

Selecting the Right Vibratory Feeder for Industrial Applications



Key Features & Components Give Precise Control of Material Flow

Vibratory feeders are a staple in bulk material handling operations. They are used to convey material from one piece of equipment to another in an efficient and timely manner. Available in a variety of styles and finishes, vibratory feeders are used to feed raw materials or finished products into mixers, furnaces, production processes or final containers.

Because they can control material flow, vibratory feeders handle bulk materials across all industries, including sand & gravel, aggregate, chemicals, pharmaceuticals, automotive, electronic, food and packaging. Whether you are dealing with bulky, chunky material or more delicate particles, vibratory feeders can get the job done.

Vibratory feeders handle a wide assortment of materials including but not limited to almonds, crushed limestone, shelled corn, powdered metal,

metal billets, various pipe fittings, scrap brass and bronze, crushed and shredded automobiles, hot dross and much more. Because they emit precise vibrations, companies also use vibratory feeders to process small parts, like coins, washers, or O-rings, as they move along a conveyor.

Other common applications of vibratory feeding include:

- Controlled flow of ingredients to mixing tanks
- Sprinkling toppings or coatings on food and dairy products
- Adding binders and carbons to foundry sand reprocessing systems
- Chemical additive feeding in the pulp and paper bleaching or chip handling processes
- Feeding metal parts to heat treating furnaces
- Feeding scrap or glass cullet to furnaces

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- Controlled, full width feeding to a screener to make more efficient separations.

Aside from the vibrating unit, vibratory feeders require little or no maintenance. There is minimal risk of downtime and parts are simple to replace. Other benefits of vibrating feeding include:

- Lower production costs and improved quality and throughput by ensuring controlled and consistent material flow
- Reduced cost of maintenance and part replacement compared to mechanical feeders
- Flexibility in design options ensures a seamless fit into existing production processes for specific applications
- Safety under the most hazardous conditions

HOW TO SELECT THE PROPER VIBRATING FEEDER DESIGN

There are two basic designs available when selecting a vibrating feeder: electromagnetic and electromechanical. A third option—air-powered vibrating feeders—are basically an alternate to electromechanical feeders since they apply the same simple brute force design concept—the vibratory drive is directly attached to the tray.

The following are the basic advantages and disadvantages to these three feeders:

Electromagnetic Feeders provide variable intensity with typically a fixed frequency of 3600 vibrations per minute (VPM). They only require single phase power, offer quick stopping and are ideal for cold weather. However, they are sensitive to line voltage fluctuations, temperature swings and are not suitable for hazardous areas. They may also need tuning if there are rate or load changes.

These units work well with dry, free-flowing, pelletized or granulated material. They can control material flow from a few pounds to several tons per hours and can be custom designed to accommodate material flow from a few feet (with a single drive) to up to 20 feet (with multiple drives).

Electromechanical Feeders are powered by twin rotary electric vibrators which provide a broader range of stroke/frequency combinations. Their flexibility is further enhanced with a variable frequency drive (VFD), which provides quick and easy adjustment of force output without having to manually adjust the eccentric weights.

A VFD with dynamic braking or a magnetic starter with a dynamic brake will end the vibration faster to limit the erratic motion at shut down. This design provides the quietest operation and is less susceptible to head loads. These feeders work well in hazardous conditions when explosion-proof vibrators are installed.



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Air-powered Feeders work best under hazardous conditions because they are driven by an air-cushioned piston vibrator, which produces smooth linear force and can work safely in high temperatures. It is the simplest of the three feeders to maintain and the controls are the most economical.

While an air-powered feeder does not require tuning, there are limitations to the physical size of the tray and feed rates. These units are also less suitable for outdoor operation because the air lines can freeze up. These feeders are also susceptible to head load.

VIBRATORY FEEDER DESIGN

Typically, a feeder application will require the movement of some given material with a known bulk density over a desired distance. Parameters that influence the sizing and design of a vibratory feeder include:

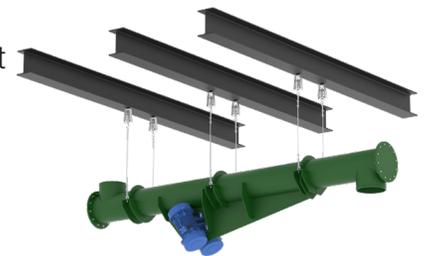
- The inlet and discharge conditions for that piece of equipment
- How the material is being placed on the feeding surface
- The dimensions of the incoming material stream
- Batch dumping vs. continuous flow
- Feeding another piece of equipment, such as a belt conveyor, bucket elevator or furnace
- Feed rate of material or product
- Material properties, including bulk density and particle or part size.

The distance the material must travel determines the length of the unit and may even include some additional length to properly interface with the receiving equipment. The volume of material moved per hour plus the materials' bulk density helps determine the width and depth of the vibratory tray. The size of equipment that passes material onto the vibratory feeder also factors into the optimum feeder's width.

PROPER LOCATION OF VIBRATORS ON FEEDERS

There are several options when deciding where to install the vibrators on a particular feeder model. With vibratory feeders, there is a concern about the product discharge height, as the equipment is often feeding material downstream to other devices.

Typically, on vibratory feeders the default location is "below deck" where the vibrators are attached on the underside of the unit, below product flow. With below deck vibrators, the feeder will need a higher discharge height compared to a similarly sized unit where the vibrators are "side mounted" or even in some applications where the vibrators are attached "above the deck", where vibrators are installed above the product flow.



Functionally, there is no difference when locating the vibrators above, on the side or below the unit. Provided the structure is appropriately designed for the force output of the vibrators and they "sense" each other or synchronize when using twin motor vibrator electromechanical design, any of these vibrator locations can provide satisfactory results.

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CONTROLLING MATERIAL FLOW FROM A FEEDER

Precise metering of material flow (whether moist or dry) onto trays or other receptacles is critical to the operation of any vibratory feeder, particularly those equipped with a hopper. The three factors below influence the material flow, but when all three are combined, it is possible to vary the flow rate and provide very repeatable results as the material cascades off the feeder end discharge.



Bed depth of material on the tray. The material must be free flowing and always available in the hopper to charge the feeder. Not enough material will “starve” the feeder, reduce the bed depth, and cause inconsistent discharge rates.

A hopper slide gate helps adjust material depth. Opening the gate allows for a higher volume of material to be removed from the hopper to flow through the feeder, resulting in a deeper material flow and higher volume off the feeder end. Likewise, reducing the opening restricts the volume of flow out of the hopper, resulting in more shallow material flow as well as lower volume.

Frequency of vibration applied to the feeder tray. Different materials respond better to different frequencies of vibration which influences the type of vibrator installed on the feeder.

For example, feeders manufactured using the twin motor electromechanical design, operate using rotary electric vibrators that are designed with various frequencies to accommodate different materials:

- Two-pole vibrators that operate at 3600 vibrations per minute (VPM) have the highest frequency and smallest amplitude
- Four-pole vibrators that operate at 1800 VPM
- Six-pole vibrators that operate at 1200 VPM
- Eight-pole vibrators that operate at 900 VPM offer larger strokes

Heavier materials tend to require higher frequency drives, while lighter materials feed more effectively with lower frequency drives.

Vibrators are installed based on the selected feed rate. This selection is based on the frequency of vibration and the maximum force output of the vibrator.

Necessary adjustments to the eccentric weights of the vibrators on models manufactured using the twin motor electromechanical design, can be made to reduce the force output from the unit's rated maximum. For a given frequency, more force output will result in a larger amplitude or stroke of the finished equipment.

INCORPORATING HOPPERS INTO FEEDERS

Hoppers can aid in feeder performance plus provide health and safety benefits for your workforce. Hoppers can be stationary with steep sloping walls to allow free-flowing material to readily discharge onto the feeder at the feed end of the equipment. Due to their steep walls, these hoppers can have a high dump height depending on the volume.

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For lower dump heights and/or poor flowing materials, a vibrating hopper is the solution as the hopper is attached to the vibrating body and the vibrators are upsized to compensate for the increase in vibrating weight. With this design, the material is fed out of the hopper directly onto the feeder.

There are several applications where the material is being fed either manually or by some type of bulk loading dumper. This can lead to overloading the tray at the feed end and cause spillage. Utilizing a hopper provides the operator a much larger target, so there is much less chance for spillage. A gate is provided at the discharge end of the hopper to help control the material flow out of the hopper and on to the feed end of the feeder tray.

The hopper takes the brunt of the dump which saves wear and tear on the feeder tray. Additionally, the hopper makes first contact with the product which reduces wear and tear on the feeder tray. Further, both the hopper and feeder tray can be lined with abrasion-resistant material, some of which can provide the added benefit of noise reduction.

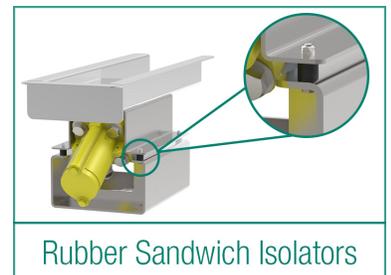
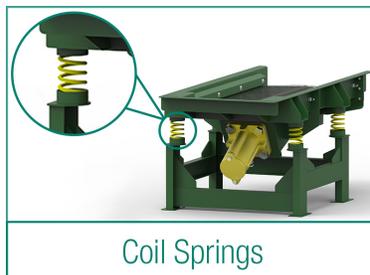
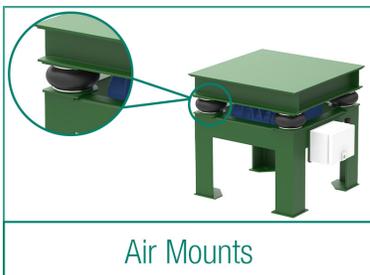
Consider liners that are fabricated from urethane, UHMW or rubber when handling nosier materials like metal parts or billets. Other liner coatings include neoprene, non-stick polymer, non-stick textured surfaces, or removable abrasive-resistant steel plate.

The health and safety benefits of a hopper include reduced wear and tear on the operators that manually dump material to load feeders. These operators can experience serious health issues to backs, shoulders, arms, and even lungs and eyes if the material is dusty. Additionally, using a hopper puts the operator further from the vibratory feeder which reduces their level of noise exposure.

SELECTING THE BEST ISOLATOR

Customizing a feeder includes choosing the right isolator. This type of mount isolates vibration energy, allowing the feeder tray to properly vibrate without transferring vibration energy to your floor or structure. Here are the options:

- Rubber sandwich isolators are solid, molded rubber “sandwiched” between either male metal threaded studs or female metal threads on both ends for mounting. These are ideal for small air-powered feeders.
- Coil springs compress to prevent the vibratory force from extending beyond the vibrating body. They can handle shear forces produced by most feeders on the market.
- Marsh mellow mounts are a combination of fabric and rubber with a solid rubber core, a hollow center and fabric reinforced body. They provide very good isolation and can also handle shear forces.
- Air mounts are inflatable rubber/fabric bellows which isolate the vibratory force from the vibrating body when they are inflated with air to their design heights when loaded. These are extremely versatile and provide superior isolation but are more difficult to install and replace compared to the other options.



SERVICE AND TRAINING

Cleveland Vibrator's in-house testing lab includes an EMF Electromechanical Vibratory Feeder with independent variable frequency and manual amplitude adjustment controls. This allows CVC's engineers to determine optimal vibration conditions for any material and prediction of feed rates and process outcomes.

Customers can visit the facility, or they can view the testing online in real-time or request a video of their product test.

Cleveland Vibrator provides ongoing support and training for its vibratory feeders. *If you need assistance or have any questions about proper operation, contact Cleveland Vibrator at 800-221-3298.*

ABOUT CLEVELAND VIBRATOR COMPANY

The Cleveland Vibrator Company has been driving innovations in materials handling since 1923. From its corporate headquarters in Cleveland, Ohio, and in partnership with HK Technologies in Salem, Ohio, the organization has met the challenges of more than 15,000 customers around the globe in a vast array of industries. Cleveland Vibrator Company's comprehensive product line includes air-piston, rotary electric, electromagnetic, turbine and ball vibrators, as well as a wide variety of fabricated feeders, vibratory screeners, ultrasonic screeners, vibratory conveyors, and vibratory tables used for light, medium and heavy-duty industrial applications.

For more information and to view our complete product line, visit www.clevelandvibrator.com.

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