GENERAL QUESTIONS

Q. Why should I use isolators?

A. Isolators offer many benefits that save money and time.

- Installation Savings – Machines are installed faster and easier than anchoring.
- Case Histories have shown that the precision leveling and alignment features of Micro/Level® Isolators reduces machine wear and tear; increases tool life; and increases productivity by reducing downtime and improving part quality and repeatability.
- Reduce vibration and shock levels for a better work environment.
- Releveling and moving the machine is also much faster and easier.

Q. How are Vibro/Dynamics Isolators different from others on the market?

A. Vibro/Dynamics doesn't use a "*one size fits all*" approach to isolator selection. Every Micro/Level Isolator size has a wide variety of different elastomeric inserts to precisely meet the isolator characteristics required to solve a particular problem.

Our design is unique. Look at a cross-section drawing of a Vibro/Dynamics Micro/Level® Isolator. Its design is unlike anything on the market. Notice that the isolator has pins or "fingers" that extend down from the support housing, pass through the bearing plate, and then fit into "grippers" molded into a custom-engineered elastomer. This feature, called "Glide/Damping™", reduces the isolator's horizontal stiffness and provides a greater degree of isolation. It also helps keep machines from walking by decoupling the support housing from the elastomer.

Q. Why don't presses "walk" on isolators?

A. Presses don't walk on properly selected free-standing isolators due to friction between the isolator and the foundation. To keep a machine from walking, the static deflection (compression) of the isolator under load must be greater than any dynamic unloading of the isolator caused by the operation of the machine. Properly selected and applied isolators always carry load, so the friction of the elastomer on the floor is usually sufficient to overcome any horizontal forces that cause a machine to walk.

Q. My press is rocking. Is this normal?

A. Yes, to an extent. A press with an unbalanced crankshaft or eccentric will generate a rocking force. Isolators compress and shear in reaction to these forces, so it is normal that a press will rock to some degree. The softer the isolator is, the more the press will rock. Depending on the press and isolators, one-quarter inch at the crown is not unusual. The human eye tends to magnify motion, so what looks like excessive motion may not be.

2443 Braga Drive ● Broadview, Illinois 60155-3941 USA ● 708-345-2050 ● Toll Free 1-800-842-7668 ● Fax: 708-345-2225
www.vibrodynamics.com ● vibro@vibrodynamics.com

Q. How long will isolators last?

A. It is not uncommon for Vibro/Dynamics Isolators to last 30 years or more. When properly applied and installed, the isolators can last the life of a machine.
Chemicals can be harmful. Vibro/Dynamics has three alternate elastomeric compounds to handle most environments. Consult with us if your isolator installation will be subjected to a high degree of chemical exposure.

Q. Why are you recommending a larger isolator than your competitor?

A. It could be due to two reasons. *One*, Vibro/Dynamics manufactures vibration isolators as opposed to simple machinery mounts. Our goal is to provide the best isolation possible while keeping machinery motion to an acceptable level. A larger area isolator is usually a softer isolator. Due to the larger area, greater isolator deflection is possible without over stressing the isolator's elastomeric element. Overstressing causes leveling instability (due to elastomeric creep) and the higher stress on the foundation.
Two, a larger isolator may have been recommended to provide better support coverage of the machine foot. The isolator support housing should span the foot gussets.

Q. Why does the isolator stick out from under the machine foot? Is this a problem?

A. There are really two questions here. *One*, is it a problem for the isolators and *two*, is it a problem for the machine? In answer to the first question, the support housing of a Micro/Level® Isolator is designed to transfer the load on the isolator's support housing to the leveling adjustment screw, which then distributes the load uniformly over a heavy-duty steel bearing plate. The isolator has a built-in swiveling capability that automatically compensates when the bottom of the machine foot is not parallel to the floor, assuring that the isolator's elastomer is uniformly loaded.
In answer to the second question, most machines have foot and leg designs strong enough to allow them to be supported at the mounting hole. Of course, there are exceptions and the Applications Engineering Staff at Vibro/Dynamics can offer assistance in this regard. Vibro/Dynamics has a complete line of vibration isolators designed for almost every situation. If the machine cannot be supported at the mounting hole, then Vibro/Dynamics will recommend a wedge-style isolator that can be placed anywhere under the machine foot.

Q. How do isolators reduce noise?

A. Isolators are very effective at reducing *structural-borne* noise caused by transmitted vibration. Vibration causes noise when it excites the natural frequencies of a structure. This "*sounding board*" effect is directly related to vibration in the supporting surface. Since isolators reduce vibration, structural-borne noise is reduced.

Q. Is it OK to use isolators on a press with a rolling bolster or die cart?

A. Absolutely. This is very common. The alignment tolerance for most rolling bolster and die carts is sufficient so that it is not a problem.

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VIBRATION REDUCTION

Q. Where does the vibration go when I mount my press on isolators?

A. Internal forces caused by the stamping operation occur whether the press is bolted to a foundation or installed on isolators. However, the magnitude of the vibration within the press is lower when using vibration isolators.

It is a common misconception that bolting a press to a foundation somehow "*sucks*" the vibration out. Bolting a press to a foundaton actually subjects it to more vibration and impact force. Vibration isolators are cushions that transform a sudden shock pulse into a decaying series of longer duration forces.

Imagine hitting a brick wall with your fist. It would hurt! Now imagine hitting the wall with the same energy, but with your hand in a well padded boxing glove. It hurt less! Why? It's because the impact duration is longer, effectively reducing the impact force. Short duration impacts mean higher force.

This is the same thing that happens on a hard-mounted press. The sudden release of potential energy at snap-through causes the press foot to slam against the foundation. This fast duration, high magnitude force hits the foundation and the foundation responds in kind, sending damaging forces back into the press.

Q. Why do I still feel vibration in the floor when my press is on your isolators?

A. Vibro/Dynamics rates isolation effectiveness as a percentage compared to the levels that would exist if the machine were anchored or "hard mounted". It is not possible to obtain 100% with a passive isolation system, but you can come close.

When selecting isolators, many factors are taken into account. But it usually comes down to *two issues*: How much *isolation* is required and how much *motion* can be tolerated? Isolators are usually selected to achieve the highest amount of vibration isolation possible while keeping motion to an acceptable level. These are conflicting goals. To reduce machine motion, the stiffness of the isolator is often increased, at the detriment of isolation, resulting in some vibration being felt in the floor.

Inertia Force, which is the force generated by the motion of the press slide, is another possible cause of remaining vibration in the floor. Run the press without material to see if inertia is the cause of the vibration. If vibration is felt, then inertia is contributing to the vibration in the floor.

Elastomer isolators are not usually designed to isolate inertia force. These are *high-tuned* isolators, which means the isolator's natural frequency is higher than the operating speed (SPM) of the press, resulting in no inertia force isolation. In order to isolate inertia force, the natural frequency of the isolator must be lower than the operating speed of the press. Vibro/Dynamics VS Series Spring Isolators have natural frequencies as low as 2.5 Hz., which is ideal for machines running over 250 SPM. Added weight is usually required to keep press motion to an acceptable level.

See the following question for information on reducing inertia force.

Q: What can I do to reduce the vibration in my press?

A: Vibro/Dynamics isolators have been installed on tens of thousands of presses. We have a lot of experience isolating machines with a wide variety of different press designs, jobs, and soil conditions. Lowering the shock level within the machine will improve tooling and machine life and will further improve the work environment with less vibration in the plant. The following list of suggestions will help reduce vibration and save a lot of downtime and money.

- Increase shear in the dies, flat punches will deliver very high snap-through loads.
- Use an appropriately sized press for the job. Most press manufacturers do not design their machines to accommodate overloads. For long life, it is advisable to allow some safety factor in the job tonnage. A hard or thick batch of steel or bad tooling can create an overload, causing damage to the machine and higher vibration levels.
- Avoid small dies in machines with a large die space. Sometimes it has to be done, but small dies tend to load up and store energy by deflecting the slide like a bow.
- For High-Speed blanking in eccentric geared presses, Vibro/Dynamics has noticed that 500 ton and higher capacity eccentric geared presses running faster than 30 SPM tend to generate much more shock. For these cases, coil spring isolators are strongly recommended.
- Set the air counter-balance properly.
- Make sure the press is level and not twisted.
- Reduce the moving weight or speed. As press speed increases, so does inertia. In some cases, the reciprocating mass of the slide and upper die can generate enough force that it starts to approach the weight of a press, causing the press to “walk”. The formula for determining the “inertia force” generated by the slide and upper die is: inertia force (Peak-Peak)= $W/g*r*\omega^2$ where W=moving weight, g=acceleration of gravity (9.8 m/s^2 or 386 in/s^2), r=stroke length, and ω=machine operating speed in rads/sec (1 SPM = 0.105 rad/sec). Note that the machine speed is a dominant term, doubling the speed quadruples the inertia force.
  To check for an inertia force vibration problem, run the machine without hitting material at the speed that normally causes problems. If the vibration problem persists, then the inertia force generated by the unbalanced moving mass is the cause of the vibration.

  Some machine builders reduce the generated inertia forces in their fast running machines by using a “dynamic balancer”, a slide that runs 180° out-of-phase (directly opposite) from the main slide and upper die. The dynamic balancer is often 100% balanced for a “typical” upper die weight, but may be restricted due to clearances within the press crown structure. Spring isolators can be used to install most dynamically balanced presses, but a motion analysis over the press’ speed range should be done first.
- Make sure the tie rods are stretched correctly.
- Make sure there are no “short circuits.” Avoid beams, deck plates, and feeds that are connected to both the press and the foundation.
- Check and maintain press level.

2443 Braga Drive ● Broadview, Illinois 60155-3941 USA ● 708-345-2050 ● Toll Free 1-800-842-7668 ● Fax: 708-345-2225
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Q: My machine is installed and the vibrations are interfering with nearby offices or sensitive equipment. What can I do to fix this?

A: Once machines are installed and a vibration problem is discovered, it is often very difficult and expensive to relocate the offending machine or sensitive area. Surface vibration waves are typically the culprit. The amplitude, or severity, of surface waves decreases by a function of at least $(1/\text{distance from vibration source})^{0.5}$. High frequency waves will dissipate over shorter distances than longer wavelength, low frequency waves. Vibration waves are further attenuated by damping losses characteristic of the materials they are travelling within. Steel, concrete, and frozen water/soil are efficient conductors of vibration. Surface waves can thus travel significant distance and still cause problems. It is most effective to reduce the amplitude of the waves at the source and at the sensitive area. The most cost efficient way to achieve isolation of the vibration waves is by using passive vibration isolators.

Many other methods have been employed to attempt to reduce the surface wave vibrations, with generally limited success:

1. Digging trench vibration barriers between the offending equipment and the sensitive area can reduce vibrations levels by 25% and sometimes more. Hard barriers such as concrete are generally ineffective, although introducing any dissimilar material will result in some wave reflection. The barrier method is very expensive and great care must be taken to design the trench. If the trench is too shallow, the surface waves may pass below it. If the trench does not completely encircle the source, the vibrations may bend and reflect and bypass the barrier on the sides. There will be a shadow zone behind the trench where the vibration waves are reduced. Trenches may also be ineffective if the offending vibrations are compression waves reflecting from deep rock. Trench barriers will reflect some waves back towards the source resulting in increased vibration levels around the offending machine.
2. Replacing conductive soil or structures with more highly damped or more flexible connections at uneven intervals can reduce vibration transmission. This method is now common in pipe runs from vibration producing equipment within building structures. Within industrial plants these measures are generally impractical and the vibration reduction usually small.
3. Separating the foundation from the surrounding soil and making the support area of the foundation as deep as possible will reduce surface waves. Like trench barriers, this method is expensive and space inefficient. This method works on the principle that surface waves do not travel efficiently at depth.

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4. Stiffening a vibrating structure that is in resonance can resolve problems in mezzanines and simple structures. A common problem is a multi-story or temporary office floors have low natural frequency modes that can be excited efficiently by machinery shocks or, more commonly, periodic vibrations. Machines like stamping presses and hammers introduce a high magnitude shock into the surroundings that cause a large transient wave to propagate. Many machines with rotating components such as high speed presses, vibrators, flywheels, generators, and motors can produce steady periodic vibrations. Stiffening the flooring of such structures to raise the natural frequency can alleviate the problem. Stiffening an existing structure is expensive because often the stiffness needs to be at least doubled to achieve noticeable results. When the problem is a machine with a very flexible arm such as on CMMs, EDMs, robotic welders or torches, and some mills, stiffening the arm can be a simple and effective solution.
5. Adding weight to the sensitive equipment is somewhat effective with diminishing returns as weight is added. Sometimes referred to as mass loading, this method increases the inertia of the equipment. This method is most effective when employed with passive vibration isolators to create a very low natural frequency system. In the form of a large inertia mass with isolators and a sub-foundation, the isolated system is termed an isolated foundation.

To avoid costly vibration mitigation measures, it is best practice to be aware of vibration problems before a machine is installed. It is important to understand the frequency content of the source and the sensitive frequencies of the surroundings.

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FOUNDATIONS

Q. Do I still need a foundation if I use machinery mounts or isolators?

A. Isolators do not eliminate the need for a well-designed foundation. The foundation must be strong enough to support the physical weight of the machinery, plus the dynamic forces generated by the machine. Dynamic forces vary with machine characteristics. Well-designed isolators will reduce the dynamic force transmitted into a foundation, but determining the amount going into a foundation is very difficult.
(See the following question).

Q. How much force is transmitted to the foundation when a machine is installed on isolators?

A. This question is often asked by civil engineers and architects when designing machinery foundations. The short answer is, "we cannot determine the exact magnitude of the transmitted impact forces."

In order to determine the transmitted force, the frequency and forces being generated must be known as well as the characteristics of the soil, foundation, and machine construction. Many of the variables influencing the magnitude of the input forces are not known or even measurable. Factors that strongly influence the transmitted force:

- machine construction
- structural response of machine to shock
- stamping operation (i.e., blanking, coining, drawing, etc.)
- soil conditions
- foundation size and rigidity
- die design
- material properties
- isolator properties

Estimates of transmitted forces can be made, but they are only estimates. Vibration isolators are the most important factor in reducing transmitted vibration. However, the vibration isolators must be given the proper conditions to function at peak efficiency.

Q. Is my current foundation or floor sufficient?

A. Local Civil Engineers or Architects are the best people to answer this question. They can assess the local soil conditions, the status of the existing concrete, and the status of the existing reinforcing steel. Areas with high water tables or that have been filled could potentially cause problems if the foundation design doesn't take them into consideration.

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