# 5 key factors to consider in choosing the right cable size

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In our line of work, we get many good questions on what is a suitable cable size to use. We hope this article serves as a good checklist on some of the key considerations we recommend looking into to determine the suitable cable size. This article is primarily a reference for low voltage power cables with copper conductor.

We recommend downloading the guide where it would take you through a step-by-step cable sizing example on how to use the relevant tables while keeping these 5 considerations in mind.

The guiding principle in choosing the right cable size is how well your cable can carry the required current load in your installation environment, without causing excessive voltage drop from your supply voltage.

Once you know the load that the cable will carry (Ampere), here are some of the conditions that would affect the ultimate cable size you choose. Going through the considerations below may bring you to different recommended conductor size. The key is that the minimum conductor size you end up selecting, must at least be the minimum allowable cable size that can cover all the various conditions you have looked into.

With that in mind, here are five questions we would typically ask:

- **How are you planning to install these cables?**
- **What cable construction are you considering for the cables?**
- **What is your cable length?**
- **What is your ambient temperature?**
- **How many circuits will you be placing together?**

## 1. Installation Method

This is the first thing we look at, because how and where the cable will be installed directly affects whether a cable could be overloaded (eg. in conduit, on cable tray, in free air, grouping, spacing, trefoil, laid flat). In general, the more enclosed the cables are (eg. in conduit versus. in free air), the more you may need to use a larger cable size to ensure it can withstand the current and allow proper heat dissipation.

## 2. Cable Material

Cable insulation material (the extruded layer that comes after the conductor) plays an important role in cable sizing because it directly affects your cables maximum operating temperature. We have placed common insulation materials: PVC, XLPE, EPR in the guide for your reference.

In standard cable materials, PVC has a maximum operating temperature of 70˚C, XLPE 90 ˚C and EPR 90 ˚C. You may wonder why then for instance we would choose PVC vs. XLPE given the lower maximum operating temperature for PVC. This would have to do with other properties of the material that work better in your installation environment. For instance, PVC is much more flexible than XLPE and therefore may be a better choice where you would require the cable to bend in tighter spaces.

You may also choose between single-core or multi-core cables depending on the installation requirement and this would also affect the current carrying capacity of the cable. A single core cable would be able to dissipate heat better than a multi-core cable and hence would have a higher current carrying capacity. However, you may still choose the multi-core cable as it could be easier to install the required conductors at a go.

## 3. Cable Length

We require cable length to assess Voltage Drop, which is the loss of electrical potential along your cable run.

In Singapore, we follow the SS638 (formerly known as CP5) wiring regulations where the voltage drop of a cable run must not exceed 4%. For instance, if a supply voltage is 415V, then the maximum permissible voltage drop cannot exceed 4% of 415V = 16.6V

Voltage drop of a circuit is mainly determined by the cable size and length of a cable line. The smaller the cable size used, or the longer the cable length that is required for your circuit, the greater the voltage loss. If you find that the voltage drop of the circuit has exceeded the 4% stated, you would need to upsize your cable.

## 4. Ambient Temperature

Our tables assume a standard ambient temperature of 30˚C in free air, or ground temperature of 15˚C with a depth of 0.5m. Do note that cable routing and ventilation will directly affect your ambient temperature and so it is important to consider the installation condition along your entire length of the cable laid. If there is a deviation from the standard temperature, you would need to apply a correction factor to the current load that your cable is expected to carry. The higher your ambient temperature from standard, the larger your cable size may be needed to carry the required load.

# 5. Number of circuits

Our tables assume that you are laying one circuit single-phase or three-phase. If you intend to group circuits together in your installation, it is crucial to apply a cable grouping correction factor so that you select the appropriate cable size that would prevent overheating issues. The more number of circuits you intend to group together, the harder the heat dissipation, hence you may need to upsize the cables accordingly.

We hope this article has presented you with a general principle on some of the key factors to look out for when determining the minimum allowable cable size to choose. To reiterate, you will need to choose the minimum economic size that can cover all the conditions you have looked into to ensure that the cable does not get overloaded. To help with your cable size estimates, please refer to the free guide below where we take you through a calculated example.

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