Electric Mill Drive Sizing

Motor rating and electrical input for a mill from the power at the rollers, gearing and drive efficiencies and Hugot's 15 % margin, with energy per tonne cane.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Mean maximum power at the rollers	200.00	kW
Gearing efficiency (motor to rollers) The default 0.94 is an assumed figure for an enclosed planetary or helical reducer; use the maker's. Hugot: 0.78–0.79 with open pinions.	94.000	%
Drive efficiency (motor and converter) Hugot: thyristor d.c. drive about 0.90.	90.000	%
Margin over the mean maximum Hugot: 1.15 for individual drives, 1.10 for combined drives.	1.1500	
Crushing rate	100.00	t/h

Calculated results

Parameter	Value	Unit
Motor shaft power	212.77	kW
Motor rating	244.68	kW
Electrical input	236.41	kW
Electrical energy per tonne cane at the mean maximum load (upper bound)	2.3641	kWh/t

Notes for this case

- E_c is worked out from the mean maximum power, so it is an upper bound on the energy used. Hugot's figure of about 2.7 kWh per tonne cane per mill for thyristor-controlled d.c. drives is an average consumption and comes out lower. Mills need constant torque down to about half speed.

Formula and method

$$P_m = \frac{P}{\rho}, \quad P_n = k\,P_m, \quad P_e = \frac{P_m}{\eta}, \quad E_c = \frac{P_e}{A}$$

Variables

P	Mean maximum power at the rollers	W
ρ	Gearing efficiency (motor to rollers)	-
η	Drive efficiency (motor and converter)	-
k	Margin over the mean maximum	-
A	Crushing rate	kg/s
P_m	Motor shaft power	W
P_n	Motor rating	W
P_e	Electrical input	W
E_c	Electrical energy per tonne cane	J/kg

Method and standards

Power chain from rollers to the supply.

Assumptions and limits

- Steady mean maximum load: the energy per tonne cane is therefore an upper bound, not the average consumption.
- The default gearing efficiency 0.94 is an assumed figure for an enclosed reducer; open pinions give about 0.78–0.79 (Hugot).

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 14 (installed power, p. 239) and ch. 15 (electric drives, pp. 241–248)

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/milling/mill-electric-drive

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.