Trash Rack Head Loss (Kirschmer)

Head loss through an intake trash rack by Kirschmer's formula from bar shape, thickness, spacing, velocity and inclination, with clogging and power lost.

Method: Kirschmer trash rack formula

Input parameters

Unit system: SI

Parameter	Value	Unit
Bar shape factor (2.42 square-nosed flat bars)	2.4200	
Bar thickness	12.000	mm
Clear spacing between bars	60.000	mm
Approach velocity	1.0000	m/s
Rack inclination from horizontal	75.000	°
Clogging multiplier	1.5000	
Flow	108,000	m^3/h
Plant efficiency	88.000	%

Calculated results

Parameter	Value	Unit
Clean rack head loss	13.940	mm
Head loss with clogging	20.909	mm
Power lost (clogged)	5.4133	kW

Notes for this case

• Kirschmer: h = k_t(t/b)^(4/3)(v²/2g)sinθ, with k_t about 2.42 for square-edged flat bars, 1.83 for round-nosed and 0.76–1.0 for streamlined bars. Debris raises losses sharply; racks are cleaned (raked) when the differential level rises. Keep approach velocity below about 1 m/s to limit losses and help fish.

Formula and method

$$h_r = k_t \left(\frac{t}{b}\right)^{4/3} \frac{v^2}{2g} \sin\theta$$

Variables

k_t	Bar shape factor (2.42 square-nosed flat bars)	-
t	Bar thickness	m
b	Clear spacing between bars	m
v	Approach velocity	m/s
θ	Rack inclination from horizontal	rad
f_c	Clogging multiplier	-
Q	Flow	m^3/s
η	Plant efficiency	-
h_r	Clean rack head loss	m
$h_{r,c}$	Head loss with clogging	m
P_{loss}	Power lost (clogged)	W

Method and standards

Rack loss.

Assumptions and limits

- Bars normal to the flow; uniform approach.

References

Kirschmer trash rack formula

Report details

Report reference	FCC-Y3DV-13W2 (the same inputs always give the same reference)
Generated	23 November 2026, 17:42 UTC
Calculator	Trash Rack Head Loss (Kirschmer)
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
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/boilers-power-plant/hydro-power/trash-rack-head-loss

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.