

## 2.3 CONDUCTORS



The fundamental concern of power cable engineering is to transmit electrical current (power) economically and efficiently. The choice of the conductor material, size, and design must take into consideration such items as:

- Ampacity (current carrying capacity)
- Voltage stress at the conductor
- Voltage regulation
- Conductor losses
- Bending radius and flexibility
- Overall economics
- Material considerations
- Mechanical properties

### **Ampacity:**

The current carrying capacity (ampacity) of aluminum versus copper conductors can be compared by referring to many documents.

### **Voltage Regulation:**

In alternating current (AC) circuits having small conductors and in all DC circuits, the effect of reactance is negligible

Equivalent voltage drop results with an aluminum conductor that has about 1.6 times the cross-sectional area of a copper conductor.

In AC circuits having larger conductors, however, skin and proximity effects influence the resistance value (AC to DC ratio, later written as AC/DC ratio), and the effect of reactance becomes important

### **Weight:**

One of the most important advantages of aluminum, other than economics, is its low density

A unit length of bare aluminum wire weighs only 48% as much as the same length of copper wire having an equivalent DC resistance

### **Direct Current Resistance:**

The conductivity of aluminum is about 61.2% to 62.0% of that of copper. Therefore, an aluminum conductor must have a cross-sectional area about 1.6 times that of a copper conductor to have the equivalent DC resistance

### **Short Circuits:**

Consideration should also be given to possible short circuit conditions, since copper conductors have higher capabilities in short circuit operation. the thermal limits of the materials in contact with the conductor (e.g., shields, insulation, coverings, jackets, etc.) must be considered

### **Conductor Sizes:**

Just as in any industry, a standard unit must be established for measuring the conductor sizes. In the US and Canada, electrical conductors are sized using the AWG system.