Voltage Drop Calculator

Result

Voltage drop: **3.22**
Voltage drop percentage: **2.68%**
Voltage at the end: **116.78**

Please note that the result is an estimation based on normal conditions. The actual voltage drop can vary depending on the condition of the wire, the conduit being used, the temperature, the connector, the frequency etc. But, in most cases, it will be very close.

Wire Material	Aluminum	
Wire Size	250 kcmil	
Voltage	120	
Phase	AC single phase	
Number of conductors	single set of conductors	
Distance*	75	meters
Load current	100	Amps

Calculate Clear

* Please use one-way distance to the load. Not round trip distance.

Search

Other Calculators

Age Date
Time Hours
GPA Grade
Height Concrete
IP Subnet Bra Size
Password Generator Dice Roller
Conversion More Other Calculators

Financial | Fitness and Health | Math | Other

Basic Voltage Drop Law

$V_{drop} = IR$

where:
I : the current through the object, measured in amperes
R : the resistance of the wires, measured in ohms

Typical AWG wire sizes

AWG	Diameter		Turns of wire		Area		Copper resistance		NEC copper wire ampacity with 60/75/90 °C insulation (A)	Approx strd metric equiv
	inch	mm	per inch	per cm	kcmil	mm^2	O/km	O/kFT		
0000 (4/0)	0.4600	11.684	2.17	0.856	212	107	0.1608	0.04901	195 / 230 / 260	
000 (3/0)	0.4096	10.404	2.44	0.961	168	85.0	0.2028	0.06180	165 / 200 / 225	
00 (2/0)	0.3648	9.266	2.74	1.08	133	67.4	0.2557	0.07793	145 / 175 / 195	
0 (1/0)	0.3249	8.252	3.08	1.21	106	53.5	0.3224	0.09827	125 / 150 / 170	
1	0.2893	7.348	3.46	1.36	83.7	42.4	0.4066	0.1239	110 / 130 / 150	
2	0.2576	6.544	3.88	1.53	66.4	33.6	0.5127	0.1563	95 / 115 / 130	
3	0.2294	5.827	4.36	1.72	52.6	26.7	0.6465	0.1970	85 / 100 / 110	196/0.4
4	0.2043	5.189	4.89	1.93	41.7	21.2	0.8152	0.2485	70 / 85 / 95	
5	0.1819	4.621	5.50	2.16	33.1	16.8	1.028	0.3133		126/0.4
6	0.1620	4.115	6.17	2.43	26.3	13.3	1.296	0.3951	55 / 65 / 75	
7	0.1443	3.665	6.93	2.73	20.8	10.5	1.634	0.4982		80/0.4
8	0.1285	3.264	7.78	3.06	16.5	8.37	2.061	0.6282	40 / 50 / 55	
9	0.1144	2.906	8.74	3.44	13.1	6.63	2.599	0.7921		84/0.3
10	0.1019	2.588	9.81	3.86	10.4	5.26	3.277	0.9989	30 / 35 / 40	
11	0.0907	2.305	11.0	4.34	8.23	4.17	4.132	1.260		56/0.3
12	0.0808	2.053	12.4	4.87	6.53	3.31	5.211	1.588	25 / 25 / 30 (20)	
13	0.0720	1.828	13.9	5.47	5.18	2.62	6.571	2.003		50/0.25
14	0.0641	1.628	15.6	6.14	4.11	2.08	8.286	2.525	20 / 20 / 25 (15)	
15	0.0571	1.450	17.5	6.90	3.26	1.65	10.45	3.184		30/0.25
16	0.0508	1.291	19.7	7.75	2.58	1.31	13.17	4.016	- / - / 18 (10)	
17	0.0453	1.150	22.1	8.70	2.05	1.04	16.61	5.064		32/0.2
18	0.0403	1.024	24.8	9.77	1.62	0.823	20.95	6.385	- / - / 14 (7)	24/0.2
19	0.0359	0.912	27.9	11.0	1.29	0.653	26.42	8.051		
20	0.0320	0.812	31.3	12.3	1.02	0.518	33.31	10.15		16/0.2
21	0.0285	0.723	35.1	13.8	0.810	0.410	42.00	12.80		13/0.2
22	0.0253	0.644	39.5	15.5	0.642	0.326	52.96	16.14		7/0.25

23	0.0226	0.573	44.3	17.4	0.509	0.258	66.79	20.36		
24	0.0201	0.511	49.7	19.6	0.404	0.205	84.22	25.67		1/0.5, 7/0.2, 30/0.1
25	0.0179	0.455	55.9	22.0	0.320	0.162	106.2	32.37		
26	0.0159	0.405	62.7	24.7	0.254	0.129	133.9	40.81		7/0.15
27	0.0142	0.361	70.4	27.7	0.202	0.102	168.9	51.47		
28	0.0126	0.321	79.1	31.1	0.160	0.0810	212.9	64.90		
29	0.0113	0.286	88.8	35.0	0.127	0.0642	268.5	81.84		
30	0.0100	0.255	99.7	39.3	0.101	0.0509	338.6	103.2		1/0.25, 7/0.1
31	0.00893	0.227	112	44.1	0.0797	0.0404	426.9	130.1		
32	0.00795	0.202	126	49.5	0.0632	0.0320	538.3	164.1		1/0.2, 7/0.08
33	0.00708	0.180	141	55.6	0.0501	0.0254	678.8	206.9		
34	0.00630	0.160	159	62.4	0.0398	0.0201	856.0	260.9		
35	0.00561	0.143	178	70.1	0.0315	0.0160	1079	329.0		
36	0.00500	0.127	200	78.7	0.0250	0.0127	1361	414.8		
37	0.00445	0.113	225	88.4	0.0198	0.0100	1716	523.1		
38	0.00397	0.101	252	99.3	0.0157	0.00797	2164	659.6		
39	0.00353	0.0897	283	111	0.0125	0.00632	2729	831.8		
40	0.00314	0.0799	318	125	0.00989	0.00501	3441	1049		

When electrical current moves through a wire it must surpass a certain level of contrary pressure. If the current is alternating, such pressure is called impedance. Impedance is a vector, or two-dimensional quantity, consisting of resistance and reactance (reaction of a built up electric field to a change of current). If the current is direct, the pressure is called resistance.

All this sounds terribly abstract, but it's really not much different from water running through a garden hose. It takes a certain amount of pressure to push the water through the hose, which is like voltage for electricity. Current is like the water flowing through the hose. And the hose causes a certain level of resistance, depending on its thickness, shape, etc. The same kind of thing is true for wires, as their type and size determines the level of resistance.

Excessive voltage drop in a circuit can cause lights to flicker or burn dimly, heaters to heat poorly, and motors to run hotter than normal and burn out. This condition causes the load to work harder with less voltage pushing the current.

Experts say that voltage drop should never be greater than 3 percent. This is done by selecting the right size of wire, and by taking care in the use of extension cords and similar devices.

There are four basic causes of voltage drop.

The first is the choice of material used for the wire. Copper is a better conductor than aluminum and will have less voltage drop than aluminum for a given length and wire size. The electricity that moves through a copper wire is actually a group of electrons being pushed by voltage. The higher the voltage, the more electrons that can be sent flowing through the wire.

Ampacity refers to the maximum number of electrons that can be pushed at one time – the word ampacity is short for ampere capacity.

Wire size is another important factor in determining voltage drop. Larger wire sizes (those with a greater diameter) will have less voltage drop than smaller wire sizes of the same length. In American wire gauge, every 6 gauge decrease gives a doubling of the wire diameter, and every 3 gauge decrease doubles the wire cross sectional area. In the Metric Gauge scale, the gauge is 10 times the diameter in millimeters, so a 50 gauge metric wire would be 5 mm in diameter.

Still another critical factor in voltage drop is wire length. Shorter wires will have less voltage drop than longer wires for the same wire size (diameter). Voltage drop becomes important when the length of a run of wire or cable becomes very long. Usually this is not a problem in circuits within a house, but may become an issue when running wire to an outbuilding, well pump, etc.

Excessive voltage drop can cause loss of efficiency in operation of light, motors and appliances. This could result in lights that are dim and motors or appliances whose life is shortened. So it is important to use the right gauge of wire when running wires for a long distance.

Finally, the amount of current being carried can affect voltage drop levels. Voltage drop increases on a wire with an increase in the current flowing through the wire. Current carrying capacity is the same as ampacity.

The ampacity of a wire depends on a number of factors. Wires are covered with insulation, and this can be damaged if the temperature of the wire becomes too high. The basic material from which the wire is made is, of course, an important limiting factor. If alternating current is being sent through the wire, the speed of alternation can affect ampacity. The temperature in which the wire is used can also affect ampacity.

Cables are often used in bundles, and when they are brought together, the total heat which they generate has an effect on ampacity and voltage drop. There are strict rules about bundling cables which must be followed for this reason.

Cable selection is guided by two main principles. First, the cable should be able to carry the current load imposed on it without overheating. It should be able to do this in the most extreme conditions of temperature it will encounter during its working life. Second, it should offer sufficiently sound earthing to (i) limit the voltage to which people are exposed to a safe level and (ii) allow the fault current to trip the fuse in a short time.

These are important safety considerations. During 2005-2009, there was an average of 373900 fires per year caused by poor electrical installations. Choosing the right cable for the job is a critical safety measure.