

Low Frequency **Vibration Control** Solutions

Second Edition - 2004

Global thinking



Fabreeka International has been a leader in the field of shock and vibration control since 1936. Our corporation provides vibration isolation and shock control solutions for industries worldwide.

- **Fabreeka International Inc**
- **Fabreeka Canada Ltd**
- **Fabreeka United Kingdom**
- **Fabreeka Holland**
- **Fabreeka Germany**
- **www.fabreeka.com**

The reliable performance of our isolation systems is proven by sound engineering principles and tested performance. Fabreeka is more than a manufacturer of isolators. We engineer solutions for your vibration and shock problems.

Contact us at any one of our worldwide facilities for assistance.

Products and Services

04 Background

Understanding vibration isolation. A brief discussion regarding isolator natural frequency, static and dynamic spring rate, damping and transmissibility, including types of isolators and isolator performance.

05 Design Services

Our Engineering Vibration Specialists offer design solutions including vibration measurement and analysis, structural design and dynamic analysis, including FEM and modal analysis.

07 Foundation Isolation

Proven materials for vibration and shock isolation including elastomeric, pneumatic and spring/damper systems. Project management: soils analysis, construction, installation and acceptance testing.

09 Pneumatic Isolators

Passive and active isolators for vibration and shock applications requiring low frequency isolation. OEM and custom designs.

11 Isolation Tables & Platforms

Stand alone isolation tables for laboratory and research applications, including enclosures, Faraday cages and a selection of work surfaces. Tabletop isolation platforms for sensitive microscopy and laboratory equipment.

13 Custom & OEM Solutions

Our worldwide Engineering group designs, manufactures and tests custom and special low frequency isolation systems for OEM customers in many industries.

15 Pneumatic Leveling Mounts

Precision-Aire™ pneumatic leveling mounts provide low frequency vibration and shock control for surface plates, coordinate measuring machines, fans, air compressors, motor/generator sets, high speed punch presses and more.



Background to Vibration Isolation

The purpose of vibration isolation is to control unwanted vibration so that its adverse effects are kept within acceptable limits.

Excitations originating from machines or other sources are transmitted to support structures, such as a facility floor, causing a detrimental environment and unwanted levels of vibration for the recipient.

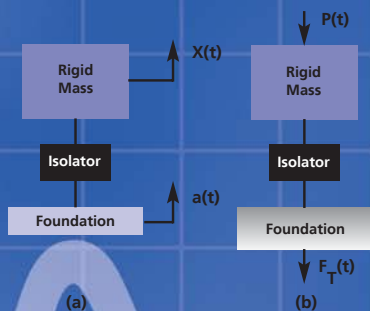
If the equipment requiring **isolation** is the source of unwanted **vibration** (Fig b), the purpose of isolation is to reduce the vibration transmitted from the source to the support structure. Conversely, if the equipment requiring isolation is the recipient of unwanted vibration (Fig a), the purpose of isolation is to reduce the vibration transmitted from the support structure to the recipient.

An isolator is a resilient support which decouples an object from **steady state** or **forced vibration**. To reduce transmitted vibration, isolators in the form of springs are used. Common springs used are pneumatic, steel coil, rubber, elastomeric and other pad materials.

Natural frequency (stiffness) and **damping** are the basic properties of isolators. They determine the **transmissibility** and isolation properties of an isolator designed to provide vibration and/or shock isolation. Additionally, other important factors must be considered in the selection of the proper isolator. Two such factors are:

- The source and type of the dynamic disturbance causing vibration or shock.
- The response of the isolator to the dynamic disturbance.

With an understanding of its static and dynamic properties, the type of isolator is then chosen primarily for the load it will support and the dynamic conditions under which it will operate.



Design Services

Vibration Measurement & Analysis

Low frequency vibrations and large shock inputs can affect the accuracy, repeatability and throughput of precision machines and equipment.

Fabreeka utilizes highly accurate instrumentation to quantify the amplitude and frequency of vibration to make proper vibration control recommendations.

Measurements with special data analysis requirements are performed regularly by our Engineering staff for unique projects worldwide.



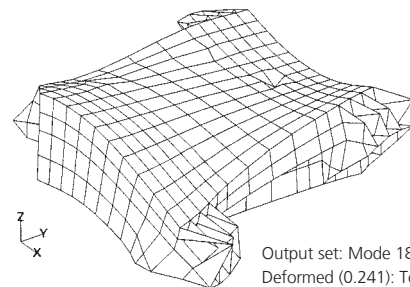
Vibration measurement software records amplitude and frequency data for analysis.

Dynamic & Modal Analysis

A modal analysis characterizes a structure's dynamic properties including rigid body and bending mode shapes, frequency response and damping.

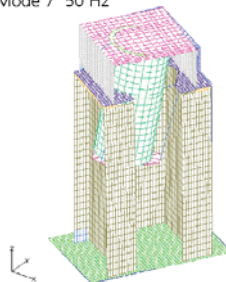
Dynamic analysis verifies the modeled response of structures and the isolation systems which support them.

Fabreeka's capabilities include NASTRAN and finite element analysis programs to analyze the static and dynamic conditions of our customers' vibration problems.



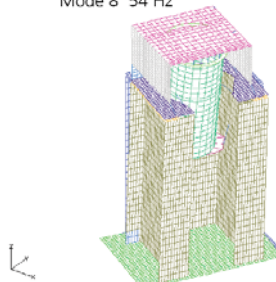
Output set: Mode 18 172.5208 Hz
Deformed (0.241): Total Translation

Mode 7 50 Hz

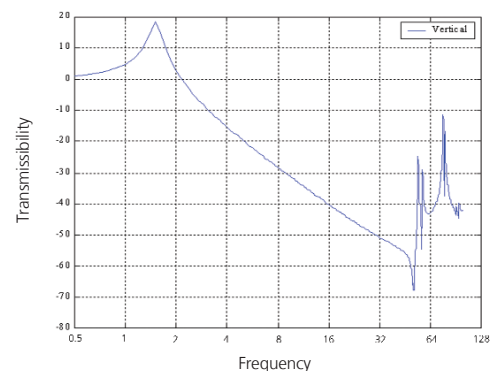


Output set: Mode 7, 50.77269 Hz
Deformed (2.169): Total Translation

Mode 8 54 Hz



Output set: Mode 8 54.56144 Hz
Deformed (1.657): Total Translation

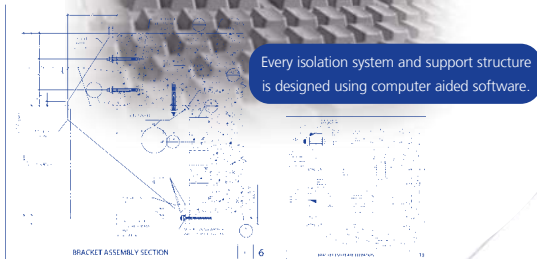


CG response to base excitation in the Vertical Z direction.

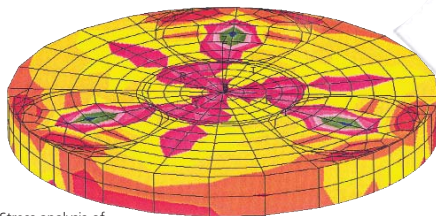
Dynamic Isolator Response

Design Services

Structural Analysis and Design



Every isolation system and support structure is designed using computer aided software.

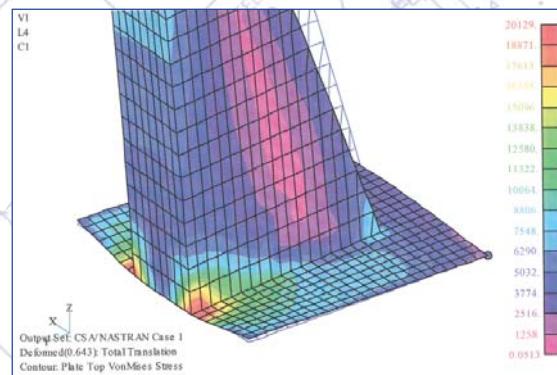


Stress analysis of 10" diameter support platform.

Inertia blocks and support foundations are sometimes required as part of an isolation system design. Fabreeka's expertise includes the design of rigid concrete masses and structural steel forms.

Our Civil and Structural Engineers design to frequency and stiffness specifications associated with the payload and the stiffness of the isolation system.

Structural analysis of steel support leg.



Consultation and Project Management

Fabreeka can provide complete, detailed design drawings and specifications for construction or fabrication.

Our Engineers can supervise critical phases of the construction and provide responsibility for the design, installation and testing of installed isolation systems.

Design review meetings are held with customers as part of overall project management.



Foundation Isolation

Fabsorb™ Isolation Material

Fabsorb™ vibration isolation material is an economical approach to foundation isolation where moderate vibration control is required.

Fabsorb™ material absorbs machine induced energy, limits the transmission of higher frequency disturbances and provides isolation from ambient and induced shock and vibration, which otherwise would affect the accuracy of the machine being installed.

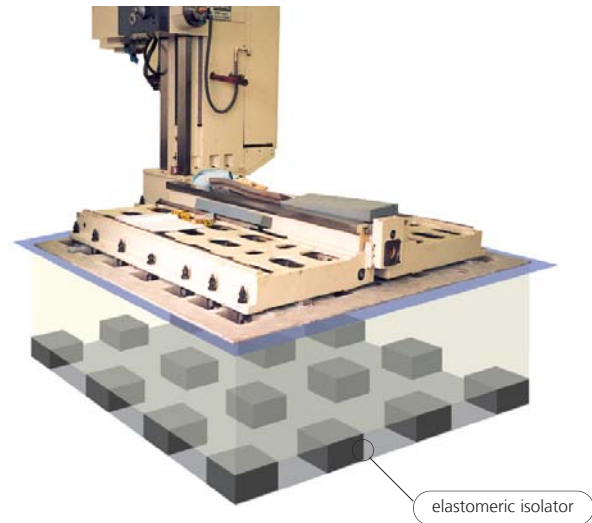
Fabsorb™ material has been specifically designed for vibration isolation applications of support foundations for machine tools, shock testing equipment, grinders and similar equipment.



Infab™ Isolation Systems

Fabreeka Infab™ vibration isolation blocks are composed of a molded elastomer which has been designed to provide low frequency isolation for foundation isolation applications.

Infab™ isolation systems have natural frequencies as low as 5.0 Hz and can be supplied with low or high internal damping. Infab™ solutions are used under large concrete foundations supporting heavy machinery, buildings, measuring machines, roller mills and similar equipment.



Elastomeric isolators and forming installed on pit floor prior to concrete pour.

Foundation Isolation



Pneumatic Isolation Systems

Fabreeka's experience includes the design of seismic reaction masses and support foundations for the aerospace/defense and automotive industries.

These programs require low frequency, self-leveling pneumatic isolation systems. Natural frequencies as low as 0.5 Hz have been achieved for ultra-low frequency isolation.

Fabreeka's pneumatic isolator design incorporates adjustable damping so the system can be "tuned" in the field for large reaction forces and dynamic inputs. Electrodynamic shakers, road simulators, dynamometers, vacuum chambers and large gantry-type measuring machines are typical applications.



Large load capacity isolators up to 120,000lbs per isolator with low natural frequencies less than 1.0 Hz in all axes.

Fabreeka Spring/Damper Systems

Fabreeka's experience also includes the design of support foundations for turbines, forging hammers, test stands and presses.

These applications require spring/damper isolators due to the large dynamic deflections encountered and the necessity for high damping to keep the deflections within an acceptable range.

Fabreeka's spring/damper solutions offer low natural frequencies around 3.0 Hz with damping values as high as 30%. Used in conjunction with an inertia mass, the supported system will remain stable within its operational limits and remain efficiently isolated.



Photo provided by KTI Germany



Spring isolator unit with integral viscous damping

Photo provided by KTI Germany

Pneumatic Isolators

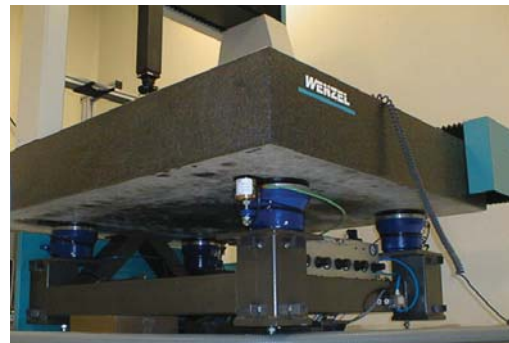
Precision-Aire™ Isolators

Precision-Aire™ Leveling Isolators provide superior low frequency isolation for metrology instruments, electron microscopes, coordinate measuring machines and precision manufacturing equipment.

PAL isolators can be designed to have natural frequencies as low as 0.5 Hz vertically and 0.4 Hz horizontally. The standard line of isolators have natural frequencies of 2.7 Hz and 1.5 Hz respectively. The natural frequency and isolation efficiency of these isolators remain constant throughout their load range.

PAL systems react quickly to position changes of supported load and center of gravity shifts by automatically compensating and releveling. Settling time is minimal with optimum damping and correct valve gain.

Vertical damping is adjustable on all PAL series isolators. Damping is achieved by directing air through a laminar flow restrictor which ensures that the damping for each system is optimum for all external inputs.



The PAL series self-leveling isolators are easily integrated into machine designs.



Fabreeka offers a broad range of standard isolators with payload capacities from 150 lbs to 120,000 lbs (66 kg to 53,333 kg).

Special Pneumatic Systems

Special Pneumatic Systems

Some applications have unique criteria which require specially designed PAL isolators and systems. Although Fabreeka offers standard design and performance characteristics, our pneumatic systems' technology enables a wide range of variations to meet custom specifications.

Lower vertical and/or horizontal natural frequencies (0.4 Hz) and specific adjustable damping characteristics (3% - 20%) have been requested and supplied by Fabreeka. Additionally, electronic repositioning and pressure options have been used for the more critical applications. Our Systems Engineers can design new isolators or modify existing standard isolators to meet special isolation efficiency criteria.



Fabreeka also manufactures low frequency, vacuum-compatible isolators for use in vacuum chambers.



A wide range of high precision leveling valves are available to meet individual requirements.



Isolation Tables and Platforms

Precision-Aire™ Tables

Fabreeka's Precision-Aire™ isolation tables provide low frequency vibration control for sensitive lab equipment including microscopes, electro-optical and vision systems, micropositioning and wafer inspection.

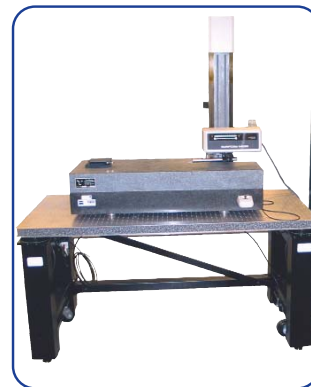
The Precision-Aire™ series table provides a self-leveling work surface and low frequency isolation in laboratories, cleanrooms and inspection areas where footfall and structural vibration can decrease performance reliability and accuracy.

These tables are designed to support payloads of 400 lbs to 2,500 lbs (170 kg to 1,100 kg). A range of sizes and work surface options are available. Work surfaces include stainless steel, plastic laminate and breadboards with mounting holes.

The work surface is isolated by four pneumatic isolators which have a vertical and horizontal natural frequency as low as 1.5 Hz. Leveling valves provide accurate, repeatable leveling of the work surface.

A wide range of accessories is available such as equipment shelves, monitor arms, lean bars, castors and a variety of enclosures.

Fabreeka provides pneumatic isolation tables and work stations for electrophysiology, biophysical and biomedical equipment. We custom build electrostatic Faraday cages for biomedical applications.



Standard tables are easily modified to custom dimensions and OEM configurations.



Isolation Tables and Platforms



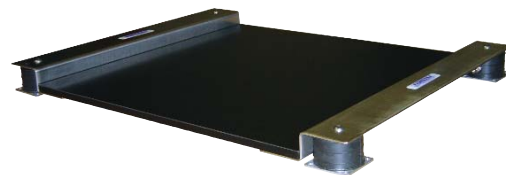
Precision-Aire™ ISO Tab-L

Iso Tab-L pneumatic , tabletop platforms provide low-frequency vibration isolation for microscopes, surface analyzers, roundness/hardness testers, balances, scales and optical equipment.



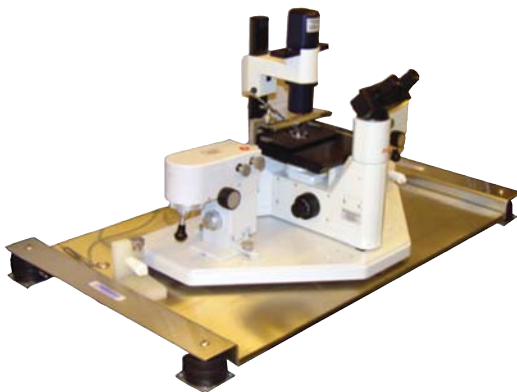
ISO Tab-L tabletop platforms are ideal for desktops in laboratories and Q.C. rooms, where they effectively isolate structural and floor vibration. Isolation is provided in the vertical and horizontal axes by pneumatic isolators located beneath the work surface. A protective shroud is supplied with all models which is isolated from the working surface and protects the system from accidental jarring.

The compact design of the ISO Tab-L enables a working height of 3 to 3.75 inches (75 mm to 95 mm) and will support and isolate precision instruments weighing between 50 lbs and 900 lbs (22 kg to 400 kg).



Custom ISO Tab-L

Fabreeka can supply ISO Tab-L systems to your specifications. Work surfaces can be supplied in special sizes and shapes, with custom hole patterns. ISO Tab-L isolation platforms can be modified in height, width and depth to meet your application requirements.



Custom and OEM Systems

Custom
and OEM Systems

Cradle Platforms and Frames

Cradle platforms and custom designed frames increase the stability of self-leveling pneumatic isolation systems and lower the supported center of gravity.



Custom Solutions

In addition to our standard line of vibration isolators, Fabreeka regularly designs and builds custom solutions for original equipment manufacturers. Pneumatic isolators are available which support payloads from 150 lbs to 13,300 lbs (66 kg to 5,985 kg) for a variety of applications.



The PAL series isolators are easily integrated into existing machine designs and are ideal for OEM applications.

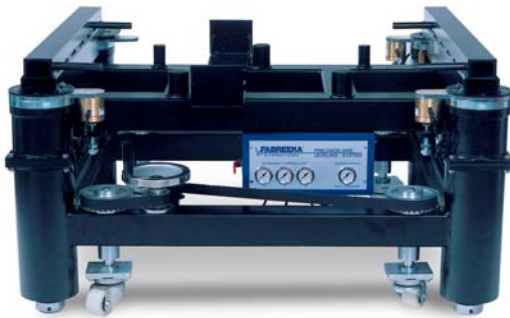


At right, 72" (1,828 mm) non-magnetic, stainless steel pneumatic isolator for 600 MHz NMR magnet.



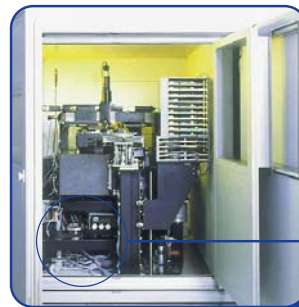
Custom and OEM Systems

Isolation Systems



Fabreeka designs vibration isolation systems which integrate our low frequency pneumatic isolators with dynamically rigid platforms and support frames.

These systems are designed and built to customer specifications and consist of either three or four isolators with a support frame designed to meet the OEM criteria for structural stiffness and geometry.



Standard tables are easily modified to custom dimensions and OEM configurations.



Custom Requirements

Fabreeka can support your custom designs for OEM requirements and integrate our isolation systems within your equipment design.

Acrylic environmental enclosures can be designed to protect sensitive measuring equipment in the lab or on the shop floor.



Pneumatic Leveling Mounts

Precision-Aire™ PLM Mounts

Precision-Aire™ pneumatic leveling mounts provide low frequency vibration and shock control for surface plates, coordinate measuring machines, fans, air compressors, motor/generator sets, high speed punch presses and more.

The Fabreeka PLM series pneumatic isolation mounts are low frequency vibration and shock isolators which provide both attenuation of disturbing vibration and equipment leveling.

For vibration control applications, the pneumatic portion of these mounts provide significant reduction of vibration occurring at frequencies above 5.0 Hz.

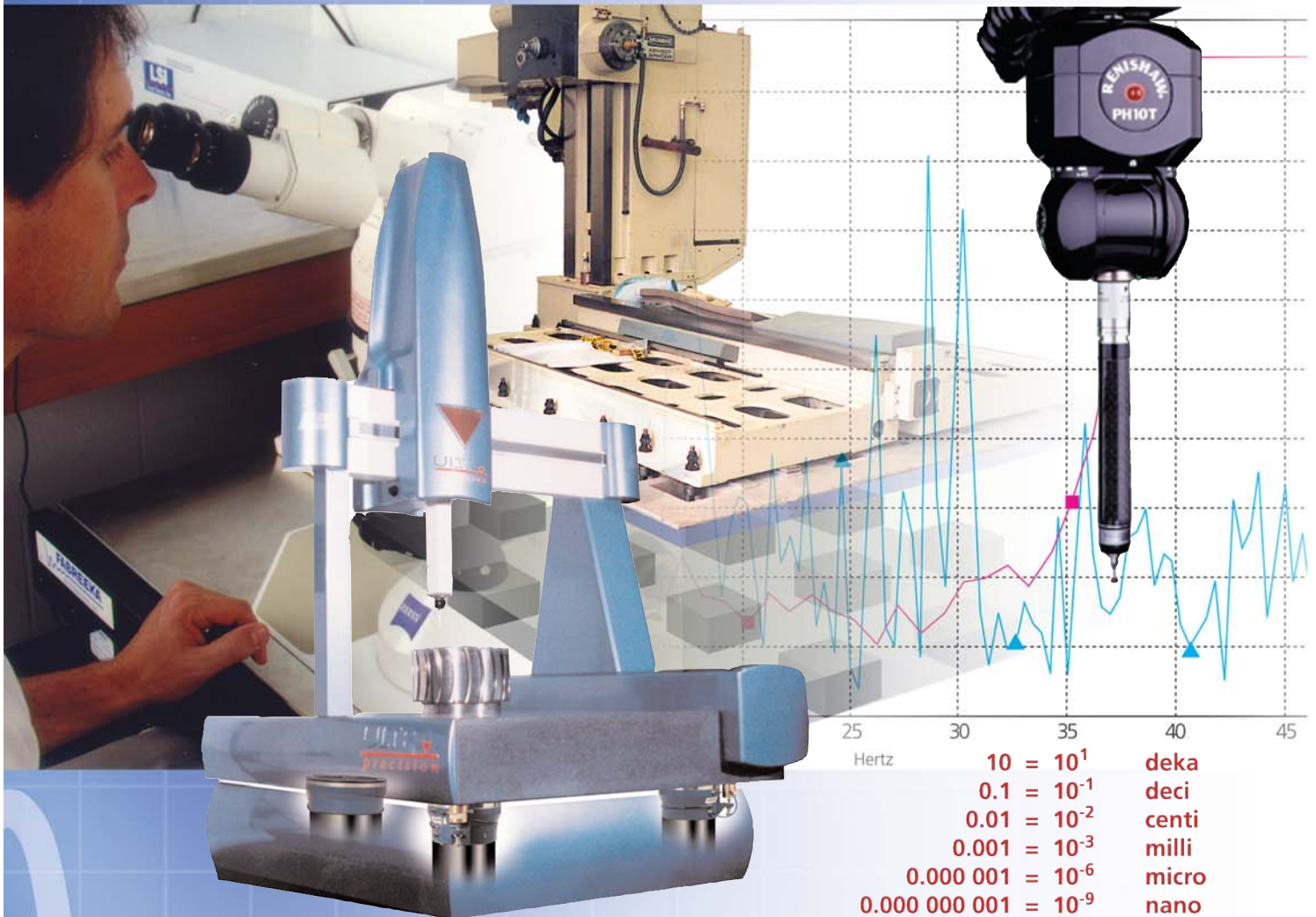
PLM isolation mounts will continue to isolate with no pressure having a vertical natural frequency of approximately 10.0 Hz.

The vertical to horizontal natural frequency ratio is approximately 1:1 with a sufficient degree of horizontal stability.

For shock or impact applications, the outer elastomeric wall construction provides a high deflection shock mount. A low natural frequency (3.0 Hz) can be maintained by utilizing an external spacer to prevent a "bottom out" condition.



The vertical to horizontal natural frequency ratio is approximately 1:1 with a degree of horizontal stability.



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