Direct from Ferro

OPTIMIZING GRINDING RESULTS

There are so many variables that affect grinding results; to change a single variable is to change the grind. These are some of the variables that affect results:

- characteristics of the raw materials (source, sizing and difficulty of grind)
- mill design and operating speed
- grinding media charge quantity and size distribution
- the raw material to grinding media ratio
- consistency of raw material and charge levels
- grinding media shape and density
- handling practices or additives
- slurry viscosity and specific gravity (wet grind)

Always consult your mill manufacturer when making changes. To optimize grinding parameters, change only one variable at a time and monitor that result. Record all details and continue comparative study. In order to maximize the life of grinding media and linings, keep the charge constant and at a reasonable level.

CRITICAL AND OPERATING SPEED

The critical speed, **Ncr**, of a mill is the speed revolutions per minute (rpm) above which the grinding media will centrifuge. Operating close to **Ncr** drastically reduces the effectiveness of the grinding action of the colliding spheres (cylinders). The critical speed of a mill depends only on the mill diameter. The mill length does not affect its critical speed.

A mill's critical speed, **Ncr** is given by: $\mathbf{Ncr} = \dfrac{42.3}{\sqrt{D}}$

where **D** is the inside diameter of the mill (meters).

The units for the critical speed and operating speed are revolutions per minute. The normal operating speed of tumbling mills **Nop**, is between 55-65% of the mill's critical speed.

60% of critical speed was used for this example:

$$\mathbf{Nop = Ncr \times 0.60}$$

MEDIA (BALL) CHARGE

Tumbling-style batch mills typically use a media charge of 50-55% of the mill volume. Continuously operated mills (often dry-grind applications) use a media charge of 40-45% of the mill volume.

Vm, the volume of the mill is: $\mathbf{Vm} = \dfrac{3.1416 \times D^2 \times L}{4}$

For obtaining the volume of the media charge in this example, the volume of the media charge is 50% of the total mill volume.

Vc, the volume of the media charge is:

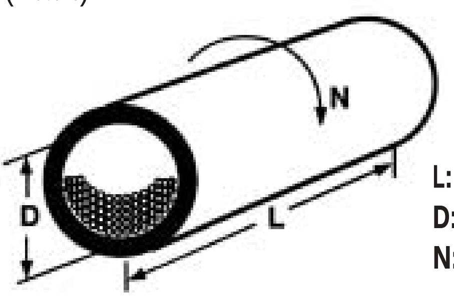
$$\mathbf{Vc} = \mathbf{Vm} \times 0.50$$

For obtaining the weight of the media charge:

Mw, is the total media charge weight in kilograms.

Mw = Vc x Media Bulk Density (kgs / m³)

where **D** is the inside diameter of the mill (meters)
L is the inside length of the mill (meters)



L: inside length (m)
D: inside diameter (m)
N: mill speed (rpm)