Rain-Type Condenser Size and Water Distribution

Section and diameter of a rain-type condenser from the vapour load (Hugot: 0.1–0.2 m² per t/h), the water pipe and the tray holes (3 × pipe area).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Vapour to condense	11.000	t/h
Section per t/h of vapour (m² per t/h) Square metres of section for each tonne per hour of vapour; Hugot 0.1–0.2.	0.15000	m²
Injection water	550.00	m³/h
Water velocity in the supply pipe	2.0000	m/s
Hole diameter	15.000	mm

Calculated results

Parameter	Value	Unit
Condenser section	1.6500	m²
Condenser diameter	1.4494	m
Water pipe section	0.076389	m²
Water pipe diameter	311.87	mm
Total hole area (3 a_p)	0.22917	m²
Number of holes	1,297.0	

Notes for this case

- Hugot: holes of about 15 mm, at least 1.8 m (better 2.4 m) of fall above the vapour entry, and an approach of 2–5 °C; these are not checked here.
- The injection water is an input and is not tied to the vapour load: check it with the condenser heat balance (multijet or barometric condenser water).

Formula and method

$$S = \sigma Q, \quad D = \sqrt{4S/\pi}, \quad a_p = \frac{Q_w}{V_w}, \quad a_h = 3a_p, \quad n = \frac{a_h}{\pi d_h^2/4}$$

Variables

Q	Vapour to condense	kg/s
σ	Section per t/h of vapour (m² per t/h)	m²
Q_w	Injection water	m³/s
V_w	Water velocity in the supply pipe	m/s
d_h	Hole diameter	m
S	Condenser section	m²
D	Condenser diameter	m
a_p	Water pipe section	m²
d_p	Water pipe diameter	m
a_h	Total hole area (3 a_p)	m²
n	Number of holes	-

Method and standards

Hugot's proportions.

Assumptions and limits

- Hugot's proportions from practice.
- σ is in m² per t/h of vapour and is shown in m² in every unit system.
- The injection water is not checked against the vapour load, and the fall height and approach are not computed.

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 40
• rain-type condensers
• pp. 893–895

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/vacuum-water/rain-condenser-sizing

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.