

Most electric cords connecting large electric appliances to a wall socket contain three separate wires. The usual colour code is blue for active wire, brown for neutral wire and green/yellow for the earth wire. The active and neutral wires conduct the current along the cord and the earth wire provides a safety mechanism in case of an electric fault.

Some appliances, such as washing machines that have metal cabinets, use 'earthing' to ensure that someone who touches the metal casing cannot receive an electric shock. This is done by connecting the casing to an earth wire. All earth wires are in turn connected to the earth by a metal stake driven into the ground.

Figure 1 shows how a series of appliances is connected by a common earth wire that is 'earthed' by attaching it to a grounded garden tap.

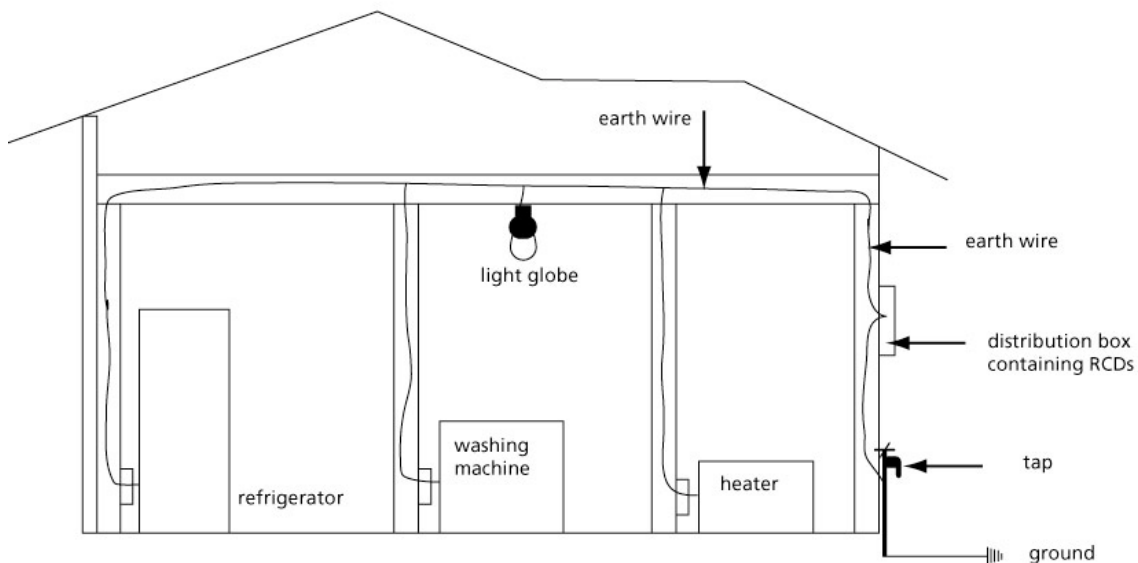


Figure 1: Earthing in the home

In the case of a serious electric fault, like an active wire accidentally touching the metal case, current flows to ground through the earth wire. If the circuit is protected by a fuse or a residual current device (RCD), the circuit will be broken, and external wiring will not overheat. Figure 2 shows how a fault in the wiring of a washing machine may occur.

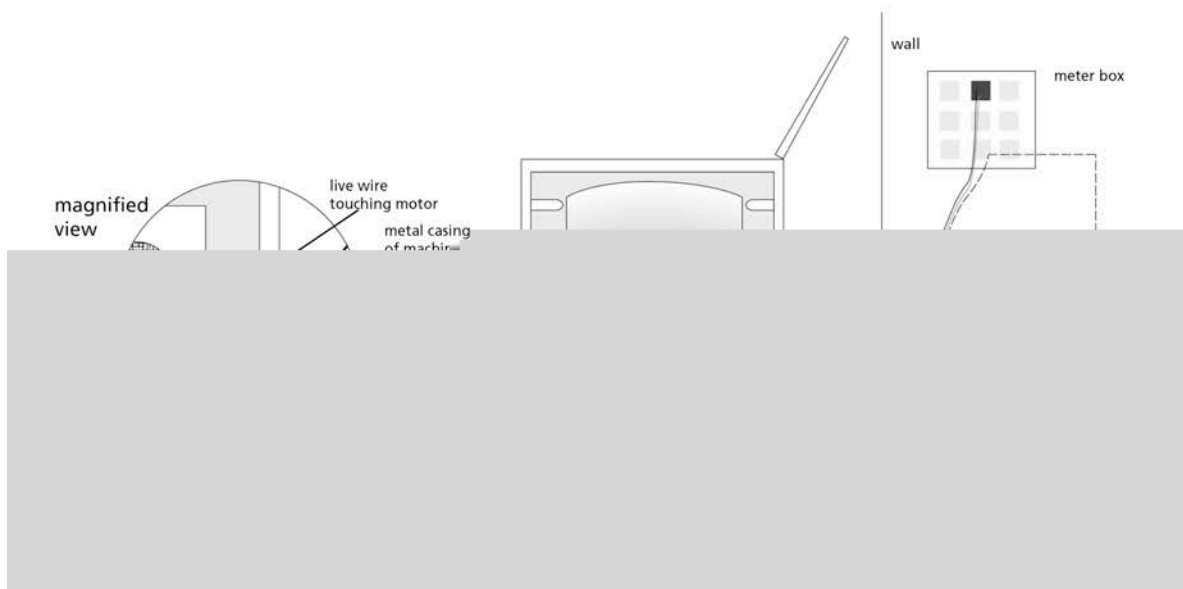


Figure 2: Faulty wiring in a washing machine

RCDs have replaced fuses as the preferred way to protect circuits because they offer better protection for people. They are designed to prevent electrocution by detecting a leakage current. This can be far smaller (typically 5-30 mA) than current needed to operate conventional circuit breakers or fuses which can be several amperes. An electric shock may cause the heart to beat irregularly (this is called ventricular fibrillation), which is the most common cause of death through electric shock. RCDs are intended to operate within 25-40 ms, before ventricular fibrillation occurs.

Questions

1. Most houses in Australia have multiple circuits that provide power to appliances and power points in various rooms. Why are there multiple circuits?

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2. Suggest why an electric oven is usually the only device on its circuit.

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3. In Figure 2, use a coloured pen to trace the flow of current from the 'live' wire to the 'earth' connection attached to the garden tap.

4. Why are some appliances connected to the power supply by two wires only (no earth wire)?

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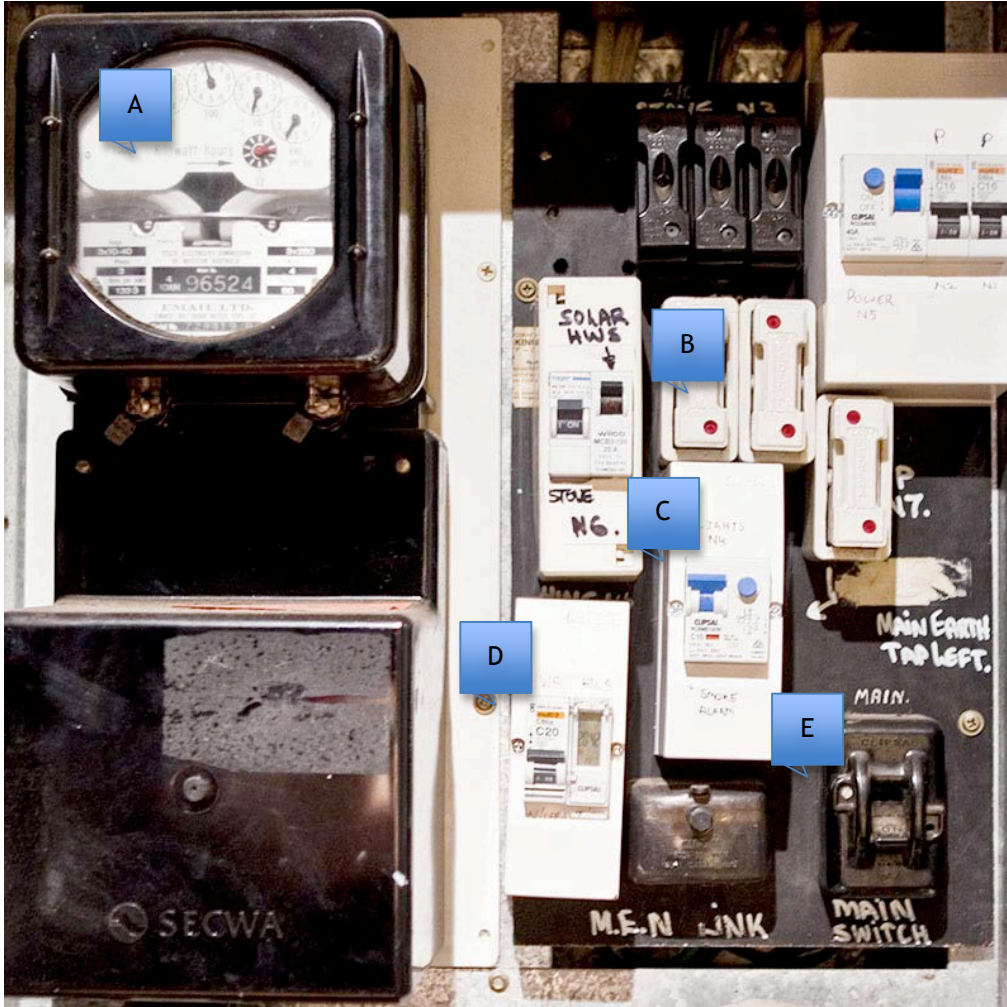
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5. Explain the function of labelled devices in this meter box.



- A. meter
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- B. fuse
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- C. RCD (residual current device)
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- D. MCB (miniature circuit breaker)
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- E. main switch
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Research questions

6. Explain what a RCD switch is, and how it works.

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7. Why is a RCD switch considered to be superior to a conventional fuse in offering people better protection against receiving severe electric shocks?

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8. Some portable electric hand devices such as electric drills are labelled 'double-insulated'. What does this term mean, and how is a user of the item protected from a fault if it develops?

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