Spray Pond Area, Nozzles and Make-Up (Hugot)

Spray pond area at Hugot's loading (eqn 40.36), cooled water temperature (40.35), nozzle flow and count (40.40–40.43) and make-up (40.44–40.46).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Warm water to the pond	3,000.0	m³/h
Loading Hugot: 750 kg/(m²·h); 650–825 in practice.	750.00	kg/(m²·h)
Warm water temperature	50.000	°C
Wet-bulb temperature	24.000	°C
Pond efficiency Hugot: 50–70 %.	60.000	%
Nozzle discharge coefficient	60.000	%
Nozzle area	2.3300	cm²
Pressure at the nozzles (head)	5.0000	m
Water per kg vapour	50.000	
Losses (evaporation, drift), share of the injection water Hugot: 3–5 % of the water.	4.0000	%

Calculated results

Parameter	Value	Unit
Pond area	4,000.0	m²
Cooled water temperature	34.400	°C
Flow per nozzle	4.9839	m³/h
Number of nozzles	602.00	
Net loss after condensate gain φ − 1/W	2.0000	%
Make-up water	58.824	m³/h

Notes for this case

• Hugot: pipes 2.5–4 m apart, nozzles 2–2.5 m along them, and margins of 3–4 m windward and 6–8 m leeward. A negative net loss means the condensate added exceeds the losses.

Formula and method

$$S = \frac{Q_2}{g}, \quad t_1 = t_2 - \rho_e (t_2 - t_0), \quad q = 0.36\, c\, s \sqrt{2gH} \ \ [\mathrm{m^3/h};\ s\ \mathrm{cm^2}], \quad N = \frac{Q_2}{q}, \quad \varepsilon = \varphi - \frac{1}{W}$$

$$N = \left\lceil \frac{Q_2}{q} \right\rceil, \quad E = \max(\varepsilon, 0)\, Q_2 \frac{W}{W+1}$$

Variables

Q_2	Warm water to the pond	m³/s
g	Loading	kg/(m²·s)
t_2	Warm water temperature	K
t_0	Wet-bulb temperature	K

ρ_e	Pond efficiency	-
C	Nozzle discharge coefficient	-
S	Nozzle area	m²
H	Pressure at the nozzles (head)	m
W	Water per kg vapour	-
φ	Losses (evaporation, drift), share of the injection water	-
S	Pond area	m²
t_1	Cooled water temperature	K
q	Flow per nozzle	m³/s
N	Number of nozzles	-
$\mathcal{E}$	Net loss after condensate gain φ − 1/W	-
E	Make-up water	m³/s

Method and standards

Hugot's spray pond rules.

Assumptions and limits

- Hugot's loadings from practice.
- φ and 1/W are shares of the injection water; the warm water Q_2 is the injection water plus condensate, $Q_2 = Q_{inj}(W + 1)/W$.
- Pond efficiency at most 100 %.

References

- Hugot
- Handbook of Cane Sugar Engineering
- 3rd ed. (Elsevier, 1986)
- ch. 40
- spray ponds
- eqns 40.35–40.46
- pp. 885–890

Report details

Report reference	FCC-TYA9-0SW0 (the same inputs always give the same reference)
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Release checks	2 reference cases of this calculator, computed independently, are checked on every release

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/spray-pond-hugot

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.