

Wire and Cable Pulling Tensions

by Southwire Communications
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Cable damaged during installation can cause service failures. Calculations should be made to indicate whether the pull looks easy or impossible. When a marginal situation is encountered, the entire pull should be reviewed. A final decision should be made based on factors known to the end user and installer. Pulling tensions may be evaluated by determining the maximum tension based on the pulling device used, and the maximum tension that can be applied to the conductors. The lesser of these two values is the maximum allowable tension. After calculating the pulling tensions, sidewall pressures may be calculated.

Do not exceed the allowable tension stated by the manufacturer of the pulling device or 10,000 pounds, whichever is less. Do not use metallic shielding wires, tapes or braids, or armor not designed for the purpose, in pulling tension calculations.

FORMULAS

SINGLE CONDUCTOR:

$$T = S * A \text{ (pounds)}$$

Where:

T = conductor tension, lbs

S = conductor stress, lbs/cmil (Table 1)

A = conductor area, cmil (Table 2)

MULTIPLE CONDUCTORS:

$$T = N * S * A \text{ (pounds) for 3 or less conductors}$$

$$T = (0.8) * N * S * A \text{ (pounds) for more than 3 conductors}$$

Where:

N = number of conductors

NOTE: Pulling different conductor sizes at the same time is not recommended if the conductor size or other cable characteristics are significantly different. If different size conductors must be pulled, it must be done with care.

**TABLE 1
MAXIMUM ALLOWABLE CONDUCTOR STRESS**

Cable Type	Material	Temper	lbs/cmil
All	Copper	soft	0.008
Power	Aluminum	Hard	0.008
Power	Aluminum	3/4 hard	0.006
Power	Aluminum	AA-8000	0.006
URD	Aluminum	1/2 hard	0.003
Solid	Aluminum	Soft	0.002

Note: 3/4 hard aluminum is allowed for power cable. The 1990 NEC defines use of AA-8000 for solid (8, 10 & 12 AWG) and stranded (8 AWG through 1000 kcmil) conductors.

**TABLE 2
CONVERSION FROM AWG to
CMIL**

(Solid and concentric stranded
Aluminum and Copper conductors)

<u>AWG</u>	<u>cmil</u>
12	6,530
10	10,380
8	16,510
6	26,240
4	41,740
3	52,620
2	66,360
1	83,690
1/0	105,600
2/0	133,100
3/0	167,800
4/0	211,600

TABLE 2 (continued)
CONVERSION FROM AWG to CMIL
(Solid and concentric stranded Aluminum and
Copper conductors)

<u>kcmil</u>	<u>cmil</u>
250	250,000
300	300,000
350	350,000
400	400,000
500	500,000
600	600,000
750	750,000
800	800,000
1000	1,000,000