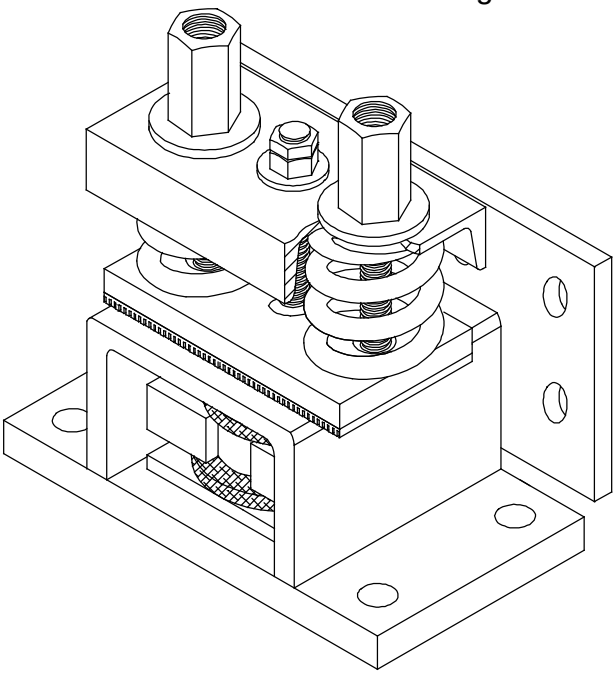
Hybrid Isolators / Restraints (FMS)

Hybrid Isolator/Restraints have been developed as an answer to many of the problems encountered in serving the widely ranging requirements present in applications today. These components reflect a major shift from past isolator designs in look, ease of installation, performance, and flexibility. They are the result of a rethink of today's isolation/restraint requirements and a "back to the drawing board" approach to design.



FMS 2-Coil Seismically Rated Spring Isolator

The Model FMS Seismically Rated Restraint/Vibration Isolator has been developed by Kinetics Noise Control using these techniques. It is a modularized system that can be used as an independent restraint device or as a seismically rated vibration isolator assembly. It is comprised of a restraint module and an optional vibration isolation module. This modular design allows the engineer to design for seismic or wind forces independent of the load and deflection requirements of the vibration isolator. The independent vibration isolation module can be varied extensively using laterally stable springs compliant with ASHRAE guidelines.

The restraint portion of the FMS is available in a wide range of capacities. Vibration isolation components are available with a full complement of capacities up to 20,000 pounds and in deflections of 1 through 4 inches. Key to the flexibility of the FMS is the ability to select the restraint module independent of the vibration isolator load and deflection requirement. This ensures a custom, no-compromise fit for restraint and vibration control. Using these features, the FMS can be optimized to a wide range of applications.

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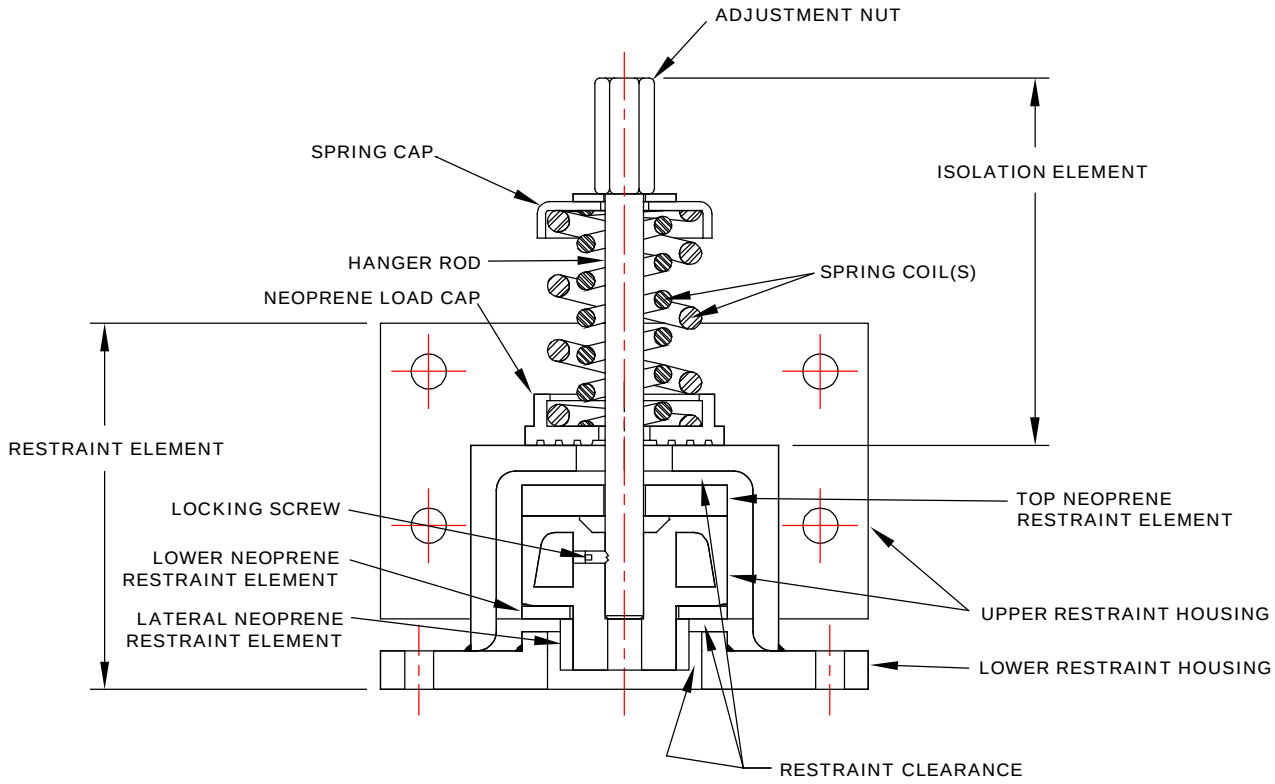

FMS Section (Typical)

Offered here is a summary of the FMS isolator/restraint system. Its features, benefits, and best applications as well as potential limitations will be addressed. While hybrid isolators, and the FMS in particular, are well suited to many applications, as with anything, they won't work everywhere.

The initial FMS concept was to shift the seismic snubbing element as close to the floor or mounting surface as possible. As discussed earlier in this chapter, shifting the snubbing surface to an elevation close to the mounting surface greatly increases the seismic force that the restraint can absorb. On the FMS, this was taken to the extreme such that all lateral loads are absorbed in a snubber element fit directly into the base mounting plate. This unique design minimizes (virtually eliminates) the vertical load components transmitted into the anchors or other attachment hardware. As a result, considerably higher seismic ratings are possible versus older, more conventional designs using similar sized connection hardware.

Shown below are load diagrams that illustrate the impact that shifting the snubbing point from the top of the restraint to the bottom has on the anchor loads.

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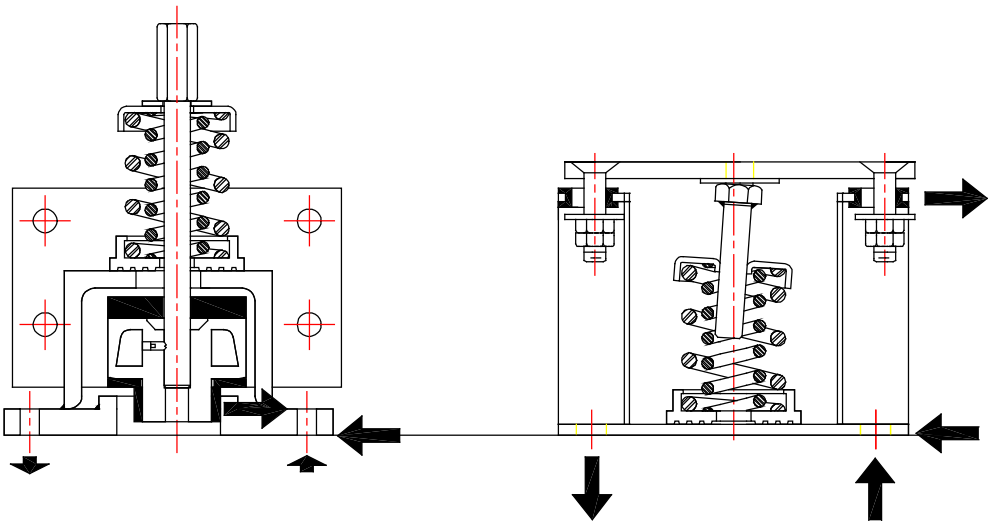
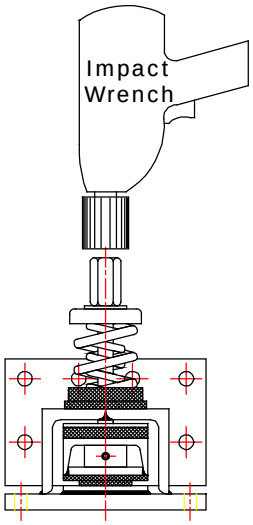


Anchor Load Reactions

A consequence of moving the restraint element to the bottom of the isolator is that the spring moves to the top. This allows the use of an open spring design where the spring is completely visible for inspection and totally accessible for adjustment. Unlike most conventional isolators, the top adjustment nut can be adjusted with a ratchet or power impact-type tool if desired.



Easy Adjustment Access

The use of a hanger rod as a pendulum offers a couple of less obvious benefits as well. First, the isolator becomes inherently stable with the hanger rod "wanting" to return to a vertical position rather than "wanting" to drift off to one side or the other. This reduces the likelihood of vibration "shorts" in the snubbing element. In addition, a pendulum in this length range has a much lower natural frequency than could be expected from laterally deflecting a coil. This offers a benefit in isolation efficiency.

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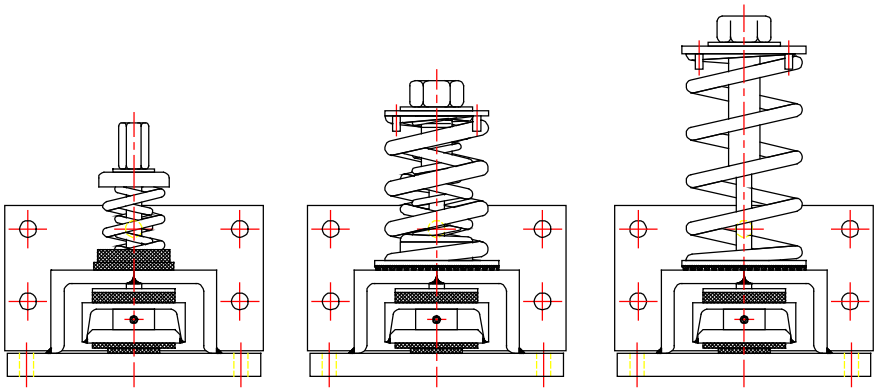
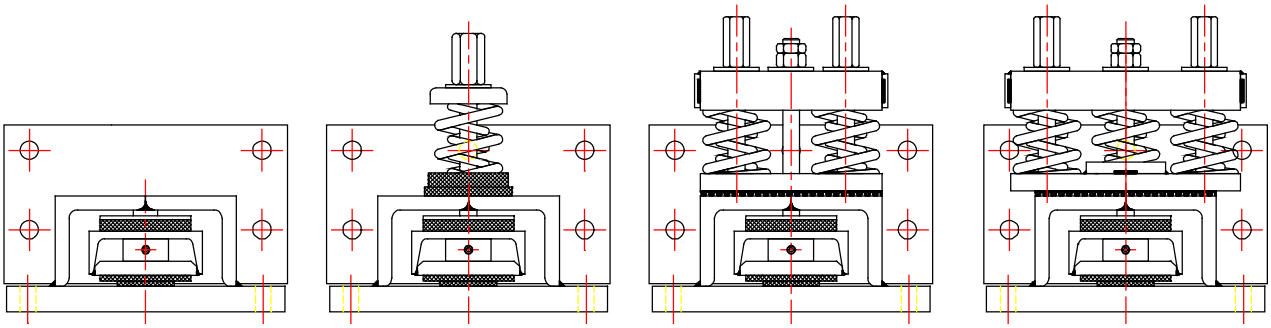
A second benefit of relocating the coil to the top of the snubber is that it can be easily changed. This is true not only in service, but also during the design phase. Within the limitations of the restraint housing top area, a wide variation of 1, 2, and 4 inch deflection coils can be fit onto the same restraint element. This flexibility allows the user to custom "select" isolator/restraint combinations that could range from as little as ¼g to as much as 10 g's



Coils with Different Deflections on the Same FMS Restraint Housing

Not only is it possible to vary capacity or deflection on a given restraint component, but it is also possible to significantly increase the capacity through the use of multiple coils if this is appropriate for the application.



Multiple Coil Options Used on the Same Restraint Housing

Restraint housing components are available in 8 sizes with horizontal force capacity ratings ranging from 1,000 lb up to 70,000 lb.

Standard isolation elements are available in 1, 2, and 4 inch deflections with support capacities ranging from 35 to 23,000 lb.

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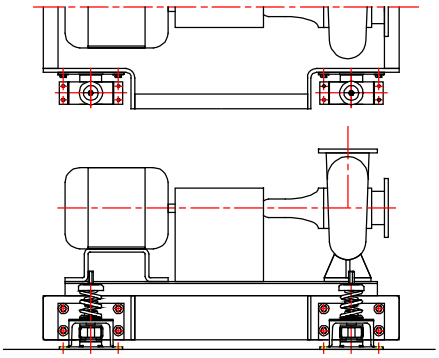
Application

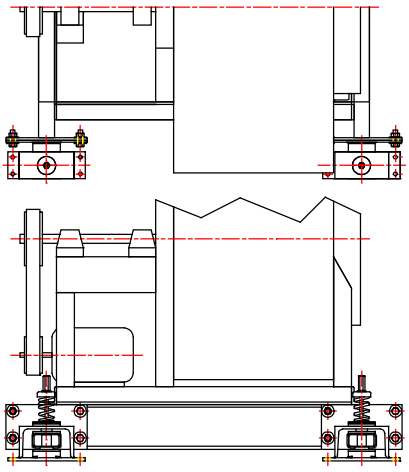
Because of the extreme design flexibility of the modular concept, Kinetics Model FMS Seismic Restraint/Vibration Isolators can be used effectively for large, heavy pieces of equipment in highly active seismic or wind-prone areas as well as for more common applications in less active areas without financial consequence. The FMS is ideal for equipment mounted on structural frames or concrete inertia bases. As with any seismic restraint or vibration isolation device, direct mounting to light pieces of equipment may not be possible without an intermediate frame.

Because of the limited vertical travel and near constant operating height, the FMS isolator is excellent for use on cooling towers, chillers, boilers, or other equipment where the potential for wide weight variations during service is anticipated.

Typical Application Details



Pump-Mounted Inertia Base Application



Structural Fan Base Application

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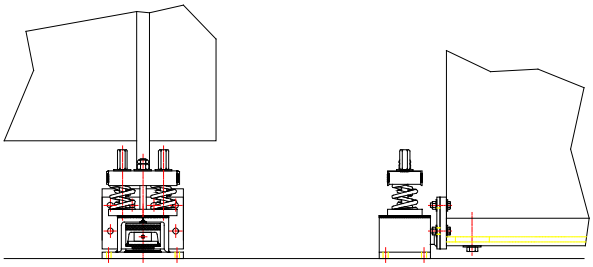
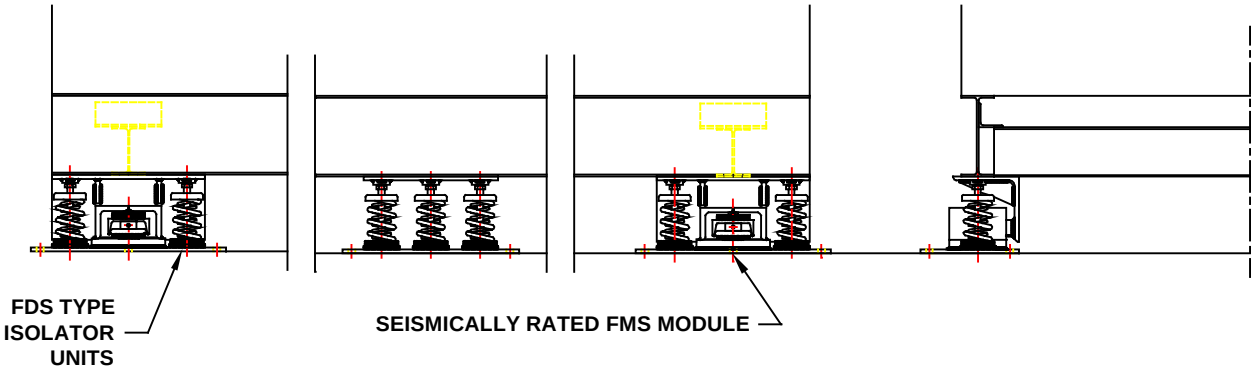


Chiller Mounting Arrangement



Cooling Tower Support Rail (FMS used as Restraint with FDS Isolator Modules)

Limitations

The FMS Isolator/Restraint uses a flange for attachment to the supported equipment. As such, it is not directly applicable to the underside of equipment mounting feet. In addition, the restraint element and support center for the isolation coil is offset from the flange mounting surface. This generates a moment force at the mounting flange that must be absorbed by the supported equipment or cross member.

Both of the above issues can be addressed through the use of an intermediate cross support member (frame or beam) that is designed to absorb these additional moments and has provisions for the attachment of the equipment.

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