

If Voltage Drops, Will It Break?

If you drop the voltage, will it break? Will it make a mess on the floor? I bet worry over these questions has kept you and your customers awake all night.

Well, relax, **voltage drop** will not make a mess on your floor, nor will voltage break when dropped. However, it *can* cause motors to fail, lights to dim, electronic equipment to malfunction, relays to “crash” and major industrial plants to shut-down unexpectedly. And, according to Murphy’s Law, these malfunctions will probably occur on the most critical plant process at the most inconvenient time.

Voltage drop is the term used by electrical engineers to describe a decrease (drop) in voltage. Excessive voltage drop is most likely to occur in low voltage, high current circuits with long cable runs. The most common solution to excessive voltage drop is to use a larger conductor size. You have probably experienced voltage drop first-hand if you have noticed that the lights in your home dim when the air conditioner or some other large appliance starts running.

Since voltage drop is an important issue for the reliable operation of electrical systems, electrical engineers have developed methods to calculate voltage drop for various cable types and conditions of use. Unfortunately, you have to be part Einstein to do these very complex calculations.

Enter The Anixter Voltage Drop Calculator

Fortunately, Anixter Part # 136419 is available that makes the calculation much easier. Although not quite as precise as a full-fledged engineering calculation, the results obtained are accurate enough for most applications. For those of you brave enough to try, the steps required to determine the conductor size for a given application are shown below:



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- Ask your customer the following questions about the planned cable system. If you don't know what all the technical terms mean, don't worry -- the electrical engineer responsible for the project will understand your questions:
 - Is it a "three-phase" or a "single-phase" system?
 - What is the circuit voltage?
 - How much current will the cable carry?
 - What is the length of the circuit?
- Select an initial conductor size that meets the application's ampacity requirements. The blue shaded area on the front of the Calculator gives ampacities for several common situations.
- In the "Wire Gauge" window of your Voltage Drop Calculator, slide the moveable insert until the conductor size lines up with the type of electrical system.
- Next, without moving the insert, find your customer's circuit length (in feet) on the "Circuit Length" scale and read the voltage drop (per amp) from the "Voltage Drop Per Ampere" scale directly below it. For example, for a three-phase, 2 AWG copper cable running 1000 feet, the voltage drop works out to be about 0.34 volts per amp.
- Finally, to determine the voltage drop in percentage, multiply the voltage drop in volts per amp by the current. Divide the resulting number by the source voltage and multiply by 100 to convert to percentage. For example, if the circuit will be operating at 90 amps and 480 volts, the voltage drop would be 6.3 % ($0.34 \times 90A \div 480V \times 100 = 6.3 \%$).

Since the maximum voltage drop allowed is usually 5 %, a 2 AWG cable would not be large enough. Let's try a 1/0 copper size. Repeating the above steps, the voltage drop for a 1/0 cable works out to 4.3 %. This is within the 5 % maximum so a 1/0 would work just fine. By the way, the maximum voltage drop allowed in most office environments is only 3 %.

Now that the cable is correctly sized for the application, you and your customer can rest comfortably all night!