



Conductor Facts / Tensile and Elongation

Tensile tests are conducted to determine the tensile strength/break strength and elongation of a conductor. These properties depend on the alloy and temper as well as the size of the conductor being tested.

Effect of Conductor Size

Tensile strength is a material property that is independent of geometry and dimensions. A material's tensile strength is dependent upon the temper of the sample being tested.

Break strength is defined as the maximum load the sample can sustain before rupture. It is dependent upon the material, its temper and the cross-sectional area of the specimen. Larger conductors of the same material and temper will have higher break strengths. Break strength is a definitive measured property which does not require any calculation.

Elongation can be affected by conductor size and specimen gauge length. Normally, elongation for a material is dependent upon its temper, however, finer diameter conductor strands with the same temper will have lower elongation. Decreasing the specimen length will increase the apparent elongation.

Measuring Techniques

Stranding can affect the tensile and elongation results of a conductor material. NEMA, military and other standards recognize that for size 22 AWG (0.4 mm²) and smaller, the tensile test is performed on the whole conductor. For conductors larger than 20 AWG (0.6 mm²), strands are removed and tensile test is performed on individual strands.

Strain rate can affect tensile and elongation results. Excessive tensile rates or shock loading can raise tensile strength and decrease elongation results. ASTM recommends a testing rate no greater than 10 inches/minute (250 mm/minute) for copper and copper alloys (ASTM B 624), and no greater than 3 inches/minute (75 mm/minute) for hard temper alloys (ASTM B 105).

Conductor Elongation

Tensile and elongation are measures of a material's temper and are usually specified in conductor requirements for most materials other than pure copper. Copper, considered the standard conductor material, has been well characterized throughout its many years of use. Its tensile characteristics are well documented and understood. Present specifications (ASTM, NEMA, etc.) require only the use of elongation as the measure of copper's temper in its final conductor form. Procurement specifications for materials other than copper should contain requirements for tensile strength or break strength and/or elongation.

TYPICAL TENSILE STRENGTH AND ELONGATION OF COMMON CONDUCTOR ALLOYS								
SOFT ALLOY	psi	kg/mm ²	Elong.		HARD ALLOY	psi	kg/mm ²	Elong.
Copper	32,000	221	10-20%		Copper	60,000	414	1%
Percon 24	60,000	414	8%		Percon 19	110,000	758	1%
C18135	60,000	414	8%		Percon 17	95,000	655	1%
Percon 17	58,000	400	6%		C162	100,000	689	1%
C162	55,000	379	6%		Percon 11	80,000	552	1%
CCS	45,000	310	10%		CCS	110,000	758	1%

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