Mill Power by Components (Hugot)

Power of a 3-roller mill by Hugot eqns 14.1–14.7: compression, journal and trashplate friction, scrapers and carrier, from load, speed, size and opening.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Total hydraulic load on the top roller	340.00	tf
Roller speed	5.0000	rpm
Roller diameter	0.81300	m
Roller length	1.6760	m
Re-absorption factor	1.3000	
Working delivery opening	13.300	mm
Compression coefficient	Later mills (0.40)	
Journal and trashplate friction coefficient Hugot Table 14.5: 0.046 minimum, 0.075 mean, 0.107 maximum.	0.075000	
Efficiency of the gearing Hugot: about 0.78–0.79 for open pinions, gears and a reducer.	78.000	%

Calculated results

Parameter	Value	Unit
Re-absorption function (6r − 5)/(√r(1 + √(r − 1)))	1.5867	
Compression power	82.519	kW
Journal and trashplate friction	76.240	kW
Scrapers and intermediate carrier	20.044	kW
Power at the rollers	178.80	kW
Power at the prime mover	229.23	kW

Notes for this case

• Hugot's formulae give metric horsepower with F in tonnes, n in rpm and D, L in metres; converted to kW here. Hugot's example (F 340 t, r 1.3, n 5, D 0.813 m, ε = e_A/D = 0.0164, i.e. e_A 13.3 mm) gives about 111 hp of compression.

Formula and method

$$P = nD\left\{F\left[k_1 f(r)\sqrt{e_A/D} + k_2\right] + 4L\right\}\ \text{[metric hp]}, \quad f(r) = \frac{6r-5}{\sqrt{r}\,(1+\sqrt{r-1})}$$

$$P_{drive} = P/\rho$$

Variables

F	Total hydraulic load on the top roller	N
n	Roller speed	1/s
D	Roller diameter	m
L	Roller length	m
r	Re-absorption factor	-
e_A	Working delivery opening	m
k_1	Compression coefficient	-

k_2	Journal and trashplate friction coefficient	-
ρ	Efficiency of the gearing	-
$f(r)$	Re-absorption function (6r − 5)/(√r(1 + √(r − 1)))	-
P_1	Compression power	W
$P_2 + P_3$	Journal and trashplate friction	W
$P_4 + P_5$	Scrapers and intermediate carrier	W
P	Power at the rollers	W
P/ρ	Power at the prime mover	W

Method and standards

Hugot's analysis of mill power by components.

Assumptions and limits

- Hugot's coefficients for normal 3-roller mills. In the compression term ε = e_A/D (Hugot's example: 13.3 mm on an 813 mm roller, ε = 0.0164).
- Notes flag k_2 outside Hugot's Table 14.5 range (0.046–0.107) and unusually high re-absorption factors.

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 14
• eqns 14.1–14.7 and Tables 14.5–14.6
• pp. 227–234

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-power-hugot

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Reopens the calculator with the inputs of this report.