

Pearson BTEC Levels 4 Higher Nationals in Engineering (RQF)

Unit 31: Electrical Systems and Fault Finding

Unit Workbook 3

in a series of 4 for this unit

Learning Outcome 3

Lighting Circuits

INTRODUCTION

LO3 Analyse the types of lighting circuits available in the industry by assessing their practical application

Types available and applications:

Construction, application, characteristics and testing of lighting circuits

Types of lights available (high-intensity discharge lamps (HID lamps) such as metal-halide and sodium, fluorescent, light emitting diode (LED) and halogen)

Practical applications

Voltages, energy usage, lumen output, efficiency, recycling

Safety requirements for use in hazardous zones

Heat and protection devices

Lighting design:

Quality of light, control of glare, luminance, internal/external lighting for visual tasks, emergency lighting, use in hazardous environments

Sample

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Sample

Construction, application, characteristics and testing of lighting circuits

Residential Lighting

For residential properties, like houses, flats and bungalows, twin and earth cables are installed into ceiling roses through a plasterboard ceiling (normally). Figure 1 illustrates the wiring scheme.

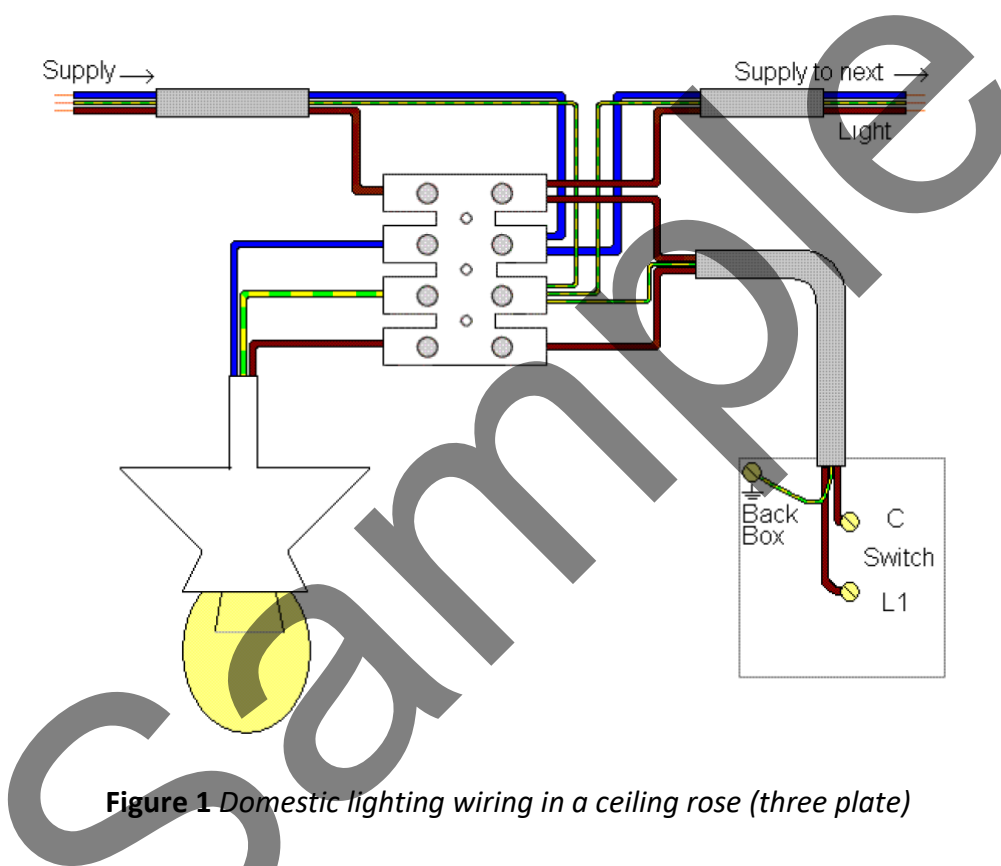


Figure 1 Domestic lighting wiring in a ceiling rose (three plate)

Such a wiring system is known as ‘three-plate’. Three twin and earth cables are used to provide a;

- Feed
- Switch line
- Supply to next room

The usual practice is to wire from the consumer unit (fusebox) to the nearest room. Normally, wiring of a circuit is undertaken with one floor on its own fuse or circuit breaker. Wiring to the nearest room from the fusebox minimises cable runs.

The feed from the first room will enter the ceiling rose for the second room, which will have other cables going to its switch and a feed for the third room etc. Once the last room on a certain floor is reached, its

ceiling rose will just contain the feed from the previous room plus the switch cable i.e. no further feed out needed. Such an arrangement is known as a Star (radiates out from the centre, in a line).

Commercial Lighting

Residential lighting uses a 'three-plate' scheme, but commercial lighting uses a 'two-plate' scheme. Here, the supply is cabled to the switch rather than the light. The commercial two-plate wiring system is shown in figure 2.

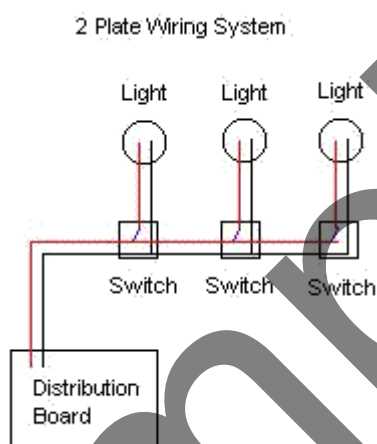


Figure 2 Lighting wiring in a commercial installation (two plate)

Testing of lighting circuits usually consists of;

- continuity testing to check for open circuits or poor connections
- insulation resistance testing – ensure switches are ON and all lamps are removed.

Types of lights available

Here we shall consider four types of lighting;

- HID (high-intensity discharge)
- Fluorescent
- Halogen
- LED

HID Lighting

High-Intensity Discharge (HID) is the term used for a general group of lamps which includes high-pressure sodium, mercury-vapour and metal halide. Let's take a look at the metal halide type.

Metal-Halide

A metal-halide lamp gives off light by producing an arc of electricity through a mixture of vaporised mercury and metal halides (MH). The metal halide can consist of a compound of metals containing iodine or bromine. The most commonly used type of MH is sodium iodide.

The applied voltage excites the gaseous mixture in the arc tube. The excitation process is not instantaneous, and so it can take several minutes for the lamp to reach its working temperature. The temperature of the light source dictates the colours which are radiated (known as 'colour temperature'). The efficacy (the amount of light, in lumens, given off per Watt of electrical power input) of an MH lamp is commonly around 100 lm/W and can be around 75% more efficient than a fluorescent lamp, with power ratings up to 1000 W. A metal-halide lamp is shown in figure 3.



Figure 3 A 200 W metal halide lamp