Three-Massecuite Boiling Scheme Balance

Sugar, final molasses, A, B and C massecuites and the B and C sugars of a three-massecuite single-magma scheme, from syrup solids and purities, by SJM balances.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Syrup dry solids	15,000	kg/h
Syrup purity	87.000	%
A (commercial) sugar purity	99.000	%
B sugar purity	92.000	%
C sugar purity	85.000	%
A molasses purity	69.000	%
C massecuite purity (B molasses)	58.000	%
Final molasses purity	36.000	%
A massecuite brix	93.000	%
B massecuite brix	94.000	%
C massecuite brix	97.000	%
Massecuite density	1,470.0	kg/m³
Crushing rate	100.00	t/h

Calculated results

Parameter	Value	Unit
A sugar (dry solids)	12,143	kg/h
Final molasses (dry solids)	2,857.1	kg/h
B sugar (dry solids)	4,099.4	kg/h
C sugar (dry solids)	2,328.0	kg/h
A molasses (dry solids)	6,956.5	kg/h
A massecuite (dry solids)	19,099	kg/h
B massecuite (dry solids)	9,284.6	kg/h
C massecuite (dry solids)	5,185.2	kg/h
A massecuite purity	88.073	%
B massecuite purity	73.012	%
A massecuite per tonne cane	139.71	L/t
B massecuite per tonne cane	67.192	L/t
C massecuite per tonne cane	36.364	L/t

Notes for this case

- Model: A massecuite from syrup and B sugar; B from A molasses and C sugar; C from B molasses (single magma). Hugot's typical purities: A 80–85, B 68–72, C 56–60.
- A massecuite purity 88.1 is outside Hugot's typical 80–85.
- B massecuite purity 73.0 is outside Hugot's typical 68–72.

Formula and method

$$S = S_0 \frac{j-m}{s-m}, \quad S_B = \frac{S(s-p_A) - S_0(j-p_A)}{s_B - p_A}, \quad M_A = S_0 + S_B - S$$

$$S_C = M\frac{p_C - m}{s_C - p_C}, \quad Q_A = S_0 + S_B, \quad Q_B = M_A + S_C, \quad Q_C = S_C + M$$

Variables

S_0	Syrup dry solids	kg/s
j	Syrup purity	-
s	A (commercial) sugar purity	-
s_B	B sugar purity	-
s_C	C sugar purity	-
p_A	A molasses purity	-
p_C	C massecuite purity (B molasses)	-
m	Final molasses purity	-
B_A	A massecuite brix	-
B_B	B massecuite brix	-
B_C	C massecuite brix	-
ρ_m	Massecuite density	kg/m³
A	Crushing rate	kg/s
S	A sugar (dry solids)	kg/s
M	Final molasses (dry solids)	kg/s
S_B	B sugar (dry solids)	kg/s
S_C	C sugar (dry solids)	kg/s
M_A	A molasses (dry solids)	kg/s
Q_A	A massecuite (dry solids)	kg/s
Q_B	B massecuite (dry solids)	kg/s
Q_C	C massecuite (dry solids)	kg/s
p_{QA}	A massecuite purity	-
p_{QB}	B massecuite purity	-
v_A	A massecuite per tonne cane	m³/kg
v_B	B massecuite per tonne cane	m³/kg
v_C	C massecuite per tonne cane	m³/kg

Method and standards

Sucrose and dry-solids balances stage by stage.

Assumptions and limits

- Single magma; no remelting; no losses.
- The massecuite purities are compared with Hugot's typical ranges, and B or C sugar purer than the sugar above it is flagged.

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 33
• three-massecuite schemes and the CBA example
• pp. 670–679; SJM eqns 39.1–39.3

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/three-massecuite-scheme

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.