

# APPLICATION NOTE

## Indalloy®291

### Used in Wave and Selective Soldering



#### Introduction

**Indalloy®291** is a direct replacement to the previously patent-protected Sn100C®\* alloy. **Indalloy®291** is commonly used in wave soldering and reworking processes as a low-silver, lead-free alternative to SAC305. **Indalloy®291** is available in bar, solder paste, and solid and cored wire.

Product Name	Melting Point	Specific Gravity	Tin	Copper	Nickel	Germanium
Indalloy®291	227°C	7.4	99.25%	0.70%	0.05%	≤0.01%

#### Standard Operating Procedures for Wave and Selective Soldering

Below are **general guidelines** for wave and selective soldering parameters:

##### Wave Soldering

- Depth in wave: 1/2 to 2/3 of board thickness
- Top side preheat temperature: 90–120°C
- Bottom side preheat temperature: 25–35°C above the top side preheat temperature
- Maximum preheat ramp rate: 2°C/second
- Contact time in wave: 3–6 seconds
- Conveyor speed: 3–6ft/minute (0.9–1.8m/minute)
- Solder pot temperature: 250–275°C

##### Selective Soldering

- Top side preheat temperature: 90–120°C
- Bottom side preheat temperature: 25–35°C above the top side preheat temperature
- Maximum preheat ramp rate: 2°C/second
- Contact time in wave: 1–4 seconds
- Solder pot temperature: 290–320°C

#### Circuit Board Finishes and Their Impacts

Board Finish	Impacts to the Solder Pot
Hot Air Level (lead-free)	Unlikely to have any changes
Hot Air Level (lead-containing)	Will contaminate the Indalloy®291 solder pot. RoHS limit is 0.1% maximum for lead and, therefore, the solder pot will have to be frequently monitored to avoid exceeding the limit.
Electroless Nickel Immersion Gold (ENIG)	Gold content will slowly build, but it is uncommon to exceed recommended limits.
Immersion Silver	Silver content will slowly build, but it is uncommon to exceed recommended limits.
Immersion Tin	Unlikely to have any changes.
Organic Soldering Preservative (OSP)	No contamination from the OSP coating, but the copper underneath can dissolve at a quicker rate than ENIG or Immersion Silver, depending on the settings of the wave solder machine. High run rates can contribute to the solder pot exceeding the recommended copper levels quickly. In this case, a copperless replenishment alloy is recommended to bring the solder pot back into proper specification.
Hard/Soft Gold	Some of the gold will dissolve into the solder pot and may lead to the solder pot falling out of the recommended specification. The best way to bring the solder pot back into specification is through dissolution.

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From One Engineer To Another®



Form No. 99835 R0

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### Indalloy® 291 Solder Pot Specifications

Element	Recommended Range by % Weight	Effect When Out of Specification	
Tin (Sn)	Balance		
Copper (Cu)	0.50–0.85%	Cu is high	<ul style="list-style-type: none"> <li>Solder will look dull or grainy</li> <li>Melting point of solder pot will increase</li> <li>Increased dross production rate</li> <li>Solder defects more prevalent (bridging, icicles, poor barrel fill)</li> </ul>
		Cu is low	<ul style="list-style-type: none"> <li>Solder will look dull</li> </ul>
Nickel (Ni)	0.02–0.07%	Ni is high	<ul style="list-style-type: none"> <li>No specification concerns, but there are no benefits to high nickel content above maximum recommended percentage</li> </ul>
		Ni is low	<ul style="list-style-type: none"> <li>Solder will look dull</li> <li>Solder defects more prevalent (bridging, icicles, poor barrel fill)</li> <li>Mechanical strength issues as intermetallic layers of solder joints grow</li> </ul>
Germanium (Ge)	0.010% MAX	Ge is high	<ul style="list-style-type: none"> <li>No specification concerns, but there are no benefits to high germanium content above maximum recommended percentage</li> </ul>
		Ge is low	<ul style="list-style-type: none"> <li>Increased dross creation rate. The formation of tin oxides can create cosmetic issues but does not decrease reliability.</li> <li>Solder defects more prevalent (bridging, icicles, poor barrel fill)</li> </ul>

### Indalloy® 291 Additives

#### • Indalloy® 291 Dross Reducer Bar

Over time, the copper content may increase to a level above the recommended levels, the nickel content may decrease to a level below the recommended levels, or both. In any of these scenarios, the addition of a Replenisher Bar into the solder pot will likely be necessary to bring the solder pot back into specification.

#### • Indalloy® 291 Replenisher Bar

Indalloy® 291 is composed of ≤0.01% germanium but, because it decreases at a faster rate, the addition of a Dross Reduction Bar into the solder pot may be necessary to maintain specification for germanium.

### Dross Formation

Oxygen exposure, humidity, agitation of the solder, and the amount of flux all contribute to the formation of solder dross, however, time and temperature are integral to prevent the formation of dross. A higher operating temperature will accelerate dross generation, as well as prolonged exposure to residual heat in the solder pot. Because increased formation of dross correlates to decreased concentrations of germanium, copper, and nickel in your alloy, Indium Corporation strongly recommends following the low-end of the solder pot temperature spectrum and turning the pot off when not in use.

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All of Indium Corporation's solder paste and preform manufacturing facilities are IATF 16949:2016 certified. Indium Corporation is an ISO 9001:2015 registered company.

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### Packaging

Solder Shape	Weight and Packaging
Indalloy® 291 Triangular Bar	25lb per box
Indalloy® 291 Hanging Bar	Approx. 50lbs per box

### Shelf Life

Product Name	Shelf Life
Indalloy® 291	Indefinite

Indalloy® 291 has an indefinite shelf life when stored in a dry, non-corrosive location. It is possible that the surface may lose its shiny appearance, resulting in a dull shade of gray. This is the result of a surface phenomenon and will not impact the product's performance.



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