Grasshopper (Shaker) Sugar Conveyor (Tromp, Hugot)

Throw per stroke, capacity and motor power of a grasshopper sugar conveyor from stroke, speed, strip angle and trough section (Hugot 35.62–35.67, after Tromp).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Eccentric stroke	40.000	mm
Eccentric speed	300.00	rpm
Inclination of the flexible strips	60.000	°
Vertical cross-section of sugar in the trough	0.030000	m²
Slip coefficient	50.000	%
Sugar bulk density	850.00	kg/m³
Horizontal surface of the trough	12.000	m²
Lift	0	m

Calculated results

Parameter	Value	Unit
Speed of projection cn/20	0.60000	m/s
Throw sin 2(π/2 − α) v²/g	31.792	mm
Return travel c sin α	34.641	mm
Capacity	15.246	t/h
Motor power 2.25 + S_h (kW) plus lift	14.250	kW

Notes for this case

- Hugot: stroke about 40 mm at about 300 rpm, strips of ash timber at 60°; incline the conveyor no more than 30° to lift sugar.

Formula and method

$$v = \frac{cn}{20}, \quad r = \sin 2\left(\frac{\pi}{2} - \alpha\right)\frac{v^2}{g}, \quad r' = c\sin\alpha, \quad Q = S(r + r')nkd$$

$$P = 2.25 + S_h\ [\mathrm{kW}] + \frac{QH}{6000}\ [Q\ \mathrm{kg/min}]$$

Variables

c	Eccentric stroke	m
n	Eccentric speed	1/s
α	Inclination of the flexible strips	rad
S	Vertical cross-section of sugar in the trough	m²
k	Slip coefficient	-
d	Sugar bulk density	kg/m³
S_h	Horizontal surface of the trough	m²
H	Lift	m
v	Speed of projection cn/20	m/s
r	Throw sin 2(π/2 − α) v²/g	m

r'	Return travel c sin α	m
Q	Capacity	kg/s
P	Motor power 2.25 + S_h (kW) plus lift	W

Method and standards

Tromp's method as given by Hugot.

Assumptions and limits

- Free-flowing dry sugar.
- The speed n is in rpm in the formulas (the Variables table gives the SI 1/s); the page converts it.
- The lift is taken as entered: the conveyor length and slope are not inputs, so Hugot's 30° limit is not checked, and the lift power QH/6000 has no drive efficiency.

References

- Hugot
- Handbook of Cane Sugar Engineering
- 3rd ed. (Elsevier, 1986)
- ch. 35
- grasshopper conveyor (after Tromp)
- eqns 35.62–35.67
- pp. 814–815

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/centrifugals-sugar-house/grasshopper-conveyor

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.