Condenser Injection and Tail Water Pumps

Injection water and tail (warm) water flows of a barometric condenser (Hugot eqns 40.24–40.25) and the pump power for their heads (40.26), with margin.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Vapour condensed	11,000	kg/h
Water per kg vapour	50.000	
Injection pump head Hugot's example: 11 m in service, 17 m at start-up.	11.000	m
Warm water pump head	15.500	m
Pump efficiency	75.000	%
Flow margin	1.2000	

Calculated results

Parameter	Value	Unit
Injection water	660.00	m³/h
Warm (tail) water	673.20	m³/h
Injection pump power	26.369	kW
Warm water pump power	37.899	kW

Notes for this case

- The injection pump runs against the vacuum once the condenser works; size it for the start-up head, when there is no vacuum.

Formula and method

$$Q_1 = kQW, \quad Q_2 = kQ(W+1), \quad P = \frac{\rho g Q H}{\eta}$$

Variables

Q	Vapour condensed	kg/s
W	Water per kg vapour	-
H_1	Injection pump head	m
H_2	Warm water pump head	m
η	Pump efficiency	-
k	Flow margin	-
Q_1	Injection water	m³/s
Q_2	Warm (tail) water	m³/s
P_1	Injection pump power	W
P_2	Warm water pump power	W

Method and standards

Hugot's pump balance.

Assumptions and limits

- Water at about 1000 kg/m³.
- The margin k is applied to the flows, and so also to the power; the power is then a pump-sizing figure, not the running power. For running power set k = 1.

References

- Hugot
- Handbook of Cane Sugar Engineering
- 3rd ed. (Elsevier, 1986)
- ch. 40
- pumps for condensers
- eqns 40.24–40.26 and examples
- pp. 883–884

Report details

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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/condenser-water-pumps

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.