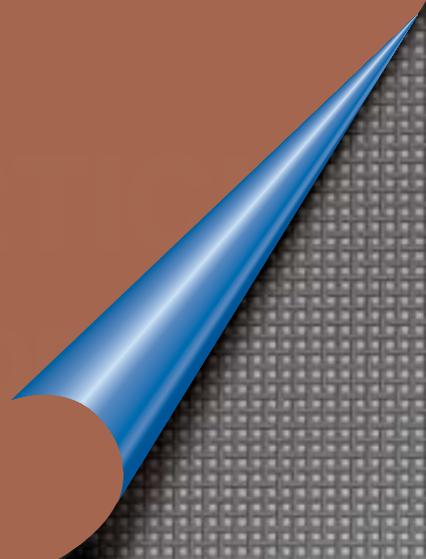




# SWECO<sup>®</sup> GRINDING MILLS



*Wet or Dry.  
Granular to Submicron  
Particle Size Reduction.*



# FAST, LOW-COST PARTICLE SIZE REDUCTION TO SUBMICRON RANGE

SWECO Vibro-Energy Grinding Mills. The most versatile line of mills available today. Wet or dry grinding. With or without particle-size classification. Closed or open-circuit processing. From small lab batches to full production grinding.

Grinding mills with working capacities as small as 1 pint, and as large as 182 gallons. And for drying grinding, chamber capacities up to 70 cu. ft.

The key feature of every SWECO Grinding Mill is its Vibro-Energy motion. A three-dimensional vibratory action, this precise, high-frequency motion is the reason why SWECO Mills can grind a greater variety of materials to a particle size of 1/2 micron or less ... with results so consistent that batch time guess work is virtually eliminated.

With Vibro-Energy motion, product contamination from media and lining wear is minimized. In addition, SWECO Mills require less energy input than conventional mills of similar capacity.

Since only a minimum of vibration is transmitted to the base of the mill, no special flooring or foundation is required. In addition, maintenance costs are reduced, as there are few moving parts, and replaceable linings are made of abrasion resistant materials.



## VIBRO-ENERGY ADVANTAGES

**High Grinding Efficiency.** The high frequency, low amplitude motion, as employed in the Vibro-Energy Mill is the most effective method of converting energy to accomplish particle size reduction from 100-micron to submicron range.

**Uniform Particle Size Distribution.** The ability to control particle size precisely is very important in most industries processing finely ground materials. The Vibro-Energy Mill is unequalled in this important aspect of grinding technology. The use of alumina cylinders coupled with this unique motion can provide a uniform particle size and distribution.

**Lowest Material Contamination.** Contamination of materials while grinding is an important consideration in many industries. Due to the rapid wear of the grinding media in ball or pebble mills, these machines cannot be used in many applications. In contrast, Vibro-Energy Mills introduce negligible media and lining contamination, due to the small impact forces generated.

**Reduced Electrostatic Charging or Agglomeration During Grinding.** Pigments produced by precipitation and filtration frequently acquire electrostatic charges during the process. These charges bond the pigment particles very tightly, slowing down conventional grinders. The high frequency impacts in a Vibro-Energy Mill quickly dissipate the small static charges originally existing in the pigment.

**Requires Less Energy Input.** The movement of media in a Vibro-Energy is very small, so a high percentage of the energy is directed into the grinding effort. Once the motion generator is up to operating speed, the inertia of the rotating eccentric weights greatly reduces the power input required to

maintain this speed. Consequently, very low energy input is required per unit of ground product produced.

**No Special Installation.** Unlike conventional ball and pebble mills, the Vibro-Energy Mill does not require deep, heavy concrete foundations or specially reinforced structures. The major vibrating forces are directed to the grinding chamber with a minimum of vibration transmitted to the base. This results in a substantial savings in installation costs.

**Low Maintenance Cost.** The inside surfaces of the grinding vessel are constructed of abrasion-resistant polyurethane, with other linings available for special applications. This feature, combined with few moving parts in the mill, significantly reduces maintenance costs.

**Vibro-Energy Mills are Versatile.** SWECO Grinding Mills can easily be operated in series for continuous processing. The units can be used in either open-circuit or closed-circuit grinding.

**Temperature Control.** Although temperature rise in the Grinding Mill is much more limited than in ball or pebble mills, provisions can be made in some models for effective temperature control to heat or cool the charge material.

**Ease of Sampling and Discharge.** Because of the unique vibratory motion, discharge of material from the Vibro-Energy Mill is accomplished rapidly and easily while the unit is in operation. Even thixotropic materials flow readily. Samples may be taken by merely opening the valve while the mill continues to operate.

# HOW THE VIBRO-ENERGY MILL WORKS

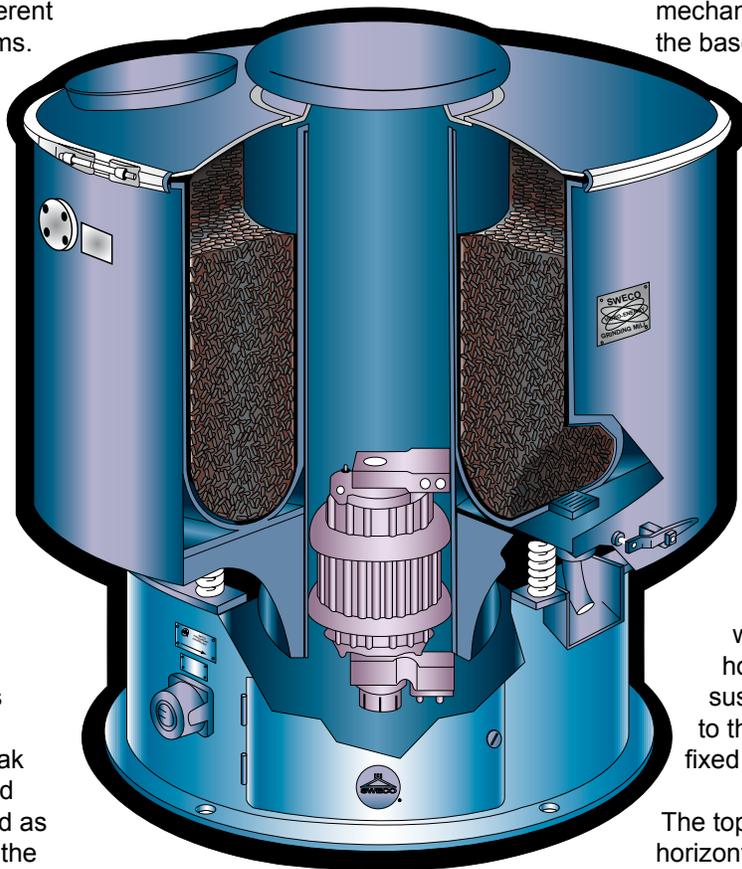
Two basic limitations are inherent in conventional milling systems. These limitations are, first, the inability to perform ultra-fine grinding economically and, second, their failure to produce uniform particle size distribution.

The Vibro-Energy principle of applying high frequency, three dimensional vibration to a chamber containing small cylindrical grinding media helps to overcome both of these limitations.

It takes less total energy to reduce or break a small particle than it does a large one. For ultra-fine grinding, only very small impact forces are necessary. Any force in excess of that needed to break the material results in wasted energy which will be dissipated as heat. In addition, the greater the number of grinding impacts per unit of time, the faster a given particle size reduction can be accomplished. Therefore, the Vibro-Energy Grinding Mill, using small amounts of energy with high frequency vibration, is more efficient than the high impact, low-frequency principle applied in conventional grinding systems.

In most industries which process finely ground materials, uniform particle size is of utmost importance. However, this close particle size distribution has been extremely difficult to achieve with ball and pebble mills. In the lower micron range, their point contact offers decreasing probability of further particle reduction and increasing probability of wide particle size distribution.

The use of cylindrical grinding media, coupled with the unique Vibro-Energy motion, enables SWECO Mills to achieve a narrow particle size distribution. The Vibro-Energy Mill normally uses small alumina cylinders



designed to achieve a combination of point, line and face contact. When two pieces of cylindrical grinding media are vibrating against each other, the large particles will be worked on first, and reduced in size, while the smaller particles will remain protected. When the larger particles are reduced in size, by the combination of point, line and face contact, to the same size as the smaller ones, close particle size distribution has been achieved. Further size reduction maintains this same close range.

Basically, the Vibro-Energy Mill consists of a grinding chamber and vibrating mechanism.

The grinding chamber is in the form of a vertical cylinder which is filled with small pieces of very hard grinding media. Most often this is sintered alumina, in the form of half-inch cylinders. The material to be ground is introduced into the voids between the grinding media. The vibration

mechanism is attached directly to the base of the grinding chamber.

The whole assembly is suspended on high-tensile steel springs. Thus, all the energy from the vibrating mechanism is imparted directly to the grinding media without the necessity for intermediate gears, drives or clutches.

The vibrating mechanism consists of a specially designed electric motion generator having a heavy shaft mounted in heavy-duty bearings. At each end of the shaft are attached "out-of-balance" weights. The top weight, which is in the same horizontal plane as the top of the suspension springs, is connected to the motion generator shaft in a fixed position.

The top eccentric weight causes a horizontal gyration of the grinding chamber, while the bottom eccentric weight provides a gyrating tilt. This unique motion causes three dimensional, high-frequency vibration, which constitutes the transfer agent converting the motive energy into grinding impacts.

In general, any material that can be broken by impact can be ground in a Vibro-Energy Mill. Thus, most materials which are processed in ball mills, pebble mills or hammer mills can be processed in Vibro-Energy Mills to produce a finer product with increased efficiency.

The major benefit derived from Vibro-Energy is its ability to give SWECO Grinding Mills their extraordinarily high-degree of sophisticated chamber movement. Unlike competitive systems, SWECO Grinding Mills feature precise control, dust-free operation, and virtually no transmitted vibration to the floor.



## DRY GRINDING MILLS

model	chamber capacity		lining		motor hp	media load		width		height		shipping weight	
	ft <sup>3</sup>	m <sup>3</sup>	in	mm		lb	kg	in	mm	in	mm	lb	kg
DM1	1.2	0.033	1.000	25.4	.33	80	36	24	610	39	991	220	100
DM3	3	0.085	.3125	8.0	1.25	300	136	33	838	41	1041	475	215
DM10	10	0.283	.7500	19.0	5	1000	454	48	1219	44	1118	1100	499
DM20	20	0.566	.7500	19.0	10	2000	907	63	1600	60	1524	2700	1225
DM70	70	1.982	1.000	25.4	40	7000	3175	89	2261	74	1880	9000	4082

## WET GRINDING MILLS

model	max working capacity		motor hp	media load		width		height		shipping weight	
	gal	liter		lb	kg	in	mm	in	mm	lb	kg
M18	2.6	10	.25	200	91	18	457	30	762	200-250	91-113
M45	27	102	5	2100	953	48	1219	55	1397	1400-2200	635-1000
M60	70	265	10	5600	2540	66	1676	76	1930	5500-7500	2500-3400
M80	182	689	40	14 000	6350	83	2108	103	2616	11 000-16 000	5000-7250

Lining configurations available for low amplitude mills:

- L - Replaceable abrasion-resistant elastomer lining.
- S - Type 316 Stainless Steel grinding chamber. Water jacket available.
- RC - Cast bottom with bolt-on inner and outer type 316SS walls to permit easy replacement as needed.
- C - Ceramic lined chamber.
- T - Ceramic lined with a solvent resistant fluoropolymer elastomer.





## APPLICATIONS

In countless industries, SWECO Mills are providing the particle size reduction and distribution needed to fulfill specific application requirements. And in many cases, they have created opportunities for the development of products not even possible with competitive grinding methods.

**Ceramics.** A closely-controlled particle size distribution is extremely valuable in the production of body slips and glazes. Grinding time cycles are also reduced.

**Pharmaceuticals and Cosmetics.** Production of a uniform fine particle size is important in the grinding and dispersing of dermatological grinding and dispersion of emulsions in suspension.

**Food.** The grinding of key ingredients into small particle sizes produces more surface area and consequently more taste strength per unit. SWECO Mills enable the food industry to produce small particle sizes with minimal contamination and low product cost.

**Agricultural Chemicals.** In the production of pesticides, herbicides and fungicides, SWECO Mills help create superior flowables with uniform solids-to-liquid ratios. Products have a longer shelf life without settling-out, and spray jet clogging is reduced. In addition, the increase total surface area of

the finer particles enhances the effectiveness of the materials. This permits smaller amounts of material to be used in achieving the desired results.

**Enabled Ware.** The Vibro-Energy Mill is especially suitable for grinding porcelain enamel powder. Advantages include the ability to produce a product that will give maximum opacity and smoothness without producing excessive fines. Elimination of oversize particles and uniformity of distribution contribute to higher quality in the end product.

**Organic Pigments.** The Vibro-Energy Mill meets the requirements for achieving the full color strength important in grinding and dispersing or organic pigments. Contamination is controlled and heat rise is reduced during the grinding of colors.

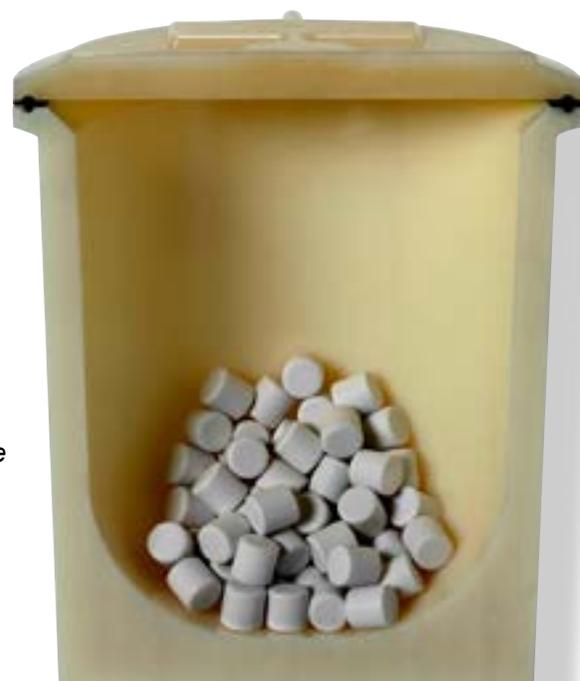
**Inorganic Pigments.** In the production of inorganic pigments for use in ceramics, paints, plastics, paper coatings, inks, leather finishes, floor and wall coverings, rubber, etc., narrow particle size distribution is highly desirable. Materials such as titanium dioxide, zirconium silicate, calcium carbonate and kaolin are being milled in Vibro-

Energy equipment to very critical limits to create particles with maximum light scattering powder and with a minimum of oversize and undersize particles.

**Abrasives.** In the abrasives industry where media wear is a problem, the use of Vibro-Energy Mills provide extended media life and subsequent savings. The ability to grind particles under 10 microns is of particular importance in the development of new artificial abrasives.

**Special Applications.** SWECO Mills are also well suited to processing a wide variety of other materials including: powdered metals, tungsten carbides, rubber molding compounds, catalyst carriers and iron oxide for magnetic tape production.

*SWECO offers a complete line of grinding media, developed by evaluating results from extensive testing in many industrial applications.*





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