

How to Select and Size an Industrial Vibrator



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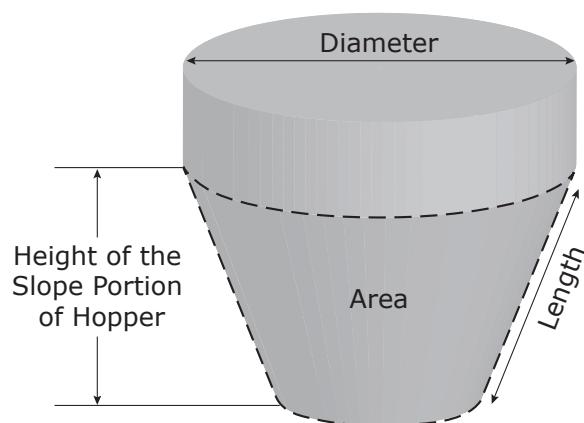
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How to Select and Size an Industrial Vibrator

Rotary Vibrators or Linear Force Vibrators are widely used to initiate or restore the flow of stored bulk materials, and have proven to be effective in most situations. Industrial vibrators are available in many types and sizes. The key factors in using them effectively are to select the proper type and size of vibrator for your specific application, and to ensure that the vibrator is properly mounted.

Selecting an Industrial Vibrator for Your Application

The first consideration in selecting an Industrial Vibrator is to determine the mass of the bulk material that must be vibrated. To do this, first determine the volume and weight of the material **in the sloped portion of the hopper** (Note: If optimum flow is achieved with the material in the sloped portion of a properly designed hopper, the remaining materials will flow properly.)



A Five-Step Approach to Selecting an Industrial Vibrator:

1. Using the “**Global Calculators**” select the style of the hopper and enter the dimensions of the sloped portion of the hopper as indicated.
2. Enter the density of the bulk solid stored in the hopper.
3. Select the appropriate weight to force ratio:
 - a. If the bulk material is less than 90 lb/ft³ or flows freely in normal conditions, select a ratio of 1 lb force/10 lb material.
 - b. If the bulk material is greater than 90 lb/ft³ or is sticky, has high moisture content, or bridges easily, select a ratio of 1 lb force/5 lb material.

c. If the bulk material has characteristics of both a and b, e.g., bulk material that is heavier than 90 lb/ft³, but tends to flow easily, or materials that are lighter and often bridge or cling in normal conditions, use a ratio of 1 lb force/8 lb material.

Note: These ratios are approximations based on field experience. While not an absolute rule, they have been proven effective in properly selecting the vibrator size.

4. To select the most effective vibrator, you should match the characteristics of the stored materials with the appropriate style vibrators. Bulk materials respond to the energy produced by Industrial Vibrators. This energy is comprised of Frequency (how rapidly the waves of energy cycle) and Amplitude (the height of the waves). The combination of these factors is calculated as **force** and typically expressed (in the USA) in pounds (or force-pound or pound-force). Generally speaking, finer materials respond more favorably to higher frequency vibration, while higher force is more effective on coarser materials.

Examples of Fine Materials	Examples of Coarse Materials
Cement	Wood Chips
Flour	Gravel
Sand	Coal
Powders	Ores

5. Select your preferred Power Source (pneumatic, hydraulic, or electric) and refer to the **Product Performance Data** to select one or more well-matched vibrators with a force output equal to or slightly greater than the force as determined using the appropriate Weight-to-Force Ratio. Or you may use the **Rotary Vibrator Selection Guide** (starts on page 6), based on 10 : 1 Weight-to-Force Ratio, to choose a vibrator as indicated in the guide.

Other Important Factors to consider when selecting vibrators:

- If your stored material is best categorized as coarse, you may achieve the best results using a Linear Vibrator (pneumatic piston) or a higher force Rotary Vibrator (motor-driven hydraulic, pneumatic or electric).
- Finer materials are more likely to respond to higher frequency Rotary Vibrators (pneumatic turbines or ball vibrators).

- Follow all recommended mounting instructions. A properly-mounted vibrator will effectively transfer the energy to the bulk material and will provide better performance, longer vibrator service life and minimize stress on the hopper. The calculated vibrator force does not need to exactly match the output of the selected vibrator. For example, if the calculated force requirement is 1,000 force-pounds (4.45 kN), you can use a vibrator with 1,200 force-pounds (5.34 kN) rating. In addition, the speed of hydraulic and pneumatic vibrators can be adjusted by reducing the flow of hydraulic fluid or compressed air. This reduction of speed will reduce the force the vibrator produces, allowing for additional "fine-tuning" of the vibrator's frequency and force.

- If a Linear Vibrator (piston) is selected, additional important considerations are bin wall thickness and bin capacity. Piston Vibrators restore material flow by producing a linear shock wave that reduces friction and forces the bulk material away from the hopper wall. To avoid damage to the hopper, do not use a larger piston vibrator than the bin wall thickness recommendations.

Piston Vibrators are available as:

- Impacting Pistons (IM)** - where the moving piston directly strikes the vibrator anvil.
- Air-Cushioned Pistons (AC)** - where a small amount of residual air remains in the space between the piston and the anvil.

Impacting Pistons produce significantly more force than similar-sized Air-Cushioned models, but Air-Cushioned models are much quieter during operation. Typically, select one size larger Air-Cushioned model than the Impacting Piston if a quieter vibrator is preferred.

Use the Piston Vibrator Selection Guide on page 5 to determine which Piston Vibrator will work best in your application.

Refer to the Rotary Vibrator Selection Guide, on pages 6 & 7, for a quick recommendation on the vibrator size. Find the material weight and move across the chart horizontally to the recommended vibrator size.

When to Use More Than One Vibrator

Occasionally, two or more industrial vibrators may be required if:

- Either the diameter of a hopper or the longest side of a hopper exceeds 10 feet (3.05 m).
- When the amount of force needed to restore material flow exceeds the capacity of the preferred vibrator.
 - Example - if the force required is 5,000 force-pounds (22.24 kN), two vibrators, each with a minimum of 2,500 force-pounds (11.12 kN) rating may be used.

The following are a couple examples on how to select and size an Industrial Vibrator.

Example A

Round Hopper

Diameter at Top - 8 ft (2.44 m)

Diameter at Discharge - 2 ft (.61 m)

Height of Sloped Portion of Hopper - 5 ft (1.52 m)

Bulk Material-Granulated Sugar - 45 lb per cubic foot

- Using the Global Calculator, we determine that there are 110 ft³ of volume in the Sloped Portion of the Hopper, and that the bulk material weight is 4,948 pounds (2,244 kg).
- Since Granulated Sugar weighs less than 90 pounds per cubic foot and tends to flow freely, we will require only one pound of force per ten pounds of sugar (4,948 divided by 10 equals 495 pounds of force [2.20 kN]).
- Granulated Sugar is a relatively "fine material", so higher frequency vibration will be most effective.
- The hopper dimensions are not excessive, so one vibrator will be sufficient.
- Because High Frequency Vibration will be required, a Pneumatic Vibrator is preferred.
 - Ball Vibrator Options - US-38 or DS-51
 - Turbine Vibrator Options - SST-25

Example B

Square Hopper

Dimension at Top – 8 ft x 16 ft (2.44 m x 4.88 m)

Dimension at Discharge – 2 ft x 3 ft (.61 m x .91 m)

Height of Sloped Portion of Hopper – 10 ft (3.05 m)

Bulk Material-Gravel – 110 lb per cubic foot

- Using the Global Calculator, we determine that there are 539 ft³ of volume in the Sloped Portion of the Hopper, and that the bulk material weight is 59,295 pounds (26,895 kg).
- Since Gravel weighs more than 90 pounds per cubic foot but tends to flow freely, we will require only one pound of force per eight pounds of gravel (59,295 divided by 8 equals 7,412 pounds of force [33 kN]).
- Gravel is a relatively "coarse material", so higher amplitude vibration will be most effective.
- The hopper dimensions are greater than the one vibrator capability, so more than one vibrator will be required.
- If a Hydraulic Vibrator is preferred:
 - ◊ Two Design Series C3-6-5HC (each producing up to 4,260 pounds of force [19 kN]).
- If a Pneumatic Vibrator is preferred:
 - ◊ Two Design Series C3-6-4AC (each producing up to 4,350 pounds of force [19 kN]).
 - ◊ Two TurboViber TV-7X (each producing up to 4,175 pounds of force [19 kN]).
- If an Electric Vibrator is preferred:
 - ◊ Three Quiet Thunder Electric DEG-2500 (each producing up to 2,630 pounds of force [12 kN]).

Customer Service

If you have questions or need more help please contact us. An experienced member of our Customer Service Team will be more than happy to assist you in selecting the best vibrator for your application.

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PISTON VIBRATOR SELECTION GUIDE

Bin Capacity	Bin Wall Thickness	Piston Size Recommendation		
lb	inches	Findeva	P-Series	Lube-Free
kg	mm			
200	1/16 - 1/8			
91	1.6 - 3.2		FP-12*	FPLF-12-M
400	1/16 - 1/8			
182	1.6 - 3.2	YJ-1.00-AC	FP-18*	P1 AC
700	1/16 - 1/8	YJ-1.00-IM	FP-25-S	P1 IM
318	1.6 - 3.2	YJ-1.25-AC		P1 ¹ / ₄ AC
1,000	1/16 - 1/8		FP-25-M	
455	1.6 - 3.2		FP-25-L	FPLF-25-M
2,000	1/16 - 1/8	YJ-1.25-IM	FP-35*	P1 ¹ / ₄ IM
908	1.6 - 3.2			TMD 1 ¹ / ₄ IM
2,000	3/16 - 1/4	YJ-1.50-AC	FP-50-M	P1 ⁵ / ₈ AC
908	4.7 - 6.3			FPLF-50-M
4,600	3/16 - 1/4		FP-60-M	
2,091	4.7 - 6.3			FPLF-60-M
6,000	3/16 - 1/4	YJ-1.50-IM		P1 ⁵ / ₈ IM
2,724	4.7 - 6.3	YJ-2.00-AC		P2 AC
20,000	3/16 - 1/4	YJ-2.00-IM		P2 IM
9,080	4.7 - 6.3			P2 IM
				TMD 2 IM
20,000	1/4 - 3/8	YJ-3.00-AC	FP-95-M	P3 AC
9,080	6.3 - 9.5			FPLF-95-M
40,000	1/4 - 3/8	YJ-3.00-IM		P3 IM
18,160	6.3 - 9.5			TMD 3 IM
40,000	3/8 - 1/2			P4 IM
18,160	9.5 - 12.7			TMD 4 IM



* If there is a * next to a FP model (Findeva model) it means any variation of that particular size will work. For example you can use a FP-12-S, or FP-12-M, or a FP-12-L. The "S", "M", and "L" refers to the stroke or speed of the piston.

ROTARY VIBRATOR SELECTION GUIDE



PNEUMATIC ROTARY VIBRATORS¹

1 The force created by Pneumatic Vibrators or Hydraulic Vibrators can be adjusted by reducing or increasing the flow

2. High Frequency Dual Ductor Vibrator may be mounted 3 wave GCI 1000 credits in 8 GCD usage 1 bolts
The tool creates a mechanical vibration which can be used for cleaning or loosening of nuts and bolts.

High Frequency Dual Roller Vibrators may be mounted 2 ways. GCL uses cradle lug & GCD uses 4 bolts.

- If you have a unit prior to September 2022 it could have a 2HM motor. The 2HM and 2HC motors are interchangeable.

4 C3 Hydraulic Vibrators are available with 2HC (High Pressure - Low Flow) or 5HC (Low Pressure - High Flow) Hydraulics.

5 D4.5 and D7 Pneumatic or Hydraulic Vibrators are available with Clamp-type Mounting System designated with a "CC" (CC4.5 & CC7) instead

ROTARY VIBRATOR SELECTION GUIDE

PNEUMATIC ROTARY VIBRATORS							ELECTRIC ROTARY VIBRATORS ⁶		
Weight of Material in Sloped Portion of Hopper	Kilo-grams	Global Ball Vibrator	TurboViber® Turbine Vibrator	High Frequency Dual-Roller Vibrator	Air Motor-Driven Design Series Vibrator	Hydraulic Motor-Driven Design Series Vibrator	Single Phase 115 Volt	3 Phase 230/460 Volt	12V / 24V DC Volt
37,000	17,010		TV-7X	TCL-6000	GCL-5500, GCD-5500 ²	D4.5-8.0-4AC ⁵		Q172-4500X	CEG-4200
40,000	18,144		TV-7X	TCL-6000	GCL-5500, GCD-5500 ²	D4.5-8.0-4AC ⁵		Q172-4500X	CEG-4200
42,500	19,278		TV-7X	TCL-6000	GCL-5500, GCD-5500 ²	D4.5-8.0-4AC ⁵		Q172-4500X	Use more than one Vibrator to achieve total force required ⁷
45,000	20,412	Use more than one Vibrator to achieve total force required ⁷	TCL-6000	GCL-5500, GCD-5500 ²	D4.5-10.0-4AC ⁵	D4.5-10.0-5HC ⁵		Use more than one Vibrator to achieve total force required ⁷	
47,500	21,546		TCL-6000	GCL-5500, GCD-5500 ²	D4.5-10.0-4AC ⁵	D4.5-10.0-5HC ⁵			
50,000	22,680		TCL-6000	GCL-6500, GCD-6500 ²	D4.5-10.0-4AC ⁵	D4.5-10.0-5HC ⁵			
52,500	23,814		TCL-6000	GCL-6500, GCD-6500 ²	D4.5-10.0-4AC ⁵	D4.5-10.0-5HC ⁵			
55,000	24,948		TCL-6000	GCL-6500, GCD-6500 ²	D4.5-10.0-4AC ⁵	D4.5-10.0-5HC ⁵			
57,500	26,082	Use more than one Vibrator to achieve total force required ⁷		GCL-6500, GCD-6500 ²	D7-12-6AC ⁵	D7-12-8HC ⁵			
60,000	27,216			GCL-6500, GCD-6500 ²	D7-12-6AC ⁵	D7-12-8HC ⁵			
62,500	28,350			GCL-6500, GCD-6500 ²	D7-12-6AC ⁵	D7-12-8HC ⁵			
65,000	29,484			GCL-6500, GCD-6500 ²	D7-12-6AC ⁵	D7-12-8HC ⁵			
67,500	29,484			GCL-6500, GCD-6500 ²	D7-18-6AC ⁵	D7-18-8HC ⁵			
70,000	31,751			GCL-6500, GCD-6500 ²	D7-18-6AC ⁵	D7-18-8HC ⁵			
72,500	32,885			GCL-6500, GCD-6500 ²	D7-18-6AC ⁵	D7-18-8HC ⁵			
75,000	34,019			GCL-6500, GCD-6500 ²	D7-18-6AC ⁵	D7-18-8HC ⁵			
77,500	35,153								
80,000	36,287								
82,500	37,421								
to 110,000	to 49,895								
120,000	54,431								
to 130,000	58,967								
Frequency (rpm) Range		3,100 - 22,000	8,500 - 40,000	9,000 - 14,000	0,500 - 14,500	7,600 - 15,400	2,700 - 5,650	Up to 5,000	3,450
	HIGH	VERY HIGH	HIGH	HIGH	HIGH	HIGH	LOW - MEDIUM	LOW - MEDIUM	MEDIUM

¹The force created by Pneumatic Vibrators or Hydraulic Vibrators can be adjusted by reducing or increasing the flow.

²High Frequency Dual Roller Vibrators may be mounted 2 ways. GCL uses cradle lug & GCD uses 4 bolts.

³If you have a unit prior to September 2022 it could have a 2HC motor. The 2HM and 2HC motors are interchangeable.

⁴C3 Hydraulic Vibrators are available with 2HC (High Pressure - Low Flow) or 5HC (Low Pressure - High Flow) Hydraulic Motors.

⁵D4, 5 and D7 Pneumatic or Hydraulic Vibrators are available with Clamp-type Mounting System designated with a "CC" (CC4.5 & CC7) instead of a "D" (D4.5 & D7).

⁶Electric Vibrators have adjustable weight settings. Additional vibrators may be used if more force is required.

⁷Vibrator performance is commutative and can be added together to achieve higher force performance. Only like models should be combined.