# Material Balance of the Tandem (Hugot)

Brix, sucrose and purity of absolute juice, first- and second-mill juice and final bagasse for a tandem with compound imbibition, after Hugot pp. 299–302.

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

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Fibre per unit cane | 15.000 | % |
| Imbibition water per unit cane | 36.000 | % |
| Brix of primary (first-mill) juice | 20.730 | % |
| Purity of first-mill juice | 89.000 | % |
| Extraction | 96.000 | % |
| Purity of residual juice in the final bagasse | 50.000 | % |
| Fibre in first-mill bagasse | 33.000 | % |
| Fibre in final bagasse | 50.000 | % |
| Brix ratio absolute / primary juice | 0.96500 | |
| Purity ratio absolute / primary juice | 0.96000 | |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Brix of absolute juice | 20.004 | % |
| Sucrose per unit cane | 14.528 | % |
| Sucrose in first-mill juice per unit cane | 10.063 | % |
| Sucrose in final bagasse per unit cane | 0.58112 | % |
| Sucrose % final bagasse | 1.9371 | % |
| Second-mill juice per unit cane | 51.455 | % |
| Brix of second-mill juice | 8.8122 | % |
| Sucrose % second-mill juice | 7.5473 | % |
| Purity of second-mill juice | 85.646 | % |

**Notes for this case**

- Hugot's example (f 0.15, w 0.36, $B_1$ 20.73, $p_1$ 89, e 96 %) gives about 1.93 % sucrose in bagasse and second-mill juice of brix 8.7 and purity 84.

## Formula and method

$$B_0 = k_B B_1, \quad s_0 = (1-f) B_0 k_p p_1, \quad s_1 = (1-b_1) B_1 p_1, \quad s_n = s_0 (1-e)$$

$$j_2 = 1 + w - b_n - j_1, \quad B_2 = \frac{M_0 - M_1 - s_n/p_n}{j_2}, \quad p_2 = \frac{s_0 - s_1 - s_n}{M_0 - M_1 - s_n/p_n}$$

### Variables

| | | |
|---|---|---|
| $f$ | Fibre per unit cane | - |
| $w$ | Imbibition water per unit cane | - |
| $B_1$ | Brix of primary (first-mill) juice | - |

| | | |
|---|---|---|
| $p_1$ | Purity of first-mill juice | - |
| $e$ | Extraction | - |
| $p_n$ | Purity of residual juice in the final bagasse | - |
| $F_1$ | Fibre in first-mill bagasse | - |
| $F_n$ | Fibre in final bagasse | - |
| $k_B$ | Brix ratio absolute / primary juice | - |
| $k_p$ | Purity ratio absolute / primary juice | - |
| $B_0$ | Brix of absolute juice | - |
| $s_0$ | Sucrose per unit cane | - |
| $s_1$ | Sucrose in first-mill juice per unit cane | - |
| $s_n$ | Sucrose in final bagasse per unit cane | - |
| $\sigma$ | Sucrose % final bagasse | - |
| $j_2$ | Second-mill juice per unit cane | - |
| $B_2$ | Brix of second-mill juice | - |
| $S_2$ | Sucrose % second-mill juice | - |
| $p_2$ | Purity of second-mill juice | - |

### Method and standards

Hugot's step-by-step balance of soluble matter and sucrose.

### Assumptions and limits

- Compound imbibition; only mills 1 and 2 send juice to process.
- Sucrose and purity are apparent values (pol), as in factory control. The defaults for k_B and k_p are typical ratios, not from a cited source: use your own.
- A second-mill juice with negative sucrose or purity above 100 % is rejected.

### References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 19
• material balance of the tandem
• pp. 299–303

## Report details

| | |
|---|---|
| Report reference | FCC-2SXT-RVPS (the same inputs always give the same reference) |
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| Calculator | Material Balance of the Tandem (Hugot) |
| Method last reviewed | 13 November 2026 |
| Software release | FireCAD Calc, release of 17 November 2026 |
| 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/milling/tandem-material-balance

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.