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Mechanical Sleeves in Substations

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ABSTRACT

Mechanical sealant for cable sleeves is a type of material or device that prevents the ingress of water, gas, or other contaminants into cable joints, terminations, or conduits. Mechanical sealant can also provide mechanical protection, fire resistance, and electrical insulation for cables and pipes. There are various types of mechanical sealant for cable sleeves, such as rubber gaskets, metal clamps, plastic plugs, or epoxy resin. Some of the factors that affect the performance and selection of mechanical sealant for cable sleeves are the type and size of the cable or pipe, the environmental conditions, the installation method, and the cost. This paper reviews the current state of the art of mechanical sealant for cable sleeves and compares the advantages and disadvantages of different sealing solutions. The paper also discusses some of the challenges and future directions for the development of mechanical sealant for cable sleeves.

Keywords: Mechanical Sleeves, Cable Management, Water Ingress in to Building.

I. INTRODUCTION

Cable sleeves are tubular structures that are used to cover, protect, and organize cables and wires in various applications, such as electrical, telecommunication, industrial, or marine. Cable sleeves can be made of different materials, such as metal, plastic, rubber, or fabric, depending on the required properties and functions. However, cable sleeves alone may not be sufficient to prevent the ingress of water, gas, or other contaminants into cable joints, terminations, or conduits, which can cause corrosion, short circuit, fire, or explosion. Therefore, mechanical sealant for cable sleeves is a type of material or device that is applied or installed at the ends or openings of cable sleeves to create a tight and secure seal. Mechanical sealant can also provide mechanical protection, fire resistance, and electrical insulation for cables and pipes.

The aim of this paper is to review the current state of the art of mechanical sealant for cable sleeves and compare the advantages and disadvantages of different sealing solutions. The paper will also discuss some of the challenges and future directions for the development of mechanical sealant for cable sleeves.

Major hurdle in electrical oriented construction industries is facing water ingress into the substation

through the electrical cable sleeves which post a great danger to the structure as well electrical short circuits. Construction industries tried conventional waterproofing system which is not much capable of handling water pressure and leakages into buildings. Following are the major issues due to water ingress into substations and manholes which incur high cost of ownership.

- Water Stagnation ➔ constant dewatering
- High Humidity ➔ short life
- Corrosion ➔ High maintenance
- Partial Discharge ➔ System failures
- Short Circuit ➔ Supply disruptions

To eliminate these issues, mechanical sleeves are used which protect the water ingress into substation building in high water tide areas (Figure 1 shows the mechanical sleeve).

II. MECHANICAL SLEEVE

Mechanical seals are devices that prevent fluid leakage in a system along gas tight, humidity tight and rodent safe (Figure 1 shows the mechanical sleeve). There are several types of mechanical sleeves available like Knockout sleeves, Core seal, Frame seal, Module with multidiameter UG and Trefoil.

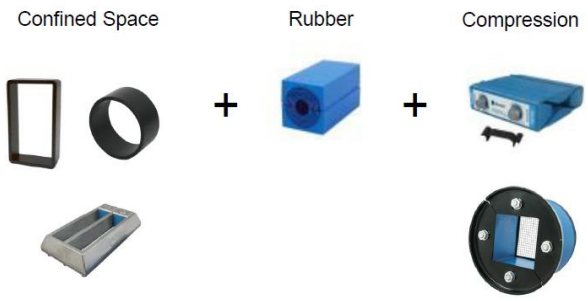

FIGURE 1. MECHANICAL SLEEVE

III. PROS AND CONS

Pros and cons associated with mechanical sleeves are below.

A. Pros

1) Secure Connection: Mechanical sleeves provide a tight, secure physical connection between cables, preventing cables from pulling apart. The metal teeth or ridges in the sleeve grip the cable jackets.
2) Quick Installation: Sliding a mechanical sleeve over the stripped cable ends and crimping it using a crimping tool is relatively fast and easy compared to other connection methods.
3) Versatile: Mechanical sleeves can be used to join cables of different gauges and materials. They come in a wide variety of sizes.
4) Reusable: Unlike tape or twist on wire connectors, mechanical sleeves can be removed and reused if needed. The connection can be re-crimped.
5) Vibration resistant: The tight physical grip of a mechanical sleeve makes it more resistant to vibration compared to some other connectors. This is useful in applications like automotive or machinery.

B. Cons

1) Rigid Connection: The sleeved connection is rigid and inflexible compared to handwriting or using tape. This limit bending and flexing of the cables.
2) Specialized Crimping Tools: A ratcheting crimp tool is required to properly install mechanical sleeves. Improper crimps can cause connection failures.
3) Less Impact: Mechanical splices take up more space compared to Twiston wire nuts or inline splices. Not ideal when space is very limited.
4) Higher Initial Cost: Mechanical splicing supplies cost more than basic tape or Twiston connectors, though they can save time and effort overall.
5) Permanent: The connection cannot be easily undone like with twiston connectors or tape. The sleeve must be cut off to separate cables.

IV. CONCLUSION

Mechanical sleeves offer a fast, secure, and durable splicing solution for electrical cables in industrial settings. However, proper installation tools and technique are mandatory for safe and lasting crimp connections. Careful selection of connector type and size matching to cables is critical. While requiring some initial investment, mechanical sleeves can save time and effort for large electrical projects.

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