Capacity of a Tandem with Mills of Different Sizes

Equivalent mill factor and crushing capacity of a tandem whose mills differ in size or speed, by Hugot's weighting (eqn 12.10) of the first mill and the rest.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Cane preparation	Two knife sets and a shredder (1.22)	
Total rollers in the tandem	15.000	
Fibre % cane	14.500	%
Mill 1: roller diameter	0.91400	m
Mill 1: roller length (0 if no mill)	1.8290	m
Mill 1: speed	5.0000	rpm
Mill 2: roller diameter	0.86400	m
Mill 2: roller length (0 if no mill)	1.6760	m
Mill 2: speed	5.5000	rpm
Mill 3: roller diameter	0.86400	m
Mill 3: roller length (0 if no mill)	1.6760	m
Mill 3: speed	5.5000	rpm
Mill 4: roller diameter	0.86400	m
Mill 4: roller length (0 if no mill)	1.6760	m
Mill 4: speed	5.0000	rpm
Mill 5: roller diameter	0.91400	m
Mill 5: roller length (0 if no mill)	1.8290	m
Mill 5: speed	4.5000	rpm
Mill 6: roller diameter	0.91400	m
Mill 6: roller length (0 if no mill)	0	m
Mill 6: speed	4.5000	rpm

Calculated results

Parameter	Value	Unit
Number of mills	5.0000	
First-mill factor $n(1 - 0.06nD)LD^2$	5.5449	
Equivalent mill factor	5.2289	
Crushing capacity	153.35	t/h

Notes for this case

- The first mill carries half the weight in Hugot's mean; the other mills share the rest equally. Factors in rpm·m³; the capacity formula gives t/h, converted here.

Formula and method

$$G_i = n_i(1 - 0.06\,n_i D_i)L_i D_i^2, \quad G_m = \frac{(N_1 - 1)G_1 + G_2 + \ldots + G_{N_1}}{2(N_1 - 1)}, \quad A = \frac{0.9\,c\,G_m\sqrt{N}}{f}$$

Variables

C	Cane preparation	-
N	Total rollers in the tandem	-
f	Fibre % cane	-
D_1	Mill 1: roller diameter	m
L_1	Mill 1: roller length (0 if no mill)	m
n_1	Mill 1: speed	1/s
D_2	Mill 2: roller diameter	m
L_2	Mill 2: roller length (0 if no mill)	m
n_2	Mill 2: speed	1/s
D_3	Mill 3: roller diameter	m
L_3	Mill 3: roller length (0 if no mill)	m
n_3	Mill 3: speed	1/s
D_4	Mill 4: roller diameter	m
L_4	Mill 4: roller length (0 if no mill)	m
n_4	Mill 4: speed	1/s
D_5	Mill 5: roller diameter	m
L_5	Mill 5: roller length (0 if no mill)	m
n_5	Mill 5: speed	1/s
D_6	Mill 6: roller diameter	m
L_6	Mill 6: roller length (0 if no mill)	m
n_6	Mill 6: speed	1/s
N_1	Number of mills	-
G_1	First-mill factor n(1 − 0.06nD)LD²	-
G_m	Equivalent mill factor	-
A	Crushing capacity	kg/s

Method and standards

Hugot's weighted mean mill factor in his capacity formula.

Assumptions and limits

- Hugot's empirical formula, with n in rpm, L and D in metres and A in t/h (the page converts from SI).
- Mills are listed in order without gaps, and the total rollers N must be at least three per mill entered (extra rollers for a crusher or feed rollers are allowed).

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 12
• eqns 12.6 and 12.10
• pp. 191–195

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-tandem-mixed-sizes

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Reopens the calculator with the inputs of this report.