

Optical Fiber Proof Testing



Document

AN0002

Abstract

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

Keywords

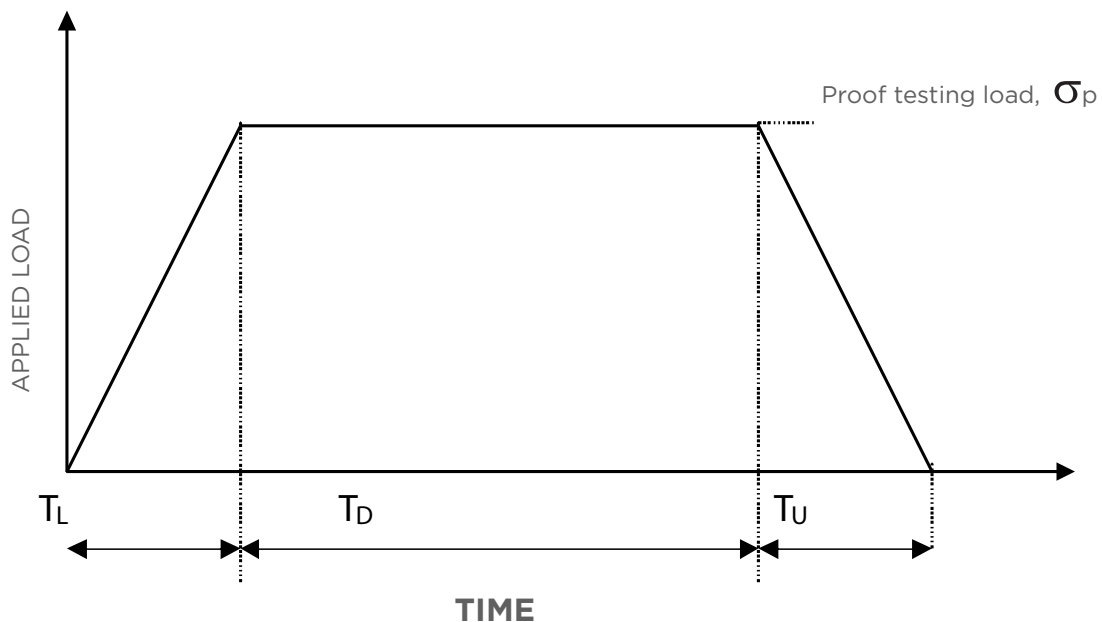
Optical fiber, Proof-testing

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 6GPa²-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

1. Glaesemann. G.S., "The effect of proof testing on the minimum strength of optical fiber", IWCS, 1991, pp.582-586.
2. "Proof testing of optical fiber by Tension", FOTP-TIA/EIA-455-31C
3. "Measurement methods and test procedures-Fiber proof test", CEI IEC 60793-1-30
4. "Power law theory of optical fiber reliability", IEC SC 86A/WG 1, September 1996.
5. Bhaumik Sudipta, "Correlation between Size and Distribution of pre- and post Proof Test level flaw of draw-abraded fiber", WCTS, Wire-Expo, 2002,Chicago,USA.
6. Fuller.E.R. et al, "Proof testing of ceramics Part2-Theory", J. of Material Science, 15(1980), pp. 2282-2295.



About STL - Sterlite Technologies Ltd

STL is an industry-leading integrator of digital networks.

We design and integrate these digital networks for our customers. With core capabilities in Optical Interconnect, Virtualized Access Solutions, Network Software and System Integration, we are the industry's leading end-to-end solutions provider for global digital networks. We partner with global telecom companies, cloud companies, citizen networks and large enterprises to deliver solutions for their fixed and wireless networks for current and future needs. We believe in harnessing technology to create a world with next generation connected experiences that transform everyday living. With intense focus on end-to-end network solutions development, we conduct fundamental research in next-generation network applications at our Centre of Excellence. STL has a strong global presence with next-gen optical preform, fibre and cable manufacturing facilities in India, Italy, China and Brazil, optical interconnect capabilities in Italy, along with two software-development centres across India and one data centre design facility in the UK