Kaiser Aluminum "FLOATS" 75 Ton Roll Grinder and Its
235 Ton Foundation on Korfund Spring Isolators

Hold tolerances of ± 0.0002" by protecting grinder against vibration and shock from foil mill.

Reversing the usual problem of isolating a plant building from the shock and vibration of presses or other heavy machinery, Kaiser Aluminum & Chemical Corp.'s Permanente, Calif. foil mill had the problem of protecting an exceptionally high-precision unit from plant shocks and other external disturbances.

The 75 ton Cincinnati roll grinder for their new 60" rolling mill was mounted on a 235 ton concrete block, isolated from the main building foundations on Korfund Vibro-Isolators. Vibration and shock of all types are absorbed by the springs which "float" the grinder, permitting it to continue its precision work unaffected by other machinery.

Kaiser engineers felt the protection of a Korfund-suspended foundation was vital in view of the extremely fine tolerances required in grinding and polishing the mill rolls: ± 0.0002", and finish of 1.4 mu in. rms. The 45' long grinder handles rolls up to 192" long and 36" dia., and overhangs its foundation by 7 feet. It took 28 Korfund Isolators, each containing 9 coil springs, to float this grinder.

The foundation system, designed by Korfund, was completed in 2 stages. First, main foundations were poured as a solid block resting on bedrock, with a recess at the top to receive the smaller grinder foundation. Next, fourteen 10" steel beams to support the
PRECISION GRINDER AT KAISER ALUMINUM PROTECTED FROM ALL VIBRATION AND SHOCK

(Continued from page 11)

Cross section drawing of grinder foundation. Spring assemblies at each side support foundation, absorb all external vibration and shock. Snubber units prevent excessive motion. At floor level, steel plates provide access to grinder. All piping and other attachments linking grinder to plant are flexible.

Photos for this article were furnished by Kaiser Aluminum & Chemical Corporation. A detailed article describing this Korfund engineered installation at Kaiser Aluminum Co. appeared in the July 1955 issue of Plant Engineering magazine.

THE KOMMENTATOR

PROTECTING ACCURACY OF HIGHLY SENSITIVE INSTRUMENTS FROM EXTERNAL DISTURBANCES

Analytical balance at Southwest Potash Corporation Carlsbad, New Mexico.

Now a really practical, highly effective method is available for protecting sensitive scientific instruments against vibration and shock. By mounting such instruments as analytical and micro-balances, spectrophotometers, spectrogaphs, electron microscopes, and electronic control equipment, on Korfund Steel Spring Vibro-Isolators, vibration and shock from external sources can be definitely prevented from interfering with the accuracy of performance.

The photograph shows a delicate analytical balance in one of the laboratories of the Southwest Potash Corporation in Carlsbad, N. M. Protection against vibration and shock transmitted from the crushers and shakers in this large chemical processing plant is provided by mounting the balance on a concrete block which is supported on Korfund Steel Spring Vibro-Isolators.

The photograph shows how the highest degree of accuracy is maintained by completely isolating the concrete block from the table—enabling the operator to work at the table without disturbing the balance. The photo shows the built-in isolator adjusting bolts which are used for precision leveling of the installation.

THE KOMMENTATOR

"BURIED" LABORATORY GROOVES GLASS

IN AN UNDERGROUND Laboratory at Rochester, N. Y., there's a machine so sensitive that if a person stands over it for a few minutes it may be thrown out of adjustment for many hours. The slightest temperature change may cause intolerable errors in its work.

This remarkable instrument of the Bausch and Lomb Optical Company is a ruling engine for making diffraction gratings. Its job is to cut grooves in a thin aluminum coating on glass, but its work is done with such precision that it may cut as many as 180,000 lines in a six-inch glass.

The heat from a person's body may expand the ruling machine by as much as 1/100,000 inch, which may cause a "big" error in its work. Therefore, the instrument has been installed below ground in a room within a room, and elaborate precautions have been taken to protect it from external disturbances.

The laboratory is built on solid rock with walls 21 inches thick. The walls and ceiling are covered with sound absorbing material, and the floor measures 13 inches in thickness. The ruling engine is mounted on a three-ton block of concrete and the entire mass is supported on vibration-absorbing steel springs. An Aluminum room has been built all around the instrument, so in effect it is floating in air. A special air conditioning system prevents the temperature from varying more than 1/10 degree, and the humidity is kept very low. Thus the ruling engine and the gratings upon which it works are almost free from disturbances of temperature, humidity, and vibration. To isolate it further, some of the engine's operating parts are floated in mercury. The operator remains outside the room when the machine is at work.

A diamond point engravings precise, parallel grooves in the aluminum coating. Just as important as the number of grooves per inch is the accuracy of spacing of grooves, for each groove must be cut in exactly the right position or the light reflected from it might cause an error in spectral analysis.

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THE KOMMENTATOR

TREMENDOUS SAVINGS IN DOWN-TIME AND REPAIRS WHEN FURNACES ARE FLOATED ON KORFUND VIBRO-ISOLATORS!

The most common application for vibration isolators has been to prevent the transmission of disturbance from equipment that is detrimental to the building, nearby sensitive equipment, or personnel. It is not always feasible to isolate existing installations, or the disturbing source can’t be isolated, as with passing trains or trucks.

In such cases, we “float” the sensitive equipment on spring mountings, effectively isolating it from interference which could damage its functions or its components. A case in point is the rotary hearth furnace shown in a plant of one of the largest automotive manufacturers. It is located next to a forging press – other forging operations are also conducted nearby.

To prevent premature destruction of the firebrick ceiling, Lithium Company recommended that Korfund spring isolators be supplied when the furnace installation was made. (Two similar furnaces are also mounted thus in this plant.) Firebrick life of this Korfund-protected furnace is substantially greater than it is for rigidly mounted furnaces operating under the same rigorous conditions. Many customers report that the life of furnace arches and tops has been increased 2½ to 3 times after mounting the equipment on Korfund Vibro-isolators.

The tremendous savings realized in this manner become immediately apparent, since the productive period before the furnace must be shut down for repairs is twice as long. It takes time to cool the furnace, it takes time to repair it, it takes time to reheat. And today, when production schedules MUST be met, time makes all the difference between profit and loss in many cases.

The same principles of protecting vibration-sensitive equipment from outside disturbances apply whether it is a furnace, microbalance, jig borer, lathe, anechoic chamber, or roll grinder which must be protected.
Delicate electronic instruments and other sensitive equipment often perform inaccurately because of disturbances transmitted to the equipment. Typical sources of disturbance are trucks, trains, machinery.

The Speed Regulator pictured above is located on a steel control landing in a paper company. Its accuracy could be affected by the many sources of vibration and shock present in a paper mill, including pumps, compressors, roll grinders and the paper making machine itself. By resiliently mounting this control cabinet on Korfund Vibro-Isolators, all external tremor is prevented from interfering with the accuracy of operation. To filter out high frequency disturbances, Elasto-Rib pads were used beneath the isolators. The structural steel saddles shown were used to maintain original installation height.

Rapid leveling — without shims — is accomplished with built-in adjusting bolts, a Korfund feature for over 30 years.

This sensitive analysis unit must be kept in an air conditioned room with controlled temperature and humidity to help insure accurate readings. Vibrations and shock from passing trains, trucks, and from disturbance-generating equipment within the plant would have adversely affected the precision of the Quantometer. To protect the equipment from external disturbance, Korfund steel spring Vibro-Isolators were used to "float" it resiliently. The structural steel cradle on which the recording console is mounted keeps the installation height at a minimum. Leveling of the equipment is simplified by the Isolator adjusting bolts.

This Quantometer now operates with the accuracy built into it by its manufacturer, regardless of vibration and impact from the equipment found in a steel plant.
The Use of Vibration and Shock Control in Reducing Noise Levels

DONALD H. VANCE
THE KORFUND COMPANY, INC.

VIBRATION and shock control for machinery in some cases provides virtually a complete solution to the problem of transmitted noise. This is particularly true if the problem is noise transmission to the floor below the machinery and, to a lesser degree, to the rooms adjoining a machinery room, or if the problem involves vibration and noise transmission through pipe lines. However, in most cases vibration and shock control for the equipment is not a complete solution, but is only a part of the overall treatment required in a successful noise reduction program. For example, resilient machinery mountings are often used in conjunction with acoustical baffles, sound hoods, acoustical treatment of walls, or other methods in order to produce the desired reduction in noise levels. In many cases the cost of resilient mountings is so low compared to the cost and inconvenience of the other types of noise reduction treatment that it often pays to start with installation of resilient mountings before going to the more expensive and more complicated forms of treatment. Although resilient mountings are most effective in preventing transmission of structure-borne noise, they are also useful in reducing noise levels within the machinery room itself as illustrated later in this paper.

Theory of Vibration Control

A very simple equation applies to determining the transmission of steady-state vibration, the constantly repeating sinusoidal wave form of vibration generated by such equipment as fans, compressors, engines, and pumps:

Transmissibility, \( T = \frac{F_t}{F_d} \)

(1)

where \( f_d \) = frequency of disturbing vibration, cycles per minute (cpm)

\( f_n \) = natural frequency of the resiliently mounted system, cpm

\( F_d \) = unbalanced force acting on the resiliently supported system

\( F_t \) = force transmitted through the resilient mountings

\( f_n = 186 \sqrt{\frac{d}{k}} \)

(2)

where \( d \) = static deflection of the resilient mounting in inches

\( d = \frac{W}{k} \)

(3)

where \( W \) = weight on the mounting

\( k \) = stiffness factor of the mounting in lbs/in. of deflection.

**This equation is exact for steel springs because they have straight-line load deflection characteristics and negligible damping. When the equation is used for organic materials, the following corrections will normally give conservative results: For rubber and neoprene, use 50 percent of the static deflection when calculating \( f_n \). For cork, use \( f_n \) equal to one and one-half times the natural frequency determined by actual test.**
The natural frequency, $f_n$, of a resiliently mounted system is the frequency at which it will oscillate by itself if a force is exerted on the system and is then released. This can be illustrated by suspending a weight from a very long rubber band. The longer the rubber band, the more deflection the weight produces in it. If the weight is then pulled down slightly by hand and released, it will oscillate up and down at the natural frequency of the system. The more deflection in the system, the lower is the natural frequency of the system. The importance of this can be seen by realizing a system may have up to six natural frequencies, but it will be found that in the practical selection of machine mountings, if the vertical natural frequency of the system is made low enough for low transmissibility, the horizontal and rotational natural frequencies will generally be lower than the vertical and can be disregarded except on machines with very large horizontal unbalanced forces or with large unbalanced moments, e.g., horizontal compressors, large two-, three- and five-cylinder engines, etc.

Reducing $f_n$, the deflection $\delta_n$ of the isolator reduces transmission of sound energy. This is illustrated in Figure 1 by the use of rubber-to-metal vibration isolators on an engine which is a critical installation. The critical isolation must be obtained, and for this purpose, a high natural frequency is required. This is provided by the isolators, which are bolted to the machine and the foundation. The machine is then mounted on the isolators, which are designed to have a natural frequency higher than the disturbing frequency of the machine. The vibration isolation is obtained by a combination of the high natural frequency of the isolators and the damping provided by the rubber material. The isolation is effective over a wide range of frequencies, and the transmitted energy is reduced significantly.

The natural frequency of a resiliently mounted system is the frequency at which it will oscillate by itself if a force is exerted on the system and is then released. This can be illustrated by suspending a weight from a very long rubber band. The longer the rubber band, the more deflection the weight produces in it. If the weight is then pulled down slightly by hand and released, it will oscillate up and down at the natural frequency of the system. The more deflection in the system, the lower is the natural frequency of the system. The importance of this can be seen by realizing a system may have up to six natural frequencies, but it will be found that in the practical selection of machine mountings, if the vertical natural frequency of the system is made low enough for low transmissibility, the horizontal and rotational natural frequencies will generally be lower than the vertical and can be disregarded except on machines with very large horizontal unbalanced forces or with large unbalanced moments, e.g., horizontal compressors, large two-, three- and five-cylinder engines, etc.

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It is important to note that the transmissibility of the system is not only dependent on the natural frequency of the system but also on the damping characteristics of the isolators. The damping provides a damping force that is proportional to the velocity of the isolator and acts in the direction opposite to the motion of the isolator. This damping force helps to reduce the amplitude of vibration and therefore reduces the transmitted energy. The damping is typically provided by the rubber material in the isolators.

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Table I—Maximum Allowable Design Transmissibilities

<table>
<thead>
<tr>
<th>Condition</th>
<th>Maximum Tolerable Transmissibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely Critical Conditions</td>
<td>10%</td>
</tr>
<tr>
<td>Critical Conditions</td>
<td>Between 10% and 20%</td>
</tr>
<tr>
<td>Non-Critical Conditions</td>
<td>Between 40% and 60%</td>
</tr>
</tbody>
</table>

Reducing $f_d$ by increasing the static deflection of the resilient mountings reduces the vibration transmission. This explains why the efficiency of machinery mountings increases as their resiliency and deflection increases.

Figure 1 shows the effect of varying frequency ratios on the transmissibility. Note that for $f_d/f_n < \sqrt{2}$, the use of mountings actually increases the transmissibility above that which would result if no isolation were used and the machine were bolted down solidly. In fact, if careless selection of the mount results in a mounting natural frequency equal or nearly equal to the disturbing frequency, a very serious condition called resonance occurs; in equation 4 the denominator of the transmissibility function becomes zero and the transmitted force, $F_t$, theoretically becomes infinite. As the ratio $f_d/f_n$ decreases beyond $\sqrt{2}$, the resilient mountings reduce the transmitted force. Table I gives some suggested maximum design transmissibilities for different types of job conditions.
1. Typical steel spring mountings. (a) Standard units of this type provide highly efficient isolation for most machines. Different sized housings accommodate from one to sixteen springs carrying loads from 50 to 23,000 lbs with spring deflections up to 11/4 in. (b) Heavy-duty isolator to support machines on concrete foundations or structural-steel chassis. Load range: 3000 to 35,000 lbs with standard deflections up to 1/2 in. Mechanical friction-type snubber shown. (c) Long spring isolators for deflection up to 10 in. Load range: 50 to 20,000 lbs per isolator. Note separate adjustable snubbers at sides of isolator. When isolators shown in a, b, and c are used on jobs where high-frequency noise transmission is a problem, separate rubber sound pads are used between the bottom of the isolator and the floor. (d) Spring hangers for suspended equipment at piping. Load range: 250 to 1000 lbs with standard deflections up to 1/4 in. Hanger contains sound insulation washer to prevent high-frequency noise transmissions.

Figure 2 shows a chart which can be used to select the proper resilient mountings when the following job characteristics are known: weight per mounting, disturbing frequency, and design transmit-ability. The chart shows the limitations of the various types of isolation materials, particularly helpful data in selecting the proper media.

Shock Absorption for Impact Machines

In addition to the loud noise produced when the dies strike the work, impact machines such as punch presses, drop hammers, forging hammers, and similar machines also create noise generated by the transient high-frequency vibration of the press parts induced by the initial shock. A secondary noise source results from floor and wall panels vibrating as diaphragms when set in motion by the initial shock. Structural transmission of the initial shock with accompanying noise, and generation of the secondary noise can be eliminated through the use of resilient mountings under these impact machines (see Fig. 3). However, these mountings are not selected on the basis of the data and equations shown above. In shock absorption, the mountings change the sudden damaging impact to a smaller, gradually applied force. In shock mountings, the natural frequency of the mountings is actually greater than the disturbing frequency, or strokes per minute, of the impact machines. Figure 4 illustrates that the more resilient mountings, providing more static deflection, re-
result in smaller forces transmitted through the mountings. Since resonance must be avoided in shock absorption too, the calculator in Fig. 2 contains a line marked "For Shock Absorption Stay Above This Line."

Types of Vibration and Shock Mountings

Cork was the original vibration and noise isolation material and has been used for this purpose for at least a hundred years. The most widely used form of cork today is compressed cork made of pure granules of cork without any foreign binder, compressed and baked under pressure with accurately controlled density. Cork can be used directly under machines, but its widest application is under concrete foundations (see Fig. 5). It is unaffected by oils, acids normally encountered, or temperatures between 0°F and 200°F, but it is attacked by strong alkaline solutions and will rot under continuous cycles of moistening and drying. Cork under concrete foundations still giving good service after twenty years indicates a long, useful life when properly applied. Cork is fairly good as a low-frequency shock absorber, but its use as a vibration isolator is limited to frequencies above 1000 cycles per minute. Cork has good sound-insulation characteristics. Because of the large amount of damping in cork, the natural frequency cannot be computed from the static deflection and must be determined in tests by vibrating the cork under different loads to find the resonant frequency, which establishes the natural frequency of the material. The limiting values for cork given

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Fig. 9. These two compressors are installed on the eleventh floor of the Pathe Television Center, New York City. The roller-in-shear rails originally used were not the proper isolation for the floor conditions and low-frequency vibration. Consequently, transmission through these mountings was so high that it was impossible to use office space on the floor below, as vibration and noise transmitted through the building were picked up on thin sound tracks several floors down. Steel spring isolators provided the deflection required to stop the transmission, and the unusual steel saddles shown were used in this case so that the original piping could remain unchanged.
Rubber has very good sound-insulation characteristics, is fairly good for low-frequency shock absorption, and is useful as a vibration isolator for frequencies above 1200 cpm. Typical rubber mountings and combination rubber and cork mountings are illustrated in Fig. 6. Rubber is not affected by acids or alkalis, but is not recommended for use in the presence of sunlight. The temperature range of natural rubber is 50 to 150°F, that of neoprene, 0° to 200°F. Neoprene rubber is recommended for applications where there is continuous exposure to oil. Special rubber compounds are available to meet conditions beyond those cited. Rubber tends to lose its resiliency as it ages. The useful life of rubber mountings is about seven years under non-impact and about five years under impact applications, though it retains its sound insulation value for much longer. Individual molded-rubber mountings are generally economical only with the light and medium-weight machines, since heavier-capacity mountings approach the cost of the more efficient steel spring isolators. Pad-type rubber isolation has no such limitations.

Steel spring isolators provide the most efficient method of isolating vibration and shock, approaching 100-percent effectiveness. The higher efficiency is due to the greater deflections which they provide: standard steel spring isolators such as those shown in Fig. 7 provide deflections up to 1/4 in. compared to about 1/4 in. maximum for rubber while they can give 1 in. or more. Since the equations for the spring constants of rubber isolators are of a complex nature, and some of the materials used are not too accurately predictable, the use of steel springs is sometimes preferred. Steel spring isolators are generally available as standard units for ready use. Table 4 gives the deflections for several standard steel spring isolators. These are shown in (a) and (b).

Applicatio...
for rubber and other materials, while special steel spring isolators can give deflections up to 10 in. Since the performance of steel springs follows very closely the equations of vibration control, their performance can be very accurately predetermined, eliminating costly trial and error which is sometimes necessary in other materials. Steel spring isolators are generally equipped with adjustable snubbers, since steel springs themselves contain no damping. (Damping is sometimes useful in limiting the movement of resiliently mounted machines, but damping reduces the isolation efficiency of the mounting.) Most steel spring isolators are equipped with built-in leveling bolts, which eliminate the need for shims when installing machinery. The more rugged construction possible in steel spring isolators provides for a long life usually equal to that of the machine itself. Since high-frequency noises sometimes tend to by-pass steel springs, rubber sound-isolation pads are usually used under spring isolators to stop such transmission into the floor on critical installations.

Table II tabulates the useful range of cork, rubber, and steel springs for different equipment speeds.

### Applications

Figures 8 through 16 illustrate the application of resilient machinery mountings to prevent transmission of structure-borne noise and vibration. Properly designed mountings now permit installation of the heaviest mechanical equipment in penthouses on roofs directly over offices and sleeping areas. The FHA has approved the use of machinery penthouses on several apartment installations when all equipment was to be mounted on high-efficiency steel spring isolators. Such upper-floor installations permit certain operating economies and release valuable basement space for garaging automobiles. When heavy machinery is installed on upper floors, great care must be used to prevent vibration transmission which often shows up many floors below when a wall, ceiling, or even a lighting fixture happens to have the same natural frequency as the disturbing vibration. The result of such resonance vibration is very annoying noise. Efficient mountings permit lighter, more economical construction of new buildings and prevent...
204 SPECIAL PUNCH PRESS-TYPE MACHINES ON UPPER FLOOR - A THOMAS A. EDISON CO. PLANT.

FIG. 15. Substantial noise reduction in the machinery room itself was obtained by eliminating foundation bolts and mounting 204 of these machines on rubber-cork mounts. (Data courtesy of Mr. Kenneth Huck, T. A. Edison Company.)

Difficulties when machinery is installed on the new concrete-filled ribbed metal deck floors. They also permit installation of heavy machinery in old buildings which were not originally designed to accommodate such equipment.

Steel spring isolators resting on rubber sound pads are used on practically all anechoic room installations to prevent transmission of structure-borne vibration and noise into these sound rooms. Vibration and noise transmission through piping, particularly on air-conditioning installations, is a serious problem. When refrigerating compressors are installed on resilient mountings, provision should be made for flexibility in the discharge and intake piping to reduce vibration transmission. This can be accomplished either through the use of flexible metallic hose (which must be of adequate length and very carefully installed in strict accordance with the manufacturer’s specifications) or by providing for flexibility in the piping itself. This is often accomplished by running the piping for a distance equal to 15 pipe diameters both vertically and horizontally before attaching the piping to the structure.

Additional protection is provided by suspending the piping from the building on resilient hangers or by supporting it from below on resilient mountings. Flexible rubber hose approximately three diameters long should be used on the intake and discharge sides of water pumps. Flexible duct connections should always be used on the intake and discharge of fans, and such flexibility should not be nullified by subsequently covering the duct with rigid insulation on air-conditioning installations.

Effective vibration control for machines is usually quite inexpensive, seldom exceeding 3 percent of the equipment cost. In many cases resilient mountings pay for themselves immediately by eliminating special machinery foundations or the need to bolt equipment to the floor. It is much cheaper to prevent vibration and structural noise transmission by installing mountings when the equipment is installed than it is to go back later and try to correct a faulty installation. Resilient machinery mountings should not be considered a panacea for noise transmission problems. However, they have a definite use in the overall solution of noise problems, and their intelligent use can produce gratifying results at low cost.

FIG. 16. Spring isolators under this piping prevent transmission of structure-borne vibration and noise. Isolators can also be designed to compensate for thermal expansion. Resilient hangers (Figs. 6 (d) and 7 (d)) are used for suspended piping.
SERIES L

ALL PURPOSE—ALL DIRECTIONAL

FOR EFFICIENT, ECONOMICAL CONTROL
OF VIBRATION, SHOCK, & NOISE

- Eliminates bolting equipment to floors
- Eliminates foundations, speeds installation
- Increases production, improves quality
- Allows better plant layout
- Reduces building and machine maintenance
- Improves working conditions
- Stops vibration and noise transmission

THE KORFUND COMPANY, INC.

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Steel spring Vibro-Isolators provide the most efficient method of isolating vibration, approaching 100% in effectiveness. Strongly recommended for most installations, they are essential on critical jobs, provide greatest over-all economy, permit equipment installations on lighter sub-structures, and are satisfaction guaranteed.

The high efficiency of steel spring Vibro-Isolators is due to the greater deflections which they provide—up to 2" for the Series L isolators (up to 10" on special Korfund Isolators) compared to about 1/4" maximum for other materials. Breakage or loss of resiliency through service in steel spring Isolators is practically non-existent because they are carefully designed so that the endurance limit is never exceeded. And, unlike other materials, steel spring performance can be accurately predetermined, eliminating costly trial and error. Rugged construction plus the properly designed steel springs give Vibro-Isolators long life—usually greater than the machine itself.

Series L Vibro-Isolators consist of steel or cast housings (see Housing Materials) containing 1 to 12 oil tempered, high carbon or chrome vanadium steel springs. The upper and lower members of the housing are held in their relative position against lateral movement by four resilient inserts. The equipment to be isolated is mounted on the top plate, from which the adjusting bolt transfers the load to the spring compression plate and to the vibration absorbing springs. The adjusting bolt provides a means for leveling the equipment, thereby eliminating the need for leveling jacks, shims, or wedges.

When the load due to the weight of the machine is first applied, the springs are compressed, causing the top plate to move down. The top plate is raised to the proper operating height and the machine leveled by turning the adjusting bolt. Installation and adjustment is as simple as that.

The resilient inserts, which resist horizontal thrust, are made of various materials depending upon the application. These inserts in the LK and LI isolators can be adjusted to provide varying degrees of damping in all directions by two horizontal bolts, one at each end to control movement. The inserts are large and designed to accomplish damping by means of internal friction thus avoiding the greater wear and greater stiffness (which causes vibration transmission) of other types which utilize surface friction.

Though Isolator springs have a large overload safety factor, Korfund's exclusive design permits changing of springs in the field without removing the Isolators should actual loads be substantially different than those calculated, e.g., if additional piping is added, or if accessory equipment is added to the isolated machine. All operating parts of the Isolator are completely visible.

(All designs and specifications subject to change without notice.)
EFFICIENT, ECONOMICAL VIBRATION CONTROL

1. Korfund isolators stopped the transmission of severe vibration from engines. They protect engines from shocks and from twisting of ship's hull.


3. Apartment rooftop installation of fans, compressors, pumps and boilers free valuable basement space for rental garages. Guaranteed voice noise control cost less than 1/4 of the mechanical contract.

4. Controls and lining of heat treating furnace are protected by Korfund isolators against shock from nearby 15,000 lb. steam hammers.

5. This 100 ton punch press installed on an upper floor could not be operated until Korfund isolators stopped vibration and noise to floors below.

6. Korfund isolation protects this delicate analytical balance from vibration and shock caused by crushing and shaking equipment in mineral processing plant.

7. Precision grinder accuracy protected against external vibration by Korfund isolators which also eliminate special foundation and costly lagging down.

8. Large compressor on research laboratory's upper floor. Korfund isolators stopped vibration transmission to sensitive instruments, reduced noise level.

9. If driving motors are not mounted machine and motor be mounted on isolation under which the isolators are placed will absorb or contain the shock or vibration.

DIRECT MOUNTING — EX

1) STANDARD ISOLATORS — The s in fig. 1. However, for most machines some fastening is required. Isolators are fastened to foundation or concrete by special cement (developed strength 48-15 Thirteenth Second).

2) ISOISATORS WITH INTERNAL ADJUSTING HOLES, isolators can be furnished to machines usually require no fastening. Isolators are furnished with tapped holes and cement; they may be bolted as shown or used as described under "To Bolt or Not to Bolt".

4) ISOISATORS WITH SYNTHETIC RUBBER pads, which are furnished with tapped holes in the base to accommodate bolts.

DIRECT MOUNTING — IN

3) MACHINES WITH OFFSET-CENTER — With offset-centered machines it is often desirable to place the machine on the center of the machine. Isolators can be furnished extra charge, or see fig. 2, where box plates of sufficient height for isolation may be furnished with tapped bolt holes in the adjusting bolts; or see fig. 1.

5) SADDLES — Where increase in height may be supported on angle or floor plates may be used to strengthen the machine base.

NOTE: Placing internally adjusted isolators between the machine and the floor, or between the machine and the floor during fabrication, is recommended; consult Korfund.

6) THRU-BOLTS — With thin concrete slabs, threaded bolts fastened to the machine, or fixed to the machine base. If driving motors are not mounted machine and motor be mounted on isolation under which the isolators are placed.

7) STEEL FRAME — It is often necessary to use iron frame, flanges and bolts from the adjusting bolts; or use fig. 5. Where box plates of sufficient height for isolation may be furnished with tapped bolt holes in the adjusting bolts; or see fig. 1.

6) POCKETS — To keep isolation in place on floor, and raising with isolators in pockets recessed in both.

8) THRU-BEAMS — The same as in fig. 1. Isolators to the ends of cast-in beams.

9) LIMIT STOPS — Where large or internal forces (e.g. dynamic equipment, limit stops should be provided. If limit stops cannot be provided, as shown.

NOTE: Placing internally adjusted isolators between the machine and the floor, or between the machine and the floor during fabrication, is recommended; consult Korfund.

THE KORFUND
48-15 Thirty Seconds
Over half a century of Vibration Control

Represents Listed under "Korfund"
The result is practically a static weight on the floor instead of (2) Maximum fastening calling for the use of foundation bolts and LO have non-adjustable inserts for alignment purposes, adjustment is slight from arrangement shown. LN in the field.

(3) Intermediate fastening requirements (e.g. some surface grinders), may be met by cementing the isolators to the floor by means of 1/4" thick Korfund felt pads—developed bond strength 65 psi. This method also avoids drilling holes in the floor, and the machines can be readily relocated by dissolving the cement with a special solvent. Note: The felt pads act only as a cementing intermediary and have little value for sound absorption or vibration isolation. If structurally borne noise transmission is a problem, use Korfund synthetic rubber sound insulation pads under the isolator (see arrangement 4, page 6).

VARIATIONS AVAILABLE

The Series L Vibro-Isolators are the most versatile vibration control mountings available. They are offered in several standard variations at no extra charge; in addition, special modifications are available at nominal extra charges.

LEVEL ADJUSTMENT: Regular, external adjustment (type LK and LN) for the majority of installations or internal adjustment (type Li and LO) are standard. The types Li and LO have internal adjustment which permits their location anywhere, irrespective of availability or location of bolt holes in the machine base or concrete foundation (see arrangements 2 and 3, page 6). The size J is available with internal adjustment only.

ADJUSTING BOLT: Standard bolt will pass through 2" machine leg. Longer bolts for thicker legs are special.

SNUBBER ADJUSTMENT: Fully adjustable snubbing by means of end nuts is standard for LK and Li isolators; for size A, adjustment is slightly different from arrangement shown. LN and LO have non-adjustable inserts for alignment purposes, without any snubbing action, they can be converted to LK and Li in the field.

SNUBBER INSERTS: Oil-resistant synthetic rubber is standard for LK and Li. Composition cork is standard for LN and LO, and in LK and Li for light loads (in Isolators using the numbers 32, 33, and 34 springs). Special rubber impregnated duck for heavy duty service, asbestos for high temperatures.

SPRINGS: Oil-tempered high carbon or chrome-­vanadium steel is standard. Special: Softer springs for lighter loads, stainless steel or coated springs for corrosion resistance.

HOUSING MATERIALS: Cast semi-steel is standard for all isolators except size H (malleable castings), and size J (welded steel). All other isolators are available in malleable castings or welded steel at extra charge.

FASTENING TO FLOOR: Slotted holes for bolts in base plate are standard. Special: Korfund felt pads, or synthetic rubber sound pads, and cement for cementing to floor.

FASTENING TO MACHINE: Single bolt is standard on types LK, LN, and LM isolators. Types Li and LO have no provision for fastening, but one tapped hole will be furnished without charge upon request. Special: extra tapped holes in top plate for bolting, felt and cement for cementing (Li and LO only).

SOUND DAMPING: For maximum noise absorption, Korfund waffle-embossed synthetic rubber pads are available at extra charge (see arrangement 4, page 6).

PROTECTIVE COATINGS: Vista Green enamel is standard. Special: zinc chromate primer (salt water corrosion), neoprene coating (chemical corrosion), canvas enclosure (heavy dust or powder accumulations), cadmium plated bolts and nuts.

KEY TO DESIGNATIONS WHEN ORDERING

<table>
<thead>
<tr>
<th>Isolator Designations</th>
<th>Accessory Pad Designations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Leveling</td>
</tr>
<tr>
<td>LK</td>
<td>External</td>
</tr>
<tr>
<td>LI</td>
<td>Internal</td>
</tr>
<tr>
<td>LO</td>
<td>Internal</td>
</tr>
</tbody>
</table>

Example LK-44-1-6: Internal leveling, non-adjustable snubbing, "A" size housing, 290 spring, rubber pad, and isolation washers for bolted arrangement.

HOW TO SPECIFY SERIES L VIBRO-ISOLATORS

The isolation mountings shall consist of steel or cast iron top and bottom housings incorporating one or more steel springs and shall be provided with built-in leveling bolts and built-in, resilient chocks to control oscillation and withstand lateral forces in all directions. They shall be Korfund Series L Vibro-Isolators or approved equal, and shall be installed in accordance with the manufacturer's instructions.
I-ISOLATORS

1. Isolators incorporate one or more rubber bushings between the bearing surfaces of the supports and the structure they support. The bushings are typically made of neoprene or synthetic rubber and are available in various sizes and types to accommodate different load and isolation requirements.

2. The bushings are designed to absorb a wide range of loads and are effective in eliminating vibration and noise. They are also effective in reducing structural transmitted vibration and noise.

3. Isolators are commonly used in a variety of applications, including industrial machinery, buildings, and transportation systems.

4. To improve performance, the rubber bushings may be replaced with more resilient materials such as polyurethane or metallic isolators.

5. The design and installation of isolators require careful consideration to ensure proper performance and longevity. It is important to consult the manufacturer's instructions for specific details on installation, maintenance, and performance.

6. As an example, the table below provides data on isolators of various types and sizes, including their maximum capacity, free height, and dimensions. The table also includes typical elevation views of the different isolator types and their application.

<table>
<thead>
<tr>
<th>ISOLATOR MAK. CAPACITY</th>
<th>TABLE A: CAPACITY &amp; CHARACTERISTICS Data Applies to Types LK, LI, LM, LN &amp; LO</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISOLATOR HOUSING SIZE</td>
<td>W (IN)</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0.4</td>
</tr>
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<tr>
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<td>0.01</td>
</tr>
<tr>
<td></td>
<td>0.005</td>
</tr>
</tbody>
</table>

Notes:
1. W = spring displacement in inches.
2. N = spring force in pounds.

TYPICAL ELEVATION VIEW OF THE TYPES LK & LN ISOLATOR, SIZE E SHOWN

TYPICAL ELEVATION VIEW OF THE TYPES LI & LO ISOLATOR, SIZE E SHOWN

TABLE B: DIMENSIONS & WEIGHTS

<table>
<thead>
<tr>
<th>ISOLATOR HOUSING SIZE</th>
<th>A (IN)</th>
<th>B (IN)</th>
<th>C (IN)</th>
<th>D (IN)</th>
<th>E (IN)</th>
<th>F (IN)</th>
<th>G (IN)</th>
<th>H (IN)</th>
<th>J (IN)</th>
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<tr>
<td>0.4</td>
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<tr>
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<td>1.6</td>
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<td>2.2</td>
<td>2.4</td>
<td>2.6</td>
<td>2.8</td>
</tr>
<tr>
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<td>1.6</td>
<td>1.8</td>
<td>2.0</td>
<td>2.2</td>
<td>2.4</td>
<td>2.6</td>
<td>2.8</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Notes:
1. All dimensions are in inches.
2. Tolerance: ±0.010 in.
Kortund Isolators stopped the transmission of severe vibration from engines. They protect engines from shocks and from twisting of ship's hull.

3 Apartment rooftop installation of fans, compressors, pumps and boilers free valuable basement space for rental garages. Guaranteed vibration-noise control cost less than 1/4 of the mechanical contract!

4 Controls and lining of heat treating furnace are protected by Kortund isolators against shock from nearby 15,000 lb. steam hammers.

5 This 100 ton punch press installed on an upper floor could not be operated until Kortund isolators stopped vibration and noise to floors below.

8 Kortund isolation protects this delicate analytical balance from vibration and shock caused by crushing and shaking equipment in mineral processing plant.

1 Mill on upper floor of steel structure. Kortund isolators solved serious problem and reduced maintenance.

2 This 100 ton punch press installed on an upper floor could not be operated until Kortund isolators stopped vibration and noise to floors below.

9 Large compressor on research laboratory's upper floor. Kortund isolators stopped vibration transmission to sensitive instruments, reduced noise level.

6 Kortund Isolation protects this delicate analytical balance from vibration and shock caused by crushing and shaking equipment in mineral processing plant.

10 Apartment rooftop installation of fans, compressors, pumps and boilers free valuable basement space for rental garages. Guaranteed vibration-noise control cost less than 1/4 of the mechanical contract!
KORFUND STEEL SPRING VIBRO-ISOLATORS PROTECT THIS DELICATE ANALYTICAL BALANCE FROM VIBRATION AND DISTURBANCES CAUSED BY CRUSHING AND SHAKING EQUIPMENT IN THIS LARGE PROCESSING PLANT. PHANTOM VIEW SHOWS HOW HIGHEST DEGREE OF ACCURACY IS MAINTAINED BY ISOLATING THE CONCRETE BLOCK FROM THE TABLE—OPERATOR MAY WORK AT TABLE WITHOUT DISTURBING THE BALANCE.
Severe external vibration from trucks and trains made accurate work on this surface plate impossible until it was mounted directly on Korfund Vibro-Isolators which solved the problem.
Severe external vibration from trucks and trains made accurate work impossible on this checker until it was mounted directly on Korfund Vibro-Isolators. Isolators set in pockets made by removing wood block flooring.
Mounting these five 37,000# Cincinnati #10-66 Duplex Vertical Broaches on Korfund Spring Isolators prevent vibration transmission from one broach into another and into adjacent precision grinders. Lower photo shows isolators under the floor.

30661

Photo 3477
Experiments cost you money. There is a right type—and many wrong types—of vibration, shock, and noise isolation product for each job. Korfund picks the right type for your job from Steel Springs, Cork, Rubber, Flexible Connectors, and Acoustical Buffers, Panels or Rooms.

Our half century of experience eliminates trial and error, yet the Korfund System costs no more than less effective, less permanent methods.

Advantages of Korfund isolation equipment
- Prevent vibration transmission, reduce dynamic loads
- Permit machinery installation anywhere
- Eliminate special foundations or structural reinforcement
- Speed equipment installation, relocation, and production-line change-over
- Lengthen building & machine life, reduce maintenance costs
- Increase production, machine speed, and quality

Engineering service
Korfund engineers, with a half century of experience in solving vibration, shock, and noise control problems and in machinery foundation design, will serve you without charge or obligation. Call on 56 Korfund engineering representatives in the U.S. and Canada listed under "Korfund" in Thomas' Register and your local telephone directory or the home office.

Plant surveys
Korfund is fully equipped to conduct plant surveys to determine the best method for controlling vibration, shock, and noise to save time and money, and prevent future permanent damage to both machinery and structure.
WHY VIBRATION AND SHOCK

Why isolate vibration and shock? Vibration, shock, and noise transmitted from rotating or reciprocating machinery are more than just annoying—they are often destructive to buildings, equipment, and employee efficiency. The Korfund System of Vibration Control serves one or more of these purposes:

1 Positive Isolation—prevents transmission of vibration and shock from impact, rotating or reciprocating equipment into precision machines, delicate equipment, and building, or to personnel.

Experience and tests have shown that excessive vibration and the noise which accompanies it have a decided influence on the nervous system, and contribute materially to mental and physical fatigue. Such fatigue is detrimental to the health, leads to accidents, and reduces the efficiency of workers. The cost of vibration and noise control will generally be recovered in a short time by an actual increase in personnel efficiency.

2 Negative Isolation—prevents transmission of external vibration and shock from other machinery, trucks, trains, etc., into machine tools or other precision equipment. The same isolators may perform more than one function at the same time under the same machine. For example, they will stop vibration transmission from a grinder taking rough cuts, then protect it against external vibrations when it takes final precision cuts.

3 Alignment—Isolators compensate for uneven floors and prevent distortion and mis-alignment of machines installed on weak floors by supporting the machines when trucks or other loads deflect the sub-structure.

Typical applications

Rubber mountings had been misapplied under this slow speed fan on a hotel roof. Transmitted vibration rendered 20 rooms unrentable. Installation of Korfund spring isolators—costing $352.00—completely solved the problem, permitting rental of the suites.

Korfund rubber and cork Elasto-Rib pads under this press speed installation, eliminate bolting to floor, and reduce vibration and noise—cost $16.00. Presses over 50 tons capacity and upper floor installations generally require steel spring isolators.

Korfund vibration control solved the problem after $25,000 forging hammer installed on rubber mounted foundation was abandoned because of shock transmitted to neighboring structures.

Korfund isolators permitted installation of six huge 1425 h.p. four cycle supercharged Diesel engine generators on poor soil without vibration transmission.

Korfund isolators permitted installation of six huge 1425 h.p. four cycle supercharged Diesel engine generators on poor soil without vibration transmission.

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Korfund isolators permitted installation of six huge 1425 h.p. four cycle supercharged Diesel engine generators on poor soil without vibration transmission.

Korfund isolation for this centrifuge and other processing equipment saved the cost of floor reinforcement, stopped cracking of floors, and permitted location on upper floors without special foundations for economical gravity flow of materials.

Korfund vibration control protected sensitive equipment such as the electron microscope against external vibration, and insured the necessary accuracy of performance.

Korfund rubber and cork Elasto-Rib Dampers under this machine tool speed installation, eliminate bolting, provide built-in leveling, and reduce vibration transmission. Cost $24.00.

Korfund isolators—cost $576—replaced improperly engineered rubber rails—cost $160—stopped severe vibrations transmitted thru five floors (brackets maintained original piping heights).
Isolation recommendations are listed opposite each machine by numbers which correspond with numbers assigned to Korfund products described on pages 4 thru 8. Where more than one product is listed, selection is governed by job conditions. Isolation recommended for highest efficiency offers in most cases advantages of easier installation, built-in leveling devices, and longer life in addition to maximum vibration isolation and noise reduction. Consequently, the over-all cost is often no higher than for alternate recommendations. Selections are based upon normal installation conditions, and are subject to variations in event of unusual job circumstances.

**type of vibration control**

The type, size, speed, service conditions, and location of equipment determine the type of isolation required. Properties of the various isolation media are discussed at top of pages 4 and 6. The table below indicates relative effectiveness of steel springs, rubber, and cork in the various equipment speed ranges.

**comparison table**

<table>
<thead>
<tr>
<th>range</th>
<th>rpm</th>
<th>springs</th>
<th>rubber or elesto-rib</th>
<th>cork</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td>up to 1200</td>
<td>required</td>
<td>not recommended</td>
<td>except for shock*</td>
</tr>
<tr>
<td>medium</td>
<td>1200-1800</td>
<td>excellent</td>
<td>good</td>
<td>suitable</td>
</tr>
<tr>
<td>high</td>
<td>over 1800</td>
<td>fair</td>
<td>not recommended</td>
<td>for shock**</td>
</tr>
</tbody>
</table>

*For non-critical installations only; otherwise, springs are recommended.

**typical specifications**

1. **Machines Mounted Directly on Isolation Material:**
   "To prevent vibration and shock transmission, the (machine) shall be resiliently mounted directly on Korfund (type of Isolator). Isolator sizes are to be determined by manufacturer and units to be installed in accordance with manufacturer's instructions."

2. **Machine and Driving Unit Mounted on Isolated Steel Base:**
   "To prevent vibration and shock transmission, the (machine and driving unit) shall be mounted on an integral steel base which shall be resiliently mounted on Korfund (type of Isolator). Isolator sizes to be determined by manufacturer and units to be installed in accordance with the manufacturer's instructions."

3. **Machines Mounted on Isolated Concrete Foundation:**
   "To prevent vibration and shock transmission, the (machine) shall be mounted on a concrete foundation which is supported on Korfund (type of Isolation). Isolator sizes to be determined by manufacturer and material to be installed in accordance with manufacturer's instructions."

4. **Fans and Motors:**
   "Fans and motors shall be mounted on structural steel bases having provision for bolting the equipment, and motor bases shall have built-in adjustable slide rails for belt tightening: the bases shall be Korfund Integral Bases and the isolating medium shall be rubber.

(Note: For high pressure fans and other types in critical locations, use specifications #2 or 3, with type JK or UP Isolators.) Complete air conditioning isolation specifications given in free Bulletin FaC.

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### Isolation Recommendations

<table>
<thead>
<tr>
<th>Machine</th>
<th>Isolation Recommended For Highest Efficiency</th>
<th>Alternate Recommendation Satisfactory For Less Critical Jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Concrete Foundation Required</td>
<td>Concrete Foundation Required</td>
</tr>
<tr>
<td>Air Conditioners</td>
<td>1.5</td>
<td>7.10</td>
</tr>
<tr>
<td>Boiling Machines</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Brakes</td>
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<td>2</td>
</tr>
<tr>
<td>Broaches</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Business Machines</td>
<td>1.7</td>
<td>7</td>
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<tr>
<td>Centrifuges</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Clickers</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Cont. Pulverizers (large)</td>
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<td>Compressors:</td>
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<tr>
<td>Vertical, V, W, Radial over 450 RPM</td>
<td>1</td>
<td>6.7</td>
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<tr>
<td>under 450 RPM</td>
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<tr>
<td>Horizontal</td>
<td>1</td>
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<tr>
<td>Centrifugal</td>
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</tr>
<tr>
<td>Cooling Tower</td>
<td>1</td>
<td>2.4</td>
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<tr>
<td>Crushers, rock, etc.</td>
<td>1</td>
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<tr>
<td>Dinkers</td>
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<tr>
<td>Low Speed</td>
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<td>Evaporative Condensers: Fans:</td>
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<td>Centrifugal</td>
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<td>7.10</td>
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<tr>
<td>Utility</td>
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<td>7.10</td>
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<tr>
<td>Furnaces</td>
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<td>6.7</td>
</tr>
</tbody>
</table>

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**KORFUND COMPANY, INC.**

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*Special Heavy Duty Pads for very high loadings—write for information*
STEEL SPRING

Steel spring Vibro-Isolators provide the most efficient method of isolating vibration, approaching 100% effectiveness. Strongly recommended for most installations, they are essential on critical jobs, provide greatest overall economy, permit installations on lighter sub-structures, and are fully guaranteed.

The high efficiency of steel spring Vibro-Isolators is due to the greater deflections which they provide—see "Theory of Vibration Control," available free from The Korfund Company. Standard steel spring isolators give up to 2½" of deflection compared to about ¼" maximum for other materials, while special steel spring isolators can give 10" or more of deflection. Unlike other materials, their performance can be accurately predetermined, eliminating costly trial and error. housings of rugged steel and replaceable construction plus properly designed steel springs gives long life, usually greater than the machine itself. Isolators are unaffected by water, oil, most chemicals, or by temperature extremes.

Isolator adjusting bolts serve as leveling jacks, eliminate shims, speed equipment installation. Adjustable snubbers to control movement are built-in or are available separately.

1 series L Vibro-Isolator with built-in leveling device

description

The series L Vibro-Isolator consists of a semi-steel cast housing. (size H is malleable casting, size J is welded steel) incorporating oil tempered carbon and alloy steel springs as the isolating medium. Quantity and stiffness of springs are varied to give proper load carrying capacity and dynamic characteristics.

The types LK and LN have a bolt which fastens the equipment to the isolator top plate and bears on a spring compression plate, transferring the load to the vibration absorbing springs; this bolt also provides built-in leveling adjustment. Additional holes may be tapped into the top plate. The types LI and LO have internal adjusting and leveling bolt (fig. 1) for machines without bolt holes. The upper and lower parts of the housing are aligned by resilient chocks which take up any horizontal thrust, and which on the types LK and LI can be adjusted for varying degrees of dampening to limit oscillation under both vibration and impact.

typical installation arrangements

If driving motors are not mounted on the machine, it is usually desirable that both machine and motor be mounted on a common structural steel base or concrete foundation under which the isolators are placed. Direct coupled machines should always have a common steel base or concrete foundation.

e. minimum height installation: If increase in height of the mounted machine is objectionable, isolators can be set under brackets which may be welded or bolted directly to the machine or to saddles, on which the machine may be mounted.

a. direct mounting — external adjusting bolt: The standard method of installing isolators is shown above. Usually it is not necessary to fasten isolators to floor. Iffastening is required they can be bolted or remounted to floor. For maximum noise reduction, sound pads may be used under mountings.

b. direct mounting — internal adjusting bolt: Cementing is accomplished to machine base and floor by means of a thin Korfund felt pad and special cement. (65 #/sq. in. bond strength). Rubber sound pads can be substituted for felt for maximum noise reduction.

c. mobile installations: Installations where large external forces may overturn the isolated equipment (e.g., marine or mobile or outdoor subject to wind loads), or large internal forces (e.g., dynamics subjected to short circuits) require limit stops. Channel iron are used if base has no extra holes.
types UN & UV Vibro-Isolators

**Type UN**
- **Load Range:** 3,000# to 35,000#.
- Heavy duty isolator most frequently used to support machinery on deep concrete foundations. The structural members cast thru foundation are supported on top of the isolator. Separate snubbing and damping control available where required. Drawings show typical installation arrangements.

**Type UV**
- **Load Range:** 3,000# to 35,000#.
- This is similar to the Type UN in design and application, but is most frequently used to support machinery on shallow concrete foundations or structural steel chasis. It is located between the structural members, rather than under them, resulting in easier adaptability to chassis and shallow blocks. Drawings show front and side views of a typical arrangement.

series S Vibro-Isolators

**Type SK**
- **Load Range:** 60# to 200,000#.
- For heavy duty marine and stationary installations demanding extreme horizontal thrust capacity; also, for punch presses weighing 60,000# and up. Available with leveling bolt on top (type SK), on side (type SW), or inside (type SI). Exceptionally rugged welded steel construction.

**Type SW**
- For load carrying capacities and design modifications are available to meet your specifications and needs.

types UP and US Vibro-Isolators

**Type UP**
- A rugged steel pipe housing in which is incorporated a steel spring designed for the application. The machine to be isolated is carried on either a structural steel base or on a concrete foundation to which the isolators are attached. Relatively long springs permit large deflections for effective isolation of slow speeds.

**Type US**
- This is a suspension type vibration isolator that has been specifically designed to mount equipment generating large horizontal forces or couples. It has a unique pendulum suspension system. The bolts on the sides are a part of a snubber system.

series V Vibro-Hangers

**Type VB**
- **Load Range:** 20# to 5,000#.
- For suspended equipment such as air conditioning machines, acoustical ceilings, and overhead piping. Various arrangements of springs within the housing permit increasing deflections and capacities. Type VB offers greatest ease of installation since only one bolt is needed to fasten the hanger. Type VH, with open construction, is used when straddling beam webs. Type VR (not shown) consists of a spring and a specially designed rubber-in-steel element in series for high frequency attenuation.

**Type VH**
- **Load Range:** 20# to 5,000#.
- For suspended equipment such as air conditioning machines, acoustical ceilings, and overhead piping. Various arrangements of springs within the housing permit increasing deflections and capacities. Type VH offers greatest ease of installation since only one bolt is needed to fasten the hanger. Type VR (not shown) consists of a spring and a specially designed rubber-in-steel element in series for high frequency attenuation.
RUBBER AND CORK

Rubber and cork provide good sound insulation and can be used effectively to prevent vibration and shock transmission in non-critical installations. For vibration isolation they are primarily limited to medium and high speed equipment. (See "Type of Vibration Control," page 3.)

Individual molded rubber mountings are generally economical only with light and medium weight machines, since heavier capacity mountings approach the cost of the much more efficient steel spring isolators. Pad type rubber isolation has no such limitations. Rubber is not affected by acids or alkalis, but is not recommended for use in the presence of sunlight. Temperature range: Natural Rubber, -30° to +150°F.; synthetic, -20° to +300°F. Synthetic rubber is recommended for applications exposed continuously to oil. It is excellent in controlling high frequency disturbance and structural borne noise. The average life of rubber is about 7 years under non-impact and about 5 years under impact applications, considerably greater for pure sound insulation (e.g., pads under spring isolators).

Cork can be used directly under machines, but is most often used under concrete foundations. It is not affected by oils, acids normally encountered, or temperatures between 0°F. and 200°F., but is attacked by strong alkaline solutions and will rot under continual cycles of moistening and drying. Cork under concrete foundations still giving good service after 20 years proves a long useful life when properly applied.

**Elasto-Rib**

Korfund Elasto-Rib has a core of high-grade cork plate, permanently bonded between two layers of waffle embossed, oil resistant synthetic rubber.

Elasto-Rib simplifies machine installations—it prevents marring floors by equipment, resists any tendency for machines to "walk," and the resiliency of the rubber compensates for slight irregularities in the floor surface; it is excellent in eliminating transmission of high frequency disturbances; i.e., noise. Installation is simple; no fastening to the floor is normally required. If desired, cement to the machine and floor with Korfund cement.

Elasto-grip—oil resistant synthetic rubber. Waffle is available without cork center. Single sheets, flat on one side, are 1/2" thick. May also be bonded together back-to-back to form a double waffle unit 1/2" thick.

**Elasto-Rib dampers**

Universal Elasto-Rib Dampers, Series E, have a load distributing steel plate with non-skid felt pad, permanently bonded to the Elasto-Rib pad for use where the machine leg is smaller than the area of pad required, or where leveling adjustment is required.

The Lev-Elasto Damper, Type EL, features a leveling device providing up to 1/4" adjustment. By eliminating shims and lag bolts, machines can be installed in minutes. It accommodates all job conditions because its internal adjustment permits installation anywhere under machines, regardless of position or availability of bolt holes in the machine base. The Type EU Elasto-Rib Damper, used when a mounting without built-in leveling is needed, has an offset hole drilled thru it. Machine may normally be placed on it without any fastening, or may be cemented or bolted. Damper may also be used if machine has built-in leveling bolt; specify if this arrangement is to be used when ordering sizes EL-60 thru 120.

**Armstrong's Vibracork and Corkfund light density machinery cork**

Machinery isolation cork plates are strong and durable resilient boards made of pure grades of cork, without any foreign binder, compressed and baked under pressure with accurately controlled density. They can be installed directly under many machines. For large foundations in pits, plates of cork are applied directly to the bottom and sides of the foundation pit, covered with asphalt felt, and joints are sealed with asphalt, presenting an unbroken, watertight form into which the concrete is poured. Cork plates can also be furnished with asphalt felt top and bottom in sheets 16" x 36".

**Load Ranges:**
- Corkfund Light Density Machinery Cork (1" and 3" thick) 400-1500 lbs. per sq. ft.; Armstrong's Standard Density Vibracork (2" and 3" thick) 500-1500 lbs. per sq. ft.; Armstrong's Heavy Density Vibracork (1", 2" and 3" thick) 4500-5500 lbs. per sq. ft.
Panel Seismo-Damper

Load Range: 250#/ per sq. ft to 4500# per sq. ft. Recommended for jobs involving very unequal or light load distribution. Provides maximum cork effectiveness. Consists of cork pads described in Item 8, bonded to underside of heavy plywood panel on which concrete is poured. Area and placement of cork is determined for optimum loading in accordance with weight distribution. Nominal thicknesses: 2" and 3".

series R rubber-in-shear hangers

Load Range: 10-2,300#. Rubber-in-shear mountings designed for use in suspended installations. Safety feature eliminates the possibility of equipment falling in the event of damage to the rubber. For suspended equipment such as air conditioning machines, acoustical ceilings, and overhead piping. These units are excellent for attenuating high frequency disturbances and structure-borne noise. Available in box-type or open housings.

type RB

type RH

rubber-in-shear units for floor mounting

There are low cost, efficient isolation mountings and are excellent for use within the limitations discussed for rubber on page 6. There is a wide range of loads for loads up to 500 pounds per mounting.

type D: A universal type of mount for non-bolted applications. Can be bolted to floor if necessary.

type RA: For bolted applications. Available in 5 sizes, each in 5 different rubber diameters to provide the greatest deflections over a wide range of loading.

fan and motor bases

The highest possible isolation efficiencies are obtained through the use of spring isolated structural steel bases, due to the greater static deflections obtainable from spring isolators. The lower the speed of the equipment, the greater must be the static deflection in the mounting.

The great majority of these spring suspended bases utilize the series L mounting as the isolation medium. (Item 1). For very low speed fans or where fans are mounted on weak upper floors, the types CP or CS mountings are used. (Item 1).

integral rubber-in-shear or cork isolated

The Korfund Integral design offers maximum strength because of its rigid one-piece integral construction. It provides the best possible isolation obtainable from a commercial rubber-in-shear or cork base, and offers the following advantages:

- integrally welded structural sections
- top channel is drilled and tapped to match the equipment mounting holes, providing a template for rapid and accurate installation.
- also available with built-in motor slide rail adjustment, costing less than separate slide rail bases.

DUPLEX TWIN RAIL DESIGN ALSO AVAILABLE

THE KORFUND COMPANY, INC.
Flexible connectors, available in both metal and rubber, are used to stop the transmission of vibration and noise thru rigid piping of air conditioning and other systems. When used in conjunction with properly applied vibration isolators, Korfund Flex-Hose helps assure maximum quiet in machinery installations.

**Metal hose**—Type F, seamless bronze tubing, is used for From connections. Fits a range of sizes of copper tubing from 1/8" O.D. to 4½" O.D. Series B & S seamless bronze or steel tubing is a general purpose hose, available with 4 types of end fittings. Fits a range of pipe sizes from 1½" I.D. to 1½" I.D.

**Rubber hose**—Consists of an inner tube of gum rubber or specially compounded synthetic stock, protected by wire-reinforced flexible layers of woven duck and rubber, overwound with an outer wrap. Type RH is made of flexible hex end connections, and fits a range of pipe sizes from 1½" J.D. to 4" I.D. Type RF has flanged end connections, and fits a range of pipe sizes from 2½" I.D. to 1½" I.D.

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**RESEARCH AND DEVELOPMENT FACILITIES**

Backed by over 50 years of experience in the field of vibration, shock, and noise isolation, the Korfund Co., Inc. now offers its services for research and development work. These facilities have recently been expanded to include a number of prominent consultants and consulting organizations who are available to help in solving your isolation problems. With its affiliated company, Federal Shock Mount Corp., Korfund has extended activities in the electronic component fields contributing to aeronautical and missile applications.

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**test facilities**

Korfund has all the facilities to perform complete vibration and shock tests on all equipment and structures. Certified performance data is available for vibration frequencies to 3,000 cps, and shock to 100 g's. Korfund is approved by the Military for qualification testing. Illustrated is just one of the equipment necessary for the development of advanced vibration and shock mounting systems.