Pressure on the Bagasse Blanket (Hugot, Deerr)

Maximum pressure under the top roller from the load and delivery opening (Hugot eqn 10.67) and Deerr's pressure for a compression ratio (eqns 10.48–10.50).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Load on the top roller (one opening)	300.00	tf
Roller length	2.1340	m
Roller diameter	1.0670	m
Work opening	20.000	mm
Compression ratio (compressed / initial volume)	0.10000	

Calculated results

Parameter	Value	Unit
Maximum pressure under the roller	288.70	kgf/cm²
Deerr static pressure for c (eqn 10.48)	70.000	kgf/cm²
Deerr exponent at that pressure	5.1159	
Pressure in the mill for c (eqn 10.50)	88.000	kgf/cm²

Notes for this case

- Deerr's relation is for static compression of bagasse; the mill value (Jenkins) is higher because of the short time under load.
- p_M comes from the load and opening, p_D and p_J from the compression ratio alone: they are separate estimates and are not cross-checked.

Formula and method

$$p_M = \frac{3F}{L\sqrt{D\,e_A}},\quad p_D = \frac{70}{(10c)^n},\quad n = 6 - \frac{5800}{p_D^2 + 1660},\quad p_J = \frac{88}{(10c)^6}\ [\mathrm{kg/cm^2}]$$

Variables

F	Load on the top roller (one opening)	N
L	Roller length	m
D	Roller diameter	m
e_A	Work opening	m
c	Compression ratio (compressed / initial volume)	-
p_M	Maximum pressure under the roller	Pa
p_D	Deerr static pressure for c (eqn 10.48)	Pa
n	Deerr exponent at that pressure	-
p_J	Pressure in the mill for c (eqn 10.50)	Pa

Method and standards

Hugot's pressure distribution under the roller (eqn 10.67) and Deerr's and Jenkins' compression laws for bagasse (Hugot eqns 10.48–10.50, pp. 146–149). Deerr's law is fitted to his static tests (Table 10.2) and tabulated by Hugot for 1 to 1 000 kg/cm² (Table 10.3, c from 0.543 to 0.064). Hugot gives the exponent-6 form, used by Jenkins for mill conditions, for pressures of 50 kg/cm² and above.

Assumptions and limits

- Empirical compression laws for bagasse. A note appears when c is outside 0.064–0.543 (Deerr) or when p_J is below 50 kg/cm² (c above about 0.11), outside the ranges Hugot gives. The load-based p_M and the compression-based p_D and p_J are

independent.

- c is h/H (eqn 10.46); Hugot notes de Boer's objection that this is not the true compression in the mill (p. 150).
- Deerr's implicit equation is solved after checking that it has a single root.

References

- Hugot
- Handbook of Cane Sugar Engineering
- 3rd ed. (Elsevier, 1986)
- ch. 10
- eqns 10.48–10.50 (Deerr, Jenkins)
- Tables 10.2–10.3
- pp. 146–149
- and eqn 10.67

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-roller-pressure

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Reopens the calculator with the inputs of this report.