Minimum Sample Mass by Gy's Sampling Equation

Minimum sample mass for a required precision by Gy's fundamental sampling error, from top size, size range, liberation size, mineral content and densities.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Top size (95 % passing)	25.000	mm
Lower size (5 % passing)	1.0000	mm
Liberation size	150.00	µm
Mineral content (mass fraction)	5.8000	%
Density of the valuable mineral	7.6000	g/cm³
Density of the gangue	2.6500	g/cm³
Particle shape	Most ores (f = 0.5)	
Required relative standard deviation	1.0000	%
Mass of the lot sampled	1,000.0	t

Calculated results

Parameter	Value	Unit
Size distribution factor	0.25000	
Liberation factor	0.077460	
Mineralogical factor	118.77	g/cm³
Sampling constant	1.1500	g/cm³
Minimum sample mass	179.66	kg
Sample mass with Wills's allowance for other errors	359.31	kg

Notes for this case

- Gy's equation estimates only the fundamental error; Wills recommends at least doubling the mass for distribution, preparation and analysis errors. For a 95 % confidence of ±x, enter σ = x / 2 (relative to the grade).

Formula and method

$$\sigma^2 = \left(\frac{1}{m_s} - \frac{1}{M}\right) C d^3, \quad C = fglm, \quad l = \sqrt{L/d}, \quad m = \frac{1-a}{a}\left[(1-a)\rho_r + a\rho_t\right]$$

Variables

d_{95}	Top size (95 % passing)	m
d_5	Lower size (5 % passing)	m
L	Liberation size	m
a	Mineral content (mass fraction)	-
ρ_r	Density of the valuable mineral	kg/m³
ρ_t	Density of the gangue	kg/m³
ore	Particle shape	-
σ	Required relative standard deviation	-
M	Mass of the lot sampled	kg
g	Size distribution factor	-

l	Liberation factor	-
m	Mineralogical factor	kg/m³
C	Sampling constant	kg/m³
m_s	Minimum sample mass	kg
$2m_s$	Sample mass with Wills's allowance for other errors	kg

Method and standards

Gy's fundamental sampling error.

Assumptions and limits

- Two-component ore; Gy's factor values.

References

- Wills and Finch
- Wills' Mineral Processing Technology
- 8th ed. (Butterworth-Heinemann, 2016)
- ch. 3
- eqs. 3.4-3.6 (Gy, 1967, 1982) and Example 3.3

Report details

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Release checks	4 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/civil/mining-minerals/gy-sampling-minimum-mass

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.