Selection Of Number Of Cable Cores
With Emphasis On Sizing Parameters

Dependance On Installation Site

The selection of number of cable cores basically depends on the type of system where it is going to be installed.

**Generally we have two types of systems:**
1. A perfectly balanced system and
2. A system with some degree of unbalance (or Unbalanced System).

**Generally cable sizing includes below parameters:**
1. Cable installation conditions and the load it will carry
2. Continuous current rating of the cable
3. Voltage drop and short circuit considerations
4. Earth fault loop impedance

Here, I am going to describe that how the number of cores can be selected.
3-Core Cables

These cables are used generally for a **perfect balanced 3-phase system**. When the currents on the 3-live wires of a 3-phase system are equal and at an exact 120° phase angle, then the system is said to be balanced. The 3-phase loads are identical in all respects with no need of a **neutral conductor**.

An important example of 3-phase load is **electric motor** and that is why, they are fed through 3-Core cables in most cases.

3.5-Core Cables

A 3-phase system may have a neutral wire. This wire allows the 3-phase system to be used at **higher voltages** while it will still support lower voltage single phase loads. It is not likely in such cases that the loads will be identical, so the neutral will carry the **out-of-balance current** of the system. **The greater the degree of imbalance, the larger the neutral current.**
When there is some degree of unbalance and the amount of fault current is very small, then 3.5 core cables are used. In these types of cables, a neutral of reduced cross section as compared to the 3-main conductors is used, which is used to carry the small amount of unbalanced currents.

4-Core Cables

When there is severe out-of-balance conditions, the amount of fault current will raise to a very high level. Generally in the case of linear loads, the neutral only carries the current due to imbalance between the phases.

The non-linear loads such as switch-mode power supplies, computers, office equipment, lamp ballasts and transformers on low loads produce third order harmonic currents (Definition of Harmonics and Their Origin) which are in the phase of all the supply phases. These currents do not cancel at the star point of a three-phase system as do normal frequency currents, but add up, so that the neutral carries very heavy third harmonic currents. That is why the neutral of the cable feeding the equipment are not reduced and made with cross sectional area same as that of the main conductor to carry this high amount of current.
5 and 6-Core Cables

Some conditions may arrive when the amount of *fault (neutral) current* becomes very large than the phase currents. When the load concerned to this type of situation is fed through a multi-core cable, it is necessary to use a 5-Core or 6-Core Cable.

In this condition, **two (or three) conductors can be used in parallel formation** to carry the high amount of generated unbalanced currents.

Source: