Copper Wire and Cable Maximum Pulling Tension

When pulling copper cable (or wire), tension must be applied to all elements of the cable. Pulling on just the sheath can stretch, tear, or pull it away from the core. Conversely, pulling solely on the core can pull it out of the sheath. In either case, care must be taken to avoid damage to the conductors. The recommended method for ensuring that the tension is applied to all elements is by using a pulling eye. While mesh-type pulling grips may be suitable in some applications, they do not apply tension to all elements and should be used with caution.

The maximum allowable pulling tension is the greatest pulling force that can be applied to a cable during installation without risking damage to the conductors. Other influences including, but not limited to, sheath type, insulation type, filled vs. air-core, length of pull, and number of bends in the installation are not factored in. The maximum allowable pulling tension is an absolute value based on the tensile and elongation properties of the copper conductors.

All that is needed to correctly calculate maximum allowable pulling tension is the number and size of the conductors, along with a formula known as TANK.

$T = A \times N \times K$

- T = Maximum allowable pulling Tension in pounds
- A = Cross-sectional Area of the conductor in circular mils[1] (In Superior Essex cables, the table to the right shows the values that should be used for A.)
- N = Number of conductors sharing the tensile load[2]
- K = Constant (K) = 0.008 pounds/circular mil

Wire Size (AWG)	Cross-Sectional Area (circular mils)
19	1,289
22	625
24	396
26	250

Example

Calculate maximum allowable pulling tension for a 22 AWG, 1,200-pair Superior Essex outside plant cable:

- T = 625 x (1,200 x 2) x 0.008
- T = 12,000 pounds

[1] A circular mil is the cross-sectional area occupied by a circle that is 0.001 inches in diameter. This is equal to 7.85 x 10-7 in². For any given conductor diameter, the area in circular mils is calculated by dividing the area in square inches by 7.85 x 10-7.

[2] When using a pulling device that shares the tensile load across all conductors, N = pair count x 2. For OSP cables, a factory installed pulling eye that applies tension to all pairs is assumed. If tension is only applied to some of the pairs, adjust conductor count accordingly.