



Radiation-Hardened Erbium-Doped Single-Mode Fiber – Er-5/125-R for In-Core Nuclear Monitoring and Space-Based Photonics

Product Overview

Winner Er-5/125-R is a specialty single-mode fiber featuring a 5 μm erbium-doped silica core and 125 μm cladding, optimized for minimal radiation-induced attenuation (RIA) under gamma and neutron irradiation. Through proprietary glass composition hardening and hydrogen-loading techniques, the fiber maintains stable optical gain and transmission characteristics even after exposure to total ionizing doses (TID) exceeding 100 kGy—making it ideal for active sensing, dosimetry, and laser-based monitoring in extreme conditions.

The fiber combines the functionality of erbium-doped gain media with exceptional radiation tolerance, enabling distributed or point sensors that operate reliably inside nuclear containment vessels or on spacecraft exposed to cosmic rays. Its enhanced mechanical strength (≥ 100 kpsi proof test) and thermal stability (-60°C to $+150^{\circ}\text{C}$) further ensure survivability in dynamic aerospace and industrial settings.

Technical Specifications

Brand Name	Winner
Model Number	Er-5/125-R



Fiber Type	Radiation-Hardened Erbium-Doped Single-Mode Specialty Fiber
Core/Cladding Diameter	$5 \pm 0.5 \mu\text{m}$ / $125 \pm 1 \mu\text{m}$
Coating Diameter	$245 \pm 10 \mu\text{m}$ (dual acrylate)
Operating Wavelength Range	1530–1565 nm (C-band erbium emission)
Radiation Tolerance	TID ≥ 100 kGy (gamma) Neutron fluence tolerance: $>1 \times 10^{14}$ n/cm ²
Radiation-Induced Attenuation (RIA)	< 1.0 dB/km @1550 nm after 10 kGy (typical) Stabilizes rapidly post-irradiation
Numerical Aperture (NA)	0.20 ± 0.02
Tension Screening Level	≥ 100 kpsi
Operating Temperature Range	-60°C to +150°C
Key Features	Hardened silica glass matrix Low RIA with fast recovery Erbium doping for active sensing/lasing High mechanical reliability in vibration/shock



Applications

- In-core temperature and radiation flux monitoring in nuclear power plants
- Fiber Bragg grating (FBG) or distributed sensors in radioactive waste storage facilities
- Space-qualified optical links for satellite telemetry and scientific instruments
- Radiation-hardened amplifiers or lasers for particle physics experiments
- Real-time dosimetry systems using luminescence or absorption-based detection

Design Notes

This fiber is intended for specialized harsh-environment applications and is not suitable for standard telecom data transmission. Optimal performance requires proper handling to avoid microbending and compatibility with pump lasers at 980 nm or 1480 nm. Pre-annealing or in-situ bleaching may be employed to further suppress long-term RIA in ultra-high-dose scenarios.