Core Average and Peak Linear Heat Rate and Heat Flux

Average and peak linear heat rate, surface heat flux and rod power of a reactor core from thermal power, rod count, active length and peaking factors.

Method: Core power distribution averages and peaking factors

Input parameters

Unit system: SI

Parameter	Value	Unit
Core thermal power	3,000.0	MW
Fraction of power deposited in the fuel (about 0.974)	97.400	%
Number of fuel rods	41,000	
Active (heated) length	3.6600	m
Rod outer diameter	9.5000	mm
Heat flux (total) peaking factor	2.2000	
Enthalpy-rise (hot rod) peaking factor	1.5500	

Calculated results

Parameter	Value	Unit
Average linear heat rate	19.472	kW/m
Peak linear heat rate	42.839	kW/m
Average surface heat flux	652.44	kW/m²
Peak surface heat flux	1,435.4	kW/m²
Average rod power	71.268	kW
Hot rod power	110.47	kW

Notes for this case

• q̄' = γP/(N L); q'_max = F_q q̄'. About 2.6 % of the energy is deposited in the moderator and structure by gammas and neutrons, hence γ ≈ 0.974. F_q is the product of radial, axial and engineering factors.

Formula and method

$$\bar{q}' = \frac{\gamma P}{N L}, \quad q'_{max} = F_q \bar{q}', \quad q'' = \frac{q'}{\pi D}$$

Variables

P	Core thermal power	W
γ	Fraction of power deposited in the fuel (about 0.974)	-
N	Number of fuel rods	-
L	Active (heated) length	m
D	Rod outer diameter	m
F_q	Heat flux (total) peaking factor	-
$F_{\Delta H}$	Enthalpy-rise (hot rod) peaking factor	-
$\bar{q}'$	Average linear heat rate	W/m
q'_{max}	Peak linear heat rate	W/m
$\bar{q}''$	Average surface heat flux	W/m²
q''_{max}	Peak surface heat flux	W/m²

$\bar{P}_{rod}$	Average rod power	W
P_{hot}	Hot rod power	W

Method and standards

Core averages and peaking factors.

Assumptions and limits

- Uniform rod count and length.

References

Core power distribution averages and peaking factors

Report details

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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/nuclear-power/core-linear-heat-rate-peaking

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.