History & Applications

Introduction

This manual contains information on the two main types of vibrators:
• Rotary vibrators (ball, roller and turbine vibrators)
• Linear piston vibrators

Historical Background...
Even today in some areas of the globe, just as it was centuries ago, the hand driven stamper still is very common as a tool to compact concrete in molds. Similarly, the sledge hammer is the tool used to support material flow.

Screens to separate chaff from corn are known to be the first vibrating application "industrialized", i.e. the first vibrating element driven by non-human energies such as water and wind.
Pneumatic driven vibrators were introduced early this century as linear piston vibrators or pneumatic hammers. Only years later was the simpler rotary vibrator with a ball or a roller running circle born. For decades this design has not been changed. The body was and still is made by many manufacturers of cast iron and the outside surface is not machined.
At the end of the sixties, the first experiments with aluminum bodies were conducted. Aluminum is very simple and clean to machine, with no black casting dust that covers machines and the hands of the endusers. Aluminum has the strength required but is not too stiff to allow cracks to form. It can be coated with paint so that modern industrial designs can be created. For applications in special environments such as pharmaceutical installations bodies are machined from stainless steel.
Today, a vast amount of work is done by vibrators. The main applications are emptying bins and hoppers, screening materials, and compacting concrete as well as feeding sand, clay, or any kind of powder or small parts such as screws. Vibration is also used in the electronics industry to detect cold joints on printed circuit boards.
In silo and bin applications air blasters are also used to loosen bulky materials.

Energy type	Vibratory motion
Electricity	Rotary/ Linear/ Magnetic
Pneumatic	Rotary/ Linear
Hydraulic	Rotary

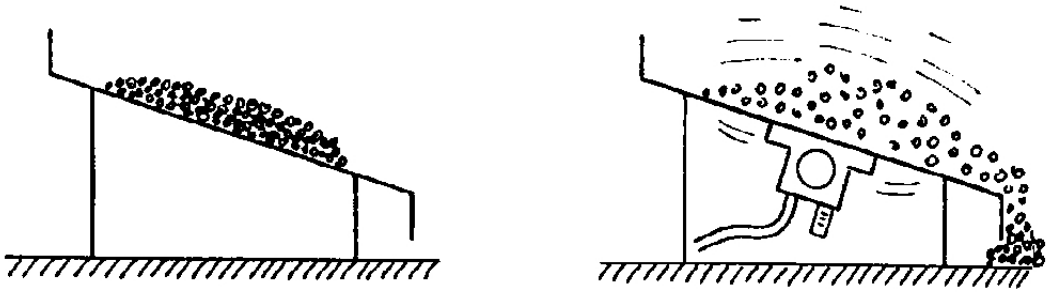
Classification of vibrators

Vibrators can be classified in general according to the type of energy they use and the type of motion they produce.

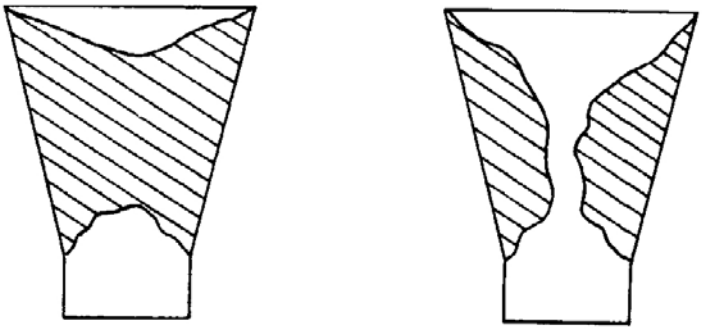
What is a vibrator good for?

With the help of vibration any kind of bulky material can be fed, compacted or separated.
In most cases vibration supports the force of gravity. For instance, bulky material may "hang" and clog in a hopper because of moisture. Vibration can loosen the material so the force of gravity can continue to move material through the hopper.

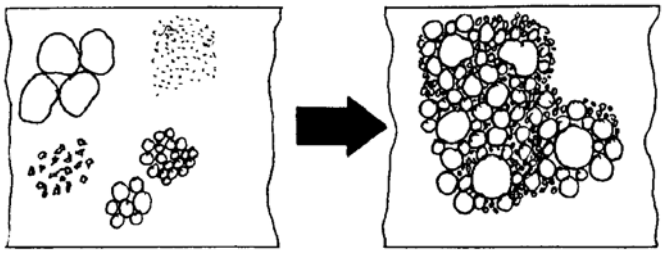
Another application for vibrators is their use with concrete. Vibrating concrete means to shake the sand and gravel particles so that they find the most compact volume possible, with no space available for air. Gravity is responsible for the first line in compacting but the vibration supports and improves it very much.
In both cases vibration will reduce friction of the product.



Vibration and gravity

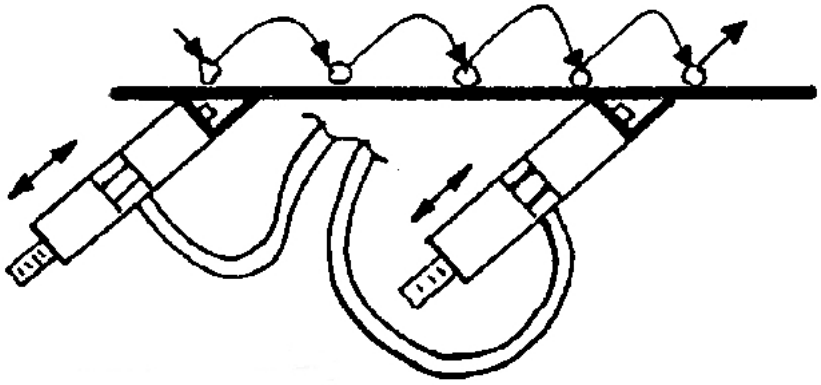


Bridging and ratholing



Compacting of concrete

Vibration does not necessarily support the force of gravity. Vibration makes material "jump" and gravity brings it back to the channel or chute. With the help of linear vibrators the direction of the material jump can be defined, and by adjusting the amplitude the length of the jump can be varied. When the chute slopes downward, rotary vibrators can be used as well.



Feeding of Materials

Basic information about Pneumatic Driven Vibrators

One thing is important to know when dealing with any kind of vibrators: You can certainly calculate natural frequencies of materials, silos, chutes, etc., but in reality your results will never be exactly as calculated.
There are tables and even calculation charts available to select and position vibrators correctly. However, the "fine tuning", that is, the optimal adjustment of the vibrator, is a matter of practical trials and tests. Field engineers with some experience may immediately select the best type of vibrator as well as the optimal mounting location.

There are some rules of thumb and selection tables available on the “SIZING” page.

To be able to perform optimal tuning of the vibrator, it is recommended that you put an air line regulator or a needle valve in the air pressure line so the air flow and the air pressure can be controlled.

Hertz	rpm
1	60
15	900
20	1200
30	1800
60	3600
100	6000
150	9000

Rpm / Hertz chart

Finding the natural frequency of the material that is to be fed, compacted or separated is the best way to tune or adjust the vibrator.
The operational frequency of pneumatic external vibrators ranges from 2,000 r.p.m. up to about 20,000 r.p.m. or from about 35 to 350 Hz. The values given in the technical datasheet were obtained while the vibrator was mounted to a heavy test block.

When a vibrator is tested hanging from a hose without being mounted to a structure
the frequency can be 2 o 3 times higher.

Often the natural frequency of a material could be out of the operational frequency range of a vibrator. Thus, a more powerful vibrator has to be used to do the job.
It is not necessary for the vibrator to run at full power to perform at its best. It is recommended that you operate a new vibrator at ¾ of its maximum power so that if force output is lost over time due to abrasion, aging, etc., the pressure & frequency
can be increased to compensate for the loss.

NOTE:
The pneumatic rotary and linear vibrator should not be operated at more than 100 PSI (7 bars).