



The Cleveland Vibrator Company

Guide for Sizing Air and Electric Vibrators for Hoppers, Bins & Chutes

1. A single vibrator will normally provide the necessary force to move materials from most hoppers and bins. The single vibrator installation requires that the force of vibration be transmitted to full 180° right and left of the vibrator mounting location. However, due to the special configurations of some hoppers, their construction or wall thickness or the characteristics of the material itself (sticky, lightweight, large particles, moisture, etc.), consideration should be given to multiple of smaller vibrators evenly arranged around the hopper in place of one large vibrator.

The maximum number of multiples is three vibrators mounted 120° apart, or two vibrators mounted 180° apart. Greater distribution of vibration will result and assurance that all areas will be vibrated equally. This arrangement is of particular importance when attempting to move material from long rectangular shaped hoppers or from hoppers with a very shallow taper at the discharge.
2. The mounting of a vibrator on a length of channel which is stitch welded vertically to the side of a hopper will provide a transmission line above and below the vibrator and will also reinforce the hopper wall as well. The width of the channel should be to suit the base dimensions of the vibrator. The length will also vary with the hopper size, however, a good rule to follow is that the channel be one-third the length of the scoping section of the hopper.
3. Moisture content of the material to be moved is also important in the sizing of a vibrator. If the moisture content is 6% or more, it is advisable to use the next size vibrator or two vibrators.
4. All vibrators provide a range of adjustability in their force output. Air vibrators can be adjusted with a simpler air regulator; electric vibrators with adjustable eccentrics; or others with SCR controls. In selecting a vibrator, remember that it can be adjusted due to changes in material make-up, lower hopper contents, or vibrator over sizing.
5. There is a reduction in vibration intensity in the non-impacting type vibrators (air-cushioned, rotary electric, ball) over the impacting piston vibrator. To achieve comparable results, the next size non-impacting vibrator should be used.
6. A short burst of vibration is normally more effective than continuous vibration. Do not operate vibrators against closed hopper gates or valves.
7. Noise level of vibrators varies with the type. A general ranking from loudest to quietest is as follows: impact, ball, air-cushioned, rotary electric.

AIR VIBRATOR SIZING CHARTS FOR BINS AND HOPPERS

Bin Capacity lbs./kg	Approx. Skin Thickness of Bin in/mm	VMS Vibrator Size
700 91	1/8 3.2	1125
ton/m. ton		
1 0.9	1/8-3/16 3.2-4.8	1150
3 2.7	3/16-1/4 4.8-6.4	1200
20 18	5/16-3/8 7.9-9.5	1300
50 45	3/8 9.5	1350
100 90	3/8 9.5-12.7	1400
100 and up 90	3/4-1 19.1-25.4	1500

The information contained in these charts is the result of many years of experience. It is a reasonably accurate approach to giving you quick information to vibrator sizing on a hopper, bin or chute. Recommended vibrator sizes are predicated on a dry granular material weighing 100 lbs. per cubic ft. Considerations to other characteristics are mentioned previously.

The sizing of rotary electric vibrators is based on the ratio of material weight in the sloped wall section to the force output of the vibrator. For the majority of applications, the ratio should be one pound of vibratory force for every ten pounds of material in sloped wall section of the hopper.

The 3600 RPM rotary electric vibrator units are used for the majority of applications and are well suited for materials which are in the "free flowing" to "difficult to flow" range. For particularly stubborn materials, the 1800 RPM units will provide greater amplitude than a 3600 RPM unit of the same force output. When selecting an 1800 RPM rotary electric vibrator, use the chart to determine the proper size 3600 RPM vibrator, then select the 1800 RPM unit which develops the same force output.

ROTARY ELECTRIC SIZING CHARTS FOR BINS AND HOPPERS

Maximum Mat'l.in Sloped-Wall Section	CVC Model	Normal Wall Thickness
1,100 lbs.	RE 0.5-2	16-20 gauge
2,200 lbs.	RE 1-2	1/8 - 3/16
4,400 lbs.	RE 2-2	3/16 - 1/4
7,700 lbs.	RE 3.5-2	3/16 - 1/4
13,200 lbs.	RE 6-2	1/4 - 3/8
22,000 lbs.	RE 10-2	3/8 - 1/2
35,200 lbs.	RE 16-2	1/2 - 3/4
50,600 lbs.	RE 23-2	3/4 - 1
66,000 lbs.	RE 30-2	1 - 1-1/4
88,000 lbs.	RE 40-2	1-1/4 - 1-1/2

To determine the weight of material in the sloped wall section, multiply the bulk density of the product by the volume (in cubic feet) of the hopper section.

To calculate the volume of a conical hopper:
 $1.0472 \times \text{vertical height} \times [R^2 + (R \times r) + r^2] = \text{Volume}$, where R is the radius of the cone at the transition point and r is the radius of the cone at the discharge.

To calculate the volume of a rectangular or square hopper:
 $\text{Vertical height} / 3 \times (B + (B \times b)^{1/2} + b) = \text{volume}$ where B is the area at the transition point and b is the area at the discharge.

BINS & HOPPERS

Most bin or hopper applications will require only one RE rotary electric vibrator. CVC recommends mounting the single drive as indicated in figure 1, locating the unit at a point on the sloped wall section that is 1/3 the height of the wall.

Applications involved with particularly stubborn material or hoppers larger than 100 ton capacity may require two or more vibrators. The recommended mounting is shown in figures 2 and 3. Normally, not more than three rotary electric vibrators would ever be required on a hopper or bin.

THE CLEVELAND VIBRATOR COMPANY
2828 CLINTON AVE. CLEVELAND, OH 44113
800-221-3298