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METRIC

Alloy No.	COPPERS				HIGH PERFORMANCE ALLOYS								BRASSES						LEADED BRASSES		
	102	110	122	1092	151	19020	19025	194	195	197	1972	18080	210	220	226	230	240	260	268	350	353
ASTM Spec. No.	B152	B152	B152	B152	B747	B422	B422	B465	B465	B465	B465	B936	B36	B36	B36	B36	B36	B36	B36	B121	B121
Alloy Name	Oxygen Free Copper	ETP Copper	DHP Copper	Low O ETP Copper	Olin Brass 151	Olin Brass 19020	Olin Brass 19025	Olin Brass 194	Olin Brass 195	Olin Brass 197	Olin Brass 1972	Olin Brass 18080	Gilding Metal	Commercial Bronze	Jewelry Bronze	Red Brass	Low Brass	Cartridge Brass	Yellow Brass	Med Lead Brass	High Lead Brass
Nominal Composition	Cu - Min. 99.95	Cu - Min. 99.9 Oxygen .05 max	Cu - Min. 99.9 P-.015-.040	Cu - Min. 99.9 Oxygen .02 max	Cu - 99.9 Zr - .1	Cu - 98.4 Ni - 1 Sn - .5 P - .05	Cu - 98 Ni - 1 Sn - .9 P - .05	Cu - 97.5 Fe - 2.35 P - .03 Zn - .12	Cu - 97 Fe - 1.5 P - .18 Co - .8 Sn - .6	Cu - 99 Fe - .6 P - .2 Mg - .05	Cu - 99.4 Fe - .3 P - .1 Mg - .13	Cu - 99.2 Cr - .5 Ag - .1 Fe - .08 Ti - .03	Cu - 95 Zn - 5	Cu - 90 Zn - 10	Cu - 87 Zn - 13	Cu - 85 Zn - 15	Cu - 80 Zn - 20	Cu - 70 Zn - 30	Cu - 66 Zn - 34	Cu - 62 Zn - 37 Pb - 1	Cu - 62 Zn - 36 Pb - 2
DENSITY g / cm ³ @ 20°C (± 27.6799 = Lbs. / in ³)	8.94	8.91	8.94	8.91	8.94	8.91	8.91	8.91	8.91	8.83	8.83	8.86	8.86	8.80	8.77	8.75	8.66	8.53	8.47	8.47	8.47
MOD. OF ELAST. kN / mm ² , tension (± 6.8948 = psi X 10 ⁸)	117	117	117	117	121	130	130	121	119	119	119	140	117	117	117	117	110	110	103	103	103
ELECT. COND. MS / m (%IACS) 20°C (68°F) as annealed	58.6 (101)	58.6 (101)	49.3 (85)	58.6 (101)	55.1 (95)	29 (50)	23.2 (40)	34.8 (60)	29 (50)	46.4 (80)	46.4 (80)	46.4 (80)	32.5 (56)	25.5 (44)	23.2 (40)	21.5 (37)	18.6 (32)	16.2 (28)	15.7 (27)	15.1 (26)	15.1 (26)
THERM. COND.0 W / m °K @ 20°C (68°F)	390	390	339	390	371	200	173	260	200	320	320	320	233	189	173	161	139	121	116	113	113
COEF. OF TH. EXP. PPM / °C from 20°C to 300°C (68°F to 572°F)	17.64	17.64	17.64	17.64	17.64	17.46	17.46	17.46	17.28	17.28	17.28	17.64	18	18.36	18.54	18.72	19.08	19.98	20.34	20.34	20.34

TENSILE STRENGTH N / mm² (KSI = N/mm² ÷ 6.8948)

YIELD STRENGTH N / mm² (Nominal 0.2% offset or range) (KSI = N/mm² ÷ 6.8948)

ANNEALED (TM00 / AM)	180-260 70	255-290 90			275-435 260	345-415 195	295-365 160						235-275 70	250-290 85	255-310 105	270-325 90	305-370 140	310-420 145	305-420 160	325-405 160	315-370 145
1/4 HARD (TM01 / 1/4 HM)	235-290 220	275-310 240			325-475 365	415-495 395							255-325 205	275-345 230	290-360 220	305-370 240	330-400 200	340-405 235	340-405 235	340-405 220	340-405 220
1/2 HARD (TM02 / 1/2 HM)	255-315 225	295-350 260	400-485 435	435-525 455	365-435 310	470-540 490	365-435 330	365-435 330					290-360 305	325-395 325	340-405 345	350-420 330	380-450 290	395-460 350	380-450 305	380-450 315	380-450 290
3/4 HARD (TM03)	285-345 295	325-385 345				515-585 530							315-385 345	360-425 370	380-450 400	395-460 380	420-490 365	440-510 425	425-495 365	425-495 415	425-495 380
HARD (TM04 / HM)	295-360 310	365-425 385	450-510 460	495-570 525	415-485 415	565-620 570	415-485 415	415-485 415	480-560 450 Min				345-405 365	395-455 400	415-475 425	435-495 420	470-530 420	490-560 495	470-540 395	470-540 470	470-540 460
EX. HD. (TM05 / SHM)	325-385 345	405-450 415	490-550 505	540-615 550	460-505 460	460-505 460	460-505 460	460-505 460					385-440 405	440-495 435	475-530 485	495-550 470	540-600 470	570-635 570	545-615 460	545-615 545	545-615 540
SPRING (TM06 / XHM)	345-400 360	440-490 455	530 Min 510 Min	580-655 600	485-525 485	605-670 605	485-525 485	485-525 485					415-470 435	475-530 470	415-570 525	540-595 495	585-640 525	625-690 595	595-655 490	595-655 580	595-655 580
EX. SPR. (TM08 / XHMS)	360 Min 350 Min				625-730 670	505-550 505	505-550 505	505-550 505	530-630 520 Min				420-475 440	495-550 485	540-595 540	565-620 525	615-670 540	655-715 615	620-685 505	620-685 615	620-685 605

ELONGATION Nominal % in 50 mm (= % in 2 inches)

DIAMOND PYRAMID HARDNESS Nominal-.020" gauge and over (Converted from appropriate Rockwell Hardness)

ANNEALED (TM00 / AM)	35	38			23	26	20 Min						45	47	40	45	50	53	52	50	56
1/4 HARD (TM01 / 1/4 HM)	23	22			25	14							47	63	61	70	69	75	75	82	71
1/2 HARD (TM02 / 1/2 HM)	71	76			128	128							30	27	28	27	26	46	42	44	48
3/4 HARD (TM03)	20	15	7	15	17	6	17	17					79	83	86	89	93	95	95	95	95
HARD (TM04 / HM)	88	80			104	145	118	122					17	12	19	14	18	30	36	28	35
EX. HD. (TM05 / SHM)	14	8			3								9	6	9	8	10	16	25	16	21
SPRING (TM06 / XHM)	93	89			153								101	114	122	128	135	142	137	137	137
EX. SPR. (TM08 / XHMS)	9	4	5	10	7	2	7	7	8				5	4	6	7	4	10	19	9	12
	100	101			128	159	124	124					110	126	132	140	150	156	150	150	150
	4	2	4	8	2	6	6						2 Max	2	4	4	2	3	7	4	6
	106	106			135	130	130						122	137	145	153	168	174	168	168	168
	3	1 Min	3	6	2	2	5	5					2 Max	1 Min	3	3	1 Min	1 Min	5	3	4
	116	110 Min			140	164	135	135					128	145	153	162	177	184	177	177	177
	3 Max				4	2 Max	1 Min		4				2 Max	1 Max	3 Max	2 Min	1 Max	5 Max	1 Min	5 Max	
	110 Min				143		137						130	150	159	168	180	192	180	180	180

- Alloys in White use standard English temper designations
- Alloys in Blue use standard English temper designations
- Alloys in Yellow use either temper in parenthesis ().

Wieland Rolled Products NA believes the information contained herein to be reliable. However, the technical, the technical information is given by Wieland Rolled Products NA without charge, and the user shall employ such information at his own discretion and risk; Wieland Rolled Products assumes no responsibility for results obtained or damages incurred from the use of such information in whole or in part.

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METRIC

Alloy No.	TIN BRASSES			PHOSPHOR BRONZES			HIGH PERFORMANCE ALLOYS						CUPRO-NICKELS			Cu-Ni-Sn	NICKEL SILVERS		
	422	425	4252	510	511	5118	638	654	655	688	7025	7035	706	710	715	725	752	762	770
ASTM Spec. No.	B591	B591	B591	B103	B103	B103	B422	B96	B96	B592	B422	B422	B122	B122	B122	B122	B122	B122	B122
Alloy Name	Lubronze	Lubaloy X	Olin Brass 4252	5% Phos. Bronze	4% Phos. Bronze	4% Adv. Phos. Bronze	Olin Brass 638	Olin Brass 654	High Silicon Bronze	Olin Brass 688	Olin Brass 7025	Olin Brass 7035	10% Copper Nickel	20% Copper Nickel	30% Copper Nickel	Cu-Ni-Sn	65-18 Nickel Silver	59-12 Nickel Silver	55-18 Nickel Silver
Nominal Composition	Cu - 87.5 Zn - 11.5 Sn - 1	Cu - 88.5 Zn - 9.5 Sn - 2	Cu - 89.5 Zn - 8 Sn - 2.25 Ni - .13 Fe - .13 P - .03	Cu - 94.9 Sn - 5 P - 0.1	Cu - 95.9 Sn - 4 P - 0.1	Cu - 95.5 Sn - 4.2 Fe - .10 Ni - .15 P - .03	Cu - 95 Al - 2.8 Si - 1.8 Co - 0.4	Cu - 95.4 Si - 3.0 Sn - 1.5 Cr - 0.4	Cu - 97.0 Si - 3.0 Sn - .09	Cu - 73.5 Zn - 22.7 Al - 3.4 Co - 0.4	Cu - 96.2 Ni - 3 Si - .65 Mg - 0.15	Cu - 96.8 Ni - 1.5 Co - 1.1 Fe - .08 Si - 0.6	Cu - 88.6 Ni - 10 Fe - 1.4	Cu - 79 Ni - 20 Fe - .5	Cu - 69.4 Ni - 30 Fe - .4	Cu - 88.2 Ni - 9.5 Sn - 2.3	Cu - 65 Zn - 17 Ni - 18	Cu - 59 Zn - 29 Ni - 12	Cu - 55 Zn - 27 Ni - 18
DENSITY g / cm ³ @ 20°C (± 27.6799 = Lbs. / in ³)	8.80	8.77	8.80	8.86	8.86	8.89	8.28	8.55	8.53	8.19	8.80	8.82	8.94	8.94	8.94	8.89	8.75	8.58	8.69
MOD. OF ELAST. kN / mm ² , tension (± 6.8948 = psi X 10 ⁶)	110	110	110	110	110	110	115	117	105	116	131	131	124	138	152	138	124	124	124
ELECT. COND. MS / m (%IACS) 20°C (68°F) as annealed	18 (31)	16.1 (28)	17 (30)	8.7 (15)	11.6 (20)	11.6 (20)	5.8 (10)	4.1 (7)	4.1 (7)	10.4 (18)	23 (40)	29 (50)	5.2 (9)	3.8 (6.5)	2.7 (4.6)	5 (11)	3.5 (6)	5 (9)	3.2 (5.5)
THERM. COND. W / m *K @ 20°C (68°F)	130	121	130	69	86	86	38	36	36	81	173	200	45	36	29	54	31	41	29
COEF. OF TH. EXP. PPM / °C from 20°C to 300°C (68°F to 572°F)	18.36	18.36	18.36	17.82	17.82	17.82	17.1	17.46	18.0	18.18	17.64	17.64	17.1	16.4	16.2	16.56	16.2	16.2	16.74

TENSILE STRENGTH N / mm² (KSI = N/mm² ÷ 6.8948)

YIELD STRENGTH N / mm² (Nominal 0.2% offset or range) (KSI = N/mm² ÷ 6.8948)

ANNEALED (TM00 / AM)	285-340 130	285-325 115		315-355 185	315-370 150		530-600 385			530-600 360	620 -760 450-620		295-345 130	295-365 145	360 Min 195	310-450 145	365-435 170	395-515 250	420-525 220	
1/4 HARD (TM01 / 1/4 HM)	325-395 260	340-405 255		340-420 255	315-400 240		620-705 565	515-620 415	415-510 275	600-695 525			350-460 365	325-435 325	400-495 310	380-515 505 Max	400-495 310	450-560 360	475-600 435	
1/2 HARD (TM02 / 1/2 HM)	370-450 380	395-475 400	400-505 415	400-505 395	380-485 385	475-580 485	690-770 640	595-695 545	495-595 310	670-770 635	655-825 585-760		400-495 435	385-485 395	455-550 470	450-550 470	455-550 435	515-625 485	540-655 540	
3/4 HARD (TM03)	415-495 440	425-510 440	470-545 490	470-545 470	460-565 495	550-635 565	725-805 685	670-770 635			690-860 655-825							510-595 515	570-675 565	605-695 635
HARD (TM04 / HM)	460-545 490	485-565 495	525-625 560	525-625 560	495-600 525	585-690 600	785-870 745	745-825 695	585-685 550	730-825 695		770-900 750-850	490-570 515	460-545 485	515-605 540	515-620 550	540-625 565	620-725 615	635-740 675	
EX. HD. (TM05 / SHM)	515-585 515	525-605 545	605-710 635	605-710 640	580-685 605	670-770 695	815-895 770	800-870 750	655-750 640	780-875 745			505-585 525	495-580 515	550-635 570	550-655 585	595-675 625	695-785 675	705-795 740	
SPRING (TM06 / XHM)	565-635 565	580-650 620	655-760 690	655-760 690	625-725 650	725-820 740	850-925 800	855-915 805	705-800 690	850-915 785	840-970 810-920		540-605 525 Min		580-650 595	585-690 620	620-695 640	750-840 725	745-825 770	
EX. SPR. (TM08 / XHMS)	605 Min. 565 Min	635 Min 600 Min	690-785 710	690-785 715	660-750 675	760-840 770	895 Min 820 Min	905-965 855		860 Min 770 Min						620-725 655	660 Min 655 Min	785 Min 705 Min	800 Min 795 Min	

ELONGATION Nominal % in 50 mm (= % in 2 inches)

DIAMOND PYRAMID HARDNESS Nominal-.020" gauge and over (Converted from appropriate Rockwell Hardness)

ANNEALED (TM00 / AM)	45 71	48 71		55 79	47 75		33 168			35 66	10 Min		35 75	40	30 Min	35 92 Max	35 91	40 103	43 96
1/4 HARD (TM01 / 1/4 HM)	29 100	35 104		41 106	36 88		16 196	33 153	30 130	19 180			12 114	15 103	17 135	5 Min 164 Max	24 110	35 132	26 137
1/2 HARD (TM02 / 1/2 HM)	16 126	20 126	20	24 130	21 120	22	10 206	23 188	17 165	9 200	7 Min		5 132	5 128	6 150	10 150	14 137	18 162	14 168
3/4 HARD (TM03)	7 140	15 147	15	15 156	10 145	18	7 220	13 200			5 Min						8 153	10 174	8 180
HARD (TM04 / HM)	4 150	9 164	10	10 174	7 164	10	4 227	6 213	8 188	4 213		4 Min	1 Min 153	2 150	3 168	3 156	5 164	4 188	4 192
EX. HD. (TM05 / SHM)	2 159	6 180	6	4 188	3 180	6	3 235	4 220	6 200	2 220			1 Min 162	1 Min 159	2 174	2 171	3 180	2 206	1 Min 213
SPRING (TM06 / XHM)	2 168	4 188	4	2 200	3 188	5	2 235	3 235	4 213	1 Min 227		1 Min	1 Max 171		1 Min 177	1 Min 180	1 Min 188	1 Max 220	1 Max 220
EX. SPR. (TM08 / XHMS)	2 Max 168 Min	2 Max 188 Min	3	2 206	2 192	3	2 Max 235 Min	2		2 Max 227 Min						1 Max 184	2 Max 188 Min	1 Max 220 Min	1 Max 220 Min

- Alloys in White use standard English temper designations
- Alloys in Blue use standard English temper designations
- Alloys in Yellow use either temper in parenthesis ().

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