

INDIUM CORPORATION OF AMERICA, EUROPE and ASIA

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INDALLOY SPECIALTY ALLOYS

Typical in-house specifications for alloy percent unless otherwise specified by customer:

- Elements <1% (as dopants not as impurities) ±50% of nominal value
- Elements 1% to <2%: ±0.25% of nominal value
- Elements 2% to <10%: ±0.5% of nominal value
- Elements >10%: ±1.0% of nominal value (Bismuth containing alloys, major constituent ±1.5%)

MECHANICAL PROPERTIES

Indalloy Number	TEMP (Temperature critical alloy: ±2°C of solidus, Non-temperature critical alloy ±3°C)		Elemental Composition (% by Mass)				TEMP		Density lb/in ³ gm/cm ³	Electrical Conductivity (1.72µohms-cm) % of IACS	Thermal Conductivity @ 85°C W/cm ² °C	Thermal Coefficient Expansion @ 20°C PPM/°C	Yield Strength M Pa	Tensile Strength PSI	Shear Strength PSI	Young's Modulus PSI x 10 ⁶	Creep N/mm ²	Elongation %	Brinell Hardness	Wetting Angle °	Latent Heat of Fusion J/g	Specific Heat SOLID J/g ² °C	Specific Heat LIQUID J/g ² °C		
	Liquidus °C	Solidus °C	Liquidus °F	Solidus °F																					
46L	8	7	61.0 Ga	25.0 In	13.0 Sn	1.0 Zn	46	44	0.2348	6.50															
51	11 E	11	62.5 Ga	21.5 In	16.0 Sn		51	51	0.2348	6.50															
60	16 E	16	75.5 Ga	24.5 In			60	60	0.2294	6.35															
77	25	16	95.0 Ga	5.0 In			77	60	0.2222	6.15															
14	30 MP		100.0 Ga				86		0.2133	5.90															
19	60 E	60	51.0 In	32.5 Bi	16.5 Sn		140	140	0.2847	7.88				4850											
162	72 E	72	66.3 In	33.7 Bi			162	162	0.2887	7.99															
174	79 E	79	57.0 Bi	28.0 In	17.0 Sn		174	174	0.3095	8.54															
27	81 E	81	54.0 Bi	29.7 In	16.3 Sn		178	178	0.3060	8.47															
224	108 E	108	52.2 In	46.0 Sn	1.8 Zn		226	226	0.2627	7.27															
53	109 E	109	67.0 Bi	33.0 In			228	228	0.3183	8.81															
1E	118 E	118	52.0 In	48.0 Sn			244	244	0.2637	7.30															
1	125	118	50.0 In	50.0 Sn			257	244	0.2637	7.30	11.7	.34	20	1720	1630				83		4.5 note 2				
71	131	118	52.0 Sn	48.0 In			268	244	0.2637	7.30	11.7	.34	20	1720	1630				83		4.5 note 2				
281	138 E	138	58.0 Bi	42.0 Sn			281	281	0.3083	8.56															
282	140	139	57.0 Bi	42.0 Sn	1.0 Ag		284	282	0.3098	8.57	4.5	.19	15	8000	500					55 note 4	23 note 1	44.8	0.167	0.201	
290	143 E	143	97.0 In	3.0 Ag			290	290	0.2666	7.38	23	.73	22	800											
87	145	118	58.0 Sn	42.0 In			293	244	0.2637	7.30															
203	150	125	95.0 In	5.0 Bi			302	257	0.2675	7.40															
88	150 MP		99.3 In	0.7 Ga			302		0.2641	7.31															
225	151	143	90.0 In	10.0 Sn			304	289	0.2641	7.31															
90	152 MP		99.4 In	0.6 Ga			306		0.2641	7.31															
91	153 MP		99.6 In	0.4 Ga			307		0.2641	7.31															
92	154 MP		99.5 In	0.5 Ga			309		0.2641	7.31															
4	157 MP		100.0 In				314		0.2641	7.31	24	.86	29	273	890	1.57					22 to 41	0.9	28.47	0.243	
281-338	170	138	60.0 Sn	40.0 Bi			338	280	0.2934	8.12	5	.30		7500							35	23.5 note 1	44.4	0.18	0.213
221	174	186	86.5 Sn	5.5 Zn	4.5 In	3.5 Bi	367	345	0.2659	7.36															
227	187	175	77.2 Sn	20.0 In	2.8 Ag		369	347	0.2619	7.25	9.8	.54	28	6800	4800	5.6					47	17			
226	187	181	83.6 Sn	8.8 In	7.6 Zn		369	358	0.2627	7.27				6600		4					85.5				
201	199 E	199	91.0 Sn	9.0 Zn			390	390	0.2627	7.27	15	.61		7940							32.5	21.5 note 1	71.2	0.239	0.272
254	205	204	86.9 Sn	10.0 In	3.1 Ag		401	399	0.2663	7.37															
249	213	211	91.8 Sn	4.8 Bi	3.4 Ag		415	412	0.2688	7.44															
238	217 E	217	90.0 Sn	10.0 Au			423	423	0.2611	7.78															
241	220	217	95.5 Sn	3.8 Ag	0.7 Cu		428	423	0.2674	7.40	13.2			6962	3916						13 (note 6)	36.5	15	42 (note 7)	
252	220	217	95.5 Sn	3.9 Ag	0.6 Cu		428	423	0.2674	7.40															
256	220	217	96.5 Sn	3.0 Ag	0.5 Cu		428	423	0.2674	7.40															
121	221 E	221	96.5 Sn	3.5 Ag			430	430	0.2710	7.50	16	.33	30	25.3 (note 5)	7200	2.41					19.3				
251	225	217	96.2 Sn	2.5 Ag	0.8 Cu	0.5 Sb	437	423	0.2663	7.37															

Indalloy Number	TEMP (Temperature critical alloy: ±2°C of solidus, Non-temperature critical alloy ±3°C)		Elemental Composition (% by Mass)				TEMP		Density lb/in ³ gm/cm ³	Electrical Conductivity (1.72µohms-cm) % of IACS	Thermal Conductivity @ 85°C W/cm ² °C	Thermal Coefficient Expansion @ 20°C PPM/°C	Yield Strength M Pa	Tensile Strength PSI	Shear Strength PSI	Young's Modulus PSI x 10 ⁶	Creep N/mm ²	Elongation %	Brinell Hardness	Wetting Angle °	Latent Heat of Fusion J/g	Specific Heat SOLID J/g ² °C	Specific Heat LIQUID J/g ² °C	
	Liquidus °C	Solidus °C	Liquidus °F	Solidus °F																				
246	225	217	95.5 Sn	4.0 Ag	0.5 Cu		437	423	0.2674	7.40				7470										
123	226	221	97.5 Sn	2.5 Ag			439	430	0.2652	7.34														
258	227	216	98.5 Sn	1.0 Ag	0.5 Cu		441	419	0.2645	7.32				5640		2.15								
243	227 E	227	99.0 Sn	1.0 Cu			441	441	0.2641	7.31														
244	227 E	227	99.3 Sn	0.7 Cu			441	441	0.2641	7.31														
128	232 MP		100.0 Sn				450		0.2630	7.28	15.6	.73	24	1900		6.1								0.222
209	233 MP		65.0 Sn	25.0 Ag	10.0 Sb		451		0.2818	7.80				17000										
129	235 MP		99.0 Sn	1.0 Sb			455		0.2627	7.27														
3	237	143	90.0 In	10.0 Ag			459	289	0.2724	7.54	22.1	.67	15	1650	1600						61		2.7 note 2	
131	238	232	97.0 Sn	3.0 Sb			460	450	0.2623	7.26				1400										
132	240	221	95.0 Sn	5.0 Ag			464	430	0.2670	7.59	12.6		23	8000	3540									0.23
133	240	235	95.0 Sn	5.0 Sb			464	455	0.2519	7.25	11.9		28	5900	6000						30	13.7		
139	251	134	95.0 Bi	5.0 Sn			484	273	0.3483	9.64														
148	271 MP		100.0 Bi				520		0.3541	9.80														
182	280 E	280	80.0 Au	20.0 Sn			536	536	0.5242	14.51				40000	40000	8.57								0.15
156	295	221	90.0 Sn	10.0 Ag			563	430	0.2713	7.51														
160	300	227	97.0 Sn	3.0 Cu			572	441	0.2646	7.52														
172	330	231	95.0 Sn	2.0 As			626	448	0.2516	7.24														
173	345	232	99.0 Sn	1.0 Ge			653	450	0.2623	7.26														
183	356 E	356	88.0 Au	12.0 Ge			673	673	0.5300	14.67														
184	363 E	363	96.8 Au	3.2 Si			685	685	0.5564	15.40														
176	382 E	382	95.0 Zn	5.0 Al			720	720	0.2385	6.60														
186	424 E	424	9																					

Indalloy Number	TEMP (Temperature critical alloy: 22°C of solidus. Non-temperature critical alloy 23°C)		Elemental Composition (% by Mass)			TEMP		Density	Electrical Conductivity (1.72μohms-cm)	Thermal Conductivity @ 85°C	Coefficient Expansion @ 20°C	Yield Strength	Tensile Strength	Shear Strength	Young's Modulus	Creep	Elongation	Brinell Hardness	Wetting Angle	Latent Heat of Fusion	Specific Heat SOLID	Specific Heat LIQUID
	Liquidus	Solidus	Liquidus	Solidus	Elemental Composition (% by Mass)	°F	°F															
207	961 MP	100.0 Ag				1,762		0.3794	10.50													
208	985	665	85.0 Cu	8.0 Sn	7.0 Ag	1,805	1,229	0.3205	8.87													
198	1020	1000	50.0 Au	50.0 Ag		1,868	1,832	0.4914	13.60													
222	1030	1025	99.0 Au	1.0 Ga		1,886	1,877	0.6818	18.87													
199	1030	360	99.4 Au	0.6 Sb		1,886	680	0.6894	19.08													
223	1063 MP	99.8 Au	0.2 P			1,945		0.6843	18.94													
200	1064 MP	100.0 Au				1,948		0.6973	19.30	73.4	3.18	14	20000		11.2		39 to 45(2in)				0.13	

NOTES

- note 1: Brinell Hardness, 2mm ball, 4kg load
- note 2: Modified Brinell hardness, using 100-kg load, 1/2 min.
- note 3: Depends on specimen preparation.
- note 4: % elongation on 5.65 (sq. root Area) gauge length
- note 5: J. Zhao, Y. Miyashita and S.L. Maman: J. Electr. Mater., Vol. 31, 8 (2002) p. 879
- note 6: Results @ 20°C, Multicore Ecosol (MSL Ref. 733 9/99)
- note 7: Mario F. Arenas, Viola L. Acoff

Conversions:

Resistivity of IACS / Elec. conductivity %IACS = Resistivity of alloy
 ex: 1.72 x 100 / %IACS = micro ohm - cm