Grain Growth from Footing to Strike

Crystal size after building a footing to a strike at constant crystal content (cube root of the volume ratio, Hugot p. 714) and crystal surface per gram.

Method: Hugot; Handbook of Cane Sugar Engineering; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Mean crystal size in the footing	0.35000	mm
Footing volume	5.0000	m^3
Final strike volume	45.000	m^3

Calculated results

Parameter	Value	Unit
Volume ratio	9.0000	
Final crystal size	0.72803	mm
Crystal surface per mass, footing	0.012029	m^2/g
Crystal surface per mass, final	0.005783	m^2/g

Notes for this case

- Hugot's example: a footing nine times smaller than the strike grows 0.35 mm grain to about 0.73 mm. Holds only if no new grain forms.

Formula and method

$$l_2 = l_1 \sqrt[3]{\frac{V_2}{V_1}}, \quad s = \frac{0.00421}{l} \ [\mathrm{m^2/g};\ l \ \mathrm{mm}]$$

Variables

l_1	Mean crystal size in the footing	m
V_1	Footing volume	m^3
V_2	Final strike volume	m^3
V_2/V_1	Volume ratio	-
l_2	Final crystal size	m
s_1	Crystal surface per gram, footing (m^2/g)	-
s_2	Crystal surface per gram, final (m^2/g)	-

Method and standards

Hugot's crystal-number argument.

Assumptions and limits

- Constant crystal count and content.

References

- Hugot
- Handbook of Cane Sugar Engineering
- 3rd ed. (Elsevier, 1986)
- ch. 33
- magma and grain growth (p. 714) and eqn 33.45 (crystal surface)

Report details

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Release checks	2 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/sugar-ethanol/pan-boiling/pan-footing-grain-growth

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.