Mechanical Pan Circulator Power and Tip Speed

Installed and average power of a mechanical circulator in a vacuum pan from Hugot's figures per m³ (2.3 and 1.0 kW/m³), with the impeller tip speed checked.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Pan working volume	40.000	m³
Impeller diameter	1.2000	m
Impeller speed Hugot: 80 rpm for a 1.2 m impeller on footings, A and B; 60 for C below 97 brix; 50 above.	80.000	rpm
Installed power per m³	2.3000	kW/m³
Average power per m³	1.0000	kW/m³
Strike time	3.0000	h

Calculated results

Parameter	Value	Unit
Installed power	92.000	kW
Average power	40.000	kW
Tip speed	5.0265	m/s
Energy per strike	120.00	kWh

Notes for this case

- Hugot: tip speeds of 5–7.5 m/s for high-purity strikes (6.5 typical), 3.5–5 m/s for low grades; circulators shorten strikes by 15–50 %.

Formula and method

$$P_i = e_i V, \quad P_a = e_a V, \quad v_t = \pi D_i n, \quad E = P_a t$$

Variables

V	Pan working volume	m³
D_i	Impeller diameter	m
n	Impeller speed	1/s
e_i	Installed power per m³	W/m³
e_a	Average power per m³	W/m³
t	Strike time	s
P_i	Installed power	W
P_a	Average power	W
v_t	Tip speed	m/s
E	Energy per strike	J

Method and standards

Hugot's specific powers.

Assumptions and limits

- Hugot's specific figures. He also gives a peak of about 1.9 kW/m³; the page shows installed and average power only.
- The tip speed is compared with Hugot's 3.5–7.5 m/s range.

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 33
• mechanical circulation
• pp. 707–710

Report details

Report reference	FCC-Z76F-RGZH (the same inputs always give the same reference)
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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-circulator-power

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.