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A Comparison of Dry Versus Gel Filled Optical Cables

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Abstract
This application note explains different terminologies related to water peak at tenuation of ITU-T G652D category optical fiber.

Keywords
Optical fiber, water peak

Reduced Water Peak performance of Single Mode Optical Fiber

The fiber optic industry has defined and established standards for water-peak performance of single mode optical fiber in its latest standards, ITU-T G.652D, and IEC 60793-2-50 B1.3. These standards require that the "water peak" attenuation at 1383 nm (after hydrogen ageing) should be equal or lower than that at 1310 nm. For typical attenuation of 0.34dB/km at 1310nm, the water peak attenuation is typically found to be in the range of 0.31dB/km to 0.34dB/km.

These Reduced Water Peak (RWP) fibers are considered Full Spectrum because the reduction of loss in the water absorption spectral region (the E band) allows transmission in this previously unusable portion of the spectrum. Table 1 shows various telecom optical wavelength bands such as 0, E, 5, C, L, from 1260nm to1625 nm, wavelengths currently considered in optical telecommunication systems.

Name	O	E	S	C	L	U/XL
Wavelength range (nm)	1260-1360	1360-1460	1460-1530	1530-1565	1565-1625	1625-1675
Note	Original band	Water peak band		Bands used by the higher performance systems		Not used

Tablel : ITU-T definition of telecom optical wavelength bands. the arrow stands for the wave length increase and the general trend toward higher performance systems.

With full spectrum of 1310nm to 1625nm open for optical transmission, G652D fiber is a full spectrum single mode fiber. It combines previously untouched 1400nm region (E band) where water peak loss rendered G652B fiber useless. This opens an extra 100nm of transmission capacity, which can support at least four more CWDM channel than G652B fiber. This represents a channel gain of at least 33% for CWDM transmission.

What are Low and Zero Water Peak fibers?

While all RWP fibers have lower loss in the E band (1360 - 1460 nm), RWP fibers can be divided further in two types

1. Low Water Peak (LWP) fibers: These have lower loss in the water peak E band of the spectrum. The attenuation at 1383 nm is less than or equal to attenuation at 1310 nm. Typically attenuation at 1383 nm is <0.34 dB/km.

2. Zero Water Peak (ZWP) fibers: These eliminate loss at the water peak and further lower the loss across the entire spectrum. Not only is the attenuation at 1383 nm less than or equal to attenuation at 1310 nm, the visible water peak is eliminated. Typical attenuation at 1383 nm is <0.31 dB/km and between 0.27-0.31 dB/km

Both LWP and ZWP fibers are ITU-T G652D compliant fibers and the only difference between them lies in the attenuation at 1383 nm (water peak attenuation) as shown in Figure/. All other -specifications remain the same.

Sterlite's OH-LITE® single mode optical fiber is complaint to both ITU-T G652D recommendation and IEC 60793-2-50 B1.3 standard and meets the requirements of LWP fibers. Sterlite's OH-LITE® Enhanced single mode fiber is compliant to both ITU-T G652D recommendation and IEC 60793-2-50 B1.3 standard and meets the requirements of ZWP fibers.

What are the sources of whipping?

Whipping can occur during high-speed rotation of fiber spools during fiber drawing, fiber proof testing, coloring and buffering. It is especially important to control whipping after proof-testing (e.g. during coloring) as any such event may not immediately break the fiber: breaks may occur later during cabling or installation.

There are five major sources of whipping:

1. Fiber breaks during high-speed winding: The broken end can strike the top layer of fiber on the takeup spool.

2. Unattached inner end of fiber on rotating spool: The fiber becomes unfastened and flails. The free end can come into contact with the fiber either already wound on the spool or being wound onto the spool. (Figure 5).

3. Inner end stuck to spool barrel during coloring: Inappropriate working practice during coloring. Sometimes during the coloring process the fiber inner end is stuck to the barrel of the take-up spool rather than being fed through the spool inner end window and stuck to the outside flange of the spool. This practice can cause whipping as the fiber end may become loose during high-speed rotation (Figure 6).

4. Whipping of stored spools: Spools kept close to the processing line (coloring, buffering line) can be struck by the flailing end of a fiber being processed.

5. Fiber break debris can fall and lodge in the fiber path and cause point damage.

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