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Wire Size Guide

Determining Wire Size

The following information is provided to assist in designing proper emergency lighting systems effectively and economically by using the smallest permissible wire size for load circuits. When remote lighting fixtures and/or exit signs are connected to emergency lighting units, circuit runs must be of sufficient size to maintain a proper operating voltage to all lamps. The National Electrical Code limits voltage to drop to a maximum of 5% of nominal. The table below gives the maximum length or wire run based on systems voltage, wire gauge and total wattage on the run. To determine the maximum length of a wire run not listed, divide the value of the load in watts into the constant listed at the bottom of each row. Example, the maximum wire run for #10 wire on a 12 volt system, with a 54 watt load, is $3397 \div 54$ or, or 62 feet.

Conversely, to determine the maximum load on a run of known length, divide the length into the constant. Example, a 36 foot run of #12 wire on a 6 volt systems can be loaded to, $534 \div 36$, or 14 watts; on #10 wire, 23 watts.

WIRING DISTANCE IN FEET (MAXIMUM VOLTAGE DROP 5%)													
Total watts on wire run	6 volt wire size				12 volt wire size					24 volt wire size			
	#12	#10	#8	#6	#12	#10	#8	#6	#4	#12	#10	#8	#6
6	89	141	225	357	356	566	900	1431	+	1425	+	+	+
8	66	106	168	268	267	424	675	1073	1707	1068	1698	+	+
9	59	94	150	238	237	377	600	954	1517	949	1509	+	+
10	53	84	135	214	213	339	540	859	1366	854	1358	+	+
12	44	70	112	178	178	283	450	715	1138	712	1132	1801	+
16	33	53	84	134	133	212	337	536	853	534	849	1350	+
18	29	47	75	119	118	188	300	477	758	474	754	1200	1909
24	22	35	56	89	89	141	225	357	569	356	566	900	1431
25	21	33	54	85	85	135	216	343	546	341	543	864	1374
27	19	31	50	79	79	125	200	318	505	316	503	800	1272
30	17	28	45	71	71	113	180	286	455	284	452	720	1145
36	14	23	37	59	59	94	150	238	379	237	377	600	954
42	12	20	32	51	50	80	128	204	325	203	323	514	818
45	11	18	30	47	47	75	120	190	303	189	301	480	763
48	11	17	28	44	44	70	112	178	284	178	283	450	715
50	10	16	27	42	42	67	108	171	273	170	271	432	687
75	7	11	18	28	28	45	72	114	182	113	181	288	458
100	5	8	13	21	21	33	54	85	136	85	135	216	343
150	—	5	9	14	14	22	36	57	91	56	90	144	229
200	—	—	6	10	10	16	27	42	68	42	67	108	171
250	—	—	5	8	8	13	21	34	54	34	54	86	137
300	—	—	—	7	7	11	18	28	45	28	45	72	114
400	—	—	—	5	5	8	13	21	34	21	33	54	85
500	—	—	—	—	—	6	10	17	27	17	27	43	68
Constant	534	849	1350	2148	2137	3397	5403	8590	13660	8548	13588	21613	34363

Longer Wire Runs

The wiring distances give the maximum length of a battery circuit, assuming that the entire load is concentrated at the end of the circuit. If loads are uniformly spaced along the circuit path (equal watts, equal distances), the lengths in the table may be increased, based on number of fixtures on a given circuit, by means of the chart and formula below.

NUMBER OF FIXTURES	2	3	4	5	6	N
Multiply by Feet	1.33	1.5	1.6	1.67	1.71	$2N/(n+1)$

For example, a 36 foot long, 6 volt circuit has (3) 9 watt heads spaced 12 feet apart. According to the wire run table, # 8 wire must be used (at 50 feet for a 5% voltage drop.) but, by multiplying the 31 feet for #10 wire by 1.5, a 46 1/2 foot wire run is acceptable, so #10 wire may be used and still meet the 5% voltage drop limitation.

Note: According to the National Electrical Code, Article 720-Y, the smallest permissible wire size for systems under 50 volts is the #12 wire gauge.