Cable Selection Challenges

Sami **BALLOUR**, Khadija **ALHAMMADI**, Dubai Cable Company (Pvt.) Limited, DUCAB, Dubai, UAE,
sami.ballour@ducab.com, khadija.alhammadi@ducab.com,

ABSTRACT

Cables are often the last component considered during system design. In many situations, cables are really the system lifeline. Selecting the wrong type of cable can lead to a cable system that costs more than it needs or as a worst scenario it can result a failure in the system. Each element in the cable construction plays a unique role. In addition, the environments in which cable systems are being used today are becoming more challenging.

This paper illustrates some examples of "Cable Constructions - to be avoided", and focuses in selecting the correct cable with respect to the application requirement.

KEYWORDS

Material selection, Flexible cable, Fire resistant cable, semiconducting layer, Graphite, Reliability.

INTRODUCTION

Cable selection can cover a wide variety of topics ranging from the composition of the wire, type of conductor, type of insulation and jacketing, flexibility, temperature, flame retardancy, environmental impacts, and the intended use of the product.

Choosing the correct construction for cable is a crucial decision. Client, contractor, consultant and cable manufacturer are the main partners who select the cable based on their different experience and knowledge may lead to conflict in selecting the cable construction and materials.

As an example, indoor cable, or cable intended for dry environment, should never be used in an outdoor setting because the exterior jacket might not be resistant to moisture, heat or radiation from sun. Therefore, over time it might deteriorate, essentially destroying any intended fire-protective qualities originally engineered into the product by the manufacturer. In comparison, it would not be necessary to use a cable designed for exterior use in an indoor setting; although it is true that it would be safe and effective, the installation costs would be highly prohibitive and unnecessary [1].

CONTRADICTION ON SELECTION

Many of today's applications have environmental influences that require unique materials and mechanical properties to ensure reliable cable performance.

The first point of selecting the cables is to define the application and the environment where the cable will installed. Some selection may affect the application by choosing materials with conflict in properties which may lead to:

- Unreliable system
- Limitation of operation and installation
- Costly mistakes

For instance, some customers are requesting cables for required application but with non-preferred combination of materials, such as:

1. Copper Class 5 with XLPE Insulation

Flexible cables are used where cable needs to make sharp bends or where cable needs to flex, move, or rotate [2].

Class 5 copper conductors has great flexibility and it's used in the places where minimum bending radius is required. However, XLPE is hard (rigid) material; hence it will not be compatible with flexible conductors to meet required application. As an alternative, EPR, Flex-PVC or XL-LSZH can be used as flexible insulation material which it will enhance the flexibility to the required application. Table 1 shows the hardness value of insulation material. The more hardness values, the better flexibility.

Table 1: Insulation Material Hardness

Material	Hardness (Shore A – Typical value)	Type
EPR	98	Thermoset
Flex-PVC	95	Thermoset
XL-LSZH	80	Thermoplastic
XLPE	70	Thermoset

2. Fire Resistance Cables with Aluminium

Fire Resistance cables are used where critical circuits need to function to keep safety equipment running even when exposed to extreme heat or fire. These cables are required to maintain the circuit integrity to conduct electricity after being subjected to fire. This means that the conductor must retain mechanical continuity, electrical conductivity and insulation must retain sufficient insulating characteristics to prevent short circuit, and must also have sufficient mechanical cohesion to form a continuous layer on the conductors.

The flame temperature can rise up to 1000 °C during fire, and the cable must withstand the full intensity of the flame without failure. The requirement for the conductor to maintain mechanical continuity has discouraged the use of aluminium in fire resistant cables because aluminium has a melting point of about 660 °C. Copper, with a melting point of 1084°C, is more commonly specified in fire resistant cables. Therefore, aluminium would appear to be unsuitable for use in conductors in such fire resistant cables [3]. For the same reason, single core aluminium armored cables are not preferred for fire resistant cables. Whereas copper armour will be more suitable in this case. Moreover, multi core steel armored cables can be used