Grinding Ball Size by Bond's Formula

Make-up ball size (and rod size) for a ball mill from feed size, work index, feed specific gravity, percent critical speed and mill diameter by Bond's formula.

Method: Duda; Cement Data Book; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Feed 80 % passing size	500.00	µm
Bond work index (metric tonne)	13.228	kWh/t
Specific gravity of the feed	2.7000	g/cm³
Mill speed as a fraction of critical	76.000	%
Mill diameter inside the liners	9.0000	ft
Grinding	Wet grinding (K = 350)	

Calculated results

Parameter	Value	Unit
Make-up ball diameter	15.842	mm
Equivalent make-up rod diameter	19.486	mm

Notes for this case

• Bond's formula gives the largest (make-up) ball; select the nearest commercial size, a little larger below 1 inch. The work index is converted to Bond's short-ton basis. Rod size by the 1.23 ratio quoted in Perry's.

Formula and method

$$B = \sqrt{\frac{F}{K}}\sqrt[3]{\frac{W_i S}{C_s\sqrt{D}}} \quad (\text{in};\ F\ \mu m,\ W_i\ \text{kWh/sh t},\ C_s\ \%,\ D\ \text{ft})$$

Variables

F	Feed 80 % passing size	m
W_i	Bond work index (metric tonne)	J/kg
S	Specific gravity of the feed	kg/m³
C_s	Mill speed as a fraction of critical	-
D	Mill diameter inside the liners	m
K	Grinding	-
B	Make-up ball diameter	m
$1.23B$	Equivalent make-up rod diameter	m

Method and standards

Bond's ball size formula.

Assumptions and limits

- Production-size mills.

References

• Duda
• Cement Data Book
• Vol. 1
• 3rd ed. (Bauverlag / Macdonald and Evans, 1985)
• sec. 5.11 (Bond's ball size formula) and Table 5.11.1

- Perry's Chemical Engineers' Handbook
- 9th ed.
- sec. 21 (rod to ball size ratio 1.23)

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/chemical/cement/mill-ball-size-bond

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.