Application Notes

Sterlite Tech

Selection of the Correct Optical Cable Outer Jacket for the Application

Issued

December 2012

Abstract

The cable jacket provides the first line of defense against the surrounding environment. It resists water entry while remaining inert to gases and liquids that the cable may be exposed to during its service life. It provides a smooth, low friction surface for cable placement. The jacket must be made of a material that will allow the cable to remain flexible and serviceable at all of the temperatures it will experience during its lifetime.

Keywords

Jacket materials, single jacket versus dual jacket, armored versus unarmored, and metallic versus dielectric armoring.

Introduction

This Cable Jacket Selection Note is intended to provide the reader with an organized selection methodology when selecting the optimum optical cable for a specific application. Sheath issues discussed: single jacket versus dual jacket, armored versus unarmored, and metallic versus dielectric armoring.

The following issues will play a role in the cable selection process:

1. Surface loading and depth of cover.
2. Area being served: urban, suburban, rural.
3. Existing plant infrastructure presently serving intended area.
4. Climate (wind and ice loading).
5. Access to right-of way.
6. Access to roads, traffic, and public.
7. Rodent damage potential.
8. Lightening issues.

This note will address those issues that directly influence the jacket or sheath selection process.

Jacket materials

The cable jacket provides the first line of defense against the surrounding environment. It resists water entry while remaining inert to gases and liquids that the cable may be exposed to during its service life. It provides a smooth, low friction surface for cable placement. The jacket must be made of a material that will allow the cable to remain flexible and serviceable at all of the temperatures it will experience during its lifetime.

It must resist abrasion during installation. It must provide, along with the cable's strength members, the mechanical strength required to survive its environment and installation forces. For indoor cables, the jacket also provides the fire retardance required by building codes.

Many different materials are available for cable jacketing making it possible to match the jacket material to the end user application requirements. The table below provides a listing of some of the more popular jacketing materials used for optical cables.

Table 1- Summary of Popular Cable Jacketing Materials

Sheath Material	Features
PE - Polyethylene[1] MDPE – medium density PE HDPE – high density PE	• Primary outside jacket material. • Good resistance to UV (sun light) due to carbon black. • Good flexibility over wide range of temperatures. • Good abrasion and crack resistance.
Anti-tracking PE	• Use in all dielectric self-supporting cable in high voltage aerial fields exceeding 12 kV, but not exceeding 50 kV applications. The anti-tracking jacket withstands a condition known as dry arcing.
PVC - Polyvinyl chloride	• Provides good mechanical protection. • Flexible at normal installation temperatures. • Flame retardant. (typical riser material) • Used for many indoor applications. • Can be protected against sunlight with various UV inhibitors.
LSZH - Low smoke, zero halogen	• Flame Retardant with low smoke and no halogenated materials • For use in unventilated areas exposed to public, e.g., subways and tunnels. • Good mechanical performance.
PVDF - Polyvinyl difluoride	• Flame retardant. (typical plenum material) • It produces low smoke and low flame propogation.

Most Outside Plant optical cables are made from medium density or high density polyethylene with carbon black for UV stabilization. In North America the National Electric Code dictates that this type of a cable jacket cannot penetrate any building by more than 50 feet. A fire retardant, listed cable must be used for indoor applications. Often a riser rated PVC jacket is used for indoor/outdoor cables that must penetrate the building more than 50 feet.

Armored Versus Non-armored Cable

Armoring increases the strength and robustness of a cable relative to its surroundings. The armoring is placed either just under the outside plastic jacket for single jacket cables or between two layers of jacket material for dual jacket cables. The armoring layer is typically corrugated metallic tape, but tightly wound steel wires, or dielectric fiber layer are options for specialty applications. Double jacket, double steel tape armor is occasionally used for increased protection in direct buried, high rodent infested areas. Rip cords are placed under the armor layer(s) to enable jacket removal during cable preparation for termination.

Non-armored cables are also available that provide suitable service in underground conduit systems or aerial pole lines. Their light weight causes placing tensions to be somewhat reduced. Non-armored cables provide an easier cable to prepare for splicing. Non-armored cable will not have the extra crush resistance, impact strength, or rodent resistance of armored cable.

[1] Various polyethylene plastics should meet Table 5.4.2 of ANSI/ICEA S-87-640.

Table 2- Comparison of Outside Plant Applications Provided by Armored/Non-armored

Armor	Aerial Plant	Buried Plant	Underground Plant	Micro-Cables
Steel Tape Armor	Double Jacket & Single Jacket	Double Jacket & Single Jacket	Single Jacket	No
Non- Armor	Fig 8, Single jacket, Double jacket, ADSS	No	In duct	In microduct

DJ – Dual Jacket, SJ – Single Jacket, Fig 8 – Figure 8, self-supporting

Single Jacket Versus Dual Jacket Armor Cable

A dual jacket is characterized by two extruded plastic jackets separated by a layer of armoring. If a second layer of armoring is used, it will be below the inner plastic jacket, just above the cable core.

A dual jacket with dual armoring will amplify the positive effects of increased robustness, i.e., provide best crush and impact resistance as compared to a single jacketed cable. A dual jacket with dual armoring sheath will also amplify the negative issues, i.e., it is heavier, stiffer, and more labor intensive to prepare for splicing than a single jacket cable.

The table that follows summarizes most of the key considerations in deciding between single and dual jacketed cables.

Table 4- Comparison between Single and Dual Jacketed Cable armor cable

Single Jacket	Dual Jacket
• Suitable for direct burial and underground applications. • Cable is lighter and easier to install. • Cable is more flexible, easier to prepare. • Metallic armoring requires the cable to be properly bonded and grounded.	• ·Suitable for direct burial and underground applications. • Extra protection for direct buried applications. • Cable is somewhat heavier than single jacket cable. • Most robust design, good crush and impact resistance. • Metallic armoring requires the cable to be properly bonded and grounded. • Extra weight makes cable more difficult to place. • Requires more time and is more difficult to prepare for splicing.

Single jacket single armor cable is used for most applications because the dual layer version does not provide sufficient benefits to support the additional cost and time associated with dual layer designs.

Steel Tape Armor Requires Bonding And Grounding

Bonding and grounding of all metallic elements is required for all outside plant equipment including optical cables. If lightening occurs or an accident takes down a power line, it is possible for unwanted current to be coupled into the metallic components of the outside plant cable. Dangerous current can potentially be coupled into any metallic cable components or into the messenger supporting strand in the case of aerial cables. If any conductor at the ground potential comes in contact with the metallic member carrying the coupled current, any unbalanced current will flow through the conductor to ground.

Improperly grounded metallic armoring in fiber cables can cause voltage potential levels to be different from the ground potential for long stretches of cable, through intermediate manholes or hand holes and even into buildings, hence the requirement for metallic element bonding and grounding at regular intervals along the cable length.

Bonding is the connection of all metallic components in the cable sheath together (metallic armor and metallic central strength members) to keep them at the same potential and ensure electrical continuity with sufficient capacity to safely conduct any imposed current to ground. Grounding is defined in the National Electric Code (NEC) as, "A conducting connection, whether intentional or unintentional, between electrical circuits or equipment and the earth, or some conducting body that serves in place of the earth."

Normally, metallic members in armored fiber optic cables are bonded at splice closures through bonding clamps at the cable entrance to the closure and a conductive strap or wire within the closure to connect the mating cables to a common bond for all cables entering the closure. The grounding within the closure also connects all metallic components entering the closure to a low-resistance ground to earth at each splice manhole, hand hole, pedestal, or at building entrance; where ever splices are located. As a result, all metallic items at the grounding manholes, hand holes, pedestals, or building entrances are bonded together and connected to a common ground.

The messenger strand in aerial plant is grounded at each support structure. Aerial splices of metallic armored fiber cables are bonded at their splice closures to their adjacent cable mate and to the messenger strand.

If all-dielectric fiber optic cables are used, they are made without any conductive paths, and as a result, do not need to be bonded or connected to existing grounds at intermediate ground locations. It is imperative that all national, local, and industry codes covering bonding and grounding be followed.

Summary

Except for the most severe Outside Plant conditions, a single jacket, either metallic or dielectric armored cable will likely provide sufficient protection to the cable required for it to provide satisfactory performance under nearly all conditions.

The cable sheath which provides the optimal balance between robustness and economics for the OSP service to be provided and environment to be encountered is the sheath design that will ultimately determine the optimal cable design.

If there are questions concerning any of this information please contact Sterlite at:

Additional Information

If there are additional questions on this topic or other fiber optic issues, please contact:

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