

**PRODUCT DATA SHEET**

# Wave Solder Flux WF-9948

## Introduction

**WF-9948** is a fourth generation high-performance no-clean wave solder flux designed for use with through-hole and mixed-technology assemblies. It performs well with both tin-lead and lead-free solders. While only containing about 3.3% flux solids, **WF-9948** is very heat stable and well-suited for selective soldering applications. **WF-9948** has been designed to pass all known reliability requirements, including J-STD-004B SIR and ECM. This modern flux is non-corrosive, compatible with probe testing, compatible with most conformal coatings, and does not contribute to detrimental circuit board insulation resistance degradation or electrochemical migration.

## Features

- **Passes J-STD-004B SIR and ECM requirements for ROL1**
- **Indium Corporation created WF-9948 by adapting Indium's very popular WF-9940 flux to the J-STD-004B requirements**
- **More active than halogen-free formulations**
- **Wide process window for soldering larger and/or thick circuit boards**  
The halogen activator allows for better soldering and heat stability with lower total flux solids than a comparable halogen-free formula.
- **More heat stable than rosin-free formulations**  
Tested compatibility with a wide range of selective solder operations
- **Tested for use with all common lead-free and tin-lead alloys, including:**  
SAC305, SAC105, SAC0307, silver-free tin-copper plus additive alloys, such as Indium Corporation's Sn995, 96.5Sn/3.5Ag, 63Sn/37Pb, 60Sn/40Pb, and many others
- **Tested compatibility with Hot Air Leveled (HASL), Immersion Silver, Electroless Nickel Immersion Gold (ENIG) and Organically Solder Preserved (OSP) Copper Surfaces**
- **Compatible with all spray fluxes**

## Physical Properties

The color of **WF-9948** is light amber, which is representative of fluxes that contain rosin. The solvent blend ensures even distribution of flux solids both during storage and during spray flux deposition. The specific gravity of **WF-9948**, 0.792 @ 25°C, is measurably higher than that of pure isopropyl alcohol. However, in contrast to higher solids content fluxes, specific gravity is not the best method to assign quality standards for **WF-9948**. This is because the flux solids content is relatively low and small amounts of water contamination can confuse specific gravity measurements. While in-process quality control of **WF-9948** is not generally required, the best method to ensure both solids content and activity level is by acid value titration.

Test	Result
<b>Color:</b>	<b>Amber</b>
<b>Specific Gravity:</b> @25°C (77°F) @15.5°C (60°F)	<b>0.792</b> <b>0.799</b>
<b>Acid Value:</b> mgKOH/g flux mgKOH/g flux solids	<b>14.9</b> <b>456</b>
<b>Solids Content</b>	<b>3.27%</b>
<b>Flash Point (°F TCC)</b>	<b>54</b>
<b>J-STD-004B Flux Type</b>	<b>ROL1</b>

Form No. 98829 R2

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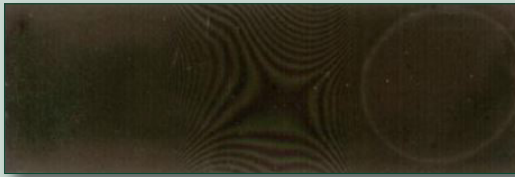


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## Test Data

### Copper Mirror



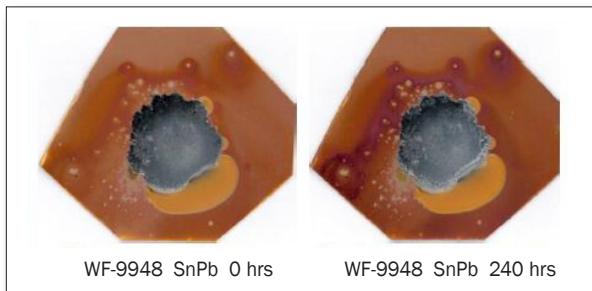
WF-9948

Std Rosin

The J-STD-004 copper mirror test is performed per IPC-TM-650 method 2.3.32. To be classified as an “L” type flux, there should be no complete removal of the mirror surface. **WF-9948** shows no complete removal of the copper mirror and, therefore, is classified as a ROLO.

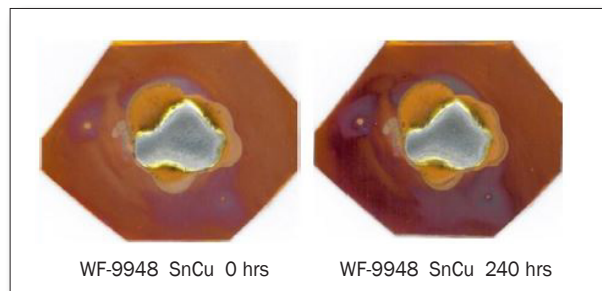
### Copper Corrosion

Copper corrosion is tested per IPC-TM-650 method 2.6.15. This test gives an indication of any visible reactions that take place between the flux residue after soldering and copper surface finishes. In particular, green copper corrosion should not be seen.



WF-9948 SnPb 0 hrs

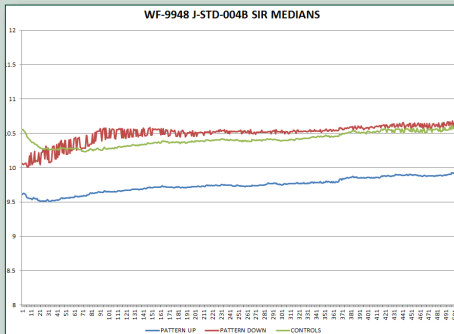
WF-9948 SnPb 240 hrs



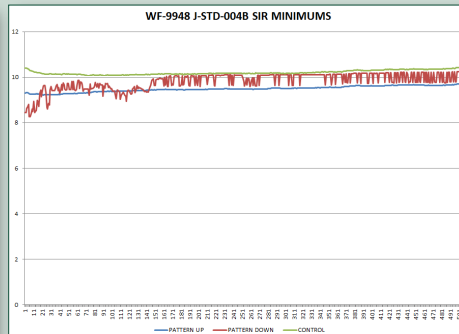
WF-9948 SnCu 0 hrs

WF-9948 SnCu 240 hrs

### Surface Insulation Resistance (SIR)



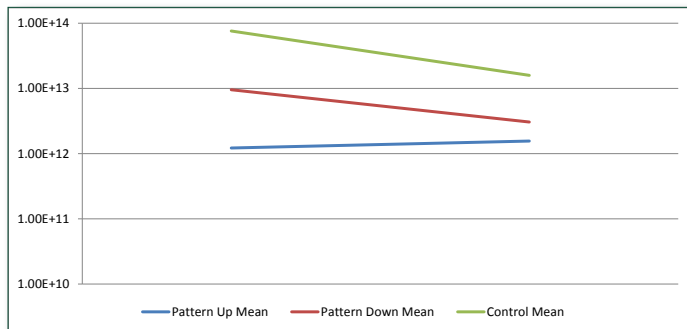
SIR Medians



SIR Minimums

The Surface Insulation Resistance test is performed per IPC-TM-650 Method 2.6.3.7, using boards prepared per IPC-TM-650 method 2.6.3.3. All boards soldered with **WF-9948** pass the requirements of having exhibited no dendritic growth, no visible corrosion, and a minimum insulation resistance of 100 megaohms ( $1 \times 10^8$ ). The values shown on the two adjacent graphs show the number of ohms times ten to the power of the vertical axis. The IPC-TM-650 SIR is a 7-day test and gives a general idea of the effect of the flux residue on the electrical properties of the surface of the circuit board.

### Electromigration (ECM)



J-STD-004B SIR Minimum Values

	Minimum Values	
	Initial	Final
Pattern Up Mean	1.22E+12	1.56E+12
Pattern Down Mean	9.50E+12	3.05E+12
Control Mean	7.60E+13	1.58E+13

The electromigration test is performed to IPC-TM-650 method 2.6.14.1 with boards prepared using IPC-TM-650 method 2.6.3.3. The test conditions for this test are 496 hours at  $65^\circ\text{C} \pm 2^\circ\text{C}$  and  $88.5\% \pm 3.5\% \text{ RH}$ . To pass this test, there should be no visible corrosion and no dendritic growth that decreases line spacing by more than 20%. In addition, the insulation resistance should not drop more than one order of magnitude after the first 96-hour stabilization period when a bias voltage is applied.

## Performance and Process Data

### Hole Fill

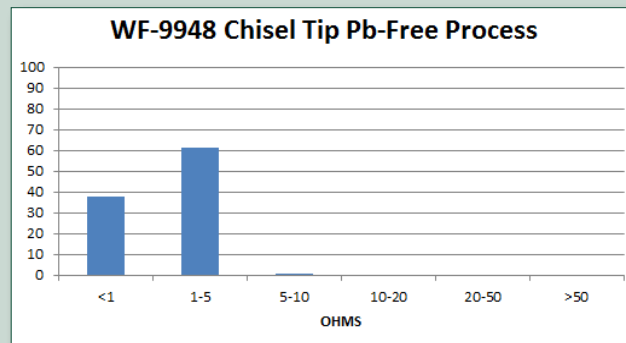
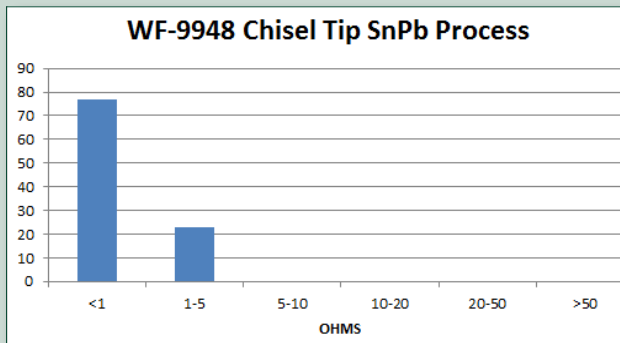


Soldering Performance*		
	Pb-Free	SnPb
100% PTH Fill Yield	97%+	99%
*0.062-inch Indium test board 7 mil to 20 mil diameter PTH		
Soldering Performance**		
	Pb-Free	SnPb
100% PTH Fill Yield	92%+	97%+
**0.093-inch Indium test board 7 mil to 20 mil diameter PTH		

Indium Corporation uses several of its own tests, based on IPC workmanship standards, for determining hole fill. Depending on the design criteria for the flux, Indium Corporation uses holes of varying sizes and circuit board finishes. However, we always look for 100% hole fill, even though the IPC recognizes that a smaller degree of hole fill is acceptable for its workmanship standards. Testing is typically performed with both lead-free (Indium Corporation's Sn995 alloy) and tin-lead (63Sn/37Pb) solders.

### Probe Testability

Indium Corporation tests its wave soldering fluxes using a test method based on IPC-9252, employing a 5.5-ounce chisel point test probe. This method measures the electrical resistance encountered by the test probe as a result of the presence of flux residue.



## Process Recommendations

Indium Corporation tests all of its wave soldering fluxes on its own wave soldering machine prior to making them available to the market.

### 62 mil-thick Circuit Board Process Recommendations

Flux Deposition Rate µg/in <sup>2</sup> solids	Preheat Temp		Preheat Time (sec)	Alloy	Contact Time (sec)	Pot Temp °C
	Top °C	Bottom °C				
500-1000	70-110	90-120	50-75	SnPb	1.5-2.0	250-260
1000-2000	85-120	85-125	50-75	Pb-Free	3-5	265-270

## Shelf Life

The shelf life for this product is **2 years** in an unopened container stored at less than 40°C. Shelf life for an opened container will vary depending on storage conditions, including open time, temperature, and humidity. For longest shelf life of an opened container, replace cap to reduce alcohol evaporation and store in a cool, dry environment.

## Residue Removal Recommendations

All of Indium Corporation's no-clean fluxes, including this formula, are designed to be electrically safe under normal consumer electronic and telecommunication operating conditions. Unless otherwise specified, electrically safe means that the post soldering residues pass J-STD-004B SIR and ECM testing. However, it is understood that some customers desire to remove residues for cosmetic reasons, improved in-circuit testing, improved compatibility with specific conformal coatings, or where the operating parameters of the circuit board may be in extreme conditions for a prolonged period.

If the removal of no-clean flux residues is desired, most commercially available cleaning agents will be effective. Indium Corporation's Technical Support Engineers work closely with cleaning agent vendors and have confirmed flux residue removal capabilities from several vendors using their recommended products and parameters. It is unlikely that users of Indium Corporation's no-clean products will need to change their current residue removal materials and parameters from those currently used. However, when establishing a new process or desiring confirmation of process recommendations, please contact Indium Corporation's Technical Support staff for assistance.

## Wave Solder Flux WF-9948

### Indium Corporation Compatible Products

- Solder Paste: Indium8.9 or Indium10.1
- Cored Wire: CW-807
- Flux Pen: FP-500

Indium Corporation's wave soldering fluxes have been designed to be fully compatible with our solder paste, cored wire, and rework flux, and are also expected to be compatible with many of our competitors' products. For example, **WF-9948** wave solder flux is not only compatible with Indium8.9HF solder paste, but also with our 5.2LS, 8.9 series, 92 series, and 10 series. Indium Corporation determines compatibility primarily by matching flux chemistry. However, a select number of wave, reflow, and rework product combinations have been thoroughly tested to ensure that the combined flux residues meet the electrical and reliability requirements of IPC J-STD-004B. Please contact Indium Corporation Technical Support if you are interested in knowing about these fully-tested combinations.

### Health, Safety, Environmental, and Shipping

#### REACH

No substances of very high concern (SVHC) are used in this product.

#### Hazard Label



#### DOT Classification

Transport in accordance with applicable regulations and requirements. UN 1219, isopropyl alcohol, 3, PG II North America Emergency Guide book - Guide #127

### Additional Information

\*J-STD-004B is the IPC Joint Industry Standard for classifying and testing soldering fluxes. It varies from the prior versions, J-STD-004 and J-STD-004A, in two very important ways. J-STD-004B uses a modified electromigration (ECM) test battery which is designed to better test the effects of the flux in high humidity conditions at normal operating temperatures and voltages. The environmental test is specifically designed to try to create dendritic growth and create failure in marginal flux formulas, unlike the prior version of J-STD-004 which used higher temperatures and voltages that did not grow dendrites as easily. Also, J-STD-004B halogen testing now reveals the total amount of halogen in a flux by first using an oxygen bomb to disassociate any halogen from the chemical compounds that they are bound to, and then collecting and quantifying them. Prior versions of J-STD-004 were unable to detect halogens that were present, but only disassociated at high temperatures (such as soldering temperature). As such, prior testing methods might give the user a false sense that no halogens are present in the flux, when in fact they are. Indium Corporation strongly supports the enhanced features of J-STD-004B because it better serves the users need for information.

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