HORIZONTAL/VERTICAL SEISMIC LOAD CAPACITY ENVELOPES (CONSTANT)

All seismically rated restraints that resist both horizontal and vertical loads and that are provided by Kinetics Noise Control represent their seismic capacity with a load envelope diagram. The vertical axis of the diagram is the vertical capacity of the restraint. The horizontal axis of the diagram is the horizontal capacity of the restraint. The area in between represents the maximum capacity for applications that have combined vertical and horizontal load components. Most applications involve combination of these forces. For restraints that resist horizontal loads only, a single number identifies their capacity.

For all seismic restraints and for most seismically rated isolators, the seismic capacity is independent of the load that the isolator might support. In some cases, however, the load being supported by the isolator can increase of decrease its seismic rating. This section addresses only those isolators where the restraint capacity is unaffected by the load.

Note: The load supported does not impact the capacity of most seismically rated isolators. Any seismically rated component that has its capacity illustrated as in the diagrams below are of the “constant” capacity type. If the seismic rating is load sensitive, the capacity diagrams will be more complex. Refer to section D4.3 for more information on these and on how to use the load diagrams appropriate to them.

On most diagrams, there are two curves. One represents the capacity of the restraint when through bolted and/or welded. This can also be assumed to be the capacity limit of the restraint device itself.

The other curve indicates the capacity of the restraint if bolted to concrete. This will be equal to or less than the through bolted capacity and it includes reductions that address the limitations that must be applied to anchors when the restraint is attached “as is” to a concrete slab. It should be noted that the concrete anchorage capacity can increase up to the limit of the through bolted capacity with the addition of optional oversized base plates and significantly larger anchors.

In some cases, a “family” of isolators or restraints may be identified on the same diagram. If this is the case, each curve will be labeled as to which family member it represents and where appropriate, both anchored to concrete and through bolted values will be shown.

In addition, not all components are intended to be anchored to concrete. If it is not appropriate for the given component, no associated curve will be published for it.

A typical set of curves is shown below.

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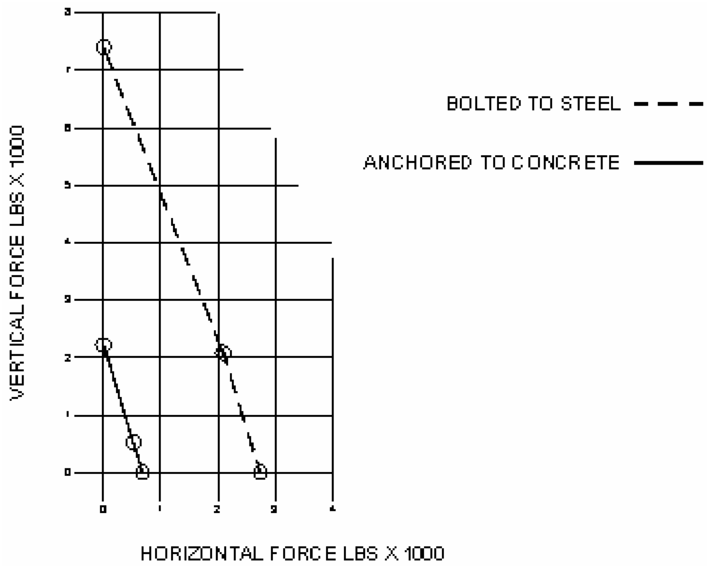

To use the diagram, the required capacity at the various restraint (or attachment) points for the application must be known (or computed). There are a number of ways to obtain these values. Some of these can be fairly simple but give very conservative values. Some are more complicated, but may substantiate the use of lower capacity attachment hardware. As part of a standard seismic analysis for given piece of equipment, Kinetics Noise Control provides these values for particular applications. ASHRAE offers guidance on alternate ways of computing these forces and there could well be other ways to do it that result in reasonable answers.

Some caution must be exercised though, as it is not as simple as dividing the total seismic force by the number or isolators to get a force per isolator (See also Section D1.3 of this manual).

Once the vertical and horizontal restraint capacity necessary has been determined, these values should be plotted on the diagram using the vertical force component for the y-variable and the horizontal force component for the x-variable. Shown below is a diagram with capacity requirement of 3500 lb vertical and 750 lb horizontal plotted on it. For our purposes, we will assume that the parameters used to calculate these values are “through bolted” parameters. (When using these charts, because the actual computed load requirement can vary depending on whether the final connection is to steel or concrete, it is critical to ensure that the load requirement used is appropriate to the anchorage type being considered. [Concrete anchorage forces compares to concrete allowables and through bolted forces compare to bolted allowables])

Note that the point falls between the “Anchored to Concrete” and “Bolted to Steel” curves. Because the point is inside the “Bolted to Steel” curve, this indicates two things. 1) The restraint itself is adequate for the application and, 2) if the application involves through

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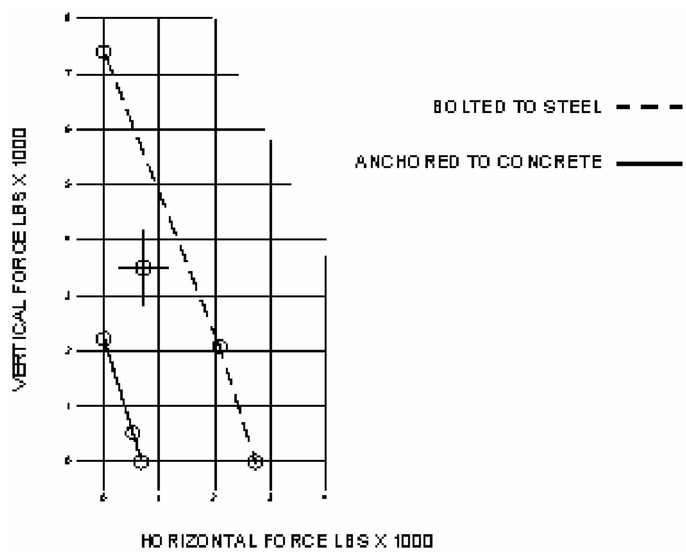
bolting the restraint to the structure, the restraint can be successfully applied “as is”.

If the point had fallen outside of the “Bolted to Steel” curve, the restraint device would have been inadequate in size for the application and a restraint with higher capacity would have to be selected.

If the force had been computed using “Anchored to Concrete” parameters, because the point falls outside of the anchored to concrete curve, it indicates that if connecting to concrete using post installed anchors, the restraint cannot be used “as is”. Since it does fall inside the “Bolted to Steel” curve however, it indicates that it could be fitted with an oversized baseplate and more (or larger) anchor bolts. If this oversized baseplate is sized to resist these forces, it offers a viable attachment option. Details on selecting an adequate oversized baseplates can be found in the Floor and Wall Mounted Equipment Chapter, Section D5.2.



If the point had fallen inside of the “Anchored to Concrete” curve, the restraint could have been used “as is” in the anchored to concrete application.

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