The World's Reactors

No. 38 U.S.S.R. *Lenin*

LOCATION	Aboard the ice-breaker *Lenin*
OWNER	U.S.S.R.
PURPOSE	Long range marine propulsion
TYPE	Pressurized water
OUTPUT	44 000 shp with three reactors each operating at 65 MW(th). Max. output per reactor 90 MW(th)
FUEL	UO_2 average enrichment 5%
MODERATOR	Light water
CORE	
Number of channels	219
Active height	1·6 m
Equivalent dia.	1 m
Lattice	Triangular, 64 mm pitch
Weight of fuel	80 kg U^{235}
Burn-up	
Average	11 000–13 000 MWd/t U (first core)
Maximum	30 000 MWd/t
FUEL ELEMENTS	
Type	36-rod bundle in circular shroud
Diameter of rods	6·1 mm
Cladding	Zirconium alloy, 0·75 mm thick
Arrangement	Concentric circles 6, 12 and 18 rods
Containment channel	Zirconium alloy 54·4 mm diameter and 1 mm thick. Spacers and end fittings of stainless steel. Overall length approximately 3 m
Burnable poison	Boron-10 distributed non-uniformly through the containment channel. Total amount per reactor for first charge 92 g
CONTROL	
Type	Regulating rods, compensating plates and safety rods
Regulating rods	6, operated in two groups of 3 rods. Average worth of each group for clean reactor; 0·36% $\Delta k/k$
PRIMARY COOLANT (design values at 65 MW)	
Flow, per loop (2 loops per reactor)	415 t/h
Inlet temperature	261°C (502°F)
Outlet temperature	317°C (603°F)
Number of pumps per reactor	4 (main)
Capacity of main pump	500 m^3/h (1 840 gal/min)
Heat exchanger surface area (2 per reactor)	375 m^2 (4 035 ft^2)
Pressurizers	Electrically heated, 4 per reactor
SECONDARY COOLANT	
Steam flow; per loop (2 loops per reactor)	43·3 t/h (95 000 lb/h)
Pressure	29 kg/cm^2 (412 psi)
Temperature	307°C (583°F)
Total designed steam capacity for 3 reactors at maximum output	360 t/h (793 000 lb/h)
CONTAINMENT AND SHIELDING	
Concentric shielding and reflector	Stainless steel and water; total thickness 225 mm
Below core	900 mm steel, 750 mm water
Above core	970 mm steel, 500 mm water, 700 mm heat-resisting graphite-based compound
Between reactor and steam generator	570 mm steel, 1·13 m water
Main containment	Steel and limonite concrete
Ventilation of reactor plant compartment (exhausting through mast)	80 000 m^3/h (2 805 000 ft^3/h)
SHIP PARTICULARS	
Displacement	16 000 tons
Length	134 m (440 ft)
Beam	27·6 m (90·5 ft)
Draught	9·2 m (28 ft)
Freeboard amidships	16·1 m (52·5 ft)
Max. speed (clear water)	18 knots
Operating speed in ice 2·4 m (7 ft 10½ in) thick	2 knots
Specific power	2·75 hp/ton

KEY

1. Reactor
2. Core
3. Control rods
4. Reactor vessel
5. Neutron shield tank
6. Primary coolant inlet
7. Primary coolant outlet
8. Gate valves
9. Heat exchanger
10. Main steam outlets
11. Main primary pumps
12. Emergency primary pumps
13. Filter and cooler
14. Volume compensators (pressurizers)
15. Biological shielding
16. Steam valves
17. Main turbines
18. Twin reduction gears
19. Propulsion generators
20. Oil cooler
21. Condensers
22. Turbine - driven circulating pumps
23. Wing propulsion motors
24. Centre propulsion motor
25. Exciter sets
26. Electrical control room
27. Auxiliary turbo-alternators
28. Ventilation filter room
29. Ventilator outlet through mast
30. Main control room

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