



	Material	Nominal Chemistry	Tensile Properties		Torsional Properties		Maximum Operating Temperature		Rockwell Hardness	Method of Manufacture	
			Minimum Tensile Strength	Modulus of Elasticity E	Design Stress	Modulus in Torsion G	°F	°C		Chief Uses	Special Properties
			psi x 10 ³ [MPa]	psi x 10 ⁶ [MPa x 10 ³]	% Minimum Tensile	psi x 10 ⁶ [MPa x 10 ³]					
High Carbon Spring Wire	Music Wire ASTM A228	C 0.70-1.00% Mn 0.20-0.60%	230-399 [1586-2751]	30 [207]	45	11.5 [79.3]	250	121	C41-60	Cold drawn high and uniform tensile. High quality springs and wire forms. Suitable for cyclic applications.	
	Hard Drawn ASTM A227	C 0.45-0.85% Mn 0.60-1.30%	CLI 147-283 [1014-1951] CLII 171-324 [1179-2234]	30 [207]	40	11.5 [79.3]	250	121	C31-52	Cold Drawn. Average stress applications. Lower cost springs and wire forms.	
	High Tensile Hard Drawn ASTM A 679	C 0.65-1.00% Mn 0.20-1.30%	238-350 [1641-2413]	30 [207]	45	11.5 [79.3]	250	121	C41-60	Cold Drawn. Higher quality springs and wire forms.	
	Oil Tempered ASTM A 229	C 0.55-0.85% Mn 0.60-1.20%	CLI 165-293 [1138-2020] CLII 191-324 [1317-2234]	30 [207]	45	11.5 [79.3]	250	121	C42-55	Cold drawn and heat treated before fabrication. General purpose spring wire.	
	Carbon Valve ASTM A 230	C 0.60-0.75% Mn 0.60-0.90%	215-240 [1482-1655]	30 [207]	45	11.5 [79.3]	250	121	C45-49	Cold drawn and heat treated before fabrication. Good surface condition and uniform tensile. Suitable for cyclic applications.	
Carbon and alloy- Specialty Spring Grade	Grade B- Carbon ASTM A 1000	C 0.55-0.75% Mn 0.60-0.90%	195-275 [1350-1897]	30 [207]	45	11.5 [79.3]	250	121	C45-49	Annealed and cold drawn or oil tempered, as specified by purchaser.	
	Grade C - Chrome Vanadium ASTM A 1000	C 0.06-0.07% Mn 0.50-0.90% Cr 0.35-0.60% V 0.10-0.50%	210-270 [1450-1860]	30 [207]	45	11.5 [79.3]	425	218	C41-55	Annealed and cold drawn or oil tempered, as specified by purchaser.	
	Grade A - Chrome Silicon ASTM A 1000	C 0.51-0.59% Mn 0.50-0.80% Cr 0.60-0.80% Si 0.20-1.60%	231-305 [1590-2100]	30 [207]	45	11.5 [79.3]	475	245	C48-55	Annealed and cold drawn or oil tempered, as specified by purchaser.	
	Grade D - Chrome Silicon Vanadium ASTM A 1000	C 0.55-0.68% Mn 0.60-0.90% Cr 0.35-0.60% Si 1.20-1.60%	245-320 [1690-2200]	30 [207]	45	11.5 [79.3]	450	230	C45-55	Annealed and cold drawn or oil tempered, as specified by purchaser.	
Alloy Steel Wire	Chrome Vanadium ASTM A 231	C 0.48-0.53% Cr 0.80-1.10% V 0.15 min%	190-300 [1310-2069]	30 [207]	45	11.5 [79.3]	425	218	C41-55	Cold drawn and heat treated before fabrication. Used for shock loads and moderately elevated temperature.	
	Chrome Vanadium Valve ASTM A232	C 0.48-0.53% Mn 0.70-0.90% Cr 0.80-1.10% V 0.15 min%	190-300 [1310-2069]	30 [207]	45	11.5 [79.3]	425	218	C41-55	Cold drawn and heat treated before fabrication. Used for shock loads and moderately elevated temperature.	
	Chrome Vanadium Valve - Modified ASTM A878	C 0.60-0.75% Mn 0.50-0.90% Cr 0.35-0.60% V 0.10-0.25%	205-290 [1414-2000]	30 [207]	45	11.5 [79.3]	430	220	C41-55	Annealed and cold drawn, hardened and tempered before fabrication. Used for shock loads and moderately elevated temperature.	
	Chrome Silicon ASTM A 401	C 0.51-0.59% Cr 0.60-0.80% Sil 1.20-1.60%	235-300 [1620-2069]	30 [207]	45	11.5 [79.3]	475	245	C48-55	Cold drawn and heat treated before fabrication. Used for shock loads and moderately elevated temperature.	
	Chrome Silicon Valve ASTM A877	C 0.51-0.59% Mn 0.50-0.80% Cr 0.60-0.80% Si 1.20-1.60%	245-305 [1690-2100]	30 [207]	45	11.5 [79.3]	475	245	C48-55	Cold drawn, hardened and tempered before fabrication. For shock loading and moderately higher temperature.	
Stainless Steel Wire	AISI 302/304 ASTM A 313	Cr 17.0-19.0% Ni 8.0-10.0%	125-325 [862-2241]	28 [193]	35	10 [69.0]	550	288	C35-45	Cold drawn, general purpose corrosion and heat resistant. Magnetic in spring tempered.	
	AISI 316 A 313	Cr 16.0-18.0% Ni 10.0-14.0% Mo 2.0-3.0%	110-245 [758-1689]	28 [193]	40	10 [69.0]	550	288	C35-45	Cold drawn. Heat resistant and better corrosion resistance than 302. Magnetic in spring temper.	
	17-7 PH ASTM A 313 [631]	Cr 16.0-18.0% Ni 6.50-7.50% Al 0.75-1.50%	Cond CH 235-335 [1620-2310]	29.5 [203]	45	11 [75.8]	650	343	C38-57	Cold drawn and precipitation hardened after fabrication. High strength and general purpose corrosion resistance. Slightly magnetic in spring temper.	

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			Minimum Tensile Strength	Modulus of Elasticity E	Design Stress % Minimum Tensile	Modulus in Torsion G				Chief Uses	Special Properties
							psi x 10 ³ [MPa]	psi x 10 ⁶ [MPa x 10 ³]			
Non-Ferrous Alloy Wire	Phosphor Bronze Grade A ASTM B 159	Cu 94.0-96.0% Sn 4.00-6.00%	105-145 [724-1000]	15 [103]	40	6.25 [43.1]	200	93.3	B98-104	Cold drawn. Good corrosion resistance and electrical conductivity.	
	Beryllium Copper ASTM B 197	Cu 98.0% Be 2.0%	150-230 [1034-1586]	18.5 [128]	45	7.0 [48.3]	400	204	C35-42	Cold drawn and may be mill hardened before fabrication. Good corrosion resistance and electrical conductivity. High physicals.	
	Monel 400 AMS 7233	Ni 66.0% Cu 31.5%	145-180 [1000-1241]	26 [179]	40	9.5 [65.5]	450	232	C23-32	Cold drawn. Good corrosion resistance at moderately elevated temperature.	
High Temperature Alloy Wire	Monel K 500 QQ-N-286 [Fed]	Ni 65.0% Cu 29.5%	160-200 [1103-1379]	26 [179]	40	9.5 [65.5]	550	288	C23-35	Excellent corrosion resistance at moderately elevated temperature.	
	A 286 Alloy [No spring specification]	Ni 26.0% Cr 15.0% Fe 53.0%	160-200 [1103-1379]	29 [200]	35	10.4 [71.7]	950	510	C35-42	Cold drawn and precipitation hardened after fabrication. Good corrosion resistance at elevated temperature.	
	Inconel 600 ASTM B 166	Ni 76.0% Cr 15.8% Fe 7.20%	100-230 [1172-1586]	31 [214]	40	11.0 [75.8]	700	371	C35-45	Cold drawn. Good corrosion resistance at elevated temperature.	
	Inconel 718 [No spring specification]	Ni 52.5% Cr 18.6% Fe 18.50%	210-250 [1448-1724]	29 [200]	40	11.2 [77.2]	1100	593	C45-50	Cold drawn and precipitation hardened after fabrication. Good corrosion resistance at elevated temperature.	
Special Purpose Alloys - Wire	Inconel x 750 AMS 5698, 5699	Ni 73.0% Cr 15.0% Fe 6.75%	No. IT 155 Min. [1069] Spg. T 190-230 [1310-1586]	31 [214]	40	12 [82.7]	750-1100	399-593	C34-39 C42-48	Cold drawn and precipitation hardened after fabrication. Good corrosion resistance at elevated temperature.	
	Elgiloy [R30003] AMS 5833	Co 39.0-41.0% Cr 19.0-21.0% Ni 15.0-16.0% Mo 6.0-8.0% Fe Bal	270-330 [1862-2275]	32 [221]	45	12 [82.8]	850	454	C40-60	Cold drawn and aged. Excellent corrosion resistance in sour environments. Non-magnetic.	
	MP35N [R30035] AMS 5844	Co Bal Ni 33.0-37.0% Cr 19.0-21.0% Mo 9.0-10.5%	260 [1793]	34 [235]	45	11.7 [80.7]	750	399	C35-55	Cold drawn and aged. Excellent corrosion resistance in sour environments.	
	NiSpan C [N09902]	Fe Bal Ni 41.0-43.5% Cr 4.9-5.75% Ti 2.2-2.75% Al 0.3-0.8%	150-190 [1034-1310]	24-29 [166-200]	40	9-10 [62-69]	150	66		Precipitation hardenable. Constant modulus alloy which is heat treatment dependent.	
	C276 [N10276] ASTM B574	Ni Bal Cr 14.5-16.5% Mo 15.0-17.0% W 3.0-4.5% Fe 4.0-7.0%	100-200 [690-1379]	30.7 [210]	40	11.8 [81.4]	700	371		High corrosion resistance. Higher temperature possible with lower stresses.	
	C22 [N06022] ASTM B574	Ni Bal Cr 20.0-22.5% Mo 12.5-14.5% W 2.5-3.5% Fe 2.0-6.0%	100-200 [690-1379]	30.8 [212]	40	11.8 [81.4]	700	371		High corrosion resistance. Higher temperature possible with lower stresses.	
	Rene 41 [N07041]	Ni Bal Cr 18.0-20.0% Mo 9.0-10.5% Co 10.0-12.0% Ti 3.0-3.3% Al 1.4-1.6%	135-200 [931-1379]	31.6 [218]	40	12.1 [83.4]	1800	982		High temperature applications possible with good corrosion/ oxidation resistance	
Ti 3-8-6-4-4 [R58640] 4957	AMS Ti 7.5-8.5% Al 3.0-4.0% V Cr 5.5-6.5% Mo 3.5-4.5% Zr 3.5-4.5%	180-210 [1241-1448]	15.4 [106]	40	5.9 [40.7]	600	316		Cold drawn and aged for best spring characteristics. Non-magnetic. Good strength/ weight ratio. Low modulus.		
Cold Rolled Carbon Steel Strip	Medium Carbon ASTM A 682 1050	AISI C 0.47-0.55% Mn 0.60-0.90%	160-280 [1103-1931]	30 [207]			250	121	B85 Max. Annld. C38-50 Temp.	Cold rolled annealed or tempered. General purpose applications.	
	Regular Carbon ASTM A 682 1074	AISI C 0.69-0.80% Mn 0.58-0.80%	160-320 [1103-2206]	30 [207]			250	121	B85 Max. Annld. C38-50 Temp.	Cold rolled annealed or tempered. Most popular for flat springs.	
	High Carbon ASTM A 682	ASTM AISI 1095 C 0.90-1.04% Mn 0.30-0.50%	180-340 [1241-2344]	30 [207]			250	121	B88 Max. Annld. C40-52 Temp.	Cold rolled annealed or tempered. High stress flat springs.	

	Material	Nominal Chemistry	Tensile Properties		Torsional Properties		Maximum Operating Temperature		Rockwell Hardness	Method of Manufacture	
			Minimum Tensile Strength	Modulus of Elasticity E	Design Stress % Minimum Tensile	Modulus in Torsion G	°F	°C		Chief Uses	Special Properties
			psi x 10 ³ [MPa]	psi x 10 ⁶ [MPa x 10 ³]		psi x 10 ⁶ [MPa x 10 ³]					
Stainless Steel Strip	ASTM A 666	Cr 16.0-18.0% Ni 6.0-8.0%	240-270 [1655-1862]	28 [193]			300	149	C48-52	Cold rolled to high yield strength. Magnetic in spring tempered.	
	ASTM A 666	Cr 17.0-19.0% Ni 8.0-10.0%	185-230 [1276-1586]	28 [193]			550	288	C42-48	Cold rolled. General purpose corrosion and heat resistant. Magnetic in spring tempered.	
	AISI 316	Cr 16.0-18.0% Ni 10.0-14.0% Mo 2.0-3.0%	170-230 [1172-1586]	28 [193]			550	288	C38-48	Cold rolled heat resistant and better corrosion resistance than 302. Magnetic in spring tempered.	
	17-7 PH ASTM A 693 [631] AMS 5529	Cr 16.0-18.0% Ni 6.5-7.5% Al 0.75-1.5%	Cond CH 240 Min. [1655]	29 [200]			650	343	C46 Min.	Cold rolled and precipitation hardened after fabrication. High strength and general purpose corrosion resistance. Magnetic in spring tempered.	
Alloy Steel Strip	Chrome Vanadium AMS 6455	C 0.48-0.53% Cr 0.80-1.10% V 0.15% Min.	200-250 [1379-1724]	30 [207]			425	218.5	C42-48	Cold rolled and heat treated after fabrication. Used for shock loads and moderately elevated temperature.	
	Chrome Silicon 9254	AIS C 0.51-0.59% Cr 0.50-0.80% Si 1.20-1.60%	250-325 [1724-2241]	30 [207]			475	246	C47-51	Cold rolled and heat treated after fabrication. Used for shock loads and moderately elevated temperature.	
Non - Ferrous Alloy Strip	Phosphor Bronze Grade A ASTM B103	Cu 94.0-96.0% Sn 4.0-6.0%	95-110 [655-758]	15 [103]			200	93.3	B94-98	Cold rolled. Good corrosion resistance and electrical conductivity.	
	Beryllium Copper ASTM B194	Cu 98.0% Be 2.0%	180-200 [1241-1379]	16-18.5 [111-128]			400	204	C39	Cold rolled and may be mill hardened before fabrication. Good corrosion resistance and electrical conductivity. High physicals.	
	Monel 400 AMS 4544	Ni 66.0% Cu 31.5%	100-140 [690-765]	26 [179]			450	232	B98 Min.	Cold rolled. Good corrosion resistance at moderately elevated temperature.	
	Monel K 500 QQ - N - 286	Ni 65.0% Cu 29.5% C/Fe/Al/Ti	170-200 [1172-1379]	26 [179]			550	288	C34 Min.	Excellent corrosion resistance at moderately elevated temperature.	
High Temperature Alloy Strip	A 286 Alloy AMS 5525	Ni 26.0% Cr 15.0% Fe 53.0%	160-200 [1103-1379]	29 [200]			950	510	C30-40	Cold rolled and precipitation hardened after fabrication. Good corrosion resistance at moderately elevated temperature.	
	Inconel 600 5540 ASTM B 168	Ni 76.0% Cr 15.8% Fe 7.2%	145-170 [1000-1172]	31 [218]			700	371	C30 Min.	Good corrosion resistance at elevated temperature.	
	Inconel 718 5596, 5597	Ni 52.5% Cr 18.6% Fe 18.5%	180-204 [1241-1407]	29 [200]			1100	593	C36	Cold rolled and precipitation hardened after fabrication. Good corrosion resistance at elevated temperature.	
	Inconel x 750 5542	Ni 73.0% Cr 15.0% Fe 6.75%	150 [1034]	31 [214]			750-1100	399-593	C30 Min.	Cold rolled and precipitation hardened after fabrication. Good corrosion resistance at elevated temperature.	
Special Purpose Alloys - Strip	Elgiloy [R30003] AMS 5875	Co 39.0-41.0% Cr 19.0-21.0% Ni 15.0-16.0% Mo 6.0-8.0% Fe Bal	170-325 [1172-2241]	32 [221]	45	12.0 [82.8]	850	454	C40-58	Cold drawn and aged. Excellent corrosion resistance in sour environment. Non-magnetic.	
	MP35N [R30035]	Co Bal Ni 33.0-37.0% Cr 19.0-21.0% Mo 9.0-10.5%	200 [1379]	34 [235]	45	11.7 [80.7]	750	399	C35-50	Cold drawn and aged. Excellent corrosion resistance in sour environment.	
	NiSpan C [N09902] AMS 5521 AMS 5223 5525	Fe Bal Ni 41.0-43.5% Cr 4.9-5.75% Ti 2.2-2.75% Al 0.3-0.8%	150-190 [1034-1310]	24-29 [166-200]	40	9-10 [62-69]	150	66		Precipitation hardenable. Constant modulus alloy which is heat treatment dependent.	
	C276 [N10276] ASTM B575	Ni Bal Cr 14.5-16.5% Mo 15.0-17.0% W 3.0-4.5% Fe 4.0-7.0%	100-200 [690-1379]	30.7 [210]	40	11.8 [81.4]	700	371		High corrosion resistance. Higher temperature possible with lower stresses.	
	C22 [N06022] ASTM B575	Ni Bal Cr 20.0-22.5% Mo 12.5-14.5% W 2.5-3.5% Fe 2.0-6.0%	100-200 [690-1379]	30.8 [212]	40	11.8 [81.4]	700	371		High corrosion resistance. Higher temperature possible with lower stresses.	