FUSION SPLICING FIBER OPTICS

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Abstract: Fiber optic "cable" refers to the complete assembly of fibers, strength members and jacket. Fusion Splicing-The controlled aligning, melting and pushing together of hair-thin strands of glass resulting in a transparent, non-reflective joint.

Fiber optics; fusions splicing; ribbon fiber

1. Problems generals

Fiber optic "cable" refers to the complete assembly of fibers, strength members and jacket. Fiber optic cables come in lots of different types, depending on the number of fibers and how and where it will be installed.

Picture sending signals zipping along from one location to another in the form of light guided through thin fibers of glass or plastic. These signals can be analog or digital - voice, data or video information and fiber can transport more information longer distances in less time than any copper wire.

Fusion Splicing-The controlled aligning, melting and pushing together of hair-thin strands of glass resulting in a transparent, non-reflective joint (Figure1).

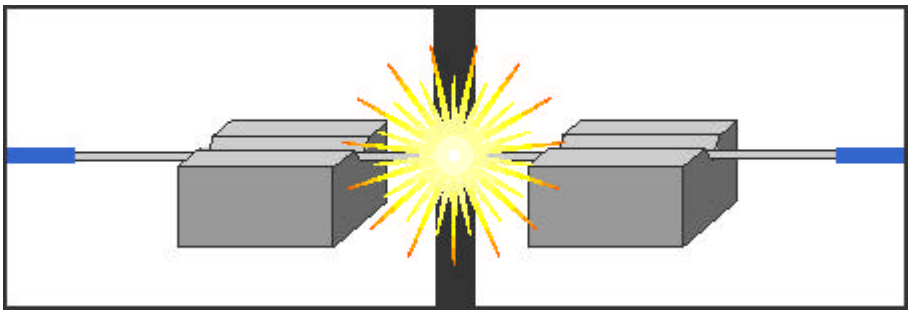


Figure 1 - Fusion Splicing

2. Types Of Fusion Splicers

Full-Featured - Includes machines that are fully automatic, provide extremely low splice losses, and have plenty of special features to make splicing as easy as possible.,br;

- Mass - Includes machines that can splice ribbon fibers from 2-12 fibers. Also splice single fiber.
- Micro - Includes machines that are very portable, yet still maintain many of the features of the full-featured machines. Still fully automatic.
- Manual - Includes machines that are not automatic. Require more user skill, but are the least expensive available.

Fusion splicer actually

- Aligns the Fiber
- Checks for Problems
- Fuses the Fibers
- Estimates the Loss of the Splice

Fusion Splicers do each of these steps with varying degrees of accuracy. Overall, the more accurately the machine does these steps, the lower your actual splice loss will be.
Active Alignment: The splicer uses various methods to see the fibers. It uses that input to have precisely controlled motors move the fibers along their X (horizontal), Y (vertical) and Z (in and out) axes until they are aligned. Active alignment is the most precise alignment available.
Passive Alignment: Follows the fibers rest in a fixed V-groove that relies on the concentricity of the outside of the glass to align them in along the X and Y axes. Z alignment is done by the splicer or the user (in manual machines). Typically, this is referred to as a fixed V-groove.
Fixed V-Groove (passive)

- Precise groove in materials used to align fibers
- Alignment of fiber based on shape of outside bare glass

- PAS - Profile Alignment System (Core Detect): Cameras Analyze Image of Fiber to Determine Location of Core.
- L-PAS (Video) - Lens Profile Alignment System: Cameras Analyze Image of Fiber and Align Profile (Cladding) of Fiber As Well As Bright Center Line (Lens Effect).
- Warm Image Processing: Cameras see the glow of the core when it is heated.
- LID-System® - Local Injection and Detection: Local Transmitter Injects Light Into Core And Splicer Positions Cores To Maximize Light Received During Alignment (Figure 2).

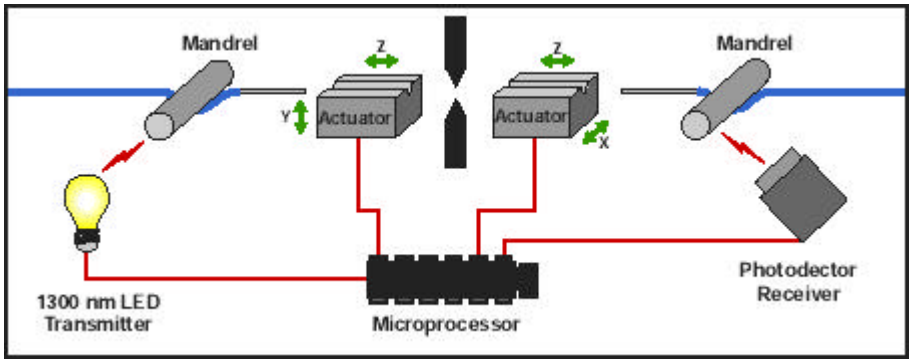


Figure 2-Example of LID-System

Auto Fusion Time
The LID-System unit allows Corning Cable Systems' M90 and X77 to splice using a feature called Auto Fusion Time.

- Splices fiber for optimal time by monitoring LID level while fusing until maximum level detected.
- Like baking cookies till edges are golden brown, not burnt, not doughy.
- M90 and X77 only.

Here's

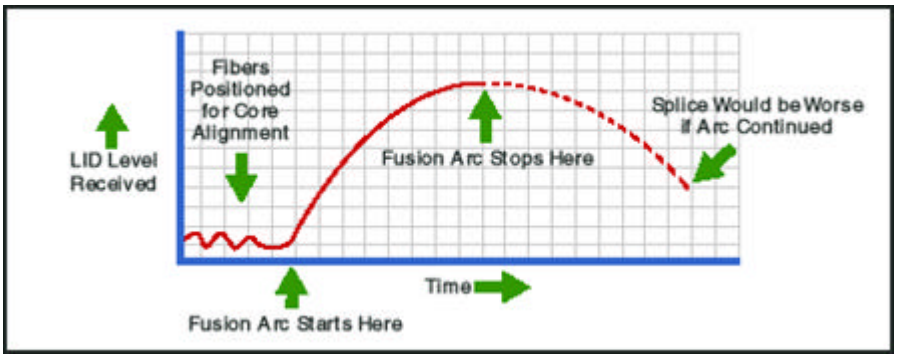


Figure 3-A graph showing how the LID-System unit is used for Auto Fusion Time.

Profile Alignment System - Core Detect (PAS)

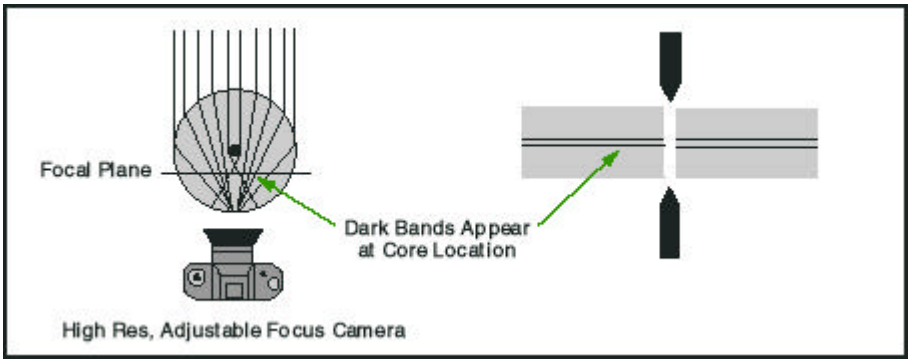


Figure 4 The PAS System "sees" the core by detecting the refraction of light caused at the core-cladding.

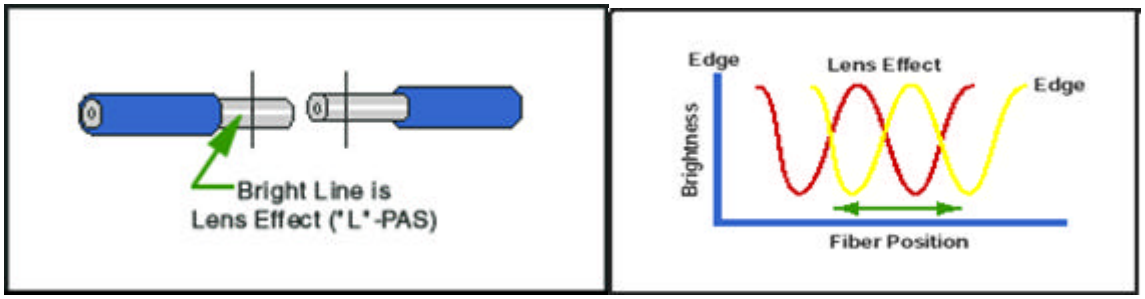
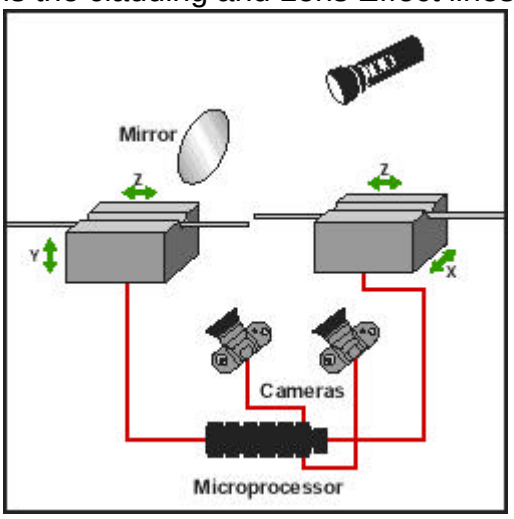


Figure 5 -Lens - Profile Alignment System (L-PAS) Video Program

The L-PAS System aligns the cladding and Lens Effect lines of the fibers (Figure 6).



Figur 6-The L-PAS System

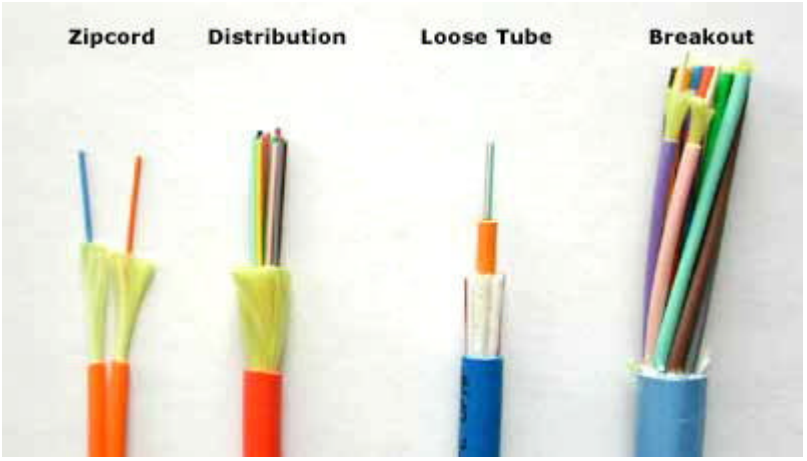


Figure 7-Cable types

Fiber Optics is sending signals down hair-thin strands of glass or plastic fiber. The light is "guided" down the center of the fiber called the "core" (Figure 8). The core is surrounded by a optical material called the "cladding" that traps the light in the core using an optical technique called "total internal reflection." The core and cladding are usually made of ultra-pure glass, although some fibers are all plastic or a glass core and plastic cladding. The fiber is coated with a protective plastic covering called the "primary buffer coating" that protects it from moisture and other damage. More protection is provided by the "cable" which has the fibers and strength members inside an outer covering called a "jacket" [1÷7].

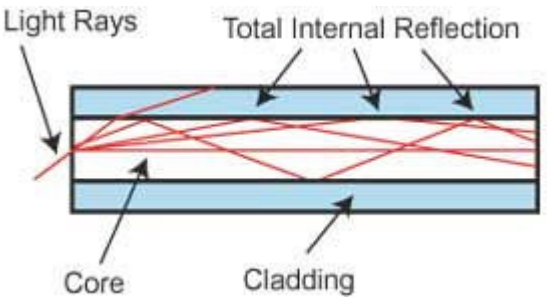


Figure 8-Fiber optic – details

Multimode & Singlemode fiber are the two types of fiber in common use. Both fibers are 125 microns in outside diameter - a micron is one one-millionth of a meter and 125 microns is 0.005 inches- a bit larger than the typical human hair (Figure 9).
Multimode fiber has light traveling in the core in many rays, called modes. It has a bigger core (almost always 62.5 microns, but sometimes 50 microns) and is used with LED sources at wavelengths of 850 and 1300 nm for slower local area networks (LANs) and lasers at 850 and 1310 nm for networks running at gigabits per second or more.
Singlemode fiber has a much smaller core, only about 9 microns, so that the light travels in only one ray. It is used for telephony and CATV with laser sources at 1300 and 1550 nm.
Plastic Optical Fiber (POF) is large core (about 1mm) fiber that can only be used for short, low speed networks.

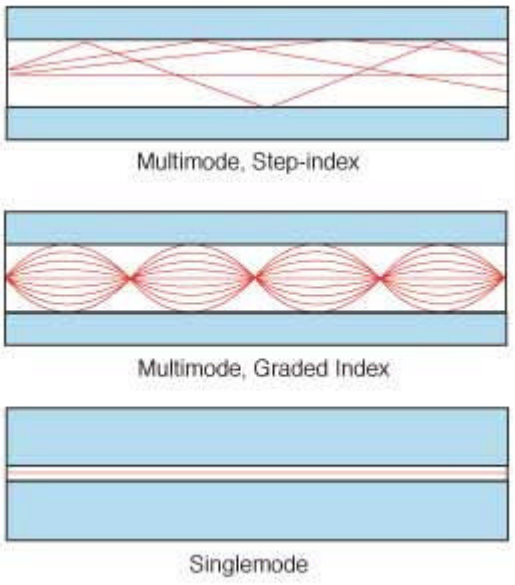


Figure 9-Multimode & Singlemode Fibers

Figure 10 presents a Fusion Splicer-Detail

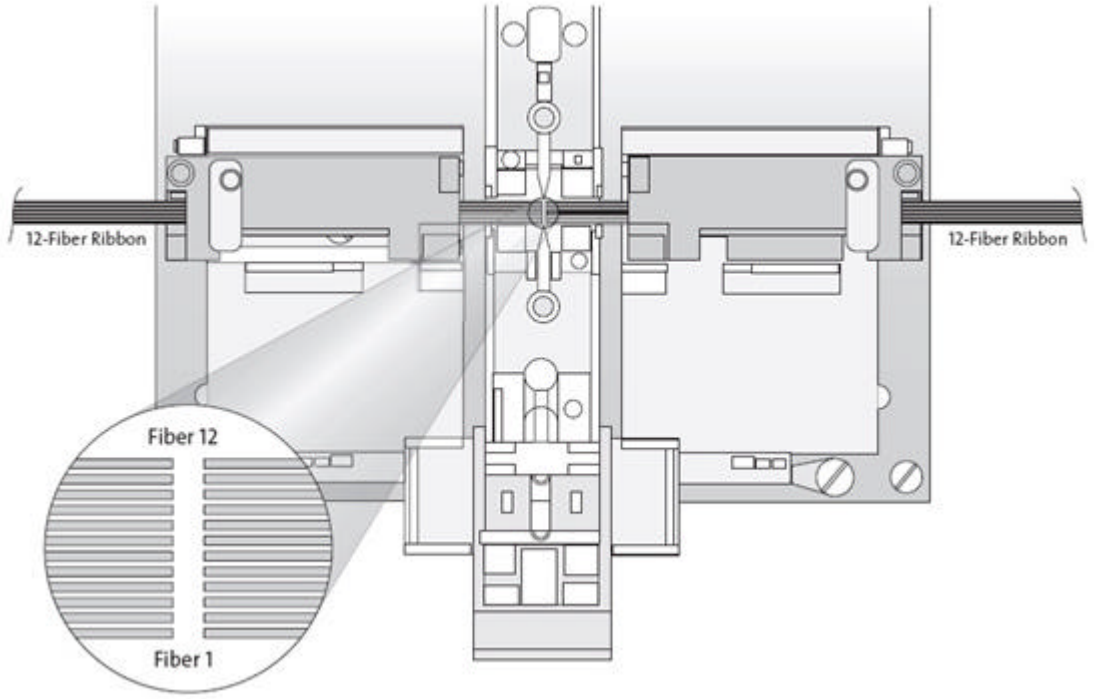


Figure 10- Fusion Splicer-Detail

3.Terminology

Connector: A non-permanent device for connecting two fibers or fibers to equipment where they are expected to be disconnected occasionally for testing or rerouting. It also provides protection to both fibers.
Ferrule: A tube which holds a fiber for alignment, usually part of a connector
Splice: a permanent joint between two fibers
Mechanical Splice: A splice where the fibers are aligned created by mechanical means
Fusion Splice: A splice created by welding or fusing two fibers together
Fusion Splicer: An instrument that splices fibers by fusing or welding them, typically by electrical arc.
Hardware: Terminations and Splices require hardware for protection and management: patch panels, splice closures etc.

4. Conclusions

4.1 Fiber optic ”cable” refers to the complete assembly of fibers.
4.2 Fusion Splicing the controlled aligning, melting and pushing together of hair thin strands of glass resulting in a transparent, more reflective joint.
4.3 The terminology is very important and it is also approached.

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