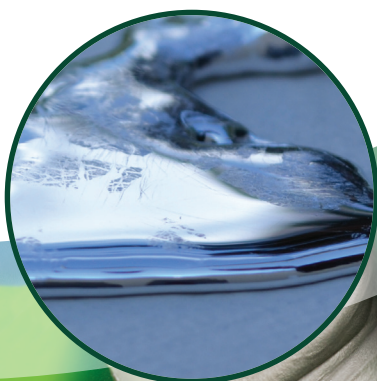
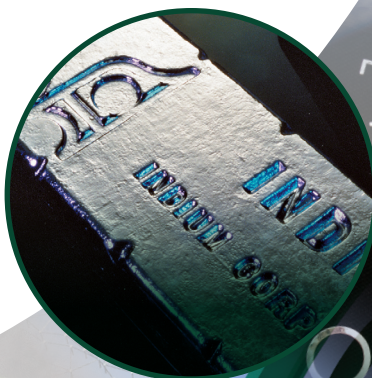
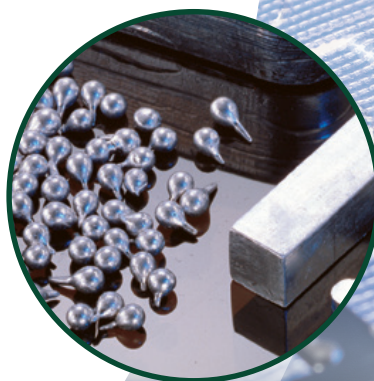
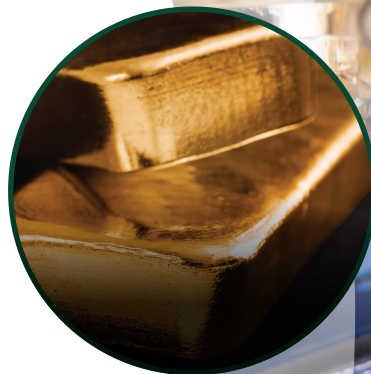


SOLDER ALLOY DIRECTORY

Indium Corporation's Guide to Materials for:

- Soldering
 - PCB
 - Low-Temperature
 - High-Temperature
 - Special Applications
- Metal TIMs
- Hermetic & Cryogenic Sealing



INDALLOY® SPECIALTY ALLOYS

INTRODUCTION

Since our founding in 1934, Indium Corporation has been the world's leader in specialty solders and alloy development. Our R&D staff, including many Ph.D. metallurgists, works with our core set of metals to develop alloys that will address the latest soldering, sealing, and thermal management challenges.

The alloys in this book are the result of decades of listening to our customers and finding solutions that enable cutting-edge technologies. Melting temperatures range from 7–1,064°C.

There are six main alloy families:

- Gallium (Ga)
- Bismuth (Bi)
- Indium (In)
- Tin (Sn)
- Lead (Pb)
- Gold (Au)

There are also other metals that can be used in these alloys:

- Antimony (Sb)
- Silver (Ag)
- Germanium (Ge)
- Cadmium (Cd)
- Copper (Cu)
- Zinc (Zn)

Since the first criteria for choosing a solder is usually the melting temperature, the alloys and pure metals in this book are arranged by melting temperature (°C). We have also included a variety of attributes for many of the solders, as well as information on how the testing was done. The RoHS-compliant alloys are highlighted for your convenience.

Six Alloy Families

The more popular alloys in each family.



Gallium

Since gallium and gallium alloys are liquid at room temperature, they are not typically used for solder applications but find a home with thermal applications. Gallium is also a replacement for the mercury (Hg) in batteries.

Indalloy® #	Composition	Liquidus/Solidus Temperature (°C)
51E	66.5Ga/20.5In/13Sn	11 Eutectic
60	75.5Ga/24.5In	16 Eutectic



Bismuth

Most bismuth alloys are considered low-temperature and many of them are Pb-free. Although bismuth is considered to be fairly brittle, BiSn and BiSnAg are widely used in step-soldering applications and other applications where a lower temperature is required.

Indalloy® #	Composition	Liquidus Temperature (°C)	Solidus Temperature (°C)
281	58Bi/42Sn	138 Eutectic	
282	57Bi/42Sn/1Ag	140	139



Indium

Indium is a very versatile metal, often used for soldering to gold, thermal applications, low-temperature solders, bonding to ceramics, hermetic and cryogenic sealing, and CTE mismatch.

Indalloy® #	Composition	Liquidus Temperature (°C)	Solidus Temperature (°C)
1	50In/50Sn	125	118
1E	52In/48Sn	118 Eutectic	
2	80In/15Pb/5Ag	154	149
3	90In/10Ag	237	143
4	100In	157 Eutectic	
7	50In/50Pb	210	184
164	92.5Pb/5In/2.5Ag	310	300
204	70In/30Pb	175	165
205	60In/40Pb	181	173
227	77.2Sn/20In/2.8Ag	193	113
290	97In/3Ag	143 Eutectic	



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Tin

Tin is the basis for most electronics grade solders. It has excellent wetting, but is not recommended for soldering to thick Au-plating since the tin will leach or scavenge the gold. Adding antimony (Sb) to tin will give higher creep strength at temperatures up to 100°C.

Indalloy® #	Composition	Liquidus Temperature (°C)	Solidus Temperature (°C)
106	63Sn/37Pb (Sn63)	183 Eutectic	
121	96.5Sn/3.5Ag	221 Eutectic	
133	95Sn/5Sb	240	237
256	96.5Sn/3Ag/0.5Cu (SAC305)	220	217



Lead

Alloys containing lead are not RoHS-compliant, so alternatives are being sought to replace the SnPb alloys of the past. Several applications require higher temperatures and can still use lead.

Indalloy® #	Composition	Liquidus Temperature (°C)	Solidus Temperature (°C)
151	92.5Pb/5Sn/2.5Ag	305	298
164	92.5Pb/5In/2.5Ag	310	300



Gold

Gold is considered a noble metal and can be used in fluxless reflow environments. Pure gold has a melting point of 1,064°C but can be alloyed with tin (Sn), silicon (Si), or germanium (Ge) for lower melting points. 80Au/20Sn, a eutectic alloy, is the most popular gold-based alloy.

Indalloy® #	Composition	Liquidus Temperature (°C)	Solidus Temperature (°C)
182	80Au/20Sn	280 Eutectic	
183	88Au/12Ge	356 Eutectic	
184	96.8Au/3.2Si	363 Eutectic	
200	100Au	1,064 Eutectic	

At Indium Corporation, we take pride in offering a range of versatile and top-grade soldering materials, including solder paste, preforms, and wire. We provide a diverse array of alloys and pure metals, each available in a variety of formats to suit your individual specifications and requirements.

As a global leader in our field, our expert Technical Support Engineers are available for consultative support. Whether you prefer communication via phone or email or wish for a personal, onsite visit, our team is ready to offer innovative solutions and professional advice.

We invite you to explore our extensive offering on our website at www.indium.com. Please note that while we strive for diversity in our product selection, some of our alloys may not be available in every form.

Visit our online store below to find research soldering solutions available for immediate purchase.



buy.solder.com



Antimony
Increases tensile strength of solders. Used in flameproofing compounds. Alloyed with indium to form InSb (indium-antimonide) used in infrared/thermal imaging applications.



Often alloyed with Sn or Pb, used in low-temperature solders to reduce PCB warpage. Excellent for component attach of low-temperature flexible circuits.



Cadmium
Increases corrosion resistance of solders. Increases service temperature and strength of solder. Used in electroplating and fission rate control in nuclear reactors.



When alloyed with indium, creates an alloy that is liquid at room temperature and used in thermal applications. Low-temperature metal enables flexible/self-healing circuits and soft robotics.



When alloyed with Au or Al, will reduce the melting point and increase strength. Used as dopant in solders to improve wetting to Ni. Used in fiber optic transmission lines, automotive semiconductor sensors, and catalyst for polyethylene production.



Contact our engineers: askus@indium.com

Nonmetal

Noble Gas

Actinide

									18 8A
									2 He Helium 4.0026
		13 3A	14 4A	15 5A	16 6A	17 7A			
		5 B Boron 10.81	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180		
		13 Al Aluminum 26.982	14 Si Silicon 28.085	15 P Phosphorus 30.974	16 S Sulfur 32.06	17 Cl Chlorine 35.45	18 Ar Argon 39.948		
11 1B	12 2B								
29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.630	33 As Arsenic 74.922	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 83.798		
47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.60	53 I Iodine 126.90	54 Xe Xenon 131.29		
79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98	84 Po Polonium [209]	85 At Astatine [210]	86 Rn Radon [222]		
111 Rg Roentgenium [282]	112 Cn Copernicium [285]	113 Nh Nihonium [286]	114 Fl Flerovium [289]	115 Mc Moscovium [289]	116 Lv Livermorium [293]	117 Ts Tennessine [294]	118 Og Oganesson [294]		

64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.05	71 Lu Lutetium 174.97
96 Cm Curium [247]	97 Bk Berkelium [247]	98 Cf Californium [251]	99 Es Einsteinium [252]	100 Fm Fermium [257]	101 Md Mendelevium [258]	102 No Nobelium [259]	103 Lr Lawrencium [260]



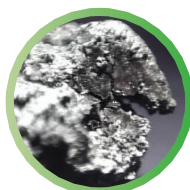
Gold

Highly conductive and resistant to corrosion. High melting point is reduced when alloyed with Sn, Si, or Ge. Used in implantable electronics, high-temperature and harsh environments.



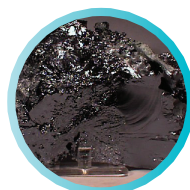
Indium

Soft, pliable, and malleable—even at cryogenic temperatures. Pure indium can form hermetic seals with non-metals, including quartz, ceramic, and glass, and is also a key component in many low-temperature solders. It has high thermal conductivity making it invaluable in TIM applications.



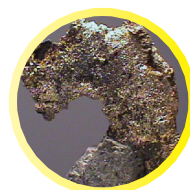
Lead

Economical material, soft and ductile. Offers increased strength when alloyed with other elements. Pb alloys provide high-temperature performance.



Silicon

When used with Au or Al, will reduce melting point, increase strength, and improve wettability. Used to produce silicon wafers and in photovoltaic cells.



Silver

Exhibits the highest electrical and thermal conductivity of all metals. Ag nanoparticles enable low-temperature silver sintering for die-attach applications, such as LED and RF communications.



Tin

Excellent wetting characteristics. Readily forms alloys and intermetallics to improve bond strength. Is a key component in many solders.

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SORTED BY SOLIDUS TEMPERATURE

- Pb- and Cd-Free
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Indalloy® Number	Temperature		Elemental Composition (% by Mass)	Density (g/cc)	Electrical Conductivity (% of IACS Value @ 1.72 = Value * 10% (Sn))	Electrical Conductivity (100% = 1/1.72 ohms-cm) % of IACS	Thermal Conductivity		Thermal Coefficient Expansion @ 20°C	Tensile Strength (psi)	Shear Strength (psi)	Young's Modulus (psi x 10 ⁶)	% Elongation (@ Break)
	Solidus (°C)	Liquidus (°C)					@ 85°C W/cm-°C	@ 20°C W/cm-°C					
46L	6.5	7.6	61Ga/25In/13Sn/1Zn	6.5									
307	7.2	15	70Ga/20In/8Sn/2Zn	7.26									
306	10	19	68.5Ga/21.5In/10Sn	6.44									
51E	11	11	66.5Ga/20.5In/13Sn	6.32									
51	11	17	62.5Ga/21.5In/16Sn	6.5									
60	15.7	15.7	75.5Ga/24.5In	6.35									
300E	15.7	15.7	78.6Ga/21.4In	6.16									
77	16	25	95Ga/5In	6.15									
14	29.8	29.8	100Ga	5.9									
117	47	47	44.7Bi/22.6Pb/19.1In/8.3Sn/5.3Cd	9.16	2.62	4.5	0.15		25	5400			38
16	47	52	44.7Bi/22.6Pb/16.1In/11.3Sn/5.3Cd	9.16									
17	54	56	49.14Bi/20.89In/17.92Pb/ 11.55Sn/0.5Cd	9.01									
140	57	65	47.5Bi/25.4Pb/12.6Sn/9.5Cd/5In	9.47	2.03	3.5	0.15			3720			78
136	58	58	49Bi/21In/18Pb/12Sn	9.01	1.34	2.3	0.11		31	8020		2.6	15
21	58	69	49Bi/18Pb/18In/15Sn	9									
19	60	60	51In/32.5Bi/16.5Sn	7.88	1.92	3.3		0.25	22	3460		3.2	>55
147	61	65	48Bi/25.63Pb/12.77Sn/9.6Cd/4In	9.46									
18	61.5	61.5	61.72In/30.78Bi/7.5Cd	8.02									
158	70	70	50Bi/26.7Pb/13.3Sn/10Cd	9.58	2.33	4	0.18		22	5990			
22	70	73	50.5Bi/27.8Pb/12.4Sn/9.3Cd	9.67									
23	70	73	50Bi/25Pb/12.5Sn/12.5Cd	9.6	1.8	3.1				4550			30
24	70	73	50Bi/25Pb/12.5Sn/12.5Cd (0.05Ag Dopant)	9.59	1.8	3.1				4550			30
26	70	78	50Bi/34.5Pb/9.3Sn/6.2Cd	9.89									
43	70	102	40.5Bi/27.8Pb/22.4Sn/9.3Cd	9.32									
47	70	105	35.3Bi/35.1Pb/20.1Sn/9.5Cd	9.48									
65	70	123	46Pb/30.7Bi/18.2Sn/5.1Cd	9.74									46
162	72	72	66.3In/33.7Bi	7.99									
55	72	113	40Bi/33.4Pb/13.3Sn/13.3Cd	9.63									
35	73	93	50Bi/39Pb/7Cd/4Sn	10.11									
59	75	118	38.2Bi/31.7Sn/26.4Pb/2.6Cd/1.1Sb (Cu Dopant)	9.06									
28	77	82	50Bi/39Pb/8Cd/3Sn	10.13									
25	78	78	48.5Bi/41.5In/10Cd	8.49	2.2	3.78			42.31	5284			37.17
174	79	79	57Bi/26In/17Sn	8.54					15.52	5859			25.72
31	80	89	50.3Bi/39.2Pb/8Cd/1.5Sn/1In	10.15									



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	Solidus (°C)	Liquidus (°C)					@ 85°C W/cm-°C	@ 20°C W/cm-°C					
32	80	89	50.9Bi/31.1Pb/15Sn/2In/1Cd	9.63									70.58
27	81	81	54.02Bi/29.68In/16.3Sn	8.47				0.12	16	6350		2.1	5
29	81	85	50.3Bi/39.2Pb/8Cd/1.5In/1Sn	10.15									
34	83	92	52Bi/31.67Pb/15.33Sn/1Cd	9.69									
33	87	91	51.08Bi/39.8Pb/8.12Cd/1In	10.21					25.19	5807			
36	87	93	51.4Bi/31.4Pb/15.2Sn/2In	9.64									
37	90	94	52Bi/31.7Pb/15.3Sn/1In	9.67	1.45	2.49			24.51	6496			118.34
197	92	92	51.6Bi/40.2Pb/8.2Cd	10.25	1.51	2.59			30	6789			21.54
63	92	121	56.8Bi/41.2Pb/2Cd	10.36									
8	93	93	44In/42Sn/14Cd	7.46			0.36		24	2630			
40	93	99	50Bi/31Pb/19Sn	9.58									
68	93	127	38Pb/37Bi/25Sn	9.48									
38	95	95	52.5Bi/32Pb/15.5Sn	9.71	1.57	2.7	0.13		26	6430		4.1	83
257	95	95.5	52Bi/32Pb/16Sn	9.69			0.13		24	5060	3800	4.1	149
46	95	104	56Bi/22Pb/22Sn	9.37									
57	95	104	50Bi/30Pb/20Sn	9.53									
50	95	108	46Bi/34Pb/20Sn	9.59									
44	95	115	50Bi/25Pb/25Sn	9.32									
69	95	129	51.6Bi/37.4Sn/6In/5Pb	8.58									
76	95	136	36Bi/32Pb/31Sn/1Ag	9.22									
78	95	136	36.7Bi/31.8Pb/31.5Sn (Ag Dopant)	9.19									
80	95	137	36.4Bi/31.8Pb/31.8Sn	9.19									
42	96	96	46Bi/34Sn/20Pb	8.99				0.14	28	7630		4.6	81
49	96	107	45Bi/35Pb/20Sn	9.6									
72	96	133	34Pb/34Sn/32Bi	9.15									
74	96	135	38.4Bi/30.8Pb/30.8Sn (Ag Dopant)	9.21									
81	96	137	43Pb/28.5Bi/28.5Sn	9.43									
83	96	139	38.4Pb/30.8Bi/30.8Sn	9.3									
85	96	143	33.4Bi/33.3Pb/33.3Sn	9.16									
105	96	180	60Sn/25.5Bi/14.5Pb	8.25	3.51	6.04			22.61	8147			9.27
48	98	105	52.2Bi/37.8Pb/10Sn	9.97									
54	98	112	51.6Bi/41.4Pb/7Sn	10.13									
41	100	100	50Bi/28Pb/22Sn	9.44	1.85	3.19			19.63	8666			34.11
45	102	103	54Bi/26Sn/20Cd	8.78									
52	102	108	54.5Bi/39.5Pb/6Sn	10.14	1.17	2.02			26.3	8556			19.18

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	Solidus (°C)	Liquidus (°C)					@ 88°C W/cm ² ·°C	@ 20°C W/cm ² ·°C					
58	103	117	53Bi/42.5Pb/4.5Sn	10.24									
217-440	103	227	48Bi/28.5Pb/14.5Sn/9Sb	9.29	17.44	30				13000			
56	104	113	54.4Bi/43.6Pb/1Sn/1Cd	10.38									
224	108	108	52.2In/46Sn/1.8Zn	7.27	6.17	10.62			29.12	2890			46.01
61	108	119	53.7Bi/43.1Pb/3.2Sn	10.29									
53	109	109	67Bi/33In	8.81									
323	112	191	75.5Sn/20In/3.8Ag/0.7Cu	7.25									
324	112	191	76.5Sn/20In/2.8Ag/0.7Cu	7.25									
● 227	113	193	77.2Sn/20In/2.8Ag	7.25	5.76	9.9	0.54	0.68	28	5990	4800	6.8	8
62	117	120	55Bi/44Pb/1Sn	10.39									
● 1E	118	118	52In/48Sn	7.29	5.28	9.08	0.41		14	3100	1630	3.5	42
● 1	118	125	50In/50Sn	7.29	5.23	9		0.41	14	3100	1630	3.5	42
71	118	131	52Sn/48In	7.296									
87	118	145	58Sn/42In	7.29									
64	120	121	55Bi/44Pb/1In	10.39	1.06	1.82			25.64	7194			30.31
89	120	152	42Pb/37Sn/21Bi	9.16	3.98	6.85			27.68	7788			24.16
98	120	167	50Sn/40Pb/10Bi	8.77									
70	121	130	40In/40Sn/20Pb	7.86									
79	121	136	55.1Bi/39.9Sn/5Pb	8.67									
93	122	160	54.5Pb/45.5Bi	10.59									
253	123	123	74In/26Cd	7.62									
255	124	124	55.5Bi/44.5Pb	10.44	0.99	1.7	0.04	0.13		6940		3.3	30
67	124	126	58Bi/42Pb	10.4									
13	125	125	70In/15Sn/9.6Pb/5.4Cd	7.63			0.39		27	1470	2000		
203	125	150	95In/5Bi	7.4									
73	128	133	56.8Bi/41.2Sn/2Pb	8.6									
101	130	173	50Pb/30Sn/20Bi	9.47									
99	131	170	51.5Pb/27Sn/21.5Bi	9.58									
84	132	139	45Sn/32Pb/18Cd/5Bi	8.63									
5	134	181	37.5Pb/37.5Sn/25In	8.42	4.53	7.8	0.23		23	5260	4300		101
139	134	251	95Bi/5Sn	9.64									
282D	137	141	57.5Bi/41.25Sn/1Ag/0.15Cu/0.1In	8.56									
● 281	138	138	58Bi/42Sn	8.56	2.44	4.2	0.19	0.16	15	11700	5000	6.3	74
322	138	139	60Sn/39Bi/1Ag	8.13									



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	Solidus (°C)	Liquidus (°C)					@ 85°C W/cm-°C	@ 20°C W/cm-°C					
281–338	138	170	60Sn/40Bi	8.12	2.91	5	0.3			7500			35
• 282	139	140	57Bi/42Sn/1Ag	8.57	2.33	4		0.13	15	10600		5.5	114
283	139	140	57.6Bi/42Sn/0.4Ag	8.56						12858		5.7	21.85
230	140	152	54Sn/26Pb/20In (Cu Dopant)	8.06									
95	140	162	48Sn/36Pb/16Bi	8.78									
225	143	151	90In/10Sn	7.31	7.48	12.86			18.2	811			53.05
310	143	156	96In/4Ag	7.4	11.57	19.9				1982		2.3	59.46
309	143	170	95In/5Ag	7.42	13.52	23.25				2141		2.5	57.04
311	143	183	94In/6Ag	7.45	11.65	20.04				1991		2.4	60.23
312	143	190	93In/7Ag	7.45									
• 3	143	237	90In/10Ag	7.54	10.58	18.2		0.71	27	1710	1600	2.5	38
• 290	143.3	143.3	97In/3Ag	7.38	15.17	26.1	0.73	0.84	38	1200		2.1	50
86	144	144	60Bi/40Cd	9.31									
97	144	163	43Sn/43Pb/14Bi	9.02					24	6400		3.5	41
181	145	145	51.2Sn/30.6Pb/18.2Cd	8.45			0.35		24	6260			
94	145	160	50Sn/25Cd/25Pb	8.36									
102	146	176	47.5Pb/39.9Sn/12.6Bi	9.13									
319	149	152	95In/5Sn	7.29									
• 2	149	154	80In/15Pb/5Ag	7.85	9.19	15.8		0.53	22	3370	2150	1.9	40
88	150	150	99.3In/0.7Ga	7.31									
320	151	173	60Pb/40Bi	10.64									
90	152	152	99.4In/0.6Ga	7.31									
91	153	153	99.6In/0.4Ga	7.31									
92	154	154	99.5In/0.5Ga	7.31									
9	154	167	70Sn/18Pb/12In	7.79	7.09	12.2	0.45		24	5320	4190		136
• 4	156.7	156.7	100In	7.31	11.15	19.17		0.83	30.89	386	890	1.73	67
240	160	173	46Sn/46Pb/8Bi	8.97					22	6000		5.2	48
• 204	165	175	70In/30Pb	8.19	5.12	8.8	0.38		28	3450			
235	165	195	58In/39Pb/3Ag	8.59									
234	166	172	49.7Sn/41.8Pb/8Bi/0.5Ag	8.82									
111	170	197	55.5Pb/40.5Sn/4Bi	9.21									
• 205	173	181	60In/40Pb	8.52	4.07	7	0.29		27	4150			
231	174	186	86.5Sn/5.5Zn/4In/3.5Bi	7.36									
103	177	177	67.8Sn/32.2Cd	7.68									

- Pb- and Cd-Free
- Featured Products

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INDALLOY® SPECIALTY ALLOYS

SORTED BY SOLIDUS TEMPERATURE

- Pb- and Cd-Free
- Featured Products

Indalloy® Number	Temperature		Elemental Composition (% by Mass)	Density (g/cc)	Electrical Conductivity % of IACS Value (1/2 = Value * 10 ⁶ S/m)	Electrical Conductivity (100% = 1/1.72 μhm-cm) % of IACS	Thermal Conductivity		Thermal Coefficient Expansion @ 20 °C	Tensile Strength (psi)	Shear Strength (psi)	Young's Modulus (psi x 10 ⁶)	% Elongation (@ Break)
	Solidus (°C)	Liquidus (°C)					@ 85 °C W/cm-°C	@ 20 °C W/cm-°C					
115	177	210	55Pb/44Sn/1Ag	9.11									
100	178	182	62.6Sn/37Pb/0.4Ag	8.41	7.66	13.17			29.19	9177			49.24
104	179	179	62.5Sn/36.1Pb/1.4Ag	8.41	7.62	13.1	0.5	0.45	27	10910	7450	3.3	114
Sn62	179	181	62Sn/36Pb/2Ag	8.44	7.62	13.1	0.45		27	10910	7540	3.3	114
137	179	189	61.5Sn/35.5Pb/3Ag	8.43									
127	179	232	60Pb/37Sn/3Ag	9.39									
210	179	253	70Pb/27Sn/3Ag	9.84									
142	179	260	50Sn/47Pb/3Ag	8.86									
154	179	289	57Pb/40Sn/3Ag	9.26						6593			
226	181	187	83.6Sn/8.8In/7.6Zn	7.27						6600		4	86
106 (Sn63)	183	183	63Sn/37Pb	8.39	7.5	12.9	0.48		25	8720	6200	5	37
107	183	184	65Sn/36Pb	8.33									
108	183	186	70Sn/30Pb	8.16	7.27	12.5		0.5	22	7530	5200	5	49
109	183	191	60Sn/40Pb	8.5	7.33	12.6	0.49		24	7280	5600	4.3	61
110	183	192	75Sn/25Pb	8	7.33	12.6				6593			
113	183	200	55Sn/45Pb	8.68									
308	183	201	82.5Sn/15In/2.3Ag/0.2Cu	6.03	9.01	15.5				6783		7.2	17.58
114	183	205	85Sn/15Pb	7.69									
116	183	212	50Sn/50Pb	8.87	6.34	10.9	0.48		29	6350	5200		70
118	183	213	90Sn/10Pb	7.55									
119	183	216	50Sn/49.5Pb/0.5Sb	8.85									
120	183	218	52Pb/48Sn	8.95									
122	183	222	95Sn/5Pb	7.42									
125	183	227	55Pb/45Sn	9.07									
130	183	238	60Pb/40Sn	9.28	5.87	10.1	0.44		50	7300	4600	3.3	45
135	183	247	65Pb/35Sn	9.49									
141	183	257	70Pb/30Sn	9.72	5.76	9.9	0.34		25	7790	4000	3	11
145	183	268	75Pb/25Sn/	9.96						3420			53
149	183	280	80Pb/20Sn	10.21	5.06	8.7	0.37	0.59	26	5790	3000	2.9	41
153	183	288	85Pb/15Sn	10.47						4700	4470		
213	183.7	183.3	62Sn/38Pb	8.43								4.3	
7	184	210	50In/50Pb	8.86	3.49	6	0.22		27	4670	2680	1.5	55
144	184	263	73.7Pb/25Sn/1.3Sb	9.88									
146	184	270	79Pb/20In/1Sb	10.16						7819			



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Indalloy® Number	Temperature		Elemental Composition (% by Mass)	Density (g/cc)	Electrical Conductivity (% of IACS Value @ 1.72 = Value * 10 ¹⁶ S/m)	Electrical Conductivity (100% = 1/1.72 ohms-cm) % of IACS	Thermal Conductivity		Thermal Coefficient Expansion @ 20°C	Tensile Strength (psi)	Shear Strength (psi)	Young's Modulus (psi x 10 ⁶)	% Elongation (@ Break)
	Solidus (°C)	Liquidus (°C)					@ 88°C W/cm ² °C	@ 20°C W/cm ² °C					
126	185	231	58Pb/40Sn/2Sb	9.17									
134	185	243	63.2Pb/35Sn/1.8Sb	9.39									
138	185	250	68.4Pb/30Sn/1.6Sb	9.63									
301LT	189	205	84.4Sn/12.5In/2.9Ag/0.2Cu	7.4	6.35	10.93		0.43		8360		7.6	17.41
206	197	231	60Pb/40In	9.29	3.02	5.2	0.19		26	5000			
201	199	199	91Sn/9Zn	7.27	8.14	14	0.61		30	8090			57
302	199	215	91.25Sn/2.25Ag/0.5Cu/6Bi	7.4-7.5	7.62	13.1						4.8	
254	204	205	86.9Sn/10In/3.1Ag	7.37	6.84	11.77			18.36	9102			29.78
314	205	221	89.88Sn/5.16Bi/2.54Ag/1.65Sb/ 0.56Cu/0.15In/0.06Ni	7.46									
304	206	217	93.5Sn/3Ag/3Bi/0.5Cu	7.35						11403		6.3	22.9
249	211	213	91.8Sn/4.8Bi/3.4Ag	7.44				0.58		11770		6.7	24
284	212	224	89.7Sn/3.4Ag/3.2Bi/3Sb/0.7Cu (Co, Ni Dopants)	7.41	6.8	11.7						6.8	
238	214	214	90Sn/10Au	7.78						7280			1
277	214	223	89Sn/3.8Ag/3.5Sb/2.5In/ 0.7Cu/0.5Bi	7.32									
292	214	229	86.7Sn/5.5Sb/3.2Ag/3.2Bi/ 0.7Cu/0.5In/0.2Ni	7.4	4.94	8.5			18.57	11776			10.67
258	215	227	98.5Sn/1Ag/0.5Cu	7.32	9.24	15.9		0.43		5640		2.1	13
272	216	226	90Sn/3.8Ag/3.5Sb/1.5Bi/1.2Cu	7.39	6.95	11.96			29.12	10919			14.92
275	216	227	97.2Sn/0.3Ag/0.7Cu/1.6Bi/0.2In	7.33									
241	217	220	95.5Sn/3.8Ag/0.7Cu	7.38	7.91	13.6				6990	3916	7	33
252	217	220	95.5Sn/3.9Ag/0.6Cu	7.38	8.08	13.9				8251		7.7	53.2
256	217	220	96.5Sn/3Ag/0.5Cu	7.35	7.67	13.2		0.61	21.4	5740		6.9	49
246	217	225	95.5Sn/4Ag/0.5Cu	7.4	7.67	13.19			22.03	7582		2.6	40.66
251	217	225	96.2Sn/2.5Ag/0.8Cu/0.5Sb	7.37									
260	217	226	98.5Sn/1Ag/0.5Cu (Mn Dopant)	7.32						5620		2.1	16
263	217	227	99Sn/0.3Ag/0.7Cu	7.31	8.76	15.07				6882		6.7	34.1
268 (SACM0510)	217	227	98.5Sn/0.5Ag/1Cu (Mn Dopant)	7.32	8.9	15.3				4580	3590	7.1	42
278	217	227	98.5Sn/0.5Ag/1Cu (Mn Dopant)	7.3									
321	221	219	93.6Sn/4.7Ag/1.7Cu	7.44									
121	221	221	96.5Sn/3.5Ag	7.36	7.5	12.9	0.33		24	5690	2700	6.8	34
315	221	223	96Sn/4Ag	7.4									
267	221	224	97Sn/3Ag	7.37	7.34	12.63				6773		7.4	54.3
123	221	226	97.5Sn/2.5Ag	7.34									

- Pb- and Cd-Free
- Featured Products

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INDALLOY® SPECIALTY ALLOYS

SORTED BY SOLIDUS TEMPERATURE

- Pb- and Cd-Free
● Featured Products

Indalloy® Number	Temperature		Elemental Composition (% by Mass)	Density (g/cc)	Electrical Conductivity % of IACS Value (1.72 = Value * 10%) (S/m)	Electrical Conductivity (100% = 1/1.72 ohms-cm) % of IACS	Thermal Conductivity		Thermal Coefficient Expansion @ 20°C	Tensile Strength (psi)	Shear Strength (psi)	Young's Modulus (psi x 10 ⁶)	% Elongation (@ Break)
	Solidus (°C)	Liquidus (°C)					@ 85°C W/cm-°C	@ 20°C W/cm-°C					
279	221	228	89.3Sn/5.5Sb/3.8Ag/0.9Cu/0.5In	7.42	6.98	12				12407		7.5	39.75
132	221	240	95Sn/5Ag	7.39	6.8	11.7		0.76	23	5570	3540	5.9	33
156	221	295	90Sn/10Ag	7.51	6.63	11.4		0.48	25			8.5	25
292C	223	230	89.4Sn/5.5Sb/3.2Ag/0.7Cu/ 0.5Bi/0.5In/0.2Ni	7.23	6.51	11.2						8.2	
276	223.6	232.7	90.6Sn/5.5Sb/3.2Ag/0.7Cu	7.32	6.3	10.83			23.11	9859		7.4	30.97
243	227	227	99Sn/1Cu	7.31				0.68	27	5210			38
244	227	227	99.3Sn/0.7Cu	7.31	8.66	14.9		0.66		4070			46
Sn992	227	227	99.2Sn/0.5Cu/0.3Bi (Co Dopant)	7.32	8.08	13.9				7942		6.7	53.13
291 (SN100C)	227	227	99.25Sn/0.7Cu/0.05Ni (Ge Dopant)	7.3					18.11	6285			50.91
291 RPB	227	227	99.95Sn/0.05Ni (Ge Dopant)	7.31									
160	227	300	97Sn/3Cu	7.32	7.44	12.8				4618			
172	231	330	98Sn/2As	7.24									
128	232	232	100Sn	7.28	7.91	13.6	0.73		25	2800		6.1	60
129	232	234	99Sn/1Sb	7.27									
173	232	345	99Sn/1Ge	7.26									
209	233	233	65Sn/25Ag/10Sb	7.8					36	17000			
131	235	237	97Sn/3Sb	7.26					26	3860		5.1	44
10	235	267	75Pb/25In	9.97	2.67	4.6	0.18	0.31	29	5120	3520	2.2	20
● 133	237	240	95Sn/5Sb	7.25	6.51	11.2	0.58-0.61		15	5600	6000		46
236	237	247	83Pb/10Sb/5Sn/2Ag	10.35									
152	239	285	92Pb/5Sn/3Sb	10.82									
264	241	248	91.5Sn/8.5Sb	7.28	6.58	11.32				6332			83.25
259	243	257	90Sn/10Sb	7.24	6.51	11.2	0.49	0.41		8560	2336	6.6	40
313	244	247	92Sn/8Sb	7.28									
233	245	255	85Pb/10Sb/5Sn	10.36	3.49	6				5570			4
150	252	258	81Pb/19In	10.27	2.62	4.5	0.17	0.31	26	4910			24
143	252	260	90Pb/10Sb	10.59									
157	252	295	95Pb/5Sb	10.96	4.59	7.9							
261	262	360	89Bi/11Ag (Ge Dopant)	9.85			0.09			8000		5.4	
265	262	360	89Bi/11Ag	9.85								4.8	
202	266	266	82.6Cd/17.4Zn	8.35									
228	267	290	88Pb/10Sn/2Ag	10.75	5.23	9	0.27	0.52	29	5030		3.9	18
159	275	302	90Pb/10Sn	10.75	5.23	9	0.25	0.36	29	4950	2400	3.6	28
242	275	302	89.5Pb/10.5Sn	10.75	5.17	8.9	0.25		29	4400	2400	2.7	30



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Indalloy® Number	Temperature		Elemental Composition (% by Mass)	Density (g/cc)	Electrical Conductivity (% of IACS Value) 1.72 = Value * 10% (Sn)	Electrical Conductivity (100% = 1/1.72 ohms-cm) % of IACS	Thermal Conductivity		Thermal Coefficient Expansion @ 20°C	Tensile Strength (psi)	Shear Strength (psi)	Young's Modulus (psi x 10 ⁶)	% Elongation (@ Break)
	Solidus (°C)	Liquidus (°C)					@ 85°C W/cm-°C	@ 20°C W/cm-°C					
271	278	289	79Au/21Sn	14.34									
269	278	301	78Au/22Sn	14.17									
270	278	332	75Au/25Sn	13.67									
• 182	280	280	80Au/20Sn	14.51			0.57		15	40000	40000	8.5	2
318	280	280	79.5Au/20.5Sn	14.45									
317	282	283	77Au/23Sn	14.02									
12	290	310	90Pb/5In/5Ag	11	3.26	5.6	0.25		27	5730	3180		23
155	292	292	90Pb/5Ag/5Sn	11			0.25		27				
266	296	301	93.5Pb/5Sn/1.5Ag	11.02	4.48	7.7				5944		3.5	32.01
• 151	298	305	92.5Pb/5Sn/2.5Ag	11.02	4.24	7.3	0.26	0.51	29	4780	2240	2	34
• 164	300	310	92.5Pb/5In/2.5Ag	11.02	3.2	5.5	0.25	0.35	25	4530	2830	2.5	30
11	300	313	95Pb/5In	11.06	2.97	5.1	0.21	0.3	33	5160	3220	2	35
168	300	320	98Pb/2Sb	11.19	4.88	8.4				3484			
161	303	303	97.5Pb/2.5Ag	11.33	5	8.6				4400	2900		42
237	304	304	93Pb/3Sn/2In/2Ag	11.07						4780			
229	304	365	94.5Pb/5.5Ag	11.35	3.49	6	0.23		30	4420			
273	305	310	96Pb/3Sn/1Ag	11.14									
175	305	364	95Pb/5Ag	11.3									
171	308	312	95Pb/5Sn	11.06	4.59	7.9	0.23	0.4	29	4800	2100		21
165	309	309	979.5Pb/1.5Ag/1Sn	11.28	3.49	6	0.23	0.47	31	4060			30
163	309	312	95.5Pb/2.5Ag/2Sn	11.2	5	8.6	0.26		28	4210	2100		
169	310	322	98.5Pb/1.5Sb	11.23						3736			
239	313	313	91Pb/4Sn/4Ag/1In	11.05									
167	315	315	98Pb/1.2Sb/0.8Ga	11.17									
170	327	327	100Pb	11.35	4.59	7.9	0.35		29	1800	1800	2.6	55
185	340	395	95Cd/5Ag	8.73									
• 183	356	356	88Au/12Ge	14.67			0.44		13	26800	26825	10.5	
199	360	1030	99.4Au/0.6Sb	19.08									
• 184	363	363	96.8Au/3.2Si	15.61			0.27		12	36900	31900	12	
194	370	800	98Au/2Si	16.92									
176	382	382	95Zn/5Al	6.59									
186	424	424	55Ge/45Al	3.71									
177	451	465	75Au/25In	13.68									
178	451	485	82Au/18In	14.89									

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INDALLOY® SPECIALTY ALLOYS

SORTED BY SOLIDUS TEMPERATURE

- Pb- and Cd-Free
- Featured Products

Indalloy® Number	Temperature		Elemental Composition (% by Mass)	Density (g/cc)	Electrical Conductivity % of IACS (Value/172 = Value *10 ⁻⁶ S/m)	Electrical Conductivity (100% = 1/172 ohms-cm) % of IACS	Thermal Conductivity		Thermal Coefficient Expansion @ 20 °C	Tensile Strength (psi)	Shear Strength (psi)	Young's Modulus (psi x 10 ⁶)	% Elongation (@ Break)
	Solidus (°C)	Liquidus (°C)					@ 85°C W/cm ² -°C	@ 20°C W/cm ² -°C					
189	521	585	86Al/10Si/4Cu	2.75									
188	577	577	88.3Al/11.7Si	2.66									
190	577	610	92.5Al/7.5Si	2.68									
191	577	630	95Al/5Si	2.69									
214	600	720	60Ag/30Cu/10Sn	9.58									
179	603	705	61Ag/24Cu/15In	9.48									
215	605	620	45Ag/24Cd/16Zn/15Cu	9.11									
219	605	700	35Ag/26Cu/21Zn/18Cd	8.88									
212	605	710	30Ag/27Cu/23Zn/20Cd	8.77									
217	620	650	56Ag/22Cu/17Zn/5Sn	9.21									
216	625	635	50Ag/18Cd/16.5Zn/15.5Cu	9.19									
218	630	690	50Ag/16Cd/15.5Cu/15.5Zn/3Ni	9.21									
211	640	705	80Cu/15Ag/5Pb	7.62									
192	660	660	100Al	2.7									
208	665	985	85Cu/8Sn/7Ag	8.87									
305	685	730	63Ag/27Cu/10In	9.63									
221	690	800	63Ag/28.5Cu/6Sn/2.5Ni	9.71									
220	775	785	71.5Ag/28Cu/0.5Ni	10.01									
193	780	780	72Ag/28Cu	10.01									
195	890	890	80Au/20Cu	15.67									
196	950	950	82Au/18Ni	15.92									
207	961	961	100Ag	10.5									
198	1000	1020	50Au/50Ag	13.6									
223	1063	1063	99.8Au/0.2Pb	18.94									
● 200	1064	1064	100Au	19.3	42.67	73.4	3.18		14	20000		11.2	39 to 45(2in)



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TEST STANDARDS

The following test standards were used to determine the values in this listing.

ASTM B193-02 Standard Test Method for Resistivity of Electrical Conductor Materials

ASTM B769-11 Standard Test Method for Shear Testing on Aluminum Alloys

ASTM D5470-12 Standard Test Method for Thermal Transmission Properties of Thermally Conductive Electrical Insulation Materials

ASTM E1225-13 Standard Test Method for Thermal Conductivity of Solids Using the Guarded-Comparative-Longitudinal Heat Flow Technique

ASTM E1461-13 Standard Test Method for Thermal Diffusivity by the Flash Method

ASTM E228-11 Standard Test Method for Linear Thermal Expansion of Solid Materials with a Push-Rod Dilatometer

ASTM E494-10 Standard Practice for Measuring Ultrasonic Velocity in Materials

ASTM E793-06 Standard Test Method for Enthalpies of Fusion and Crystallization by Differential Scanning Calorimetry

ASTM E8/E8M-13a Standard Test Methods for Tension Testing of Metallic Materials

Ultrasonic Wave Measurements of Elastic Moduli E, G, and μ for Product Development and Design Calculations

GLOSSARY

Density: The mass of a substance divided by its volume

Electrical Conductivity: The rate at which an alloy or metal conducts electricity

Electrical Resistivity: The rate at which an alloy or metal opposes the flow of electricity

Eutectic: An alloy that melts and solidifies at a single temperature that is lower than the melting points of the separate constituents or of any mixture of them

Liquidus: Temperature above which an alloy is entirely liquid

Plastic Range or Plastic Phase: The range between liquidus and solidus where the alloy is not entirely solid or entirely liquid

Solidus: Temperature below which an alloy is entirely solid

Tensile Strength: The resistance of a material to breaking under tension

Thermal Conductivity: The measure of a material to transfer heat from one surface to another

Thermal Resistivity: Property of a material or set of materials to resist heat flow

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INDIUM CORPORATION

WORLDWIDE

Our Goal

Increase our customers' productivity and profitability through premium design, application, and service using advanced materials.

Our Basis for Success

- Excellent product quality and performance
- Superior technical and customer service
- Cutting-edge material research and development
- Extensive product range
- Lowest cost of ownership

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- Engineered solders and alloys
- Metals and compounds
- Nanotechnology
- Semiconductor assembly materials
- Thermal interface materials

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- Provide quality products that meet or exceed customer needs, expectations, and requirements
- Create an organizational culture that focuses on meeting requirements and continuous improvement
- Have products that are compliant with relevant laws and regulations
- Focus on defect prevention
- Respond to input from external and internal customers
- Identify and provide necessary resources



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Indium Corporation recognizes that environmental responsibility is important to the sustainability of our business, our products, our brand, and our place in the community. As we pursue improvements in our business practices, we will remain mindful of the impact we have on the global environment.

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