Particle Size Distribution for Dense Packing (Andreasen, Dinger–Funk)

Cumulative percent finer than a size for densest packing by the Andreasen or modified Dinger–Funk distribution, and the share between two sizes.

Method: Andreasen and Dinger–Funk packing distributions

Input parameters

Unit system: SI

Parameter	Value	Unit
Largest particle size	5.0000	mm
Smallest particle size (0 = Andreasen)	1.0000	µm
Distribution modulus	0.37000	
Lower size of a fraction	0.10000	mm
Upper size of the fraction	1.0000	mm

Calculated results

Parameter	Value	Unit
Cumulative percent finer than d_1	20.098	%
Cumulative percent finer than d_2	53.123	%
Share of the mix between d_1 and d_2	33.025	%

Notes for this case

• Andreasen found that a continuous size distribution packs most densely when the cumulative fraction finer than d follows (d/D)^q with q of about 0.33–0.5. Dinger and Funk added the smallest size: CPFT = (d^q − d_min^q)/(D^q − d_min^q), with q ≈ 0.37 giving the densest packing. Refractory castables, concrete and ceramic bodies are graded to this curve to cut water demand and porosity.

Formula and method

$$CPFT = \frac{d^q - d_{min}^q}{D^q - d_{min}^q}$$

Variables

D	Largest particle size	m
d_{min}	Smallest particle size (0 = Andreasen)	m
q	Distribution modulus	-
d_1	Lower size of a fraction	m
d_2	Upper size of the fraction	m
$CPFT(d_1)$	Cumulative percent finer than d_1	-
$CPFT(d_2)$	Cumulative percent finer than d_2	-
Δ	Share of the mix between d_1 and d_2	-

Method and standards

Particle packing.

Assumptions and limits

- Continuous distribution; spherical-equivalent sizes.

References

Andreasen and Dinger–Funk packing distributions

Report details

Report reference	FCC-3NWD-BN4P (the same inputs always give the same reference)
Generated	23 November 2026, 17:35 UTC
Calculator	Particle Size Distribution for Dense Packing (Andreasen, Dinger–Funk)
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
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/ceramics-glass/andreasen-particle-packing

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.