

## Floor Mounted Equipment Primer

### Introduction:

This section will deal with the basics of the Kinetics Seismic Certification analysis for floor mounted equipment and the basic location and placement of the required isolators or restraints around the perimeter of the equipment. Also, there will be a general discussion concerning the required number and size of fasteners at each isolator or restraint location.

We will begin the discussion with seismic isolators and restraints that have three axis restraint elements. Table D5.1.1-1 is a listing of the common isolator and restraint models having tri-axial restraints offered by Kinetics Noise Control.

**Table D5.1.1-1: Typical Kinetics Tri-axial Seismic Isolator and Restraint Models.**

Isolator Models	Restraint Models
FHS	HS-5
FLS	HS-7
FLSS	KSMS
FMS	FMS
KRMS	-----

### Kinetics Seismic Certification Analysis Program:

Figure D5.1.1-1 shows a typical arrangement for these types of devices around a typical piece of equipment. The piece of equipment in Figure D5.1.1-1 may be a generator on an inertia base located on a concrete housekeeping pad. The Kinetics Seismic Certification analysis program calculates the code values for horizontal and vertical seismic forces acting on the equipment. These seismic forces are applied at the center of gravity (**C.G.**) of the equipment. The horizontal seismic force may come from any direction. So, the program will cycle through a full **360°** to determine the worst case loading condition for the isolators or restraints. Then the program will compute the forces acting at each isolator or restraint location, and then compare these values to the allowable limits for the selected isolator or restraint model and size. These allowable limits are based on the strength of the isolator or restraint components as well as the strength of the attachment of the isolator to the structural steel framing of the building. One half of the lower of these two values then defines the allowable limit for the isolator or restraint. If the isolator or restraint is to be attached to concrete, the concrete anchors are evaluated separately. The Kinetics Seismic Certification program will print out the safety factor for each isolator or restraint,

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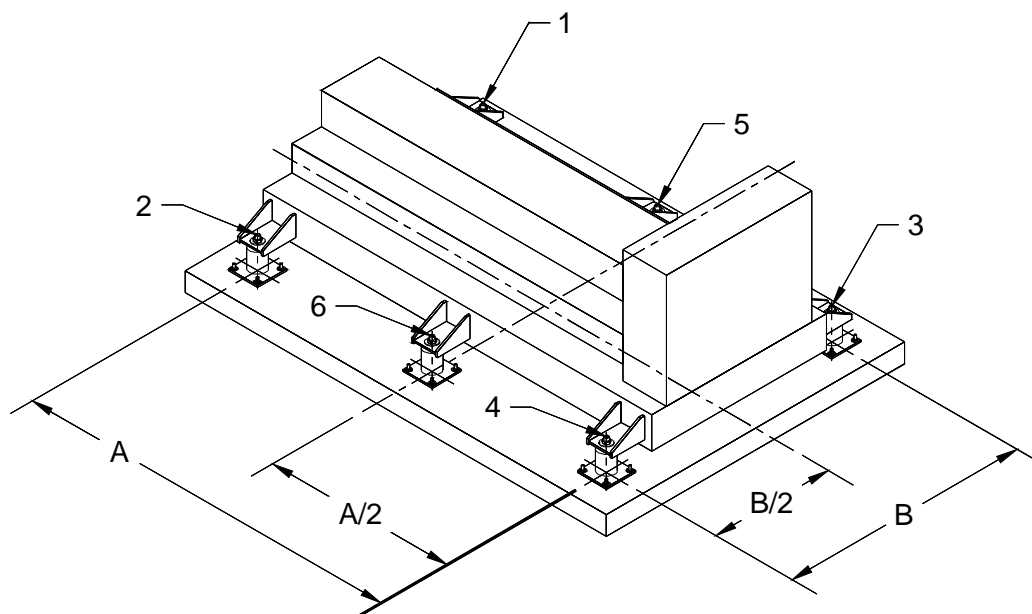
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the safety factor for the bolts required to attach the isolator to the building's structural steel, and the safety factor for the concrete anchors that fit the holes in the isolator or restraint mounting plate. Also included in the information will be the number of bolts or anchors required for each isolator or restraint location.

Occasionally the anchorage to concrete is insufficient when using the anchor size, number, and spacing provided by the standard base plate on the isolator or restraint. In these cases the Kinetics Seismic Certification program will recommend a standard oversized base plate to be used with the isolators/restraints. For a discussion on the Kinetics Noise Control oversized base plates see Documents D5.2.1 and D5.2.2.



**Figure D5.1.1-1: Typical Equipment and Isolator or Restraint Layout.**

**Isolator or Restraint Locations:**

The isolator or restraints are located on the geometric center lines of the equipment as indicated in Figure D5.1.1-1. On the Kinetics Seismic Certification sheet there is a schematic of the plan view of the equipment showing the general isolator or restraint locations. An example of this schematic is shown in Figure D5.1.1-2. The **ATTACHMENT POINT** numbers in Figure D5.1.1-2 correspond to the isolator or restraint numbers in Figure D5.1.1-1. Isolators or restraints **5** and **6** in Figure D5.1.1-1 are represented by the unnumbered **ATTACHMENT POINTS** in Figure D5.1.1-2. Note that the odd numbered isolators or restraints are always on one side of the equipment, and the even numbered Isolators or restraints are on the other. If there are more than three pairs of isolators or restraints, they should be spaced as evenly as possible along the length of the equipment between pair **1 & 2**, and pair **3 & 4** starting with pair **5 & 6** closest to pair **1 & 2**. This is

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further illustrated in Figures D5.1.1-3 through D5.1.1-5. These figures represent the plan view of a typical air handling unit that is restrained with Kinetics Noise Control Model **KSMS Seismic Equipment Brackets**. In these figures the terms  $L$  and  $W$  are the overall length and width of the equipment respectively. Dimensions  $A$  and  $B$  are the dimensions that establish the isolator/restraint locations. The variable  $N$  represents the number of isolators/restraints.

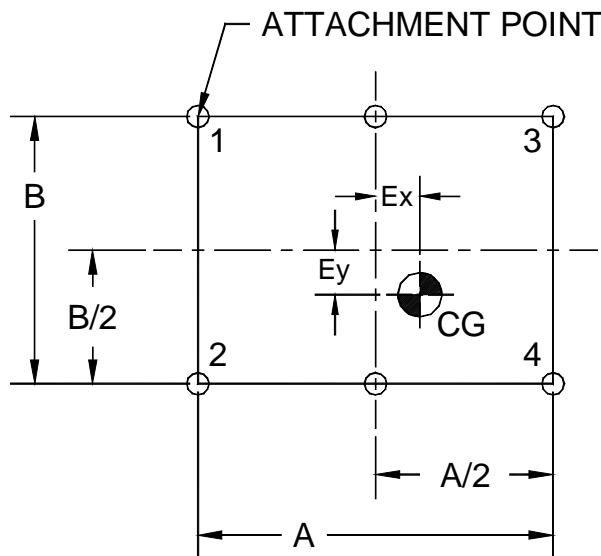


Figure D5.1.1-2: Seismic Certification Isolator or Restraint Location Schematic.

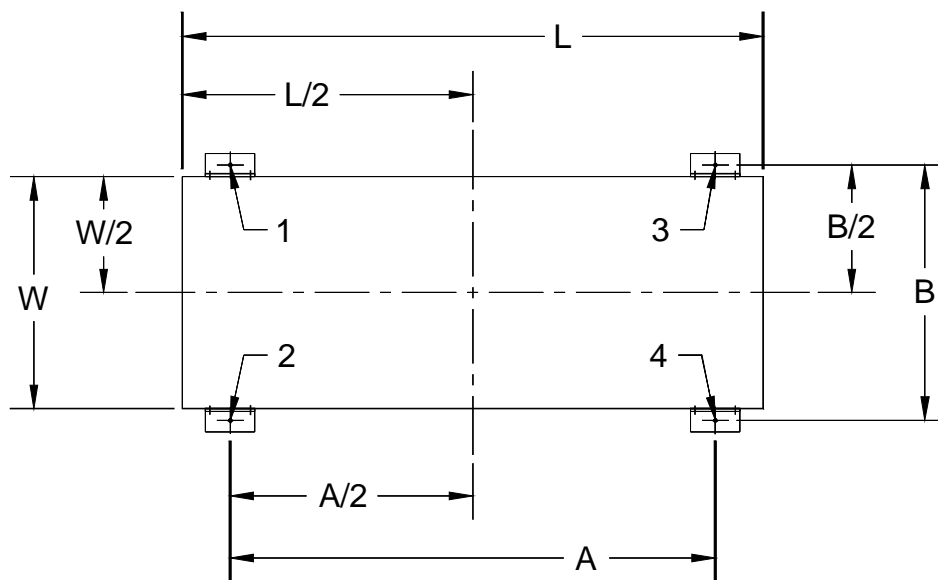


Figure D5.1.1-3: Typical of Four Isolator or Restraint Locations.

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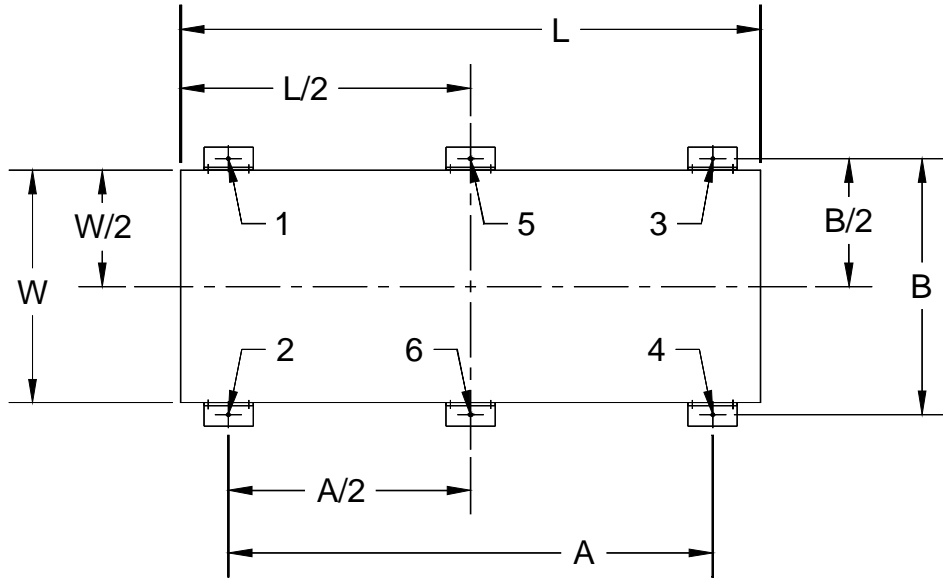


Figure D5.1.1-4: Typical of Six Isolator or Restraint Locations.

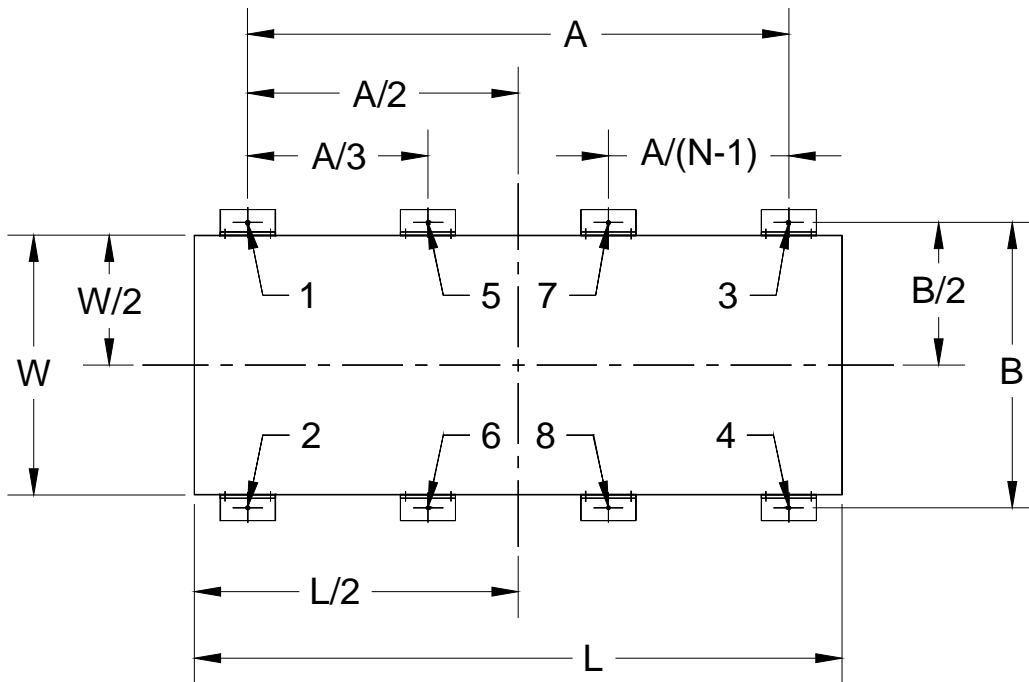


Figure D5.1.1-5: Typical of Eight or More Isolator or Restraint Locations.

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**Bolt/Anchor Number & Size and Weld Size & Length:**

In general, the number of bolts or anchors used to attach the isolator/restraint to the building structure and their size are specified on the Kinetics Seismic Certification sheet. The bolts may be **ASTM A-307, SAE Grade 2**, or better. In some instances, they may be **ASTM A-325, SAE Grade 5** or better. However care must be taken if ASTM A-490 or SAE Grade 8 bolts are used. These fasteners are made from highly heat treated steels and may behave in a brittle manner in service. The concrete anchors certified by Kinetics Noise Control for use with isolators and restraints sold by Kinetics Noise Control are Model **KCAB Seismically Rated Wedge – Type Anchors**, Model **KUAB Seismically Rated Undercut Type Anchors** and **KCCAB Seismically Rated Cracked Concrete Type Anchors**. The use of adhesive type concrete anchors or non-wedge type, or non-undercut type anchors are not currently approved by Kinetics Noise Control.

In lieu of proper documentation, the appropriate bolt or anchor size may be determined by the size of the holes in the mounting plate or the oversized base plate. Table D5.1.1-2 will be useful in obtaining the proper bolt or anchor size.

**Table D5.1.1-2: Bolt or Anchor Size vs. Hole Size**

Hole Size (in)	Bolt or Anchor Size (in)
5/16	1/4
7/16	3/8
9/16	1/2
11/16	5/8
13/16	3/4
15/16	7/8
1-1/16	1
1-3/16	1-1/8
1-5/16	1-1/4

Unless otherwise specified by Kinetics Noise Control, all of the mounting holes in the isolator or restraint mounting plate or the oversized base plate are to be used with the appropriate sized fastener to attach the isolator or restraint to the building structure.

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If the isolator or restraint is to be attached to building structure by welding, the weld size and the linear length as well approximate locations will be specified on the Kinetics Seismic Certification sheet. The welds specified will have the same strength as the proper number and type of bolts for the most highly loaded isolator or restraint.

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