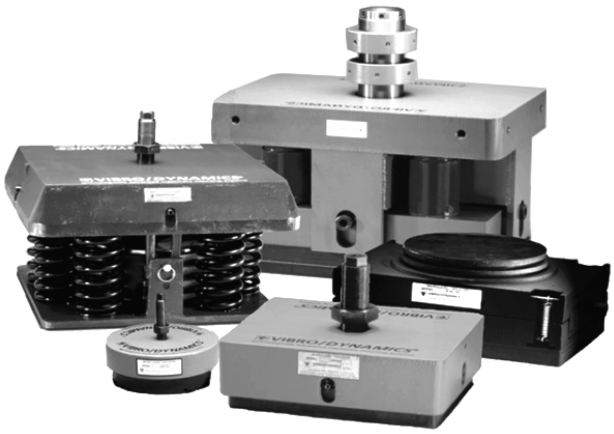
TECHNICAL BULLETIN: **M/L-675**

Elastomer or Spring Isolators: Which Type to Use and When.



Industrial machinery such as metal forming presses, die forgers, precision machine tools, and textile and container industry equipment are installed using a variety of different methods. Anchorless machinery mounting systems have become common due to the demands of customers who require faster machine installations and more plant layout flexibility. There are many different types of machinery mounting systems available today. Some are designed simply for leveling, while others feature integral leveling combined with vibration isolation capabilities. Elastomeric cushions, steel springs, air, felt, cork, and wire rope are some of the vibration isolation materials used. Isolation performance varies widely depending on the material used. This bulletin focuses on machinery mounting systems (isolators) that feature an integral leveling device or shims and use either an elastomeric cushion or steel coil springs as isolation material.

Elastomer and Spring Type Isolators are used in a wide variety of industries, including Automotive, Forging, Container, Electronics, and Textile. As industries vary, so do the types of machines used, the functions they perform, and the environments in which they are used. One isolator type is not enough to meet all the customer needs and installation requirements in these industries.

Vibro/Dynamics manufactures both elastomer and steel coil spring isolators. Vibro/Dynamics Isolators are available in several sizes, load ranges, and types to meet a wide range of customer and application needs. Each isolator type is designed for specific types of machinery applications.

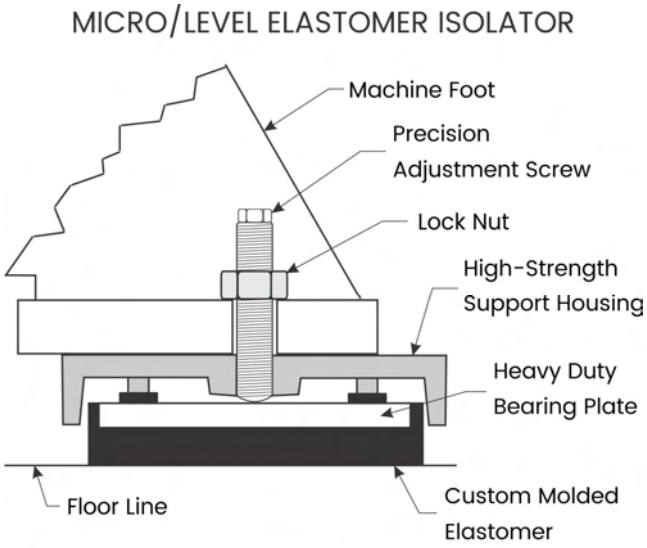


FIGURE 1

Isolator Design

The Vibro/Dynamics Elastomer and Spring Isolators as shown in Figures 1 and 2 feature High-Strength Support Housings that provide uniform support to the bottom of the machine foot. A precision leveling adjustment screw threads into the Isolator's Support Housing and transfers static and dynamic loads to the center of a heavy duty bearing plate. The bearing plate evenly spreads the load across the entire surface of the elastomeric cushion or coil spring pack. The point load configuration of the leveling adjustment screw on the bearing plate creates a unique swivel design that compensates for an out-of-parallel condition between the machine foot and the floor, resulting in uniform loading of both the machine foot and the isolator's elastomer or coil spring pack.

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The Vibro/Dynamics Hy/Tuned™ Spring Isolator, shown in Figure 3, uses shims for leveling. Shims are usually installed between the foot and the isolator and secured using either a hold-down bolt or a friction pad.

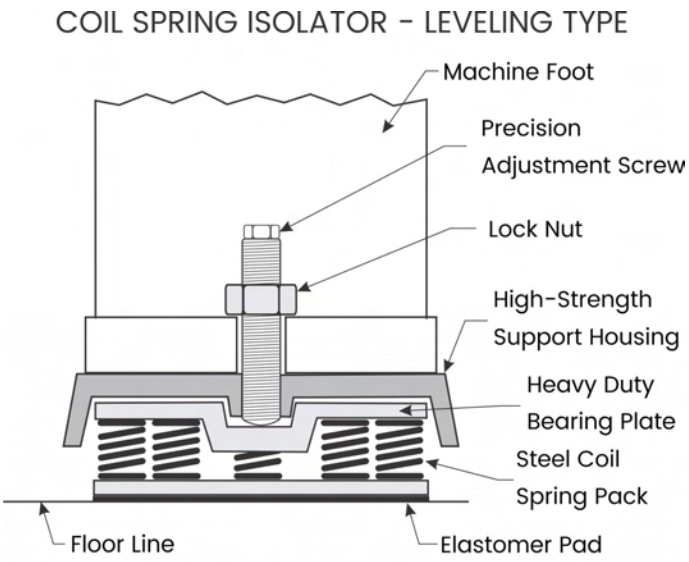


FIGURE 2

ISOLATOR APPLICATION

The application of vibration isolators and their natural frequencies relative to machine operating speeds falls into two broad categories: low-tuned and high-tuned. A ***low-tuned*** application is when the natural frequency of the vibration isolator is *less* than the operating frequency of the machine, thus isolating the inertial forces generated at the machine's operating speed. A ***high-tuned*** application is when the natural frequency of the vibration isolator is *greater* than the operating frequency of the machine. The inertial force generated at the machine's operating speed is not isolated, but high-frequency vibration caused by impact forces is effectively isolated.

Elastomeric isolators are generally used for high-tuned machinery applications. Coil Spring Isolators can be used for both low-tuned and high-tuned machinery applications.

Machines that generate high inertial forces relative to machine weight usually have to be installed in a high-tuned condition to control excessive machine motion. Elastomer isolators are ideal for this type of application because they are generally stiffer than spring isolators and better control motion caused by out-of-balance forces. Most machines are not dynamically balanced and generate impact, rocking, and inertial forces, causing them to move excessively if mounted on an isolator that is too soft.

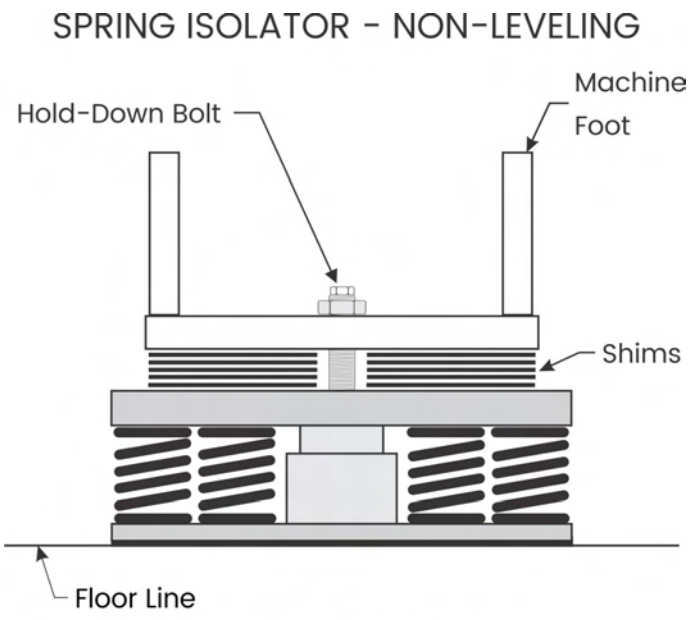


FIGURE 3

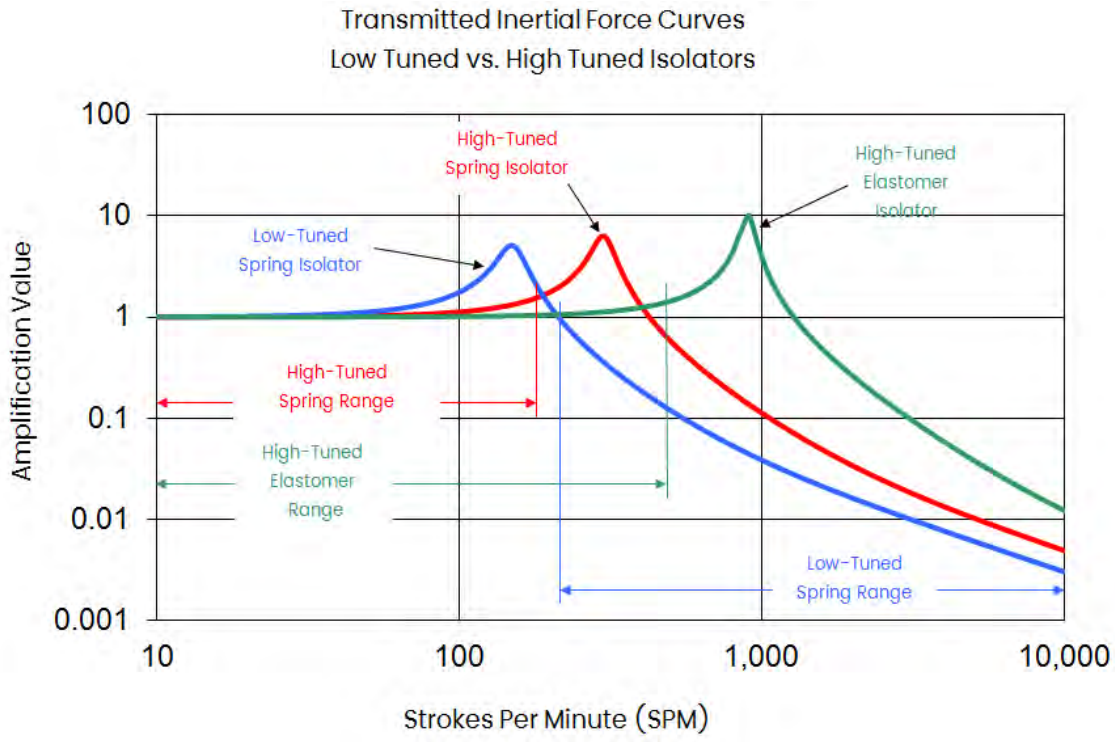
Micro/Level Elastomer and **Hy/Tuned™ SVS Spring Isolators** are very effective in reducing vibration caused by impact forces (up to 98% documented). Micro/Level elastomer isolators are an excellent choice when installing presses in an industrial area. Hy/Tuned SVS model spring mounts should be selected if a higher degree of isolation is required to head off potential neighbor problems or if sensitive machinery is close by.

Micro/Level Elastomer and SVS Hy/Tuned™ Spring Isolators are typically applied with vertical natural frequencies *greater* than the machine's operating speed range *(high-tuned application)*.

The *Transmitted Inertial Force Curves* shows the machine speed ranges for High-Tuned Elastomer and Spring Isolators and Low-Tuned Spring Isolators. High-Tuned Isolators have machine speed ranges that are *less* than the isolator's vertical natural frequency *(300 SPM or 5 Hz for the High-Tuned Spring Isolator and 900 SPM or 15 Hz for the High-Tuned Elastomer Isolators)*. Impact forces are effectively isolated but, since the isolator's vertical natural frequency is greater than the machine's speed range, the inertial forces are not isolated. Inertial forces are low at low speeds, but build exponentially as the machine speed increases. Transmitted inertial force increases as the machine speed nears the isolator's natural frequency.

Low-Tuned Coil spring isolators, like Vibro/Dynamics **Hy/Speed™ VS Spring Isolators**, are very effective in reducing both ***Impact*** and ***Inertial*** forces. These isolators should be used when sensitive machinery or neighbors are located nearby. These isolators have a vertical natural frequency that is *less* than the machine's operating speed range *(Low-Tuned application)*. Transmitted inertial forces are reduced when the machine's speed range *(Low-Tuned Spring Range)* is at least 1.41 times greater than the isolator's vertical natural frequency. For example, the Low-Tuned Isolator shown in the *Transmitted Inertial Force Curves* has a vertical natural frequency of 2.5 Hz or 150 SPM. This isolator will begin to isolate inertial forces at approximately 3.5 Hz or 212 SPM.

Low-Tuned spring isolators typically are recommended for well-balanced presses with speeds greater than 250. When applied in the Low-Tuned Spring Range, Hy/Speed *(Low-Tuned)* Isolators are very effective in reducing transmitted impact *and* inertial forces, but due to their low natural frequency and softness, excessive motion may result if large out-of-balance forces exist. This type of isolator can also be used at speeds less than the isolator's natural frequency (e.g., 1-100 SPM), but it then becomes a high-tuned application and the inertial forces will not be isolated since the isolator's vertical natural frequency now is *greater* than the speed range.



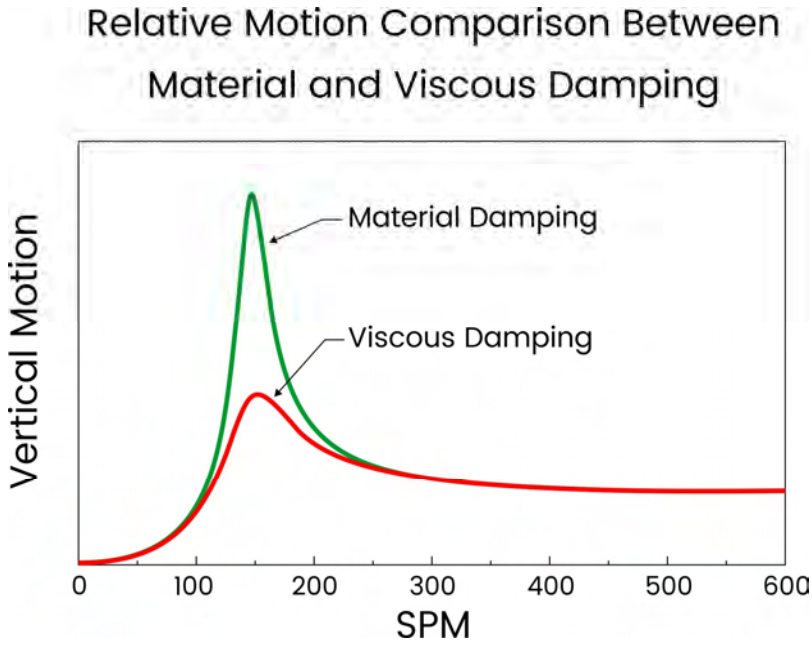
TYPES OF MOTION

There are two main types of motion that can occur: ***transient*** and ***steady-state***. Transient motion occurs when the machine starts, stops, or when it runs through the isolator's natural frequency (resonance). As the machine's speed passes through resonance, the unbalanced forces generated by the machine are amplified and may cause excessive motion. One of the ways this motion can be controlled is by simply accelerating quickly through resonance before the forces and motion have a chance to build, usually within a few strokes or revolutions of the machine. Steady-State motion occurs when the machine is running at its normal operating speed. Motion is caused by the out-of-balance forces generated by the machine and may be excessive if the vertical inertial force exceeds 10 percent of the machine's static weight.

DAMPING SYSTEMS

Proper damping of any low natural frequency isolator is essential for controlling transient and steady state machine motion. Damping is very effective for controlling transient motion. The type of damping used depends on the application. Too much damping can increase the amount of transmitted force, and too little can result in excess motion. Hy/Speed and Hy/Tuned Spring Isolators are available with either ***Material*** or ***Viscous Damping***. Material damping typically is used when a machine's operating speed is well above resonance and resonance is passed through quickly. Viscous Damping is recommended for machines that operate close to resonance, have high out-of-balance forces, or pass through resonance slowly. Material Damped Isolators are usually smaller and less costly than Viscous Damped Isolators.

The following Chart shows the relative motion comparison between Viscous and Material Damping, and illustrates how Viscous Damping is more effective in controlling machine motion at or near resonance. As machine speed increases and gets farther away from resonance, the difference in machine motion and damping effectiveness between Viscous and Material Damping lessens.



SUMMARY

Proper machine support, leveling, alignment, and vibration reduction are critical for any successful machine installation. A properly supported machine will move less, perform better, and last longer. Vibro/Dynamics' **Micro/Level®** and **Hy/Speed™** Isolators are available with built-in precision adjustment capabilities that make leveling, alignment, and support adjustments fast and easy. Vibro/Dynamics' **Hy/Tuned™ Isolators** are great for solving difficult vibration and shock transmission problems resulting from heavy blanking or forging operations.

Decisions on *Which Type of Isolators to Use and When* should be made after consulting experts who have the experience, the product line, and the application knowledge required to select the best machinery installation method. A thorough application analysis should be done in order to determine which isolator type is best for a particular application. A machine's operating characteristics, design, structure, weight, and dynamic forces should be analyzed to determine which isolator type could or should be used. In some cases, either type may be used, or the final isolator type will be determined by the degree of vibration isolation desired and the amount of machine motion that is acceptable.

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