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BASIC ELECTRICITY

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Parallel Circuits

The parallel circuit is probably the most common type of circuit you will encounter. Loads in power distribution systems are mostly connected in parallel with each other in one way or another.

Construction of a Parallel Circuit

A parallel circuit is constructed by connecting the terminals of all the individual load devices so that the same value of voltage appears across each component.

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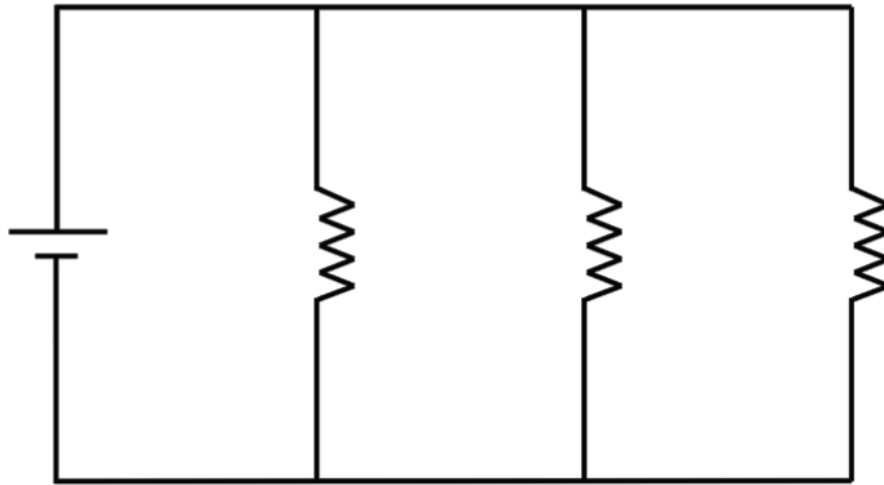


Figure 19. Parallel circuit

- The voltage across each branch is the same.
- There are three separate paths (branches) for current to flow, each leaving the negative terminal and returning to the positive terminal.

In contrast to a series circuit, current still flows to the remaining devices in the circuit if any one branch or component in a parallel circuit is opened.

Three Laws of a Parallel Circuit

There are three fundamental relationships concerning voltage, current, and resistance in all parallel circuits.

Voltage

In a parallel circuit, each load resistor acts as an independent branch circuit, and because of this, each branch “sees” the entire voltage of the supply.

Total voltage of a parallel circuit has the same value as the voltage across each branch.

This relationship can be expressed as:

$$E_T = E_1 = E_2 = E_3 \dots$$

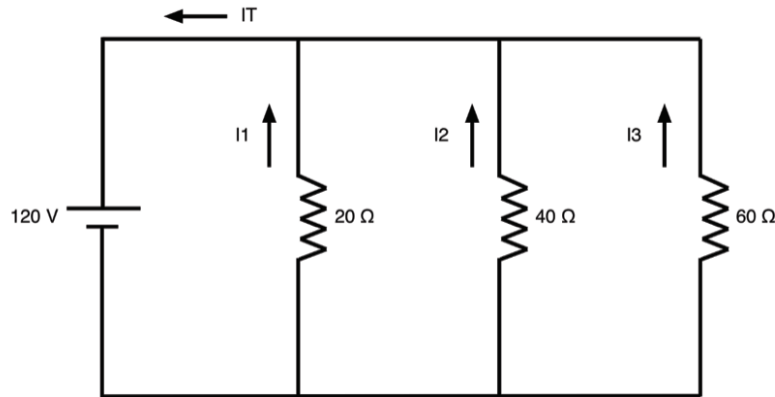


Figure 20. Parallel circuit current flow

In the above circuit, the voltage in each branch is 120 V.

Current

A parallel circuit has more than one path for current flow. The number of current paths is determined by the number of load resistors connected in parallel.

Total current in a parallel circuit is the sum of the individual branch currents.

This relationship in a parallel circuit is expressed as:

$$I_T = I_1 + I_2 + I_3 \dots$$

To solve for the total current, you must first determine individual branch currents using Ohms law:

$$I_1 = 120 \text{ V} / 20 \, \Omega = 6 \text{ A}$$

$$I_2 = 120 \text{ V} / 40 \, \Omega = 3 \text{ A}$$

$$I_3 = 120 \text{ V} / 60 \, \Omega = 2 \text{ A}$$

$$I_T = 6 \text{ A} + 3 \text{ A} + 2 \text{ A} = 11 \text{ A}$$

Resistance

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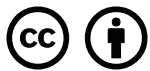
The net resistance of a parallel circuit is always less than any of the individual resistance values.

The overall resistance is commonly determined using the reciprocal equation:

$$1/R_T = 1/R_1 + 1/R_2 + 1/R_3 \dots$$

Using your calculator's inverse button can make solving total resistance easy.

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