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HSB

Optical Communication ONT

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Report
On
Fiber Optic Cables

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Fiber Optic Cables

1. Introduction

What is Fiber Optic Cable?

Cabling is the process of packaging optical fibers in a cable structure for handling and protection. In some applications bare fibers work just fine, such as fiber optic sensors and laboratory use. However for most communication applications fibers must be packaged in a cable for practical use. The major benefits of fiber optic cabling are:

- **Easy Handling**
  Some communication systems require tens or even hundreds of fibers (such as a metro backbone system). Put fibers in a cable make it very easy to install and maintain.
- **Protection from damaging forces**
  Fiber optic cables have to be pulled into place through ducts (outdoor) or conduits (indoor). Pulling eyes are attached to the strength members or cable outer jackets. This is critical for isolating the fibers from the applied pulling forces. Glass fibers cannot endure more than 0.1% to 0.2% elongation during installation.
- **Protection from harsh environment factors**
  Cable structures protect fibers from moisture (outdoor cables), extreme temperature (aerial cables) and influx of hydrogen into the fiber (which causes light absorption peak at 1380nm which in turn impair fibers' transmission properties).

Fiber Optic Cable Based on Fiber Types

Based upon fiber types in a cable, fiber optic cables can be categorized as three types.

Single Mode Fiber Optic Cable
All fibers in the cable are single mode fibers.

Multimode Fiber Optic Cable - Multi Mode Fiber Optic Cable
All fibers in the cable are multimode cables.

Hybrid/Composite Cable
Both single mode and multimode fibers are packaged in one cable, such as 4 multimode fibers and 4 single mode fibers in a single cable.

Elements in a Fiber Optic Cables

The construction design and choices of materials are vital in determining characteristics of a cable. The design factors for some types of fiber optic cables are listed below.

Indoor cables

Fire safety is the number one factor in selecting indoor cables, particularly those that run through plenum spaces. Indoor cables must pass the flame-retardant and smoke-inhibitor ratings specified by NEC.

Outdoor cables

Moisture resistance and temperature tolerance are the major factors when choosing materials for outdoor environment cables. They also need to be ultraviolet (UV) resistant.

Cable Jacket Materials

Polyethylene (PE)

PE (black color) is the standard jacket material for outdoor fiber optic cables. PE has excellent moisture – and weather-resistance properties. It has very stable dielectric properties over a wide temperature range. It is also abrasion-resistant.

Polyvinyl Chloride (PVC)

PVC is the most common material for indoor cables; however it can also be used for outdoor cables. It is flexible and fire-retardant. PVC is more expensive than PE.

Polyvinyl difluoride (PVDF)

PVDF is used for plenum cables because it has better fire-retardant properties than PE and produces little smoke.

Low Smoke Zero Halogen (LSZH) plastics

LSZH plastics are used for a special kind of cable called LSZH cables. They produce little smoke and no toxic halogen compounds. But they are the most expensive jacket material.

Aramid Yarn

Aramid yarn is a yellow color, fiber looking material. It is strong and is used to bundle and protect the loose tubes or fibers in the cable. It is the strength member to provide tensile strength along the length of the cable during and after installation. When a cable is pulled into a duct, the tension is applied to the aramid yarn instead of the fibers.

Central Strength Member
Many fiber optic cables has a central strength member, made of steel, fiberglass or aramid yarn. Central strength members are needed to provide the rigidity to keep the cable from buckling. Central strength members are common in outdoor cables and some high fiber counts indoor cables.

Gel Compound
Gel compound fills buffer tubes and cable interiors, making the cable impervious to water. It needs to be completely cleaned off when the cable end is stripped for termination.

Ripcord
Ripcord is a thin but very strong thread embedded just below the cable jacket. Its role is to split the cable easily without harming cable interiors.

Two Basic Fiber Structures

Fiber optic cable are available in a wide variety of physical constructions. Fiber cables can be anything from simple simplex or duplex (zipcord) cables used for jumpers to 144-fiber cable for intercity transmission.

However most of the fibers used in these cables come down to two basic configurations – 900µm tight buffered fibers or 250 µm coated fibers (also called bare fibers). Actually tight buffered fibers cover a coated fiber(the coating is soft plastic) with a thick layer of harder plastic, making it easier to handle and providing physical protection.

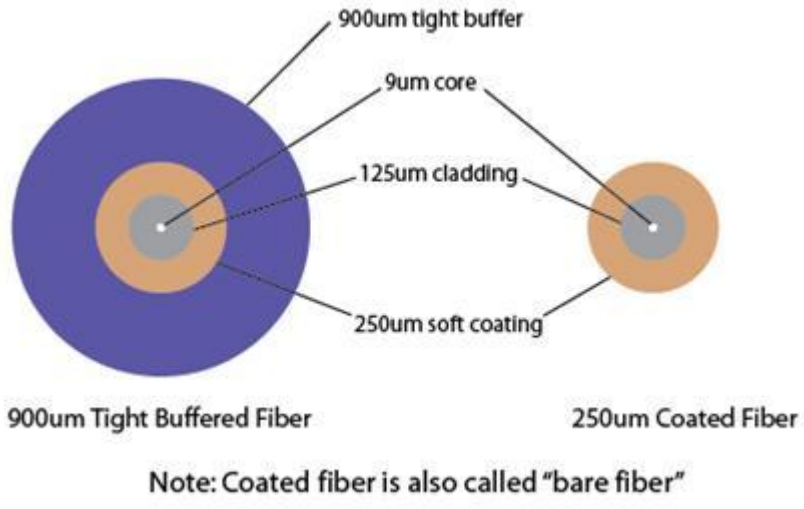

Figure1.1: Difference between Tight Buffered Fiber and Coated Fiber

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