

Transformers

James Stewart: Transformers come in all shapes and sizes, from the huge ones on the national grid to the small ones in your phone chargers or even your microwave oven.

In a transformer, a primary coil and a secondary coil are wrapped around an iron core.

Alternating current flows through the primary coil, creating a continuously changing magnetic field around it.

The magnetic field extends through the core to the secondary coil.

The secondary coil experiences this change in magnetic field.

This induces a potential difference across the ends of the secondary coil.

And this is an example of electromagnetic induction.

If the secondary coil is part of a complete circuit, the induced alternating potential difference across the secondary coil will cause an alternating current through the secondary coil.

The potential difference across the secondary coil depends on the ratio of turns between the primary and secondary coils.

In this example, the number of turns is the same on both coils, so the potential difference across the secondary coil will be the same as the potential difference across the primary coil.

To change the potential difference, we can make the number of turns on the secondary coil more or less than the number of turns on the primary coil.

According to the equation, potential difference across the primary coil divided by potential difference across the secondary coil equals the number of turns in the primary coil divided by the number of turns in the secondary coil.

For example, when a microwave oven like this one is plugged into a UK mains socket, the potential difference across the primary coil is 230 Volts.

The microwave oven's step up transformer increases the potential difference, so it can operate at 2300 Volts.

This is 10 times as much potential difference as the 230 Volts across the primary coil, so there must be 10 times as many turns on the secondary coil compared to the primary coil.

Remember, a step up transformer increases potential difference by having more turns on the secondary coil than the primary coil, whereas a step down transformer decreases potential difference by having fewer turns on the secondary coil than the primary one.