

VALUE OF PERCENT PENETRATION AND SHEAR STRENGTH FOR VARIOUS MATERIALS

Material	Designation	Approximate Chemical Analysis		Approximate Physical Properties	Application & Remarks	
Cast Steel	AISI 1030	Carbon	0.30	Tensile Strength 70,000 PSI	This alloy is used on application where the strength of cast iron is insufficient.	
	ASTM A-16	Manganese	1.00			
	Grade WCB	Phosphorous	0.04			
	UNS J03002	Sulfur	0.05			
		Silicon	0.60			
Carbon Steel Column Pipe	ASTM A536	Carbon	0.30	Tensile Strength 60,000 PSI	Used for deepwell turbine column pipe. In general has poor corrosion resistance properties.	
	Grade B	Manganese	1.20			
	UNS K03005	Phosphorous	0.05			
		Sulfur	0.06			
Carbon Steel Plate	ATSM A36	Carbon	0.25 - 0.27	Tensile Strength 58,000 PSI Yield Strength 36,000 PSI	Used in column flanges, base plates and sole plates. In general has poor corrosion resistance properties.	
	UNS K02600	Manganese	0.80 - 1.20			
		Sulfur	0.05			
		Silicon	0.15 - .04			
Stainless Steel 11.5% - 13.5% Chromium	AISI 410	Chromium	12.50	Tensile Strength 90,000 PSI	One of the least corrosion resistant stainless steels, this alloy has excellent high strength physical properties which are obtained by heat treatment. It has excellent corrosion resistance to atmospheric corrosion. Available in cast and wrought form.	
	ASTM A-743	Silicon	1.00			
	Grade CA-15	Manganese	1.00			
	UNS J91150	Carbon	0.15			
		Molybdenum	0.39			
		Sulfur	0.022			
		Iron	85.00			
Stainless Steel 12% - 14% Chrome	AISI 416	Chromium	13.00	Tensile Strength 100,000 PSI	The addition of sulfur makes alloy highly machinable. Like AISI-410 its corrosion resistance is superior to mild steel but in general but in general does not compare favorably with the 18-8 type stainless steel. Type 416 has excellent mechanical properties obtained by heat treatment and is used almost	
	ASTM B582	Silicon	1.00			
	Condition A	Manganese	1.25			
	SAE 51416	Carbon	0.15			
	UNS S41600	Sulfur	0.25			
		Phosphorous	0.06 Max.			
Stainless Steel Type 18-8 Barstock	AISI 303	Chromium	18.00	Tensile Strength 75,000 PSI	Has excellent corrosion resistance to a wide variety of substances which would attack cast iron and bronze alloys. Strength cannot be increased by heat treatment. Available in cast and wrought form.	
	ASTM B582	Nickel	9.00			
	Condition A	Manganese	2.00			
	UNS S30300	Silicon	1.00			
		Carbon	0.20			
		Sulfur	0.27			
Stainless Steel Type 18-8 Casting	AISI 304	Chromium	18.00	Tensile Strength 65,000 PSI	Due to slightly different chemical analysis this alloy is less susceptible to loss of corrosion resistance resulting from welding than type 302. Strength cannot be increased by heat treatment. It is available in cast and wrought form.	
	ASTM A743	Nickel	10.00			
	Grade CF-8	Manganese	1.50			
	UNS J92600	Silicon	2.00			
		Carbon	0.08 Max.			
Stainless Steel Type 304 Barstock	ASTM A276	Chromium	18.00 - 20.00	Tensile Strength 85,000 PSI	Type 304 is comparable to type 302, but is less susceptible to loss of corrosion resistance resulting from welding. Can be cold worked to greater tensile strength and hardness.	
	AISI 304	Nickel	8.00 - 12.00			
	SAE 30304	Silicon	1.00			
	UNS S30400	Carbon	0.08 Max.			
		Manganese	2.00			
		Phosphorous	0.045			
		Sulfur	0.03			
Stainless Steel Type 18-8 Casting	AISI 316	Chromium	18.00	Tensile Strength 70,000 PSI	The addition of molybdenum makes 316 more resistant to corrosive attack for some applications than the other 18-8 steels. Strength cannot be increased by heat treatment. It is available in cast and wrought form.	
	ASTM A743	Nickel	10.50			
	Grade CF-8M	Manganese	1.50			
	UNS J92900	Molybdenum	2.00			
		Carbon	0.08			
		Silicon	2.00			
Stainless Steel Type 316 Barstock	ASTM A276	Chromium	16.00 - 18.00	Tensile Strength 75,000 PSI	used for shafting where good corrosion resistance is required. Type 316 has superior corrosion resistance to other chromium nickel steels when exposed to sea water and many types of chemicals.	
	Condition A	Nickel	10.00 - 14.00			
	AISI 316	Silicon	1.00			
	SAE 30316	Carbon	0.08 Max.			
	UNS S31600	Manganese	2.00			
		Phosphorous	0.045			
		Sulfur	0.03			
		Molybdenum	2.00			
Stainless Steel Type 17-4 PH	ASTM A564	Chromium	15.00 - 17.50	Tensile Strength 110,000 PSI Brinell Hardness 297	Used on pump shaft requiring high strength and corrosion resistance. Corrosion resistance is similar to 304 stainless steel.	
	Type 630	Nickel	3.00 - 5.00			
	Condition H-1150	Copper	3.00 - 5.00			
	UNS S17400	Carbon	0.07 Max.			
		Sulfur	0.03 Max.			
		Manganese	1.00			
		Silicon	1.00			
Stainless Steel Alloy 20	ASTM A743	Chromium	20.00	Tensile Strength 62,500 PSI Brinell Hardness 130	Completely corrosion resistant to acids.	
	Grade CN-7M	Nickel	29.00			
	UNS J95150	Molybdenum	2.00			
		Copper	3.00			
		Silicon	1.50			
		Manganese	1.50			
Monel Alloy Type K-500	FED QQ-N-286	Nickel	65.00	Tensile Strength 100,000 PSI Brinell Hardness 160	In addition to having corrosion resistance equal to that of monel, this alloy can be heat treated to obtain better mechanical properties. It is available in wrought form only.	
	AMS 476	Copper	29.50			
	UNS N05500	Iron	1.00			
		Manganese	0.60			
		Aluminum	2.80			
Inconel Alloy Type 600	ASTM B166	Nickel	72.00	Tensile Strength 90,000 PSI Brinell Hardness 145	Has a wide range of corrosion resistance to many acids and alkalis. Inconel does not respond to head treatment. It is available in cast and wrought form including spring temper.	
	UNS N06600	Chromium	15.80			
		Iron	7.20			
		Carbon	0.04			
		Manganese	0.20			

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Leaded Red Brass	SAE 40	Copper	85.00	Tensile Strength 30,000 PSI Brinell Hardness 50	Because of its excellent castings & machine characteristic, this alloy is the most commonly used bronze alloy. It is used for a wide variety of parts such as impellers, tube bearings, shaft sleeves, glands, water slingers, etc.	
	ASTM B584	Tin	4.50			
	Alloy 836	Lead	4.50			
	UNS C83600	Zinc	4.50			
		Iron	0.25			
		Nickel	0.75			
		Antimony	0.25			
Leaded Tin Bronze	SAE 621	Copper	86.00	Tensile Strength 36,000 PSI Brinell Hardness 72	Where impeller vanes are such that a metal easy to cast is required, SAE 621 is used.	
	ASTM B143	Tin	8.00			
	Alloy 923	Lead	1.00			
	UNS C92300	Zinc	4.00			
		Nickel	1.00			
Aluminum Bronze	SAE J461	Copper	78.00	Tensile Strength 90,000 PSI Brinell Hardness 190	Good corrosion resistance and high strength. More difficult to machine than other bronzes.	
	ASTM B148	Aluminum	10.00 - 11.00			
	Alloy 955	Iron	3.00 - 5.00			
	UNS C95500	Manganese	3.50			
		Nickel	3.00 - 5.00			
Nickel Aluminum Bronze	ASTM B148	Copper	81.50	Tensile Strength 100,000 PSI Brinell Hardness 179	A high strength, ductile, extra tough corrosion and cavitation resisting material. Especially well suited for marine and sea water applications.	
	Alloy 958	Aluminum	9.00			
	UNS C95800	Iron	4.00			
		Nickel	4.50			
		Manganese	1.00			
Zincless Bronze	SAE 63	Copper	87.50	Tensile Strength 35,000 PSI Brinell Hardness 65	This bronze has its greatest application on bowl and impeller castings where a corrosive such as acid mine water or salt water is being pumped. It is not used unless specifically required for a job.	
	ASTM B505	Tin	9.50			
	Alloy 927	Lead	1.50			
	UNS C92700	Zinc	0.75			
High Leaded Tin Bronze	SAE 64	Copper	79.00	Tensile Strength 25,000 PSI Brinell Hardness 55	Because of its excellent anti-friction properties this bronze alloy commonly used for bearings & wear rings.	
	ASTM B584	Tin	9.50			
	Alloy 932	Lead	9.50			
	UNS C93200	Zinc	0.75			
		Nickel	0.75			
		Antimony	0.55			
High Leaded Tin Bronze Bearing Bronze	SAE 60	Copper	83.00	Tensile Strength 30,000 PSI Brinell Hardness 58	The excellent anti-frictional and corrosion resistant properties of this bronze make it well suited for general purpose bearing applications.	
	ASTM B584	Tin	7.00			
	Alloy 932	Lead	7.00			
	UNS C93200	Zinc	3.00			
Babbitt Nickel Babbitt	ASTM B-23	Tin	88.50	Tensile Strength 11,200 PSI Brinell Hardness 25	Used as a sleeve bearing material and especially applicable where corrosion is a problem such as acid mine water.	
	Alloy 2	Antimony	7.50			
		Copper	3.50			
		Nickel	0.50			
		Lead	0.10			
Navy G Tin Bronze	SAE 620	Copper	88.00	Tensile Strength		
	ASTM B584	Tin	8.00			Brinell Hardness
	Alloy 903	Zinc	4.00			
	UNS C90300					
Manganese Bronze	SAE 43	Copper	58.00	Tensile Strength		
	ASTM B584	Tin	0.50			Brinell Hardness
	Alloy 865	Zinc	39.50			
	UNS C86500	Aluminum	1.00			
		Iron	1.00			
Cast Iron	ASTM A-48	Rarely if ever classified by chemical analysis		Class 30 Tensile Strength	Most commonly used general purpose pump casting materials. Easy to cast and good machinability. Although used rarely if there is a corrosion problem, has been successfully used in salt water, dry chlorine and other fluids. Class 30 used most often. Other classes available if higher strength and wear	
	CL30 UNS F12101			30,000 PSI		
	CL40 UNS F12801			Class 40 Tensile Strength		
	CL50 UNS F13501			40,000 PSI Class 50 Tensile Strength 50,000 PSI		
Ductile Iron	ASTM A536	Rarely if ever classified by chemical analysis		Tensile Strength	Most commonly used for castings.	
	Grade 80-55-06			80,000 PSI		
	UNS F33800			Yield Strength		
				55,000 PSI		
Carbon Steel Shafting	AISI-C1045	Carbon	0.43 - 0.50	Tensile Strength 95,000 PSI Brinell Hardness 150	This carbon steel alloy is the standard material for turbine pump lineshaft.	
	ASTM A576	Manganese	0.60 - 0.90			
	SAE 1045	Phosphorous	0.04			
	UNS G104500	Sulfur	0.05			
Ni-Resist Type I	ASTM A436	Chromium	2.00	Tensile Strength 25,000 - 30,000 PSI Brinell Hardness 130 - 160	Substitute Ni-resist Type II for Ni-resist Type I.	
	UNS F41000	Nickel	13.50 - 17.50			
		Carbon	3.00			
		Silicon	1.00 - 2.50			
		Copper	5.50 - 7.50			
		Manganese	1.00 - 1.50			
Ni-Resist Type II	ASTM A-436	Chromium	1.75 - 2.50	Tensile Strength 25,000 - 30,000 PSI Brinell Hardness 130 - 160	Ni-resist is a comparatively moderately priced alloy which finds application in many corrosive media which do not permit use of standard materials, yet do not require use of the expensive high alloy materials. Available in cast form only.	
	UNS F41002	Nickel	18.00 - 22.00			
		Carbon	3.00			
		Silicon	1.00 - 2.80			
		Copper	0.50			
		Manganese	0.80 - 1.50			
Ni-Resist, Ductile Type D-2C	ASTM A439	Chromium	0.50	Tensile Strength 55,000 - 60,000 PSI Brinell Hardness 130 - 170	Better corrosion resistance than standard ni-resist. Good machinability. Non magnetic. Available in cast form only.	
	Type D-2C	Molybdenum	1.80 - 2.40			
	UNS F53002	Nickel	21.00 - 24.00			
		Silicon	2.00 - 3.00			
		Carbon	2.90			