

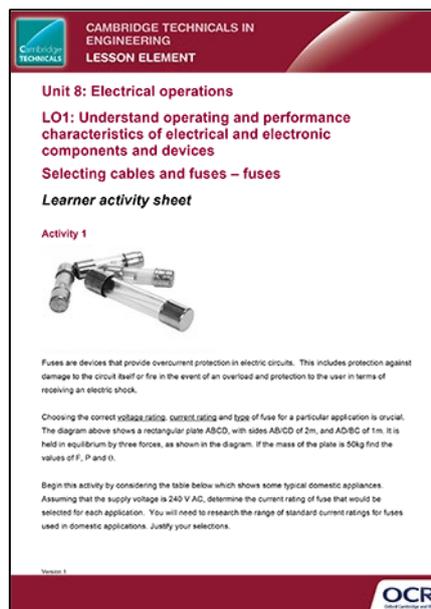
Unit 8: Electrical operations

LO1: Understand operating and performance characteristics of electrical and electronic components and devices

Selecting cables and fuses – fuses

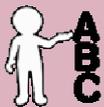
Instructions and answers for teachers

These instructions should accompany the OCR resource ‘Selecting cables and fuses – fuses’ activity which supports Cambridge Technicals in Engineering Level 3.



The Activity:

For Activity 1 learners have been tasked to determine fuse current ratings for a selection of domestic appliances. In Activity 2 learners have been tasked to investigate different types of fuse.



This activity offers an opportunity for English skills development.



This activity offers an opportunity for maths skills development.

Suggested timings:

1 hour

Activity 1

For Activity 1 learners have been tasked to determine fuse current ratings for a selection of domestic appliances.

Domestic fuses are available in a range of standard current ratings, and learners may first need to determine this e.g. 3 A and 13 A. 5 A fuses are still available.

Learners will need to determine current for each application using the formula $P = VI$

For a 240 W radio supplied with 240 V AC, the current drawn:

$$I = P/V = 240 \text{ W} / 240 \text{ V} = 1 \text{ A}$$

A 3 A (Amp) fuse would therefore be selected in this application.

The table below shows current drawn and fuse selected in each application.

| Application | Fuse Current Rating |
|------------------------|--------------------------------------|
| 240 W radio | 1 A (select 3 A fuse) |
| 400 W plasma TV | 1.7 A (select 3 A fuse) |
| 1000 W hairdryer | 4.5 A (select 5 A fuse or 13 A fuse) |
| 1600 W electric kettle | 6.7 A (select 13 A fuse) |
| 3000 W electric oven | 12.5 A (select 13 A fuse) |

Teachers might note that in several cases a much higher rating of fuse needs to be selected compared with the maximum current drawn by the device. This is due to the limited range of fuses.

In other applications, a wider range of fuse current ratings may be available allowing selection of a fuse current rating closer to the maximum permissible value.

Alternatively equipment may be internally protected with further fuses for different sub-systems and devices.

Activity 2

In Activity 2 learners have been tasked to investigate different types of fuse.

These are summarised in the table below, with typical characteristics and applications of each fuse type.

Learners may suggest more specific applications in each case.

Teachers could use data sheets for various fuse types from which learners could compare characteristics such as time to blow.

Teachers might also remind learners that in addition to current rating and time to blow, fuses also have a maximum voltage rating.

| Fuse Type | Characteristics | Applications |
|----------------------------------|---|---|
| Slow-Blow/Time delay/ Anti-Surge | <p>Slow blow fuses allow for an initial inrush of current (without interrupting the circuit).</p> <p>The fuse will blow (interrupt the circuit) in response to a relatively small overload current once the inrush of current has passed.</p> | Protection of devices with a high inrush current, such as a transformer or a motor |
| Quick/Fast Acting | Quick acting fuses react quickly to short term overload conditions. | Protection of semiconductor devices and devices containing electronic components |
| Normal | <p>Normal fuses have a characteristic that falls between slow-blow and fast acting.</p> <p>They will allow a slight overload for a short period of time.</p> | <p>Protection of domestic appliances</p> <p>Protection of general equipment (which might have internal protection of sub-systems using slow and quick acting fuses)</p> |
| High Rupturing Capacity (HRC) | <p>A fuse that can accommodate a short circuit high current, for a known time period.</p> <p>Construction of the fuse is such that internal arcing in the fuse is quenched when it blows.</p> | Typically used in high power applications such as 3-phase systems |

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