Application Notes

Optical Fiber Proof Testing

Issued:
October 2003

Document:
AN0002

Abstract
Basic understanding of optical fiber proof-testing and comparison between various standards.

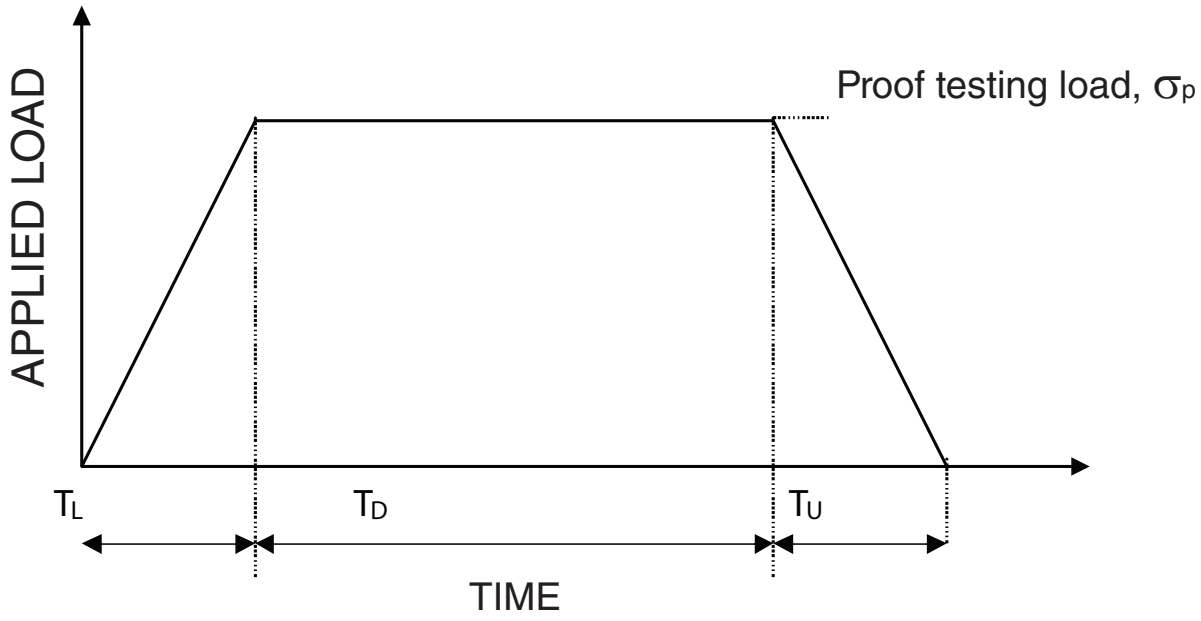
Keywords
Optical fiber, Proof-testing

1. What is proof-testing?

Proof testing is a common technique to ensure minimum strength of optical fiber and eliminate the flaws whose sizes are dependent on the stress applied during proof testing. In proof testing, predetermined load is applied on fiber by tensile loading. The fiber breaks at the weak points and the weak parts are eliminated from the fiber. The proof test will guarantee a minimum strength level (i.e. above proof testing stress) of the fiber and lifetime.

2. Proof testing cycle

Proof testing cycle i.e. variation of applied stress during proof testing with time is shown in the following figure.



where, T_L is the loading time (time to reach zero to proof testing load)
T_D is the time of applied proof testing load (also known as dwell time)
T_U is the unloaded time (time to come to zero load level)

Total Proof testing time = $T_L + T_D + T_U$

3. Strength degradation of fiber during proof testing

Strength degradation can take place due to fatigue that occurs during unloading. This is a concern because the fiber might not break regardless of the fact that its strength decreases below proof testing stress. Degradation of fiber strength during unloading is dependent on unloading time and crack growth parameters of fiber like n and B. FOTP (EIA/TIA)-455-31C describes requirement of maximum unload time to ensure specified minimum strength and corresponding minimum proof testing stress in detail.

4. Proof testing specification of Sterlite's fiber and comparison with international standards

SPECIFICATION	PROOF STRESS	PROOF TESTING TIME
ITU G652	Minimum 0.69 GPa	Not mentioned
IEC 60793	Minimum 0.69 GPa	Not mentioned
BS EN 188100:1995	Minimum 0.7%	Not mentioned
Sterlite's all optical fiber	Minimum 1% strain or 0.7 GPa or 100 kpsi	Not mentioned

To ensure minimum 0.7 GPa strength of proof tested fiber, following conditions are to be followed as per FOTP (EIA/TIA)-455-31C

	Unload time (ms)	Proof Stress (GPa)	n-value
As per FOTP (EIA/TIA)-455-31C	Maximum 75	Minimum 0.729	Minimum 15
As per Sterlite's Proof test machine's set point and hardware	Maximum 17	0.75	Minimum 20

(B value is assumed to be $6GPa^2$-ms as per FOTP (EIA/TIA)-455-31C)

Sterlite's fibers have been proof testing as per recommended standards and specification where unloading time rather than proof testing time is a requirement.

Further Reading

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3. "Measurement methods and test procedures-Fiber proof test", CEI IEC 60793-1-30
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6. Fuller.E.R. et al, "Proof testing of ceramics Part2-Theory", J. of Material Science, 15(1980), pp. 2282-2295.