Steatite Ceramic Grinding Media

Steatite ceramic grinding media and ball mill lining bricks is manufactured from the same fine-grained composite and are ideal performance partner. Thus, they retain their shape better and last longer than flint / river pebbles, natural stones, porcelain etc. Due to their higher density, hardness, toughness and a higher degree of sphericity, Steatite ceramic grinding media saves over 20-25% milling time than river pebbles.

Advantages of Steatite Ceramic Grinding Media :-

Higher density, hardness & sphericity As compared to flint river pebbles and natural stone.

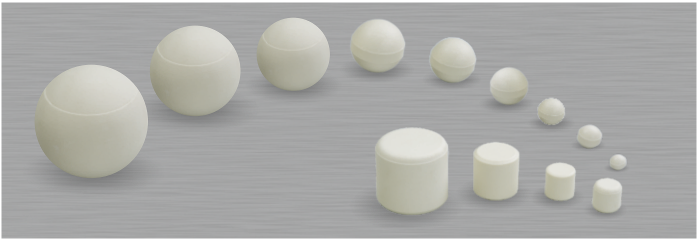
Easy to use : Steatite grinding media is fully vitrified, non-porous and satin smooth in surface finish, allowing easy and thorough cleaning while changing the charge from one colour shade to another.

Longer milling life : As Steatite grinding media have dense homogeneous internal microstructures, it offers superior wear resistance as compared to other conventional media.

Low contamination with high levels of homogeneity wear rate of our Steatite grinding media is so insignificant, that it has no effect on the colour & composition of the end milled product.

Wide range of sizes : Steatite satellite type grinding media is available in 8 assorted sizes Ø 6, 8, 10, 12.5, 15, 20, 25, 30 and Isostatic (ISO) pressed media 40, 50 & 60 mm diameter to meet the most demanding applications for dispersion and particle size reduction.

Uniform quality : Steatite grinding media is produced in the most modern plant under stringent quality control checks at various stages of manufacturing to ensure consistency in quality and elevate the grinding media to the highest quality level.



Types of Steatite Grinding Media

Steatite ceramic spherical & cylindrical grinding media for various types of mills.

Ball mills are the most commonly used mills to accomplish particle size reduction. A revolving vessel, the 'drum', lined with ceramic bricks contains grinding media and the raw material to be ground. Ball mills are classified into :-

Batch type & Continuous type :

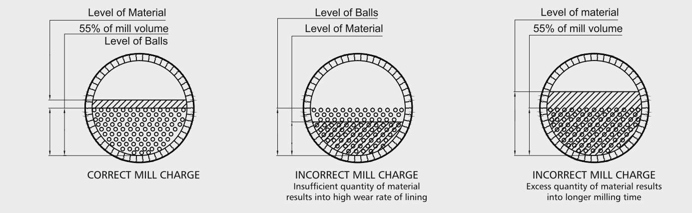
Batch type ball mills are versatile and most widely used. Particle size reduction takes place by impact on the material with the tumbling grinding media and by abrasion between the media and the mill wall.

Selection of grinding media

For a fresh charge, it is the most general practice to use three different ball sizes: 25% of large size, 50% of medium size & 25% small size. There might be cases where using 2 to 4 different size of grinding balls may be necessary. This will require a change in the proportions of each size used. For topping of the mill, we suggest a selection of the largest dia balls.

Recommended charge of material to be ground and grinding media.

Charge of material to be ground : There are no hard and fast rules about charging of mills; some general rules are adopted from experiences of operators which helps in achieving optimum milling efficiency at economical cost. In most cases, the quality of material to be ground should be 25-30% of mill’s useful volume. Non-obersvance of these limits can lead to high wear rate of grinding media and the mill lining or to a considerably longer grinding time.



Recommended quantities of grinding media:-

To obtain optimum grinding efficiency, we recommend:

1) For batch type mill: Grinding media should fill 55% of mill's useful volume.
2) For continuous type mill: Grinding media should fill 35% of mill's useful volume.

To calculate media charge for cylindrical mill. Formula is given below:

Where: M = Weight of the grinding media charge in kgs

D = Mill internal dia in cms after lining

L = Internal length of the mill in cms after lining

For batch type ball mill:

$M = 0.000691 \times D^2 \times L$

Example: To calculate grinding media charge for a Steatite brick lined batch type mill size: Ø 6’ x 6’ Long (Ø 180 cms x 180 cms L) (Mill openings are not considered).

Thickness of tapered brick = 6.5 cm

Thickness of straight brick = 4.2 cm

Therefore $D = 180 - 13 = 167$ cm

$L = 180 - 8.4 = 171.6$ cm

$M = 0.000691 \times 167^2 \times 171.6$

Grinding media quantity = 3307 kg

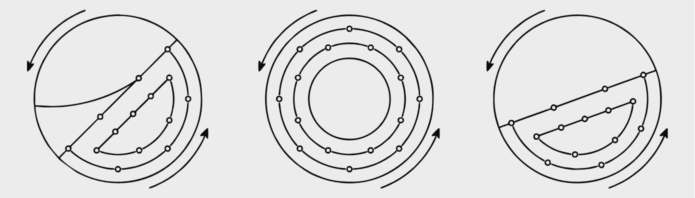
Ball mill volume, media charge & RPM

No.	Mill I.D.		Lining thickness	Usable volume of mill	Media qty @ 55% vol	Media size and quantity	Speed
	mm	inch	mm	Ltr	kg	mm	rpm
1	450	18	Taper : 47 Straight : 30	38.8	34	50% Ø 20 mm + 50% Ø 25 mm	37 - 38
2	600	24	"	108.6	95	50% Ø 25 mm + 50% Ø 30 mm	32 - 33
3	750	30	"	233.3	205	50% Ø 25 mm + 50% Ø 30 mm	30 - 31
4	900	36	Taper : 65 Straight : 42	380.2	334	25% Ø 25 mm + 50% Ø 30 mm & 25% Ø 40 mm	27 - 28
5	1050	42	"	642.4	565	25% Ø 25 mm + 50% Ø 30 mm & 25 % Ø 40 mm	25 - 26
6	1200	48	"	1004	883	25% Ø 25 mm + 50% Ø 30 mm & 25% Ø 40 mm	23 - 24
7	1350	54	"	1480.6	1303	25% Ø 30 mm + 50% Ø 40 mm & 25% Ø 50 mm	21 - 22
8	1500	60	"	2088.3	1837	25% Ø 30 mm + 50% Ø 40 mm & 25% Ø 50 mm	20 - 21
9	1800	72	"	3760.4	3309	25% Ø 30 mm + 50% Ø 40 mm & 25% Ø 50 mm	18 - 19

Recommended mill rotation speed :

Mill rotating speed is an important parameter for optimizing grinding efficiency.

- Using proper speed has a cascading effect where the charge and grinding balls roll over one another, thus developing maximum milling action with minimum wear of grinding media and lining.
- If the ball mill rotates at an excessive speed, there will be centrifugal effect and no particle size reduction will take place.
- If the speed is too slow it results in purring effect where the charge is lifted to small angle and balls tend to slide back on the lining hence the grinding action is poor.



CORRECT
Operational Speed
Cascade Effect
Efficient Grinding

INCORRECT
Excessive Speed
Centrifugation
No Grinding

INCORRECT
Very Low Speed
Purring Fall
No Grinding

Calculations for mill motor power & mill speed

Considering the weight of mill lining and grinding media, work out the motor power required in consultation with the mill manufacturer.

To calculate the motor power required for a cylindrical type ball mill, the following formula can be applied:

$$W = 0.04116 \times D^3 \times L \times n \times (0.6d + 0.4d1)$$

Where: W = Required motor power in HP

D = Internal Ø of the mill in mtrs

L = Internal length of the mill in mtrs

d = Specific gravity of grinding media

d1 = Specific gravity of substance

n = Speed of ball mill in rpm

Example: Let the internal Ø of the mill be 1.8 mtrs and internal length be 1.8 mtrs. If Steatite grinding media is used then density d = 2.7. If milling substance is Steatite in slurry form with around 70% solids, then density d1 = 1.6

d = 2.7 and d1 = 1.6 then

$$W = 0.04116 \times (1.8)^4 \times 19 \times (2.7 \times 0.6 + 1.6 \times 0.4) = 18.5 \text{ hp}$$

To calculate the speed of the mill, use the following formula:

$$Nc = \frac{76.6}{D^{1/2}}$$

Where: Nc = Critical speed

D = Internal Ø in ft.

Actual speed of the mill should be approximately 62% of the Nc for wet milling and 75% of Nc for dry milling.

Table indicating the optimum mill speed and motor power of ball mill

Inside	Inside	Dry grinding with Steatite media		Wet grinding with Steatite media	
Dia (mm)	**Length (mm)**	**Speed (rpm)**	**Motor power (hp)**	**Speed (rpm)**	**Motor power (hp)**
300	300	60	1/2	46	½
450	450	50	1/2	37	½
600	600	43	1	33	1
750	750	39	1 ½	29	1 ½
900	900	35	2 ½	27	2 ½
1050	1050	33	5	25	4 ½
1200	1200	31	7 ½	23	6 ½
1350	1350	29	12	22	8
1500	1500	27	15	21	12
1800	1800	25	25	19	20
2100	2100	23	37	17	30
2400	2400	22	55	16	45
2700	2700	20	90	15	75
3000	3000	19	125	15	100