

Phosphor Bronze (8%), C521 possesses the best spring properties of the Phosphor Bronzes. These properties- hardness, high strength, high elastic limit, formability and resistance to stress relaxation, fatigue and corrosion make this alloy applicable where the most severe forming and functional requirements must be met, where other high strength metals such as steel or stainless steel would fail by corrosion fatigue. It is particularly good for functional parts that are subjected to repeated stresses, such as diaphragms and contact springs.

Chemical Composition

Copper¹	Remainder
Tin	7.0 - 9.0%
Phosphorous	0.03 - 0.35%
Zinc	0.20% Max
Iron	0.10% Max
Lead	0.05% Max

¹ Cu + Named Elements, 99.5% min

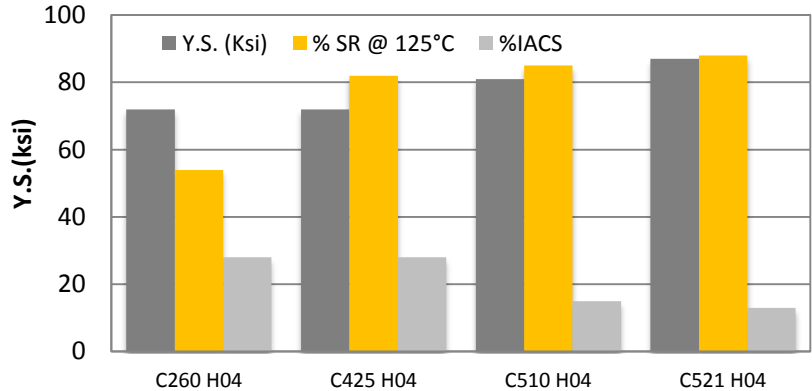


Figure 1: Comparison of Yield Strength, Electrical Conductivity and Stress Relaxation performance (@ 1000hrs) of select high strength spring materials

Physical Properties

	English Units	Metric Units
Melting Point (Liquidus)	1880 °F	1020°C
Density	.318 lbs/in ³ @68°F	8.80 gm/cm ³ @20°C
Thermal Conductivity (Annealed)	36 Btu-ft/ft ² - hr - °F @68°F	0.15 cal-cm/cm ² - sec °C @20°C
Coefficient of Thermal Expansion	10.1 PPM/°F (68-572°F)	18.2 PPM/°C (20-300°C)
Electrical Resistivity (Annealed)	79.8 ohm circ mil/ft @68°F	13.3 microhm-cm @20°C
Electrical Conductivity	13% I.A.C.S. * @68°F	0.0754 megmhos/cm @20°C
Thermal Capacity (Specific Heat)	0.09 Btu/lb/°F @68°F	0.09 cal/gm/°C @20°C
Modulus of Elasticity	16,000,000 psi	110,000 N/mm ²

*International Annealed Copper Standard

Mechanical Properties

Temper ¹	Tensile Strength		Nominal Yield Strength (0.2% Offset)		Nominal % Elongation in 2 Inch (51mm)	Approximate Hardness B Scale .020"- .039" 30T Scale .010"- .029"	Rockwell Hardness
	ksi	N/mm ²	ksi	N/mm ²			
1/4 Hard	63-75	435-515	49	340	50	64-82	59-71
1/2 Hard	69-84	475-580	63	435	37	69-88	63-75
3/4 Hard	80-92	550-635	78	540	25	83-94	71-78
Hard	85-100	585-690	87	600	21	89-95	73-80
Extra Hard	97-112	670-770	100	690	14	93-98	77-82
Spring Hard	105-119	725-820	107	740	6	95-100	78-83
Extra Spring	110-122	760-840	111	765	4	96-101	79-83
Super Spring	117 Min.	805 Min.	110 Min.	760 Min.	2 Max.	—	81 Min.

¹ Mechanical properties subject to change. All tempers listed are made to a Tensile Strength specification unless otherwise noted.

³ DATA FOR REFERENCE ONLY. R/T = Bend Radius/Material Thickness <0.016" (0.4mm) thick, 11/16 (17.5mm) wide.

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