Vertical Pipe Run Restraint Arrangements

Vertical runs of piping need to be restrained in the same manner as horizontal runs. The anchorage provided for the riser system will normally, but not always, have enough capacity to resist the maximum axial seismic load. If anchors were selected based on simple deadweight loads and included little or no overload capacity, the possibility exists that they might have to be upsized to meet the seismic requirements. Because the seismic requirements would be low as compared to the support loads, upsizing anchors by one step is normally more than adequate to meet these requirements. The required capacity of lateral restraints (guides) would, however, be closely linked to the seismic forces.

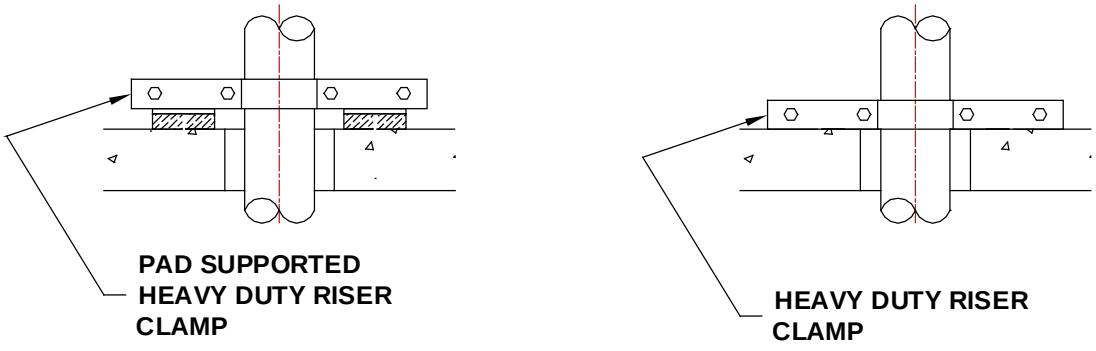
Cables or struts do not normally restrain riser systems. Instead their motion is controlled by special guide and anchor components. In non-seismic applications, these parts are put in place to limit the buckling factors that are generated in the piping by gravity factors. These are very similar to the forces generated in horizontally oriented piping by earthquakes.

Spacing for restraints on risers must meet the same maximum span condition that applies to horizontal runs, but in most instances the spacing used to place these items ignoring seismic concerns will meet this.

Although in conventional designs the spacing between the lateral restraints (or guides) will not normally be an issue, the capacity of the guides must be adequate to withstand the higher seismic forces. Applicable seismic forces for risers are the same as for horizontal runs and more detail on how to determine these can be found in chapter D4.

Typical Axial Restraint Arrangements

Below are illustrations for axial (only) pipe restraints. A simple riser clamp can act as an axial restraint. It need not be attached to the structure to perform the axial restraint function. The same basic arrangement will work for either non-isolated or pad-isolated systems and for attachment to concrete or steel. These do not offer any lateral restraint.



Concrete Supported Axial Restraint for Vertical Pipe Run

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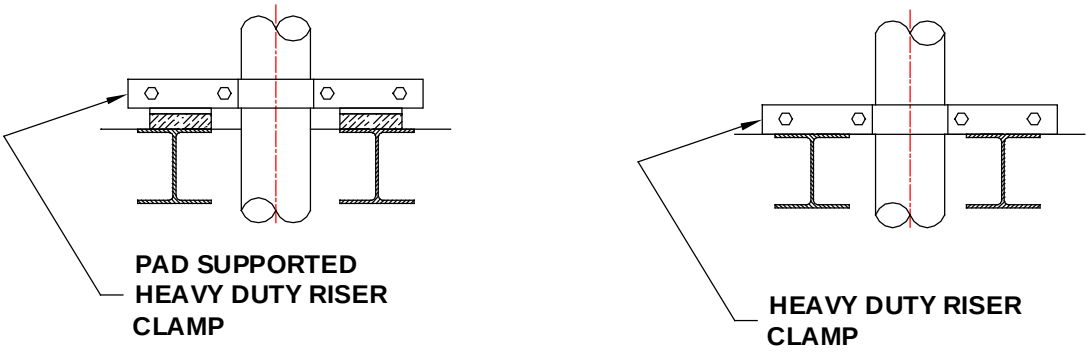
International: 614-889-0480
Fax: 614-889-0540
World Wide Web: www.kineticsnoise.com
Email: sales@kineticsnoise.com

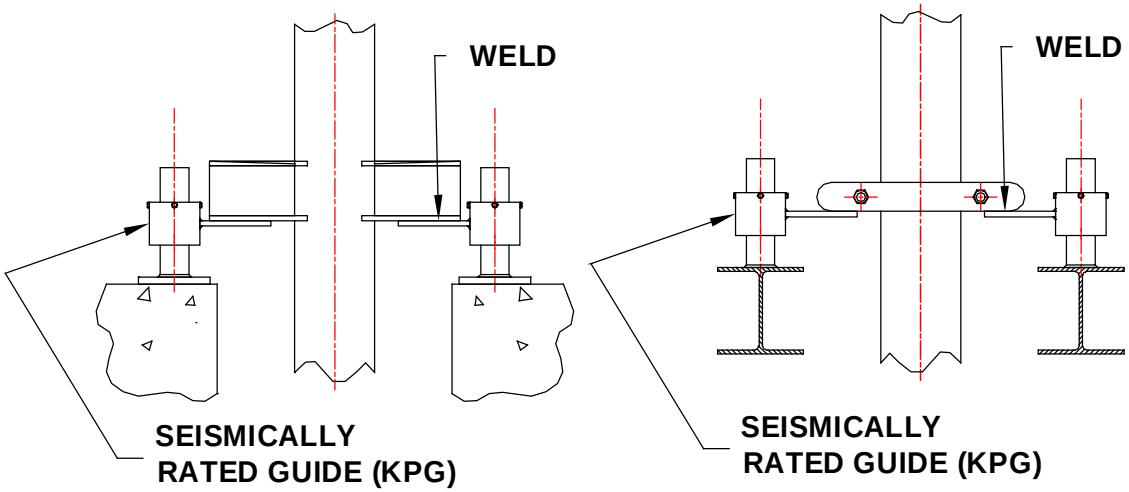


Steel Supported Axial Restraint for Vertical Pipe Run

Typical Lateral Restraint Arrangements

Pipe guides act as lateral restraints only and have a rated force capacity that is based on loads in the horizontal axis. These components do not offer any axial restraint capabilities.

There are two typical guide types. The first includes a component hard mounted to the structure, a mating portion hard mounted to the pipe, and a slip fit connection between the two. This is shown below.



Concrete-Supported Lateral Restraint (Guide) for Vertical Pipe Run

The second type is comprised of a frame with cushioned pads located on the perimeter that bear directly against the pipe itself. This eliminates the need for a direct connection to the pipe. However, if the pipe is insulated, it does require that the insulation be adequately hardened or that a hard shield be provided to prevent damage to the insulation under seismic loads. Typical concrete slab and steel structural examples are shown below.

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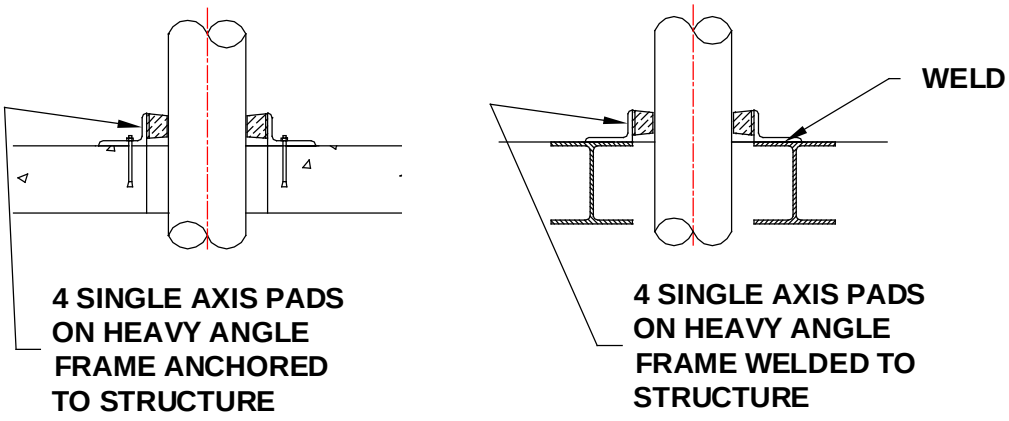
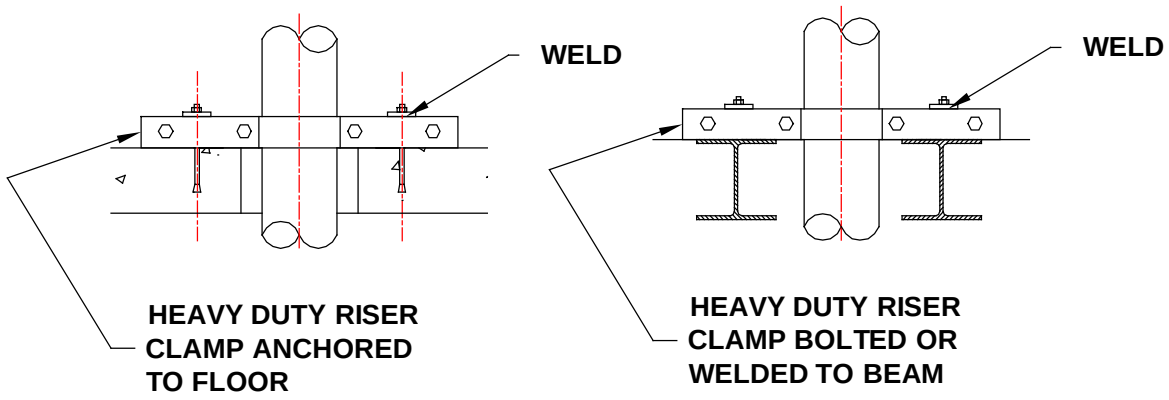


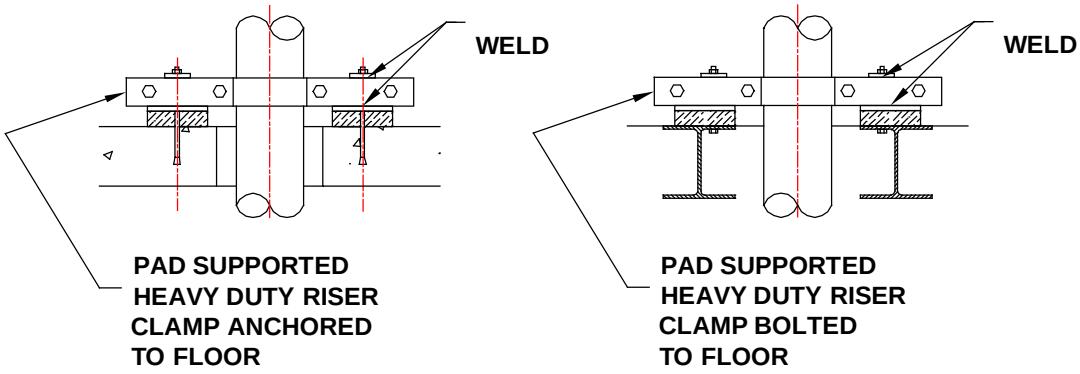
Steel Supported Lateral Restraint (Guide) for Vertical Pipe Run

Combined Lateral and Axial Restraints

In addition to the above details showing independent axial and lateral restraint devices, there are several devices used in vertical runs of pipe that offer both of these together. Anchors for riser systems are the first of these and several types are illustrated below:



Simple Hard-mounted Riser Clamp



Pad-mounted Riser Clamp

VERTICAL PIPE RUN RESTRAINT ARRANGEMENTS

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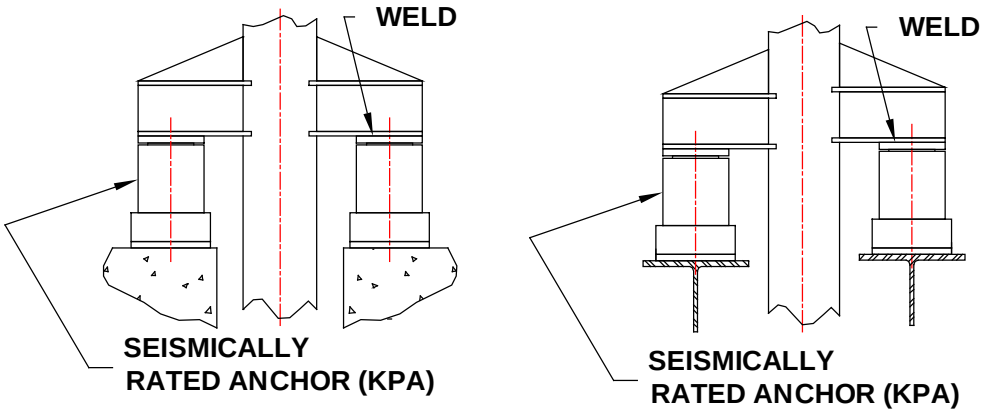
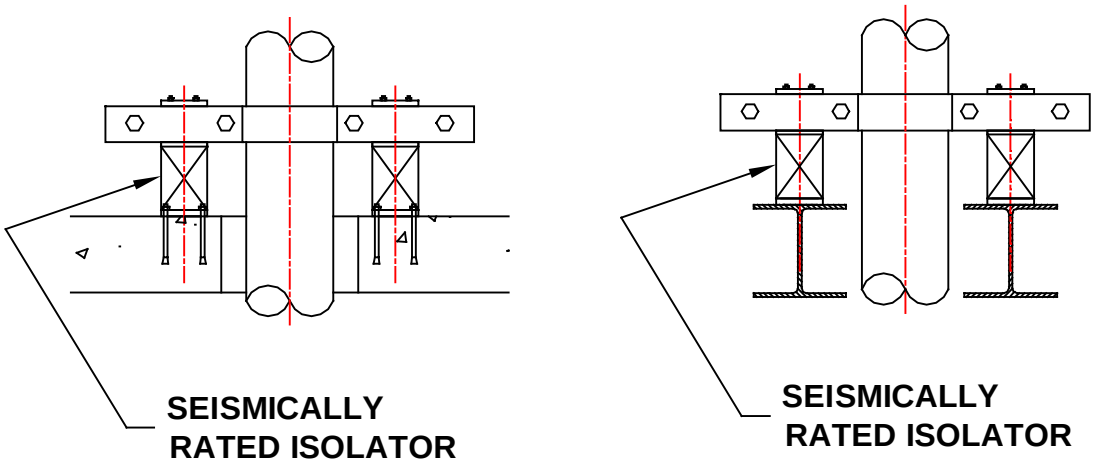


Riser Mounted on Cushioned Rated Anchor

The final combination axial and lateral restraint is a seismically rated, floor-supported isolator.



Riser Piping Mounted on Floor-Mounted Seismically-Rated Isolator

VERTICAL PIPE RUN RESTRAINT ARRANGEMENTS

RELEASE DATE: 1/6/04

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Fax: 614-889-0540
World Wide Web: www.kineticsnoise.com
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