

RESEARCH  
SOLDER KIT  
INFORMATION



**INDIUM CORPORATION OF AMERICA®**

## RESEARCH SOLDER KIT INSTRUCTIONS

Thank you for choosing a Research Solder Kit from the Indium Corporation of America. Included in this kit are the solders and fluxes you requested, along with some tools to help you in your evaluation. If you have any questions, please contact us (see contact points on back page) and ask an Application Engineer to assist you.

Solder selection depends on many factors, including:

- Maximum soldering temperature
- Maximum and minimum operating temperature
- Lead content
- Base metal compatibility
- Tensile strength
- Corrosion resistance
- Electrical conductivity
- Thermal conductivity
- Thermal coefficient of expansion
- Physical appearance
- Available solder forms

## SAFETY CONSIDERATIONS

When using fluxes and solders, be careful to avoid unsafe conditions. Always make sure your soldering equipment is in good working order and your area is well ventilated. To insure safe working conditions, refer to the Material Safety Data Sheets.

## SOLDERING

When using a soldering iron, follow the manufacturer's instructions for tip size and angle of application to achieve optimum heat transfer.

## MATERIAL COMPATIBILITY IN SOLDERING

Base Metal	Recommended Indalloy Flux #	Recommended Solder Indalloy # (Alloy)	Incompatible Solders
Gold (Au) see NOTE 1 Silver (Ag) see NOTE 2 Platinum (Pt)	#5R, #5RMA	#4 (100%In) #2 (80In 15Pb 5Ag) #7 (50In 50Pb) #10 (75Pb 25In) #11 (95Pb 5In) #150 (81Pb 19In) #204 (70In 30Pb) #205 (60In 40Pb) #206 (60Pb 40In) #164 (92.5Pb 5In 2.5Ag) #290 (97In 3Ag)	Sn, Sn/Pb, Sn/Pb/In, Sn/Pb/Bi
Copper (Cu) Copper Alloys (Brass, Bronze)	#5R, #5RMA #5RA, #4	#42 (46Bi 34Sn 20Pb) #281 (58Bi 42Sn) #104 (62.5Sn 36.1Pb 1.4Ag) #106 (63Sn 37Pb) #121 (96.5Sn 3.5Ag) #133 (95Sn 5Sb)	In, In/Pb, In/Sn In/Pb/Ag
Nickel (Ni)	#4, #5RA	#106 (63Sn 37Pb) #1E (52In 48Sn) #204 (70In 30Pb) #205 (60In 40Pb) #206 (60Pb 40In)	Compatible with most solders
Tin (Sn) Solder Plate (SnPb)	#5RMA, #5RA	#1E (52In 48Sn) #106 (63Sn 37Pb) #121 (96.5Sn 3.5Ag) #281 (58Bi 42Sn)	See NOTE 3
Aluminum (Al)	#3 see NOTE 4	#201 (91Sn 9Zn) #176 (95Zn 5Al)	Sn/Pb has poor corrosion resistance.
Stainless Steel	#2 see NOTE 4	#1E (52In 48Sn) #106 (63Sn 37Pb) #121 (96.5Sn 3.5Ag)	Avoid Pb & Cd for food applications.
Steel	#1 see NOTE 4	#106 (63Sn 37Pb) #121 (96.5Sn 3.5Ag)	Compatible with most solders.

NOTE 1: Indium containing solder is good for operating temperatures less than 125°C.  
For applications above 125°C use #182 (80Au 20Sn) or #183 (88Au 12Ge).

NOTE 2: When soldering to silver (Ag), it is recommended that the solder also contain some Ag, such as #121 (96.5Sn 3.5Ag), #104 (62.5Sn 36.1Pb 1.4Ag), #151 (92.5Pb 5Sn 2.5Ag).

NOTE 3: When using solders that contain indium, if a non-homogeneous mixture exists then the In/Sn eutectic can form which has a melting point of 118°C.

NOTE 4: This flux not recommended for electronic applications.

## CHOICE OF SOLDER

When you selected the solder for your kit, you may have used the chart below to determine the proper melting temperature and other characteristics based on your soldering application.

When soldering, you will need to heat the solder to a temperature that is about 30°C above the liquidus temperature.

## MATERIAL COMPATIBILITY

The solder and flux you have chosen need to be compatible with the base metal you are soldering to. The chart on page 3 shows the proper flux choice for various base metals.

To create a strong solder joint, the surfaces being soldered must be clean and ready to accept the solder. Selecting the proper flux is essential to the process. The choice is based on the metal being soldered, the temperature of the solder, and the application.

## SOLDER SELECTION CHART

Indalloy Number	Composition	Liquidus °C	Solidus °C	Electrical Conductivity % of IACS	Thermal Conductivity W/cm°C @ 85°C	Thermal Coefficient of Expansion PPM/°C @ 20°C	Tensile Strength PSI	APPLICATION NOTES
136	49Bi 21In 18Pb 12Sn	58	58	2.43	0.1	23	6300	Poor wettability but adequate for mechanical joining of metallic substrates if corrosive type flux is used.
42	46Bi 34Sn 20Pb	96	96	—	—	—	—	Can be used on the same metallizations as SnPb based solder.
1E	52In 48Sn	118	118	11.7	0.34	20	1720	Fair wettability on glass, quartz, and many ceramics. Good low-temperature malleability. Compensates for some difference in CTE.
281	58Bi 42Sn	138	138	4.5	0.19	15	8000	Good low melting point solder for electronics assembly or for applications where Cd and Pb are to be avoided. Also good for thermo-electric applications.
290	97In 3Ag	143	143	23	0.73	22	800	Silver added to improve strength. Has nearly the wettability and low-temperature malleability of indium.
2	80In 15Pb 5Ag	154	149	13	0.43	28	2550	Especially useful for soldering against gold because it minimizes leaching. Good thermal fatigue.
4	100In	157	MP	24	0.86	29	273	Pure indium. Soft, ductile metal. Good wettability on many surfaces including glazed ceramics, certain metallic oxides, glass, and quartz. Deforms indefinitely under load. Has no tendency to become brittle making it valuable for cryogenic application.
97	43Pb 43Sn 14Bi	163	144	—	—	24	6400	Good general purpose step soldering alloy.
9	70Sn 18Pb 12In	167	154	12.2	0.45	24	5320	General purpose solder with good physical properties.
204	70In 30Pb	175	165	8.8	0.38	28	3450	Minimizes gold leaching characteristics. Good thermal fatigue properties.
Sn62	62Sn 36Pb 2Ag	179	179	11.9	0.5	27	7000	Good general purpose solder. Can be used on silver metallized surfaces to reduce scavenging.
205	60In 40Pb	181	173	7	0.29	27	4150	Minimizes gold leaching characteristics. Good thermal fatigue properties.
SN63	63Sn 37Pb	183	183	11.5	0.5	25	7500	Standard eutectic tin-lead solder with wide application. Not recommended for use against silver or gold.
227	77.2Sn 20In 2.8Ag	187	175	9.8	0.54	28	6800	Can be used as a replacement for Sn63, Sn62, and Sn60. Has similar melting point and equal or superior physical and mechanical properties. Not for use over 100°C due to 118°C Sn/In eutectic.
201	91Sn 9Zn	199	199	15	0.61	—	7940	Recommended for soldering to aluminum using flux #3.
7	50In 50Pb	210	184	6	0.22	27	4670	Minimizes gold leaching characteristics. Good thermal fatigue properties.
121	96.5Sn 3.5Ag	221	221	16	0.33	30	5620	Use when lead-based solders do not meet temperature, strength, or safety requirements. Not recommended against gold-plated surfaces.
206	60Pb 40In	231	197	5.2	0.19	26	5000	Minimizes gold leaching characteristics. Good thermal fatigue properties.
3	90In 10Ag	237	143	22.1	0.67	15	1650	Silver added to improve strength. Has nearly the wettability and low-temperature malleability of indium.
133	95Sn 5Sb	240	235	11.9	0.28	31	5900	Used to join copper tubing for refrigeration and potable water systems. Good wettability with good creep resistance at elevated temperatures.
10	75Pb 25In	260	240	4.6	0.18	26	5450	Minimizes gold leaching characteristics. Good thermal fatigue properties.
150	81Pb 19In	275	260	4.5	0.17	27	5550	Minimizes gold leaching characteristics. Good thermal fatigue properties.
182	80Au 20Sn	280	280	—	0.57	16	4000	Strong solder with excellent thermal fatigue resistance. Can be used against gold surfaces without flux in inert atmosphere.
165	97.5Pb 1.5Ag 1Sn	309	309	6	0.23	30	4420	Wide application in semiconductor assembly. Often used in reducing atmospheres such as hydrogen.
164	92.5Pb 5In 2.5Ag	310	300	5.5	0.25	25	4560	Particularly good thermal fatigue. Minimal gold leaching properties of indium-lead alloys. Often used in reducing atmospheres such as hydrogen.
171	95Pb 5Sn	312	308	8.8	0.23	30	4000	Highest melting temperature of the tin-lead system.

MP-melting point

## BONDING TO NON-METALS

A unique property of indium is that it will wet and bond to certain non-metallics such as glass, glazed ceramic, mica, quartz, and various metallic oxides. The bond is formed by the adhesion of the indium suboxide to the non-metallic and in turn, metallic indium to its oxide. Since presence of the suboxide is necessary for adhesion, no fluxes can be used since they would reduce the suboxide.

Before bonding, thoroughly clean the non-metallic substrate with a strong alkaline cleaner. Rinse with distilled water and finally rinse with electronics grade acetone or alcohol. In case of glass, quartz, or glazed ceramics, adhesion is enhanced by heating the material to about 350°C then cooling to about 200°C. At this time, apply indium to the heated non-metallic using an indium applicator. Rub gently until the non-metallic is coated with a thin film of indium.

To bond two non-metallic substrates together, precoat each surface with indium as described above. Bring the two pretinned substrates in contact with each other and reflow at 20-30°C over the liquidus temperature of the solder used to pretin.

To bond a non-metallic substrate to a metallic substrate, precoat the non-metallic surface as described above. Pretin the metallic surface with the same indium alloy as used on the non-metallic surface, using an appropriate flux. Completely remove the flux residue. Bring the two pretinned surfaces in contact with each other and reflow at 20-30°C over the liquidus temperature of the solder used to pretin.

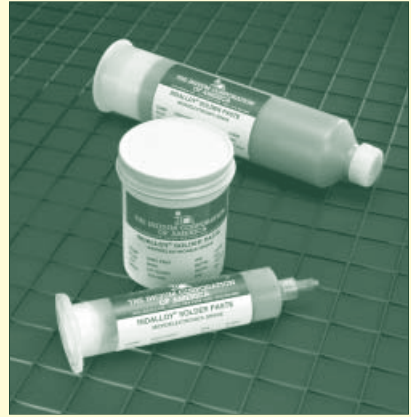
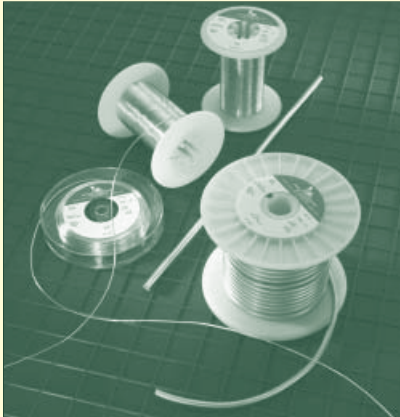
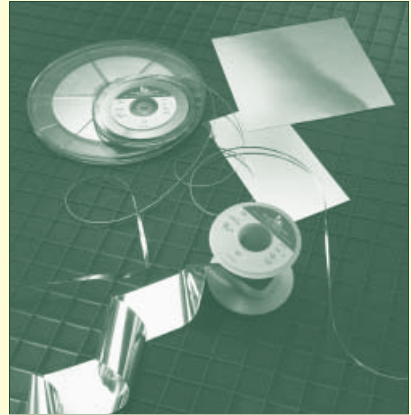
In most cases, ultrasonic energy like that generated by an ultrasonic soldering iron or pot is effective in promoting wetting of the surface. Bond strengths of 400-700/psi are typical of this bonding technique.

All statements, technical information and recommendations contained herein are based on tests, or other information, available to us which we believe to be reliable, but the accuracy or completeness thereof is not guaranteed, and the following is made in lieu of all warranties express or implied, including warranties of merchantability and fitness. Our only obligation shall be to replace such quantities of the product as is proved to be defective provided that a claim is submitted to us within 60 days from the date of shipment. We shall not be liable for any injury, loss or damage, direct or consequential, arising out of the use of or the inability to use the product. It shall be solely the purchaser's obligation to determine the suitability of the product for

his intended use and the purchaser assumes all risk and liability whatsoever in connection therewith.

No statement or recommendation not contained herein shall have any force or effect unless in an agreement signed by an authorized representative or seller.

Since we have no means of controlling the final use of the product by the consumer or purchaser it is the responsibility of the immediate purchaser and any intermediate seller or sellers to inform the user of the purposes for which the product may be fit and suitable and of the properties of the product, including any precautionary measures which must be taken in order to insure the safety of the user and of other third persons and property.



When you have completed your evaluation of the alloys, call us for assistance in helping you design the form that will work best in your application.



If you have any questions, would like to place an additional order for further evaluation, or order production quantities, please contact us at:

**CORPORATE HEADQUARTERS**

Tel: 1-800-446-3486 or 1-315-853-4900

Fax: 1-800-221-5759 or 1-315-853-1000

E-mail: [kits@indium.com](mailto:kits@indium.com)

**ASIA-PACIFIC OPERATIONS**

Tel: +65 268-8678

Fax: +65 268-5646

E-mail: [asiapac@indium.com](mailto:asiapac@indium.com)

**INDIUM CORPORATION OF EUROPE**

Tel: +44 (0) 1908 580400

Fax: +44 (0) 1908 580411

E-mail: [europe@indium.com](mailto:europe@indium.com)

Visit our web site at:

**[www.indium.com](http://www.indium.com)**



**CORPORATE HEADQUARTERS** USA: 1676 Lincoln Avenue, Utica, NY, 13502, USA • [askus@indium.com](mailto:askus@indium.com) • 315-853-4900 or 800-4 INDIUM • FAX 315-853-1000 or 800-221-5759  
**ASIA-PACIFIC OPERATIONS** SINGAPORE: 29 Kian Teck Avenue, 628908, Singapore • [asiapac@indium.com](mailto:asiapac@indium.com) • +65 268-8678 • FAX +65 268-5646

**INDIUM CORPORATION OF EUROPE** UK: 7 Newmarket Court, Kingston, Milton Keynes, MK10 0AG, UK • [europe@indium.com](mailto:europe@indium.com) • +44 (0)1908 580400 • FAX +44 (0)1908 580411

**[www.indium.com](http://www.indium.com)**