Open Channel Critical Depth, Specific Energy and Froude Number

Critical depth, critical velocity and minimum specific energy of a rectangular channel, with the Froude number and specific energy at a given depth.

Method: Open-channel hydraulics (Chow, Open-Channel Hydraulics)

Input parameters

Unit system: SI

Parameter	Value	Unit
Flow	10,800	m³/h
Channel width	2.0000	m
Actual depth	0.50000	m

Calculated results

Parameter	Value	Unit
Critical depth (q²/g)^{1/3}	0.61219	m
Critical velocity	2.4502	m/s
Minimum specific energy 1.5 y_c	0.91829	m
Specific energy at the actual depth	0.95887	m
Froude number at the actual depth	1.3548	

Notes for this case

- Supercritical (rapid) flow: Fr > 1.

Formula and method

$$y_c = \left(\frac{q^2}{g}\right)^{1/3}, \quad E = y + \frac{v^2}{2g}, \quad Fr = \frac{v}{\sqrt{gy}}$$

Variables

Q	Flow	m³/s
b	Channel width	m
y	Actual depth	m
y_c	Critical depth (q²/g)^{1/3}	m
v_c	Critical velocity	m/s
E_{min}	Minimum specific energy 1.5 y_c	m
E	Specific energy at the actual depth	m
Fr	Froude number at the actual depth	-

Method and standards

Rectangular channel hydraulics.

Assumptions and limits

- Rectangular channel, uniform velocity.

References

- Open-channel hydraulics (Chow, Open-Channel Hydraulics)

Report details

Report reference	FCC-D2H4-GRPK (the same inputs always give the same reference)
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Calculator	Open Channel Critical Depth, Specific Energy and Froude Number
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Release checks	3 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/mechanical/fluid-mechanics/open-channel-critical-depth

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.