Rotary Filter Air Pump, Filtrate Pump and Cake

Vacuum pump air, filtrate pump, power and cake thickness of a rotary vacuum filter from its area, drum speed and cake output (Hugot ch. 31).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Filter area	40.000	m²
Air drawn per m² of filter Hugot: 12.8 m³/(m²·h) ordinary filters; 31–32 with flocculant (Rapifloc); 15–18 at 50 cm vacuum (Louisiana).	12.800	m/h
Filtrate pump capacity per m² Hugot: 480–500 L/(m²·h).	0.49000	m/h
Power per m² of filter Hugot: about 0.8 kW/m² all drives and pumps.	0.80000	kW/m²
Cake output Hugot: 60–75 kg/(m²·h).	70.000	kg/(m²·h)
Time per drum revolution Hugot: 3–10 min, about 5.	5.0000	min
Cake density	1,300.0	kg/m³

Calculated results

Parameter	Value	Unit
Vacuum pump air	512.00	m³/h
Filtrate pump	19.600	m³/h
Power	32.000	kW
Cake thickness	4.4872	mm

Notes for this case

- Hugot: cake 7–13 mm thick, about 7 mm best; doubling the drum speed raises output about 1.4 times.
- The cake comes out 4.5 mm thick, outside Hugot's 7–13 mm: adjust the drum speed.
- State the air basis to the pump maker: air measured as free air at atmosphere and air at the filter vacuum differ by the pressure ratio (about 2 at 50 cmHg vacuum).

Formula and method

$$\dot{V}_a = q_a S, \quad \dot{V}_f = q_f S, \quad P = eS, \quad e_c = \frac{g\, t_r}{\rho_c}$$

Variables

S	Filter area	m²
q_a	Air drawn per m² of filter	m/s
q_f	Filtrate pump capacity per m²	m/s
e	Power per m² of filter	W/m²
g	Cake output	kg/(m²·s)
t_r	Time per drum revolution	s
ρ_c	Cake density	kg/m³
$\dot{V}_a$	Vacuum pump air	m³/s
$\dot{V}_f$	Filtrate pump	m³/s

P	Power	W
e_c	Cake thickness	m

Method and standards

Hugot's specific capacities.

Assumptions and limits

- Specific figures from practice.
- The air volume is on the same basis as the specific figure entered; free air at atmosphere and air at the filter vacuum differ by the pressure ratio (about 2 at 50 cmHg), so state the basis when sizing the pump.
- The cake thickness is compared with Hugot's 7–13 mm.

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 31
• Oliver filters
• pp. 473–483

Report details

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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/clarification/rotary-filter-auxiliaries

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.