Reflected Reactor Critical Size and Reflector Savings

Bare critical radius of a spherical core and the smaller radius with a reflector, from one-group reflector savings using the reflector constants and thickness.

Method: One-group reflector savings

Input parameters

Unit system: SI

Parameter	Value	Unit
Core infinite multiplication factor	1.1200	
Core migration area	300.00	cm²
Core diffusion coefficient	0.90000	cm
Reflector diffusion coefficient	0.92000	cm
Reflector diffusion length	54.000	cm
Reflector thickness	60.000	cm

Calculated results

Parameter	Value	Unit
Material buckling (per cm²)	4.0000e-04	
Bare critical radius	157.08	cm
Reflector savings	42.496	cm
Reflected critical radius	114.58	cm
Core volume saved	61.184	%

Notes for this case

• One-group estimate: δ = (D_c/D_r)L_r tanh(T/L_r); a reflector thicker than about two diffusion lengths acts as infinite. Two-group methods are needed when core and reflector spectra differ much.

Formula and method

$$R_0 = \frac{\pi}{B}, \quad \delta = \frac{D_c}{D_r} L_r \tanh \frac{T}{L_r}, \quad R = R_0 - \delta$$

Variables

k_∞	Core infinite multiplication factor	-
M^2	Core migration area	m²
D_c	Core diffusion coefficient	m
D_r	Reflector diffusion coefficient	m
L_r	Reflector diffusion length	m
T	Reflector thickness	m
B^2	Material buckling (per cm²)	-
R_0	Bare critical radius	m
δ	Reflector savings	m
R	Reflected critical radius	m
$1-(R/R_0)^3$	Core volume saved	-

Method and standards

Reflector savings.

Assumptions and limits

- Spherical core; one group; homogeneous core and reflector.

References

One-group reflector savings

Report details

Report reference	FCC-NF7R-MFYT (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/nuclear-power/reflected-reactor-critical-size

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.