Ball Mill Power by Bond's Equation and Operating Work Index

Specific energy and power of a rod or ball mill by Bond's equation with Rowland's efficiency factors, and the operating work index from measured power.

Method: Wills and Finch; Wills' Mineral Processing Technology; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Feed 80 % passing size	600.00	µm
Product 80 % passing size	110.00	µm
Bond work index (laboratory)	10.500	kWh/t
Throughput (dry solids)	150.00	t/h
Product of Rowland's efficiency factors (1 if none)	1.0000	
Measured mill power at the pinion (for the operating work index)	900.00	kW

Calculated results

Parameter	Value	Unit
Specific energy	5.7248	kWh/t
Mill power required	858.71	kW
Operating work index from measured power	11.005	kWh/t
Circuit efficiency (laboratory over operating index)	95.413	%

Notes for this case

• Bond's equation applies to ball and rod milling of 'normal' feeds; Rowland's factors correct for dry grinding, open circuit, mill diameter, oversize feed, fine grinding and reduction ratio. Select the mill from a calibrated power model or the maker's tables.

Formula and method

$$W = 10 W_i \left(\frac{1}{\sqrt{P_{80}}} - \frac{1}{\sqrt{F_{80}}} \right) EF_x, \quad P = WT, \quad W_{io} = \frac{P_m / T}{10 \left(1/\sqrt{P_{80}} - 1/\sqrt{F_{80}} \right)}$$

Variables

F_{80}	Feed 80 % passing size	m
P_{80}	Product 80 % passing size	m
W_i	Bond work index (laboratory)	J/kg
T	Throughput (dry solids)	kg/s
EF_x	Product of Rowland's efficiency factors (1 if none)	-
P_m	Measured mill power at the pinion (for the operating work index)	W
W	Specific energy	J/kg
P	Mill power required	W
W_{io}	Operating work index from measured power	J/kg
W_i / W_{io}	Circuit efficiency (laboratory over operating index)	-

Method and standards

Bond's equation with Rowland's efficiency factors.

Assumptions and limits

- Wet closed-circuit grinding; Bond's calibration range.

References

• Wills and Finch
• Wills' Mineral Processing Technology
• 8th ed. (Butterworth-Heinemann, 2016)
• ch. 5
• eq. 5.4 (Bond, 1952) and ch. 7
• eq. 7.11 (Rowland and Kjos, 1980)
• Example 7.2

Report details

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

This calculator online

https://calc.firecad.com/civil/mining-minerals/ball-mill-bond-sizing

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.