

PIAD

Alloy Selection Guide

Alloy Selection Guide	Alloy No. PIAD Standard	Nominal Chemical Composition	Yield Strength ksi	Tensile Strength ksi	Elongation in 2" %	Brinell Hardness 10 mm /500 kg 3000 kg*	Modulus of Elasticity	Electrical Conductivity % IACS	Notes and Comments
Alloy Group C High Conductivity Copper	C 010	Cu	3-5	25-28	48-44	33-38	17.7 x 10 ⁶	85 (minimum)	Pure electrolytic copper with small additions of de-oxidizers to bind oxygen; excellent electrical and thermal conductivity for application in heat exchangers and electrical switchgear and transformers. Material can be processed in hydrogen atmosphere.
	C 011	Cu	3-5	27-30	35-30	35-44	17.7 x 10 ⁶	98 (minimum)	Pure electrolytic copper with traces of oxygen. Superior electrical and thermal conductivity. Especially suited for application in the electrical industry for parts such as contacts, contact carriers, arc shields. Material <i>cannot</i> be processed in hydrogen atmospheres; welding must be done under an inert gas shield.
	C 021	Cu-Cr	39-44	54-59	25-20	110-130	17.5 x 10 ⁶	70 (minimum)	Age-hardened chromium-copper alloy with an excellent combination of strength, hardness, and electrical conductivity. Should be used when hardness and strength are required besides good electrical conductivity; very well suited for electrical contacts.
	C 030	Cu-Ni-Si	51-56	63-66	15-8	142-161*	17.5 x 10 ⁶	39-43	Age-hardened copper alloy with good thermal and electrical conductivity; especially suited for wire or cable clamps which are used in outside industrial atmosphere; resistant to stress corrosion.
	C 031	Cu-Ni-Si	75-79	78-83	4-3	190-204*	17.3 x 10 ⁶	27-34	Age-hardened copper alloy with same characteristics as C030 but higher mechanical strength and lower electrical properties. Used where good electrical and thermal conductivity is required under high mechanical loads; resistant to stress corrosion. Especially suited for electrode holders in resistance welding equipment.
Alloy Groups M & S Brass and Special Brass	M 010	Cu-Zn	19-24	56-64	58-41	70-95	13.6 x 10 ⁶	22-23	High-quality brass of excellent castability; suitable for complicated thin-wall parts in the electrical, machinery, hardware and equipment industries; resistant to stress corrosion and atmosphere corrosion, excellent plateability. Examples: brushholders, arc horns, meter housings, lock hardware, instrument housings.
	M 030	Cu-Zn-Pb	19-24	42-45	20-16	70-95	13.6 x 10 ⁶	20-22	High-quality brass with good machinability; recommended for parts which require additional machining; not suitable for complicated parts.
	S 010	Cu-Zn-Al	24-30	62-72	50-30	100-125	13.6 x 10 ⁶	19-17	High-quality special brass with good mechanical properties; for parts which require increased yield and tensile strength with applications for electrical switchgear components, high-pressure instrument housings, marine hardware; resistant to corrosion in industrial atmospheres.
	S 012	Cu-Zn	12-13	67-70	34-32	90-95	11.5 x 10 ⁶	36-38	Special brass with high electrical and thermal conductivity; developed for use in electrical equipment: contact carriers, terminal connectors, contacts, etc.; cannot be tin plated; material is not resistant to stress corrosion.
	S 0121	Cu-Zn	16-17	60-62	22-30	85-90	11.9 x 10 ⁶	31-30	Special brass with good electrical and thermal conductivity; for application in electrical equipment; can be tin plated and soldered.

Alloy Group A Aluminum Bronze	S 020	Cu-Zn-Pb-Mn	23-25	42-44	10-8	70-75	14.7 x 10 ⁶	8-9	Special brass with very good bearing qualities, can be used as a substitute for leaded tin bronzes. Application examples: bearings, bushings, clutch rings.
	S 030	Cu-Zn-Fe-Ni-Al	35-42	79-86	20-16	130-150*	15.8 x 10 ⁶	18-19	High-strength yellow brass for components which are subjected to high static pressure and high stresses. Application examples: bearings for motors, parts for high pressure valves, control panels.
	S 031	Cu-Zn-Fe-Al	22-31	65-75	37-28	100-125	13.5 x 10 ⁶	23-24	High-strength yellow brass for applications similar to S030 but better suited for applications where vibration is involved. Application examples: clamping pieces, levers, braces.
	S 034	Cu-Zn-Fe-Al-Mn	21-35	63-76	45-23	100-130	13.8 x 10 ⁶	18-19	High-strength yellow brass with properties similar to S031 but with improved corrosion resistance especially in marine atmosphere.
	S 070	Cu-Zn-Ni	35-38	70-75	17-15	125-140*	15.5 x 10 ⁶	10-11	High-strength "nickel-silver" alloy; has excellent corrosion resistance in many atmospheres; approved for parts used in food industry. Has silver white color and is suitable for decorative parts without plating.
	S 051	Cu-Zn	10-12	37-40	65-60	45-50	16.2 x 10 ⁶	25-24	Special brass with high copper content; good corrosion resistance, not susceptible to stress corrosion, excellent solderability and brazability.
	A 010	Cu-Al	19-22	62-72	65-53	75-95	15.0 x 10 ⁶	15-16	Good corrosion resistance to many chemical agents; excellent for cryogenic applications; shows not embrittlement down to temperatures of -200°C; suitable for application in chemical industry; nonmagnetic.
	A 011	Cu-Al-Fe	27-30	75-85	35-30	95-110	16.0 x 10 ⁶	10-12	Good corrosion resistance to many chemical agents, especially H ₂ SO ₄ and H ₃ PO ₄ ; good corrosion resistance in cold salt water and in salt water atmosphere; weldable; suitable for nonmagnetic applications.
	A 012	Cu-Al-Fe	34-44	85-95	35-25	135-155*	16.0 x 10 ⁶	10-12	Good corrosion resistance in salt water and other water application; weldable and be heat treated; non-sparking. Used for components in the valve and pump industry.
	A 020	Cu-Al-Fe-Ni	58-68	95-108	10-6	190-210*	17.5 x 10 ⁶	8.0 (maximum)	High-strength nickel-aluminum bronze with excellent corrosion resistance in atmosphere, water solution, hot and cold salt water, and many chemical agents. Performs well where cavitation and erosion are factors. Can be welded with common material and with carbon steel. Can be heat treated and is suitable for applications where non-sparking is required.
	A 021	Cu-Al-Fe-Ni	45-51	88-95	20-14	150-170*	17.2 x 10 ⁶	8.0 (maximum)	Properties similar to A020 with reduced mechanical properties but increased ductility. Should be applied where strength and corrosion resistance is required. Weldable and can be heat treated.
	A 022	Cu-Al-Fe-Ni	35-42	83-91	30-20	125-150*	16.9 x 10 ⁶	8.0 (maximum)	Excellent corrosion resistance, similar to A011 but with improved mechanical properties. Can be welded and heat treated.
	A 023	Cu-Al-Fe-Ni	63-78	98-115	7-5	210-230*	18.0 x 10 ⁶	8.0 (maximum)	High-strength nickel-aluminum bronze with excellent wear properties under high loads; used for wear parts, chuck drivers, and heavy loaded spindle nuts. Can be welded and heat treated.
A 0201	Cu-Al-Fe-Ni	63-75	98-115	6-4	210-230*	18.0 x 10 ⁶	8.0 (maximum)	High-strength nickel-aluminum bronze for high mechanical loads, similar to A020 but with increased mechanical properties.	

Alloy Group B Tin Bronzes	A 0202	Cu-Al-Fe-Ni	60-70	98-110	10-5	195-215*	17.5 x 10 ⁶	8.0 (maximum)	High-strength nickel-aluminum bronze with properties similar to A020. Especially developed for shift forks in transmissions for heavy trucks and agricultural equipment.
	A 030	Cu-Al-Fe-Ni	28-32	70-75	40-35	100-110	16.8 x 10 ⁶	8.0 (maximum)	Special aluminum-nickel-manganese bronze with good corrosion resistance and very low permeability; especially suited for applications in instruments where low magnetic properties are required.
	B 010	Cu-Sn	23-25	36-40	6-8	90-100	15.9 x 10 ⁶	11-13	Excellent corrosion resistance to many chemical agents; well suited for chemical and processing industries - housings, flanges, glands; castability of all tin bronzes in permanent mold is inferior to aluminum bronzes and brasses.
	B 011	Cu-Sn-Ni	26-30	48-52	10-13	90-100	16.0 x 10 ⁶	-	Nickel-tin gear bronze; especially suited for worm gears in speed reducers.
	B 012	Cu-Sn-Pb-Ni	23-27	41-45	6-8	80-90	16.0 x 10 ⁶	-	Leaded nickel-tin gear bronze; especially suited for worm gears in speed reducers.
	B 030	Cu-Sn-Al	13-15	30-35	26-30	60-70	18.2 x 10 ⁶	19-20	Special aluminum-tin bronze for wear applications where non-sparking is a requirement.

For More Information Contact

PIAD PRECISION CASTING CORPORATION
 112 Industrial Park Road – Greensburg, PA 15601-9359
 Phone: 724-838-5500 Toll Free: 800-441-9858 Fax: 724-838-5520

Web: www.piad.com