installations using high-pressure discharge lamps (e.g. for floodlighting), is that luminaires closer to the supply transformer may produce more light than those furthest from the transformer.

To help reduce the voltage drops in an installation the following steps may be considered;

- The voltage drop of a cable is related to the cable gauge or cross-sectional surface area. A cable with a larger cross-sectional area will have less voltage drop than a smaller cable.
- The voltage drop of a cable is related to the length of the cable. Longer cable runs will produce a larger voltage drop. Therefore smaller cable runs should be used.
- Increasing the number of transformers will allow the transformer sizes to be reduced and also allow the length of the cable runs to be reduced.
- The use of lower wattage lamps or fewer luminaires on each cable run will reduce the loading on the cabling and therefore the voltage drop (as voltage drop is related to circuit current).

8.16 Fusing

Fuses are the simplest form of circuit protection. Whilst they have generally been replaced by electromechanical methods of protection a benefit of fuses is that they can withstand much higher fault levels than other electromechanical methods of protection.

However, circuit breakers are most commonly used for protecting circuits on high voltage and low voltage circuits. For low voltage, low current applications typical of lighting installations miniature circuit breakers (MCBs) may be used to protect the final circuit. Three different categories of MCB are defined, giving different levels of performance depending upon application. These are;

Type B	used with resistive loads such as tungsten lighting
Type C	used where a mixture of light inductive and resistive loads are present
Type D	used where strong inductive loads such as motors or switched mode power supplies are present

Lamps, LEDs and Circuits

For lighting circuits generally type B MCBs are commonly used although type C variants may be present depending upon the application area.

When a lighting circuit is switched on high transient current peaks occur due to parasitic capacitances that can accumulate with the number of luminaires. These high switch-on currents can cause problems with automatic conductor cutouts. Therefore only surge-current-proof automatic cutouts should be used for lighting systems. This is of especial concern with lighting circuits using luminaires with electronic control gear. Electronic control gear starts all lamps in a circuit simultaneously, thereby causing a higher switch-on current peak than when using a choke/starter circuit, as in a choke/starter circuit lamps do not ignite simultaneously.

It should also be noted that the type of fuse used could influence the number of ballasts that may be used on one device. When using a multi-pole fuse the number of ballasts that may be connected is typically reduced by 20% compared to a single pole fuse.

You should always check manufacturers literature as to how many ballasts may be connected through one device, and remember that a luminaire may contain multiple ballasts not necessarily of the same type.

8.17 Wiring regulations

It is of great importance that the electrical connections to any lighting equipment are correctly specified. Standards for this exist, international standards such as IEC 60364 - Low-voltage electrical installations, and local standards such as BS 7671.

Previously three categories of electrical circuit were defined and lighting circuits generally fell within category 1. Now however two voltage bands have replaced these categories and generally lighting installations will fall within the requirements of voltage band II. This contains the requirements for supplies to households and most commercial and industrial installations. It should be noted that IEC 60364 and associated local versions do not apply to public street lighting installations and these are considered part of the public power gird.