Cane Knife Set: Knives, Cut and Tip Speed (Hugot)

Cane layer on the carrier, number of knives for a pitch, share of cane cut for a knife clearance, and tip speed of a cane knife set, by Hugot eqns 3.1–3.4.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Crushing rate	250.00	t/h
Carrier speed	8.0000	m/min
Carrier width	2.0000	m
Bulk density of the cane reaching the knives Hugot: 150 tangled whole cane, 175 parallel, about 300 for cane already cut by a first set.	150.00	kg/m³
Knife pitch (spacing along the shaft) First set about 50 mm; second and third 20–22 mm.	50.000	mm
Clearance between knife tips and carrier	300.00	mm
Knife tip circle diameter	1.6000	m
Knife shaft speed	600.00	rpm

Calculated results

Parameter	Value	Unit
Height of the cane layer	1,736.1	mm
Number of knives (even)	38.000	
Share of the layer passing uncut	17.280	%
Share of the layer cut	82.720	%
Knife tip speed	50.265	m/s

Notes for this case

- Knives run at 400–720 rpm; Hugot recommends about 500 rpm for the first set and 600 for the second.

Formula and method

$$h = \frac{A}{u\,L\,d}, \quad N = \left\lfloor \frac{L}{p} - 1 \right\rfloor \text{ rounded down to even}, \quad i = \min\left(1, \frac{r}{h}\right), \quad K = 1 - i, \quad v_t = \pi D_k n$$

Variables

A	Crushing rate	kg/s
u	Carrier speed	m/s
L	Carrier width	m
d	Bulk density of the cane reaching the knives	kg/m³
p	Knife pitch (spacing along the shaft)	m
r	Clearance between knife tips and carrier	m
D_k	Knife tip circle diameter	m
n	Knife shaft speed	1/s
h	Height of the cane layer	m
N	Number of knives (even)	-
i	Share of the layer passing uncut	-

K	Share of the layer cut	-
v_t	Knife tip speed	m/s

Method and standards

Hugot's continuity of the cane layer on the carrier and the geometry of the knife clearance.

Assumptions and limits

- Even layer across the carrier width. With a clearance of at least the layer height nothing is cut (a note says so). A note appears outside 400–720 rpm.

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 3
• eqns 3.1–3.4
• pp. 37–41

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/cane-preparation/cane-knife-set

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Reopens the calculator with the inputs of this report.