Electrolyser Stack Sizing: Current, Cells and Active Area

Stack current, number of cells and stacks and total active area of a water electrolyser from power, cell voltage, current density and cell area.

Method: Series stack arithmetic

Input parameters

Unit system: SI

Parameter	Value	Unit
Electrolyser power	10.000	MW
Cell voltage	1.9000	V
Current density	2.0000	A/cm²
Active area per cell	3,000.0	cm²
Maximum cells per stack	250.00	

Calculated results

Parameter	Value	Unit
Cell (stack) current	6,000.0	A
Cells needed	878.00	
Stacks	4.0000	
Total active area	263.40	m²
Stack voltage with full stacks	418.00	V
Power per active area	37.965	kW/m²

Notes for this case

• Cells in series carry the same current I = iA_c; N = P/(V_cI). PEM electrolysers run at 1–3 A/cm², alkaline at 0.2–0.5 A/cm², so alkaline stacks need several times more area for the same power.

Formula and method

$$I = iA_c, \quad N = \frac{P}{V_c I}, \quad n_s = \left\lceil \frac{N}{N_{max}} \right\rceil$$

Variables

P	Electrolyser power	W
V_c	Cell voltage	V
i	Current density	A/m²
A_c	Active area per cell	m²
N_{max}	Maximum cells per stack	-
I	Cell (stack) current	A
N	Cells needed	-
n_s	Stacks	-
A_{tot}	Total active area	m²
V_{stack}	Stack voltage with full stacks	V
P/A	Power per active area	W/m²

Method and standards

Stack sizing.

Assumptions and limits

- Uniform cells; constant current density.

References

Series stack arithmetic

Report details

Report reference	FCC-7V0H-ESTQ (the same inputs always give the same reference)
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Calculator	Electrolyser Stack Sizing: Current, Cells and Active Area
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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/environmental/hydrogen-fuel-cells/electrolyser-stack-sizing

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.