

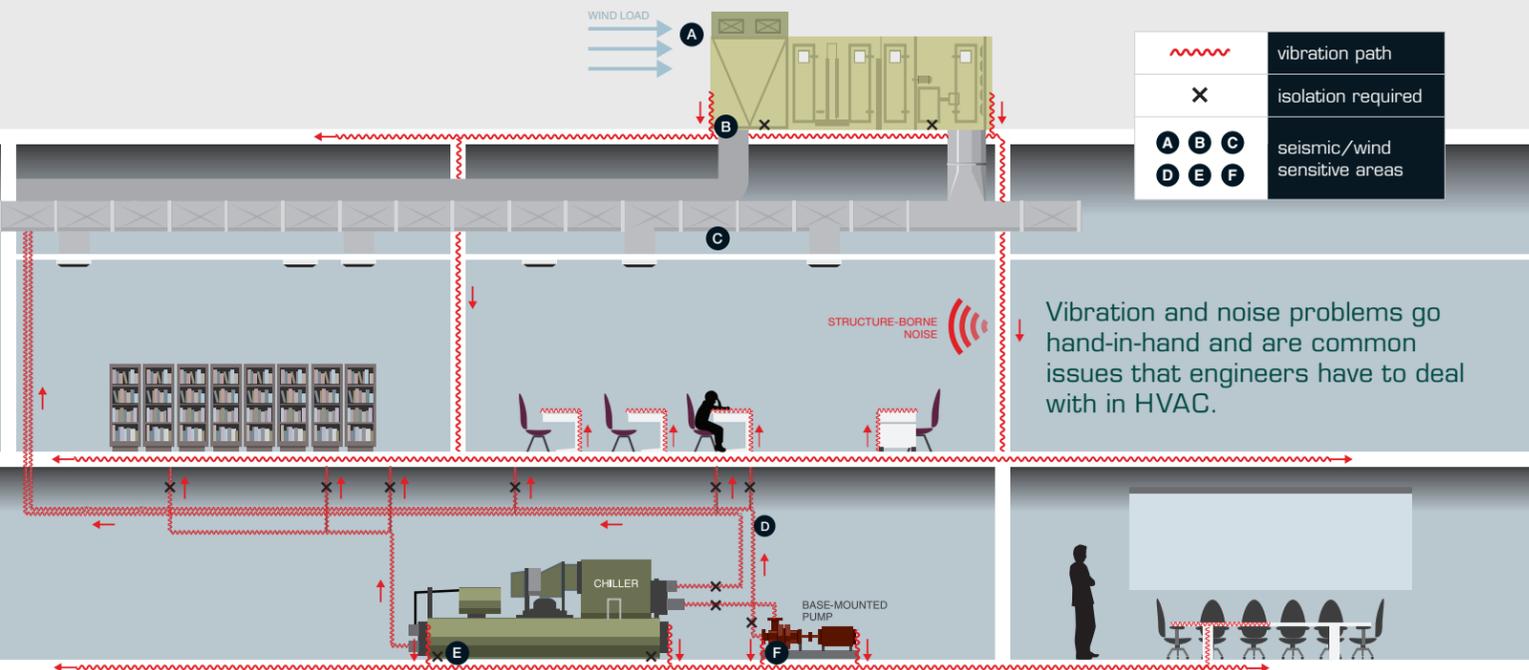
VIBROACOUSTICS®

A Swegon Group company



Vibration Isolation and Restraint Systems

Vibration, Structure-Borne Noise, & Seismic/Wind Effects



Vibration and noise problems go hand-in-hand and are common issues that engineers have to deal with in HVAC.

Vibration problems are usually caused by the moving and rotating mechanical elements found inside HVAC equipment.

The source vibration, if not properly isolated, can transfer to the structure and connected piping or ductwork. Sometimes, occupants

of a room may only sense the vibrational effect as something that's felt, but inaudible. In many cases, however, the vibration can propagate and radiate as a low frequency humming sound—this is known as structure-borne noise.

Without a careful, methodical approach to the proper selection and application of vibration isolators, problems can arise with significant consequences, including additional costs, extra work, lost time, and damage to professional reputations.

Restraint Requirements

A	Are wind load calculations required?
B	Is the equipment adequately attached?
C	Are restraints required for ductwork?
D	Is there thermal expansion?
E	Which anchors are required?
F	What embedment and edge distance is required?

Achieving code compliance (e.g., IBC or NBC) is crucial. Seismic and wind events can induce damage from a building's non-structural components, creating life-safety issues and devastating loss of revenue. If neither the design nor the construction teams have adequate expertise in extreme event engineering, an unacceptably high degree of risk and liability may be borne by both.

Traditional Practices

Traditional practices in vibration isolation selection don't always allow for the best solutions. One traditional approach is to rely on vibration isolation products that are supplied by the HVAC equipment manufacturer. The downside to this approach is that engineers can't be sure that the end result will meet the design criteria. Proper isolator selection and application depend greatly on the driving frequencies of the equipment (especially equipment with variable speed drives), location and supporting structure deflection, and surrounding and connected elements such as piping and ductwork.

When selecting isolators, the standard approach is to refer to the ASHRAE table; however, industry knowledge is necessary in order to use this table to arrive at the best solution for the system.

Labor-Savings Timeline

Our goal is to save you labor.

For vibration isolation and restraint systems, what cost should contractors carry for materials and labor? How can contractors avoid scope and labor creep? These are difficult questions to answer when systems aren't scheduled, locations aren't determined, and specifications are vague. It's up to the contractor to figure it all out.

The cost of labor is estimated to be 10 times the cost of isolation and restraint material. Unfortunately, this labor is also at risk of ballooning over the project timeline. Reducing labor directly impacts the project margin.

At Vibro-Acoustics we have one focus when it comes to vibration isolation and restraint systems—to deliver labor savings to installing contractors. This is our mantra. We have worked extensively on multiple labor-saving programs across all customer facing departments. Our Labor-Savings Timeline (right) illustrates some of the ways we save our customers labor when we partner together on projects.



1

Scope Discussion
to account for all products and labor before the project starts and to reduce scope overlap.

2

Kick Off Meeting
takes place after projects are awarded to discuss project schedule, urgent deliverables, and contractor installation plans.

3

Classroom Training
provided on larger projects to the installation team by Vibro-Acoustics' Field Engineers. The focus is on how to install the product quickly and correctly.

4

Project Management
is provided with a single point of contact to help contractors achieve code compliance with the least amount of labor.

5

Custom Engineering
is often required because standard products are not always the most economical to install. Vibro-Acoustics has significant experience in this area.

6

Product Installation
of Vibro-Acoustics' products is the fastest in the market. Our champion is the BulletBrace™ cable restraint system.

7

Site Visits & Sign Off
will be provided by Vibro-Acoustics' Field Engineers to ensure products have been installed as per code and specification requirements.

Suspended Systems

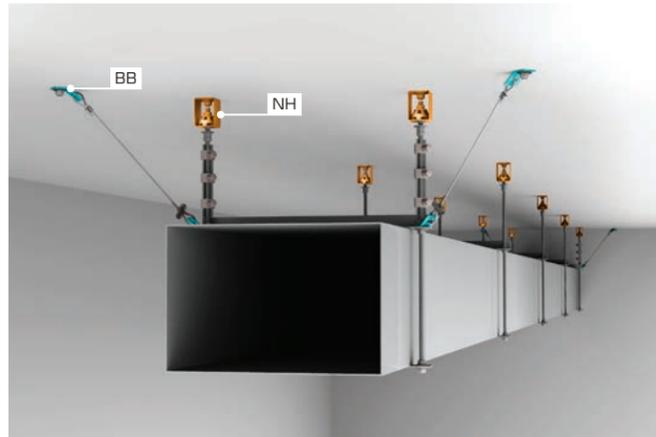
A key factor in effective piping and ductwork isolation and restraint is site planning and coordination before installation. For restraints, the first step is choosing between cable or rigid. Selecting the proper restraint system requires a study of piping or ductwork placement, an examination of site conditions—including wall and ceiling location and construction—and an understanding of the vibration isolation needs. If vibration isolation is required, then cable restraints should be used instead of rigid restraints.

Ductwork

Vibro-Acoustics offers a variety of standard and custom isolation and restraint solutions for duct systems. These solutions, combined with our seismic engineering capabilities, give contractors and engineers the advantage of single-source responsibility.

isolation products **NH / SH**

restraint products **BB / BBR / VAC / RRK**



NH: Neoprene Hanger

This advanced element design, which includes 12 unique neoprene extrusions, achieves desired deflections at the rated loads. This results in better acoustic performance of the product.



SH: Spring Hangers

Vibro-Acoustics' family of spring hangers are available in a variety of load capacities and configurations of rubber and springs.

Spring hangers are also available with and without rubber elements (SHR and SH), bottom cups (SHB), both elements and cups (SHRB), and precompressed versions for all four options (PSH, PSHR, PSHB, and PSHRB). Uplift stopwashers are provided for seismic applications.

SHRB Spring Hanger shown on right.



VAC: Rod Stiffener Clamp

To keep hanger rods from bending and buckling due to seismic activity, additional steel angles are clamped to them using Vibro-Acoustics' easy-to-install VAC rod stiffener clamps.



BB: BulletBrace™ Adjustable Cable Restraint System

Utilizing the uniquely designed BulletLock™ (patent pending) securing mechanism, the BulletBrace™ is the fastest adjustable cable restraint system in the market.

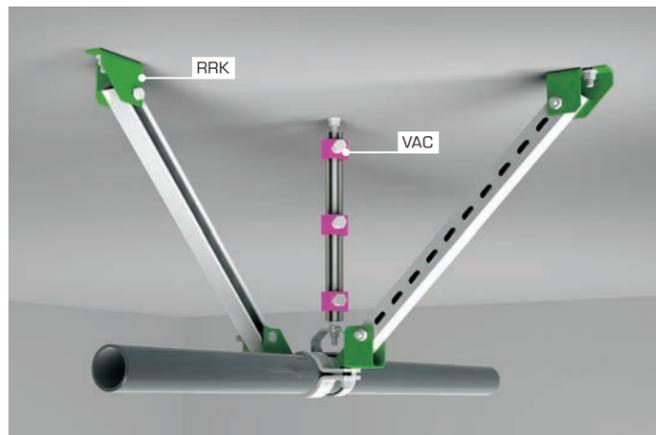


Piping

Restraining piping can pose a challenge due to limited room, high ceilings, and a web of ductwork, piping, and electrical conduit. Vibro-Acoustics provides on-site trade coordination and custom pipe stand designs that help installing contractors achieve code compliance with minimal labor costs. Piping systems have unique parameters to consider when selecting vibration isolation and seismic restraints, most notably different pipe materials and thermal expansion and contraction.

isolation products **SH**

restraint products **RRK / VAC / BB / BBR**



RRK: Rigid Restraints

The Vibro-Acoustics RRK rigid restraint brackets provide installation savings, post-equipment installation capability, and a universal bracket design that simplifies product installation. For more information, see our RRK brochure.



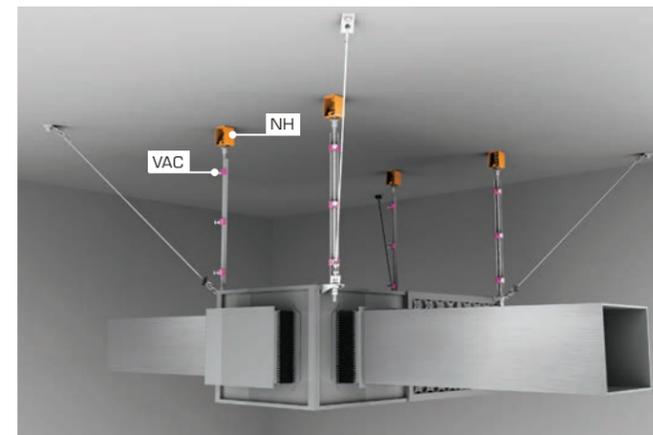
No matter what the site conditions require (single clevis hung, trapeze, pipe stands, etc.), Vibro-Acoustics can apply a vibration isolation and restraint system that fits with the preferred installation method.

Fan Coil Units, Heat Pumps & Terminal Units

In some cases, restraint of small suspended equipment can be unnecessary or handled by alternative means. Our design and engineering staff can help specifying engineers create clear project-specific specifications and help contractors determine the most cost effective methods to ensure code compliance, especially on projects with many terminal units.

isolation products **NH / SH**

restraint products **BB / BBR / VAC**

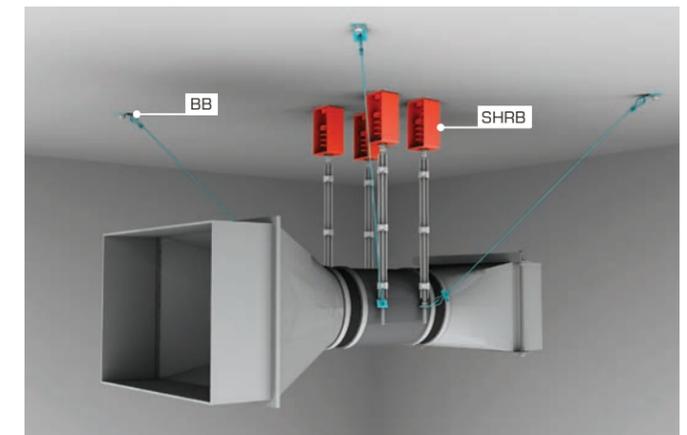


Fans

Duct-mounted or suspended fans vary in size, configuration, and horsepower. These variables, coupled with location and application, will help determine the correct isolation and restraint solution. Fans will often require a solution for both airborne and structure-borne noise.

isolation products **SH / AHCS Thrust Restraints / NH**

restraint products **BB / BBR**



BULLETBRACE™

THE FASTEST ADJUSTABLE CABLE RESTRAINT SYSTEM

Vibro-Acoustics' BulletBrace™ cable restraint system is the fastest adjustable cable restraint system on the market. Thanks to the uniquely designed BulletLock™ (patent pending) cable securing mechanism, our pre-assembled BulletBrace kits can be secured quickly and easily.



Adjustable vs. Non-Adjustable

Unlike non-adjustable cable restraints, adjustable cable restraints allow the installer to correct minor cable tension problems without having to replace or splice installed cable restraints. This saves needless installation time and cost.



BULLETLOCK™

Just Slide and Secure

With BulletBrace™, the cable length can be adjusted quickly after installation to remove excess sag of the cable. For the contractor, the adjustability eliminates the need for reinstalling the cable, and the time saved reduces the installer's labor.

BBR: BulletBrace™ with Retrofit Brackets

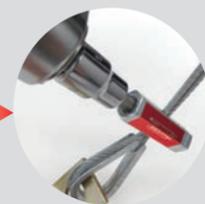
Vibro-Acoustics' BBR BulletBrace™ Retrofit Kits meet various application requirements. Designed specifically for ease of use in retrofit jobs, our Retrofit Brackets provide even more labor savings.

Just Slide and Secure

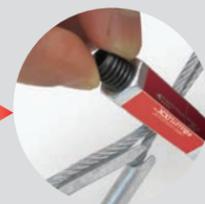
Vibro-Acoustics knows contractors care about labor savings. The BulletBrace™ offers significant labor savings over other cable securing mechanisms to lower the cost of installation.



Step 1
Slide and Secure the cable



Step 2
Tighten the Secure Screw



Step 3
Insert the Lock Screw

Seismically-Rated Floor-Mounted Isolators

Vibro-Acoustics' line of restraint spring isolators provide vibration and restraint control for mechanical equipment such as chillers and cooling towers.

SCSR-H: Seismic Restrained Spring Isolators

Designed to withstand more than 1g of lateral seismic force, the SCSR-H is available in multiple load ratings with one standard height for installation. The hot-dip galvanized finish provides protection for outdoor applications.

Robust Housing

The SCSR housing is composed of formed components, creating a robust unified frame when welded together. This optimizes load distribution and will provide a high capacity for the housing itself.



Powder-Coated SCSR
(for attachment to concrete structure)

Hot-Dip Galvanized SCSR
(for attachment to steel structure)



SFS: Seismic Free Spring Isolators

Unlike FS isolators, SFS isolators are seismically-rated and uniquely engineered to withstand at least 1g of lateral seismic force. These isolators are designed to limit vertical and lateral equipment movement caused by earthquake or wind loads.



SFS-1A and -2A isolators use springs that are precompressed to 2/3 capacity. This reduces labor required to adjust the springs since they are preloaded.

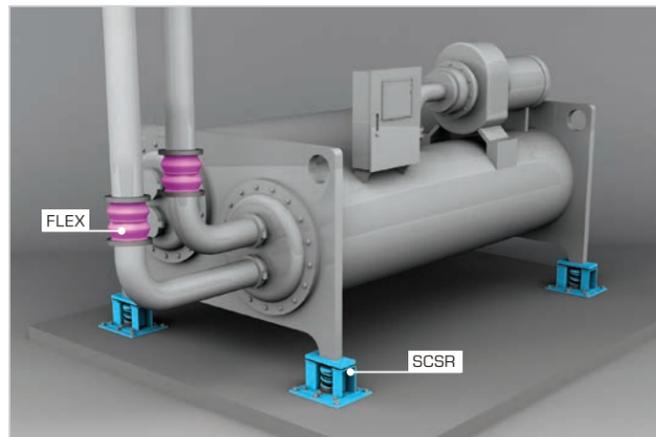
More Non-Suspended Systems

Indoor Chillers

To avoid excessive stress on piping connection during chiller maintenance, restrained isolators should be selected. Factors such as exposure to a seismic/wind event, location in the building, the noise/vibration criteria, the rotating speed(s) of the equipment, quantity of mounting locations, attachment method, and weight distribution are also required to correctly select the appropriate mount.

isolation products **FLEX / CSR / RD**

isolation/restraint products **SCSR**



SCSR: Seismic Restrained Spring Isolators
Uniquely designed to withstand more than 1g of lateral seismic force, the SCSR is available in multiple load ratings with one standard height for installation. Different attachment methods are available.

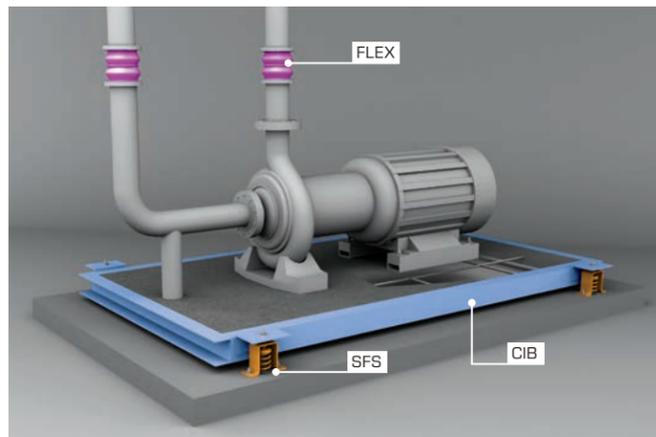
Base-Mounted Pumps

Base-mounted pumps normally require a concrete inertia base. Selection and sizing of the base should ensure that the range of motion is limited and provide the appropriate vibration isolation for the system. House-keeping pad depth and size, exposure to extreme events, pump type, horsepower, rpm, size, location in the building, and weight distribution are contributing factors in selecting the appropriate isolator.

isolation products **FLEX / CSR / FS / RD**

isolation/restraint products **SFS / SCSR**

base products **CIB**



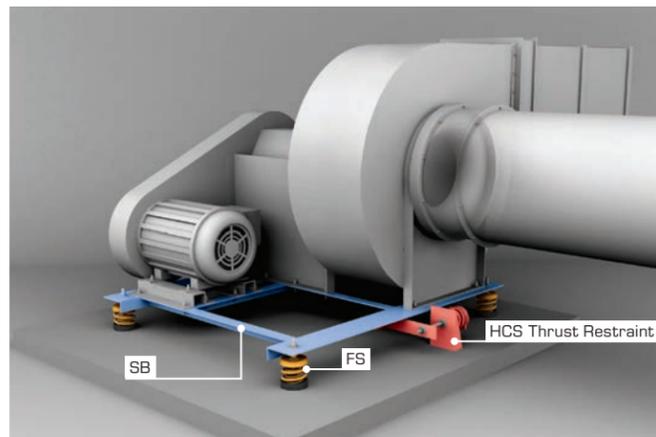
Base-Mounted Fans

Depending on the application and type of base-mounted fan, either a concrete or steel base could be required. A typical isolation solution is a Vibro-Acoustics steel base in combination with FS isolators and thrust restraints.

isolation products **FS / HCS Thrust Restraint / CSR**

isolation/restraint products **SCSR / SFS**

base products **SB / CIB / IFB**



Vibro-acoustics has a full line of isolation and restraint mounts for all HVAC equipment. More importantly, we have the expertise to apply these products and provide solutions that achieve both the desired noise and vibration control as well as code compliance.

CSR: Restrained Spring Isolators
Vibro-Acoustics' CSRs are designed to isolate floor-mounted equipment that could fluctuate in weight during the life of the product.



SFS: Seismic Free Spring Isolators
FS: Free Spring Isolators
For fan and pump applications, SFS seismic isolators are ideal for extreme event projects, while FS non-seismic isolators are suited to standard projects.



FLEX: Flexible Connectors
Vibro-Acoustics' flex connectors are applied to piping connections with HVAC equipment that could be a vibration source.



AHCS/HCS: Thrust Restraints
Vibro-Acoustics offers thrust restraints with both floor and wall mounting brackets.



SB: Steel Bases
CIB: Concrete Inertia Bases
Vibro-Acoustics' base offering includes standard and custom steel and concrete bases for all HVAC equipment.



Other available base types: Cooling tower base (CTB); integral steel fan base (IFB); L-shaped reinforced concrete inertia base (LCIB); and T-shaped reinforced concrete inertia base (TCIB).

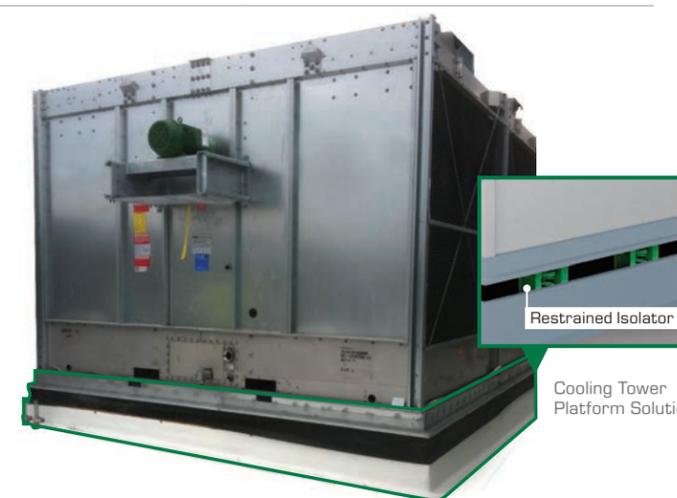
Cooling Towers, Outdoor Chillers & Condensing Units

Avoid point loading and multiple roof penetrations. Vibro-Acoustics' cooling tower isolation platform is uniquely engineered to save significant project cost with lowered architectural screens. The guaranteed acoustic package considerably reduces time and cost, and provides customers with single-source responsibility for noise and vibration control, as well as cooling tower support.

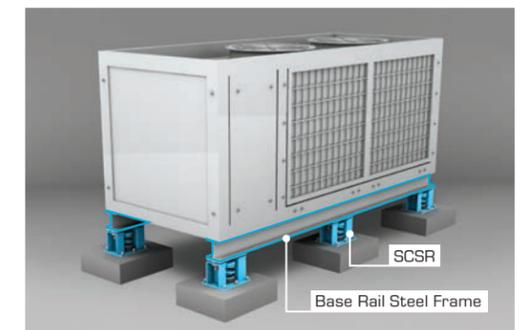
isolation products **CSR**

isolation/restraint products **SCSR**

base products **Cooling Tower Platform / CTB / Steel Base**



RD: Rubber-in-Shear Mounts
Vibro-Acoustics' RD rubber-in-shear mounts are color-coded for ease of installation and identification.



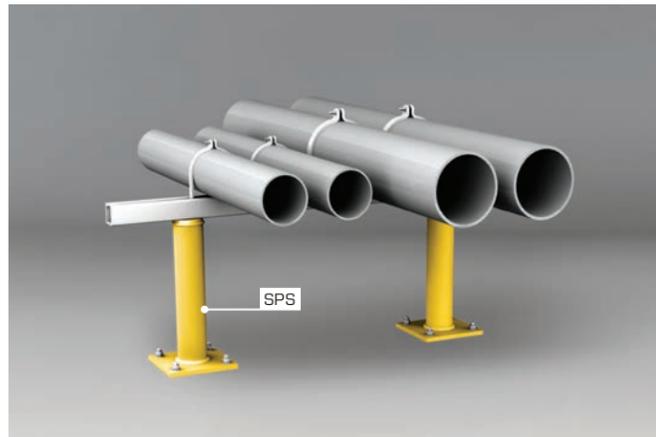
Above: Outdoor Chiller
Vibro-Acoustics can perform calculations for and provide seismically-rated, perimeter base rail supporting steel frames for cooling towers and other outdoor equipment.

More Non-Suspended Systems

Roof Piping and Duct

Site scheduling is critical when coordinating installation of roof piping with pipe stands. The building code requires the stands to be connected directly to the structure, and this can be a labor intensive and costly task if the roof membrane is already installed. Vibro-Acoustics' seismic pipe stands are designed with a removable pipe support strut to allow for quick and easy roof membrane installation.

restraint products **SPS / SPSA**



SPS/SPSA: Seismic Pipe Stands

Vibro-Acoustics' SPS/SPSA pipe stands are pre-designed for over 1g of lateral seismic force and are available in both fixed and adjustable-height models.



SIPS: Seismic Inline Pump Stands

This patented design saves installing contractors more than 40% compared to field-fabricated solutions. The pre-engineered solution provides capacity of more than 1g of lateral seismic force and includes pre-drilled holes for ANSI 125# flanges.

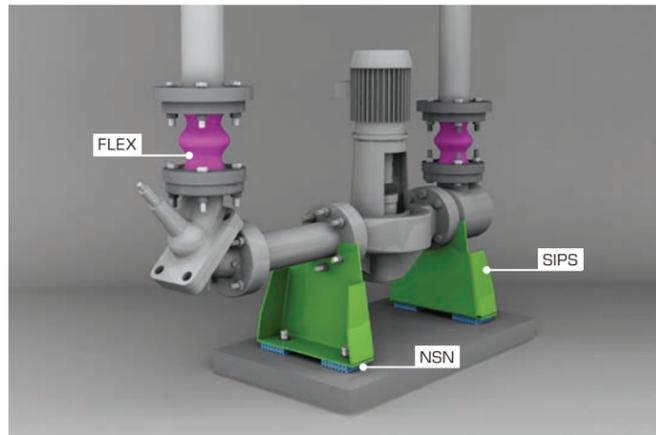


Vertical Inline Pumps

Since many vertical inline pumps are not installed on a concrete inertia base, restraining them for extreme events can be a challenge. Utilizing Vibro-Acoustics' pre-engineered pump stands eases installation and ensures code requirements are met. These pump stands are also used with spring hangers and cable restraints for suspended vertical inline pumps.

isolation products **FLEX / NSN / SH**

restraint products **SIPS / SRK**



Tanks (expansion, hot water, fuel, etc.)

Tanks (such as expansion tanks) often do not have allocated mounting "feet" for extreme event applications. Vibro-Acoustics' seismic mounting brackets should be utilized at three to four locations around the base. Depending on the tank location and size, wall straps and custom tank cages could be required.

restraint products **SRB**



N/NSN: Neoprene Pads

This isolation pad with integral load distribution plate provides high-frequency vibration isolation and is designed to fit the system.



SRB: Seismic Restraint Bracket

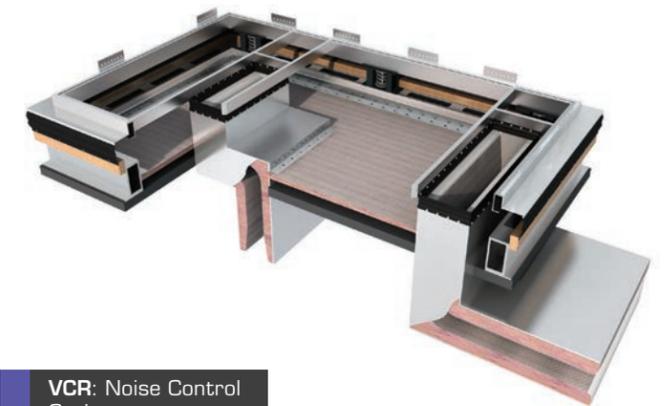
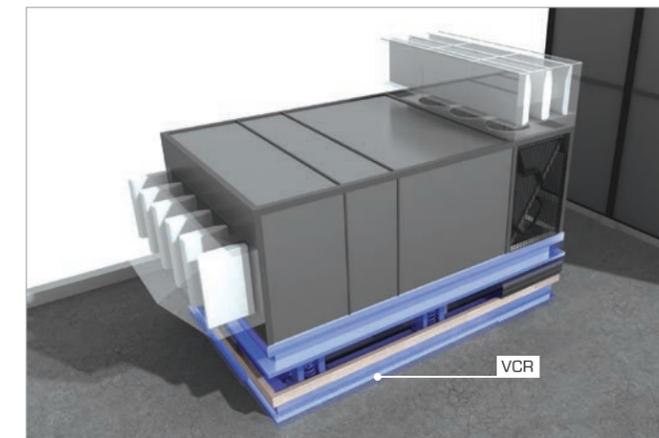
Vibro-Acoustics' series of pre-engineered seismic brackets provide a bracing solution for tanks, AHUs, and other HVAC equipment.



Rooftop Units & Curb Mounted Fans

Rooftop units, primary sources of vibration problems, are often culprits of non-compliance with background sound criteria. To avert a vibration or structure-borne noise problem, engineers should specify Vibro-Acoustics' noise control curb, which provides external vibration isolation, not just isolation of the usual suspects inside the unit (fan, compressor, etc.). Rooftop units with curbs require additional calculations and bracing for extreme events to secure the two attachment planes: the unit to the curb, and the curb to structure. The Vibro-Acoustics VCR curb for extreme event applications comes with the necessary calculations, stamped by a PE/P.Eng.

isolation/restraint products **VCR / RTR / RC**



VCR: Noise Control Curb

Vibro-Acoustics offers a fully integrated noise and vibration control curb, engineered for the specific project requirements and criteria. To learn more, visit our website to view the brochure on this solution.

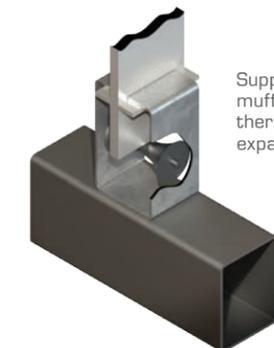
Other available curb types: Standard Curbs (RC) and Isolated Rails (RTR)

Fit-the-System Solutions

Not enough room to install a standard product? Does the standard product not solve the problem? Has the site conditions changed last minute? Need to save labor on installations? If you encounter any of these situations, you can contact Vibro-Acoustics for fit-the-system solutions.

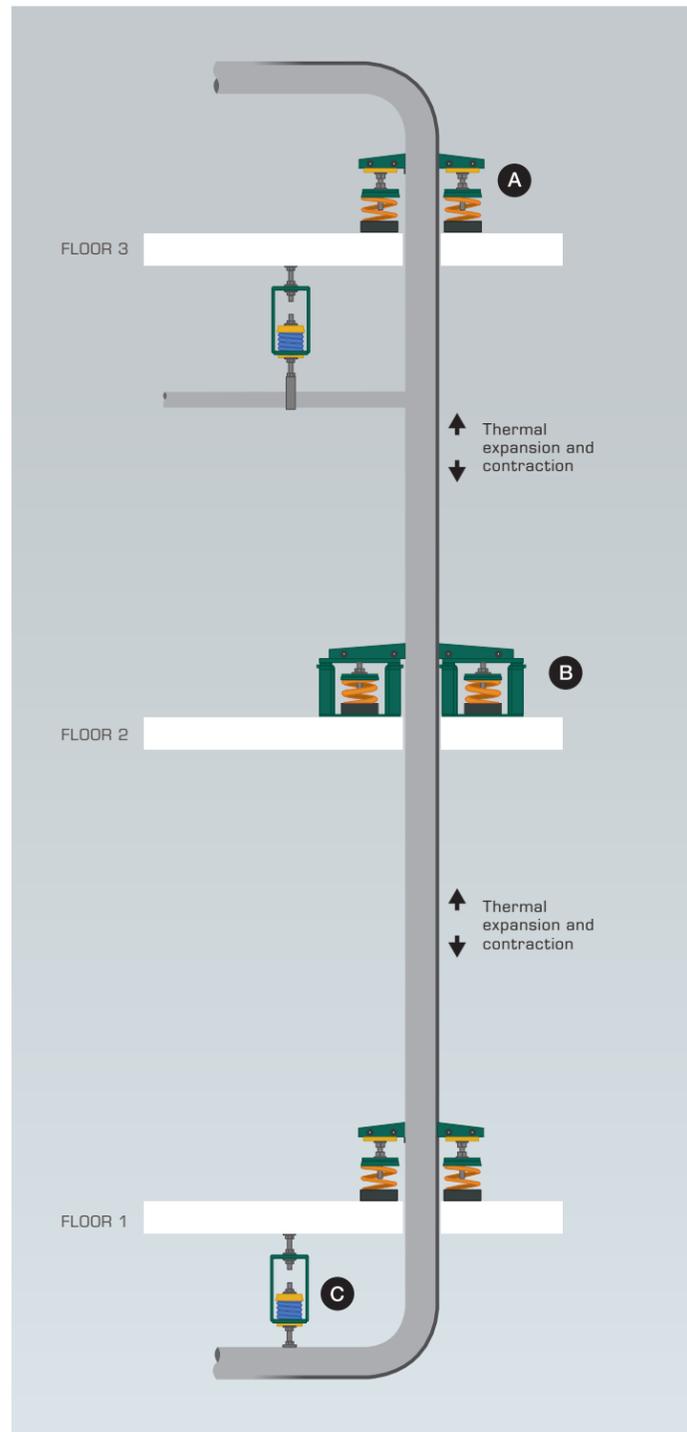


Height-saving bracket for chiller isolation



Support for exhaust muffler to accommodate thermal contraction and expansion

Floating Riser Solutions



Vibro-Acoustics' floating riser solutions are designed to address thermal growth and vibration issues for vertical piping systems in a building.

Pipe risers undergo changes in temperature as chilled or heated water enters the pipe. As the temperature changes, the pipe expands or contracts. If the piping system is anchored to the structure, the thermal growth or shrinkage will apply stress on the pipe riser support points, potentially damaging the building structure and pipe. It is also important to isolate the pipe from the building structure in order to eliminate unwanted noise and vibration paths. If required, seismic considerations need to be taken into account to ensure the piping system can withstand a seismic event.

Vibro-Acoustics is an expert in designing thermal and seismic solutions for vertical piping systems. Our spring riser supports provide complete noise and vibration control and are designed to allow controlled expansion and contraction of pipe risers. Floating riser solutions fully isolate the piping system from the structure with the use of spring isolators, eliminating high pipe anchor loads at the floor supports. Vibro-Acoustics will also specify the final load at the structure during the submittal phase for each floor mount. For seismic applications, we will consider lateral seismic loads in the design of the floating riser system to achieve optimal performance.



A Free Spring Isolator with Top Plate



B Restrained Spring Isolator



C Spring Hanger

Seismic Inline Pump Stands



Powder-Coated
Pump stands are powder-coated enamel for corrosion protection

Save up to 40% cost over field-fabricated solutions with Vibro-Acoustics' SIPS Seismic Inline Pump Stands, which offer a more convenient solution to support and restrain vertical inline pumps.

SIPS: Seismic Inline Pump Stands

Vertical inline (VI) pumps are increasingly popular with design engineers and contractors, as they tend to take up less space in mechanical rooms. Since these pumps are typically located close to the floor, floor-mounted seismically-rated supports are ideal when a seismic restraint solution is required.



SIPS Seismic Inline Pump Stands with neoprene pads

Vibration Isolation Pads
Neoprene pads with steel distribution plates are available as an option for vibration isolation



Low-Profile SIPS Seismic Inline Pump Stands with two SCSR seismically-restrained spring isolators

Bolt Holes
Cutouts are sized to accommodate standard class 150 flanges

Our Services

Vibro-Acoustics complements its full line of vibration isolation and restraint products with our three-stage extreme event engineering and application engineering service.

Step 1: At the Design Stage

Our Lay-in Service saves consultants, on average, 16 hours per project. We work with consultants as an extension of their design team and provide them with a complete set of customized bid documents for noise and vibration control solutions (specifications, schedules, and sectional drawings).

Step 2: Order and Submittal Coordination

Between our Project Managers and Design staff, Vibro-Acoustics will provide:

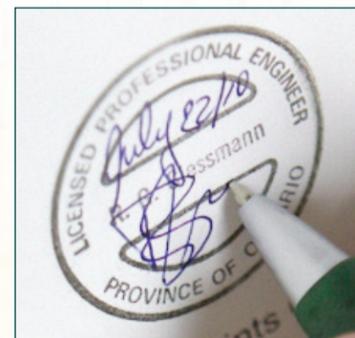
- Order coordination
- Kick-off meetings (if required)
- Submittal and product scheduling
- Seismic & wind overturn calculations
- Mark-up of piping and ductwork for cable/rigid restraint locations
- Structural analysis and design of custom restraint solutions such as pipe stands, duct stands, racks, and supports
- On-site training for installation teams and cost savings
- Vibration isolation selection
- Vibration analysis
- Custom product design
- Riser isolation
- Thermal expansion calculations
- PE/P.Eng. professional engineering stamps

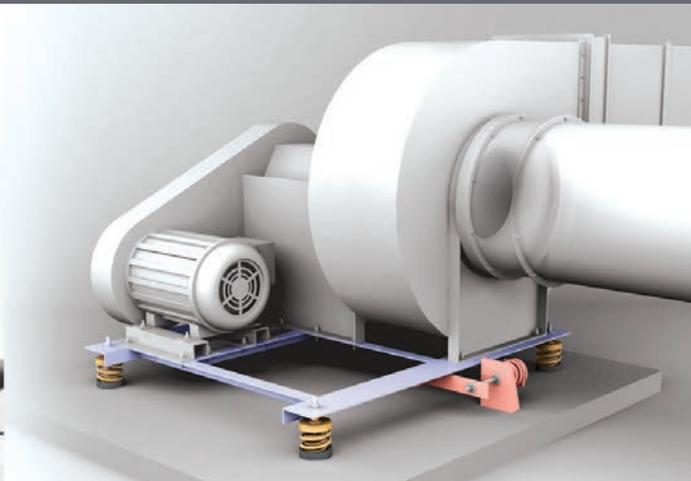
Step 3: On-Site Coordination

Our numerous field service staff will work with contractors to provide labor saving solutions and training, coordinate between multiple trades, help installers improvise and adapt to field conditions, and provide sign-off letters that are required for occupancy permits.



Vibro-Acoustics is able to provide stamped calculations for seismic and wind restraint selections in all 50 U.S. states and all 10 provinces plus 3 territories of Canada.





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