross Braces – The Anchors Attaching the Stand to the Floor Must be Seismically Rated Cracked Concrete Anchors with a Current ICC-ESR Number

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14.7 – Longitudinal (L) Cable Restraint Schematics for Floor and Roof Mounted Duct:

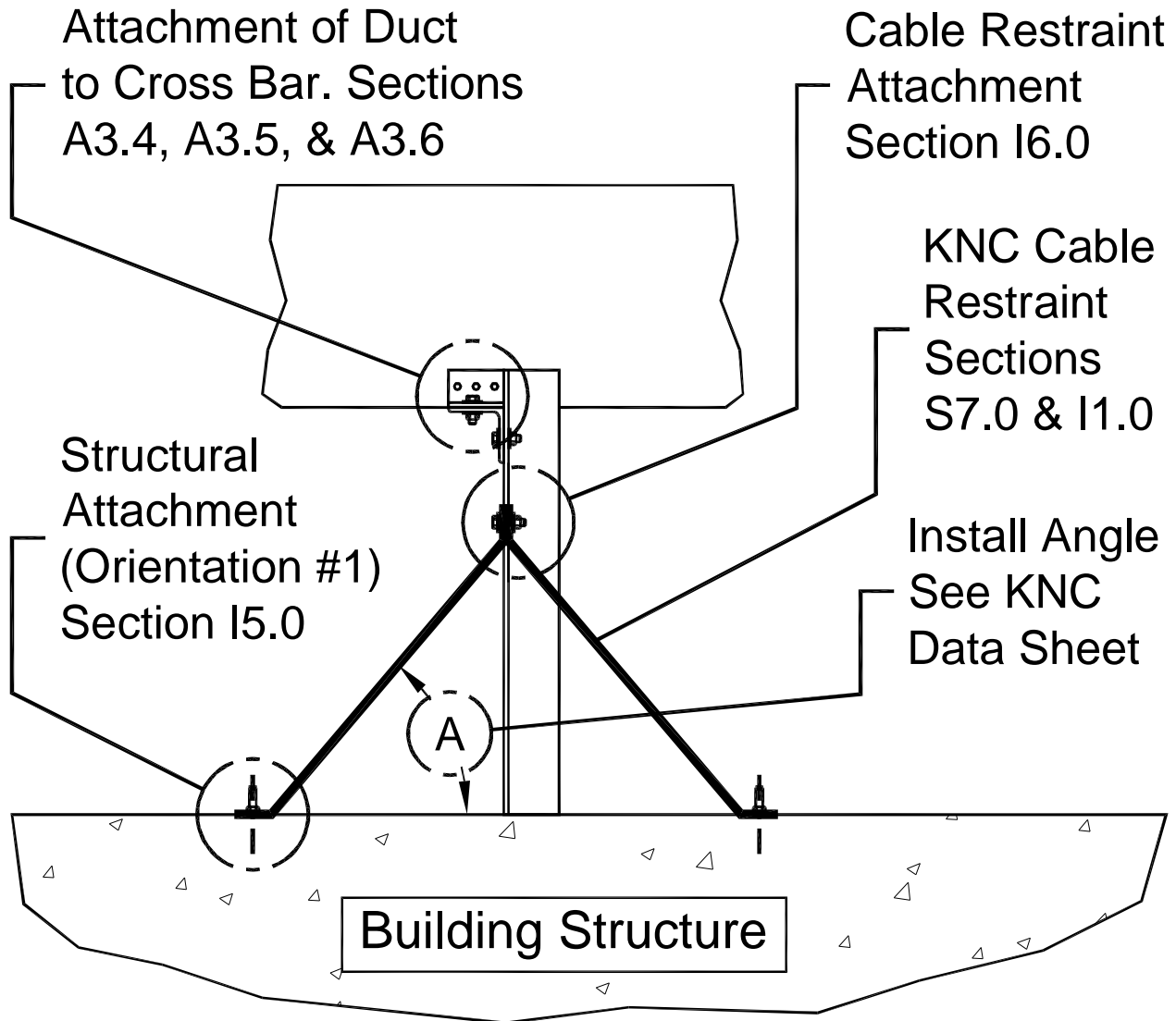


Figure I4-23; Longitudinal (L) Cable Restraint Schematic Arrangement for Floor or Roof Mounted Duct – Restraints Attached to the Floor Stand or Support

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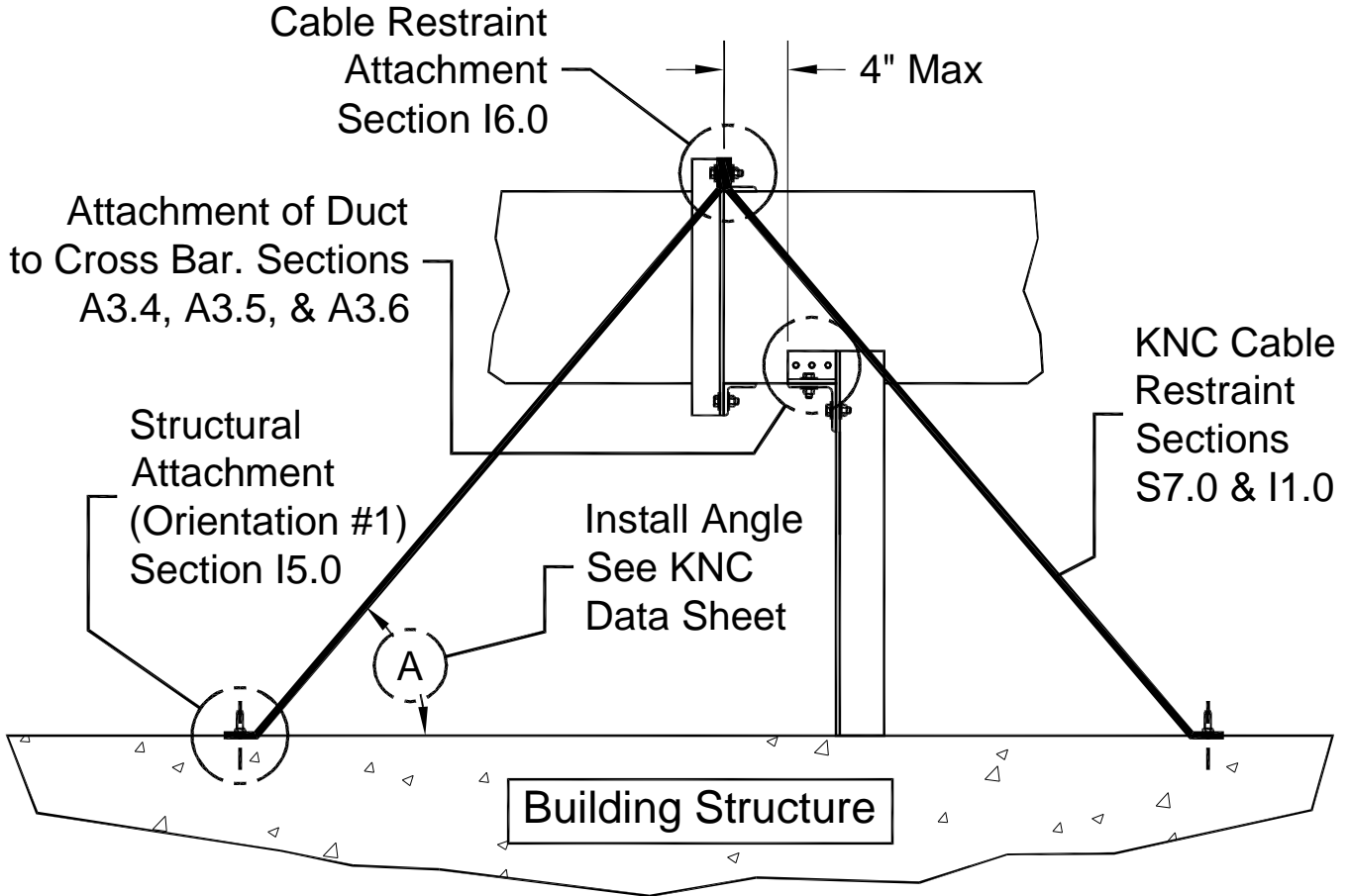


Figure I4-24; Longitudinal (L) Cable Restraint Schematic Arrangement for Floor or Roof Mounted Duct – Restraints Attached to the Duct

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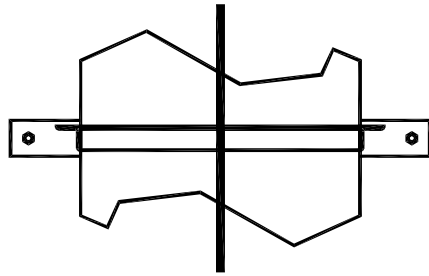
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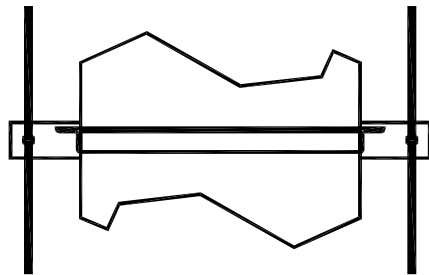
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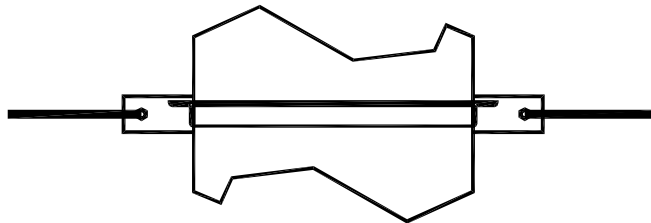
14.8 – Transverse (T), Longitudinal (L), and Combined (TL) Restraint Plan View Arrangements for Ducts:



Sheet A2 - View A
Longitudinal (L)
Restraint
Plan View
Option #2



Sheet A2 - View A
Longitudinal (L)
Restraint
Plan View
Option #1



Sheet A2 - View A
Transverse (T)
Restraint
Plan View

Figure I4-25; Transverse (T) and Longitudinal (L) Basic Plan View Restraint Arrangements for Duct
– Note: The Longitudinal (L) Restraint Cables in Longitudinal Restraint Options #1 & #2 are Arranged to Prevent Twisting of the Duct – An Extra Restraint Kit Is Required for Longitudinal (L) Restraint Option #1

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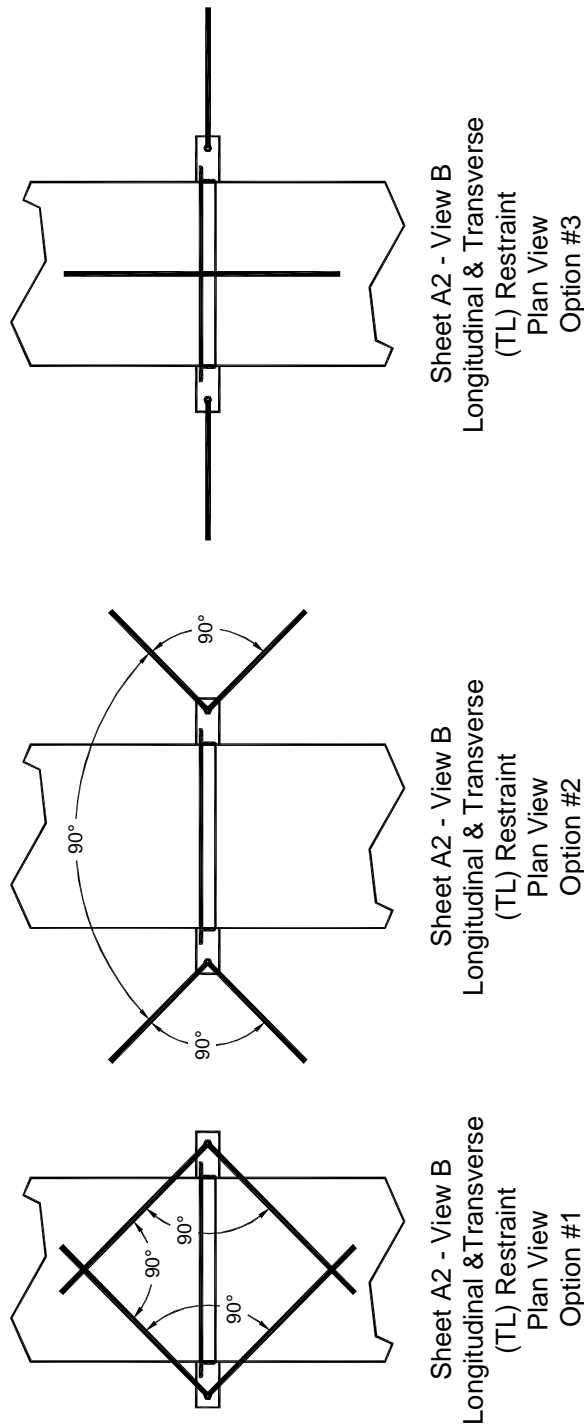


Figure I4-26; Combined Transverse and Longitudinal (TL) Basic Plan View Restraint Arrangements for Duct – Note: The Restraint Cables in Options #1, #2, & #3 are Arranged to Prevent Twisting of the Duct – An Extra Restraint Kit Is Required for Combined Transverse and Longitudinal (TL) Restraint Options #1 & #2

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14.9 – Attachment of Seismic Restraints to Ducts and Trapeze Bars:

It is necessary to have a verifiable positive load path between the duct and the building structure. Duct that is restrained in accordance with the SMACNA “Seismic Restraint Manual – Guidelines for Mechanical Systems” will have this verifiable load path. The methods recommended in this manual by SMACNA are compatible with most forms of sheet metal duct construction techniques, and the seismic requirements of many locations. However, there will be some projects whose seismic requirements exceed the limits published by SMACNA. For these situations, fasteners used to attach the duct to the trapeze bars which are restrained, or the seismic restraints to the duct may be selected based on the information found in Appendices A3.4, A3.5, and A3.6. These fastener selections are based on the Horizontal Force Class for the duct being restrained. This system of Horizontal Force Classes is discussed in Section S7.0 of this manual.

14.10 – Summary for Seismic Cable Restraints for Duct:

1. The schematics and arrangements presented in this section are intended to be used as guidelines for installation of seismic restraints for duct. They do not represent fully engineered designs for specific projects. The specific design details of each installation are the responsibility of the design professional of record for the systems that are being installed.
2. A **minimum of two seismic restraint cables acting 180° apart** are required for each transverse and each longitudinal seismic restraint location.
3. When locating and specifying seismic restraints for a project, Kinetics Noise Control will **always** list the minimum required number of seismic restraint kits for each restraint location. The actual installation circumstances may require additional restraint kits at certain locations particularly for trapeze supported duct or round duct supported by two hanger rods to balance the restraint forces from side-to-side on the duct.
4. Hangers and/or hanger rods at seismic restraint locations must be rigid members such as all thread rods in order to be able to transmit seismic uplift reaction forces from the duct to the building structure.

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5. Hangers, trapeze bars, and hanger rods at seismic restraint locations must be properly sized and specified by the design professional of record for the system to handle the expected seismic forces as well as the dead weight loads from the duct.
6. Attachment of seismic restraints to the duct, hangers, trapeze bars, and hanger rods must be approved by the design professional of record for the system.
7. For floor or roof mounted duct where the restraints are installed as shown in Figure I4-22, the anchors attaching the stand or support to the building structure form part of the seismic load path. As such, these anchors must be seismically rated anchors for use in cracked concrete, and must have a current ICC-ESR number.
8. Attachment of seismic restraints to the building structure must be approved by the structural engineer and/or the architect of record.

