Date: May 20, 2008

Non-Kink STFOC
Fish Bite – Sharp Bend Test

Objective: Subject Non-Kink STFOC (Strong Tether Fiber Optic Cable) to simulated fish bites by using standard scissors and test bend loss during and after maximum bend. Check cable integrity and fiber breakage. This cable is designed to enhance the strength and barrier properties of STFOC with increased flexibility and bend resistance.

Scissor Test

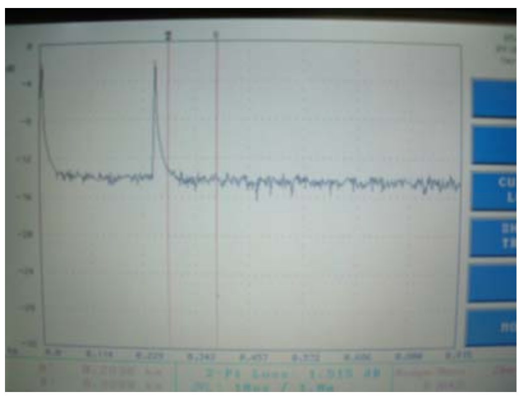

Figure 1. Loss Measurement Before

Loss was measured before testing began and proved to be normal at approximately 0.42dB/km @ 1550nm. See Figure 1.

The cable is then placed in a standard pair of scissors as shown in Figure 2. The longitudinal axis of the cable is perpendicular to the scissor blades' plane of motion. As the blades are closed the fiber begins to pry apart the blades and force them to shift out of plane. See Figure 3. When the scissors are fully closed, the cable has further forced the blades apart and the cable's longitudinal axis is now parallel with the blade's plane of motion. See Figure 4.

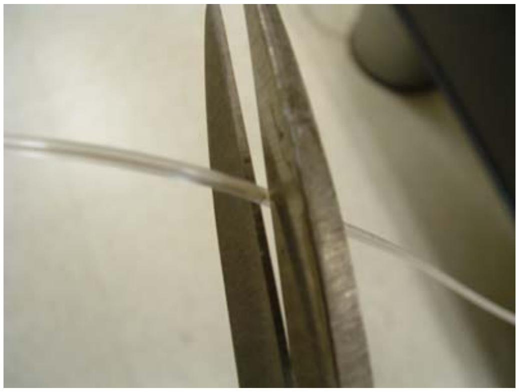

Figure 2. Scissor Test – 1

Figure 3. Scissor Test - 2

Figure 4. Scissor Test - 3

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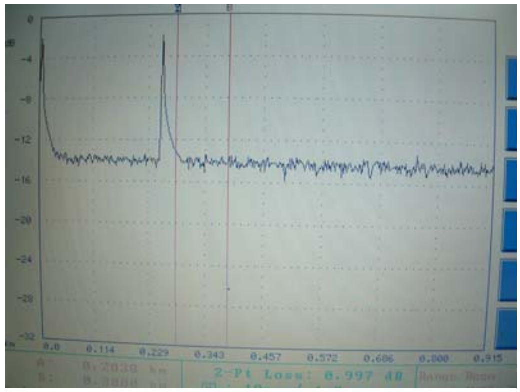

Figure 5. Loss While Under Load.

As shown in Figure 5, the loss is measured while the cable is in the final position and under stress. No appreciable loss is measured. The dB/km loss is still 0.42.

Sharp Bend

Again, loss was measured before the test began and was shown to be normal; Approximately 0.4dB/km as with the scissor test above. The before results are shown in Figure 6.

Once this measurement had been taken, a sharp bend was introduced as shown in Figure 7. While the cable is under this sort of micro bend, the loss at that point is nearly 100% and light is no longer propagated along the remainder of the cable as shown in Figure 8.

Figure 6. Loss Before Sharp Bend Test


Figure 7. Sharp Bend

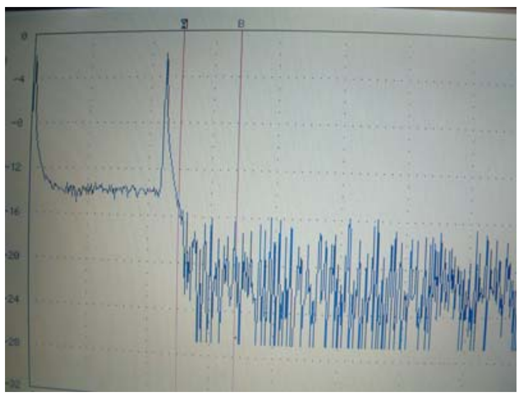
Figure 8. Loss During Load

This bend was measured (Figure 9) and as the figure shows, the bend radius of the cable is approximately 2mm. After this measurement is made, the sharp bend is released and the cable is allowed to return to a straight position (Figure 10). The fiber is unharmed and the loss returns to normal as shown in Figure 11 below.

Figure 9. Sharp Bend Scale

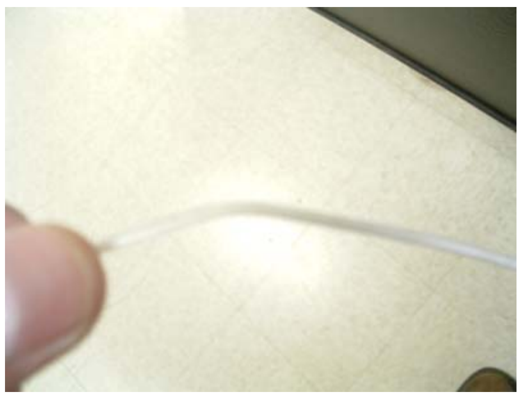
Figure 10. Post Bend Position

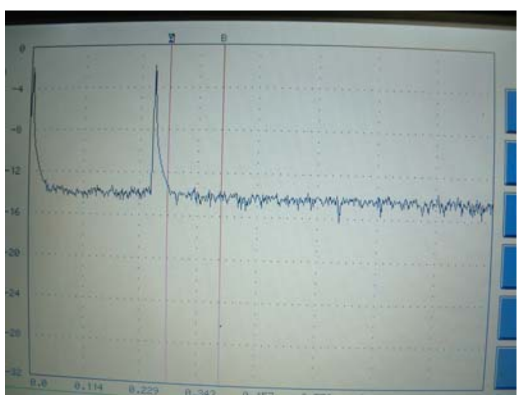
Figure 11. Loss After Sharp Bend Test

Minimum Bend

Once again, loss was measured before the test began and was shown to be normal; Approximately 0.4dB/km as with both tests above. The before results are shown in Figure 12.

Once this measurement had been taken, a bend was introduced that would be limited only by the material (i.e. the sharpest possible bend was introduced to the cable) as shown in Figure 13. Figure 14 shows the sharp bend along side a ruler. As with the sharp bend test, the loss at that point is nearly 100% and light is no longer propagated along the remainder of the cable as shown in Figure 15.

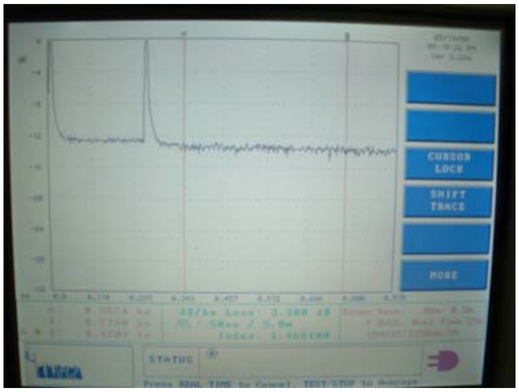

Figure 12. Loss Before Minimum Bend Test


Figure 13. Cable Bent to the Material Limit

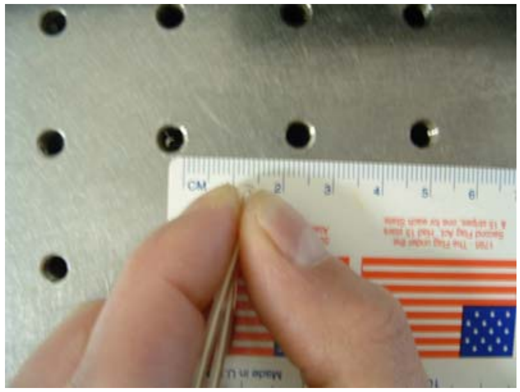

Figure 14. Minimum Bend Scale

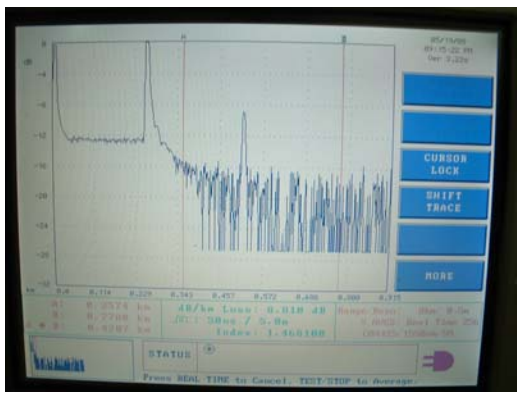

Figure 15. Loss While Under Load

The fiber was released from the minimum bend and allowed to return to a straight position as shown in Figure 16. Some memory of the bend can be seen right at the index finger. Once again, no damage was done to the fiber and loss appeared normal as shown in Figure 16.

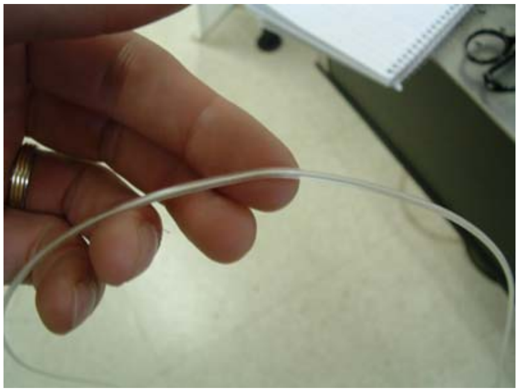

Figure 16. Post Bend Position

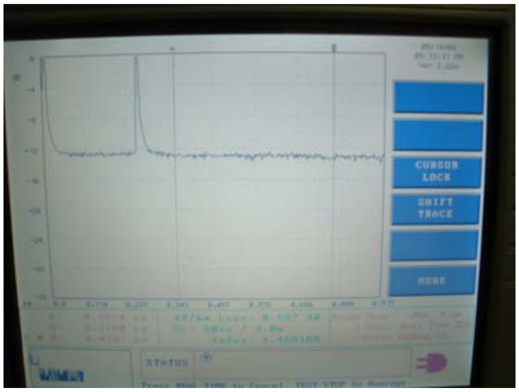

Figure 17. Loss After Minimum Bend Test

Conclusion

Linden's proprietary design of Non-Kink STFOC can provide not only the ultimate in tensile strength, but resilient properties that allow for extreme flexibility and protection from pinching and sharp bends that replicate those induced by marine life. When cable is laid on the ocean floor, different depths provide for different stresses that may be introduced by the marine life in that ecosystem.

Designed to prevent kinking from slack during robotic installations in subsea environments, Non-Kink STFOC also provides a jacket resistant to bend or pinch induced breakage. By preventing breakage, Non-Kink STFOC will help prevent costly repairs or the need to lay new cable links.

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