Turbine Spiral Case Inlet Size and Section Areas

Spiral case inlet velocity from a velocity coefficient and net head, the inlet area and diameter, and section areas around the spiral for uniform flow distribution.

Method: Constant-velocity spiral case sizing

Input parameters

Unit system: SI

Parameter	Value	Unit
Rated flow	144,000	m³/h
Net head	80.000	m
Inlet velocity coefficient (v = K_v√(2gH))	0.18000	
Wrap angle	345.00	°

Calculated results

Parameter	Value	Unit
Inlet velocity	7.1301	m/s
Inlet area	5.6101	m²
Inlet diameter (circular)	2,672.6	mm
Section area 90° from the inlet	4.1466	m²
Section area 180° from the inlet	2.6831	m²

Notes for this case

• Constant mean velocity around the spiral: each section carries the flow not yet delivered to the stay vanes, so area falls linearly with angle: A(φ) = A_in(1 − φ/θ_wrap). Velocity coefficients of about 0.15–0.25 are common for Francis spirals; designs following free-vortex (constant angular momentum) give slightly different areas. Final shapes come from model tests.

Formula and method

$$v_{in} = K_v\sqrt{2gH}, \quad A_{in} = \frac{Q}{v_{in}}, \quad A(\varphi) = A_{in}\left(1 - \frac{\varphi}{\theta_{wrap}}\right)$$

Variables

Q	Rated flow	m³/s
H	Net head	m
K_v	Inlet velocity coefficient (v = K_v√(2gH))	-
θ_{wrap}	Wrap angle	rad
v_{in}	Inlet velocity	m/s
A_{in}	Inlet area	m²
D_{in}	Inlet diameter (circular)	m
A_{90}	Section area 90° from the inlet	m²
A_{180}	Section area 180° from the inlet	m²

Method and standards

Spiral case.

Assumptions and limits

- Constant mean velocity; uniform outflow to the stay vanes.

References

Constant-velocity spiral case sizing

Report details

Report reference	FCC-P6E8-65W7 (the same inputs always give the same reference)
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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/boilers-power-plant/hydro-power/spiral-case-inlet-sizing

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.