

PRODUCT DATA SHEET

WF-9946-NP

Wave Solder Flux

Introduction

WF-9946-NP is an alcohol, halogen-free, rosin containing no-clean wave solder flux designed for wave soldering through-hole, bottom-side surface mount and mixed-technology circuit boards. It performs well with both Pb-free and SnPb solders and processes. **WF-9946-NP** is formulated using a non-ozone depleting alcohol for environmentally friendly manufacturing. **WF-9946-NP** exhibits low tendency to form green corrosion even when the flux is trapped and not allowed to outgas. The **WF-9946-NP** contains no halogens and passes BS EN 14582 as halogen-free.

Features

- Light color residue
- Pin testable
- Pb-free and SnPb compatible
- Compatible with Hot Air Solder Leveled (HASL), Immersion Silver, Electroless Nickel Immersion Gold (ENIG), and Organically Solder Preserved (OSP) Copper surface finishes
- Uses a non-ozone-depleting solvent for environmentally friendly manufacturing
- Halide- and Halogen-free formulation
- Conforms to J-STD-004B Flux Type ROL0

Physical Properties

As received, Indium Corporation's **WF-9946-NP** flux is light amber in color. This amber color is a result of more than one-half of the 5.25% flux solids being composed of amber-colored rosin or rosin derivatives. The balance of the flux is an anhydrous alcohol having a flash point of 22°C. This solvent blend ensures even distribution of flux solids both during storage and during spray flux deposition. The specific gravity of **WF-9946-NP**—0.815 at 25°C—is measurably higher than that of pure alcohol. However, in contrast to higher solids content fluxes, specific gravity is not the best method to quality control **WF-9946-NP**. This is because flux solids content is relatively low and small amounts of water contamination can confuse specific gravity measurements. While in-process quality control of **WF-9946-NP** is not generally required, the best method to ensure both solids content and activity level is by acid value titration. The **WF-9946-NP** formula contains no ionic or nonionic halogenated compounds. The total halogen content, as shipped, is warranted not to exceed 50ppm.

Test	Result
Color	Amber
Specific Gravity at 25°C (77°F) at 15°C (60°F)	0.815 0.821
Acid Value mgKOH/g flux mgKOH/g flux solids	20.6 382
Solids Content	5.25
Flash Point (°F TCC)	22°C
J-STD-004B Flux Type	ROL0

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Test Data

Copper Mirror

The J-STD-004B copper mirror test is performed per IPC-TM-650 method 2.3.32. To be classified as a Type L flux, there should be no complete removal of the mirror surface. **WF-9946-NP** shows no removal of the copper mirror.

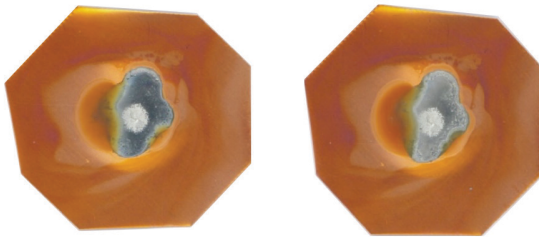


WF-9946-NP

Standard Rosin

Copper Corrosion

IPC-J-STD-004B Copper Corrosion



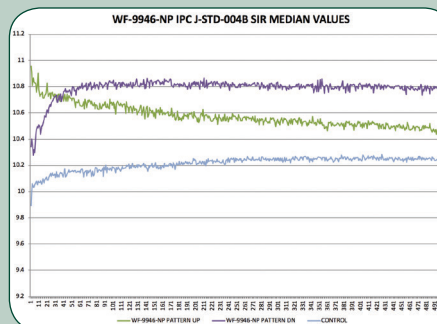
Pb-Free 0 Hours

Pb-Free 240 Hours

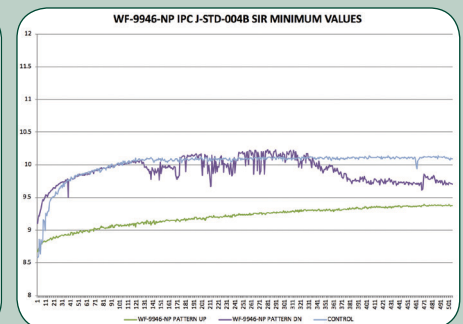
Copper corrosion is tested per IPC-TM-650 method 2.6.15. This test gives an indication of any visible reactions that take place between the flux residue after soldering and copper surface finishes with exposure to high humidity. In particular, one should not see green copper corrosion for a Type L flux.

Surface Insulation Resistance (SIR)

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-9946-NP** pass the requirements of having exhibited no dendritic growth, no visible corrosion, and a minimum insulation resistance of 100 megohms (Log 8). 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.



SIR Medians



SIR Minimums

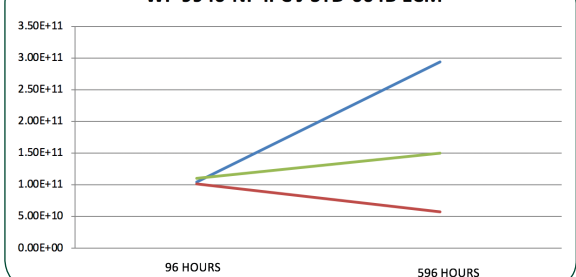
Electrochemical Migration (ECM)

J-STD-004B Insulation Resistance Values

	Average Values	
	Initial	Final
Pattern Up	1.04E+11	2.94E+11
Pattern Down	1.01E+11	5.80E+10
Control	1.10E+11	1.50E+11

The electrochemical migration 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 596 hours at $65^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and $88.5\% \pm 3.5\%$ RH. To pass this test, there shall be no visible corrosion, there shall be no dendritic growth that decreases line spacing by more than 20% and the insulation resistance shall not drop more than one order of magnitude after the first 96 hour stabilization period when a bias voltage is applied.

WF-9946-NP IPC J-STD-004B ECM



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Performance and Process Data



Hole Fill

Indium Corporation uses several of its own tests, based on the IPC workmanship standards, for determining hole fill. Depending on the design criteria for the flux, Indium Corporation will use holes of varying size 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 performed with both lead-free (typically Indium Corporation's SN995 alloy) and tin-lead (typically 63Sn/37Pb) solder.

Soldering Performance*

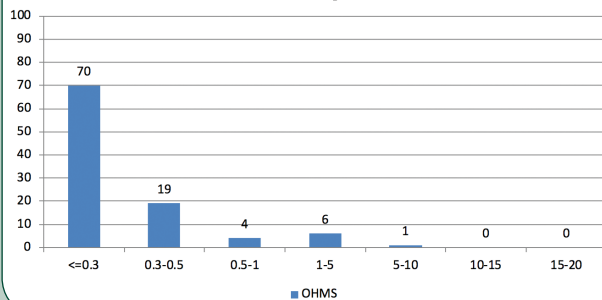
	Pb-Free
100% PTH Fill Yield	97%+

*0.062" 4-layer Indium Corporation test board

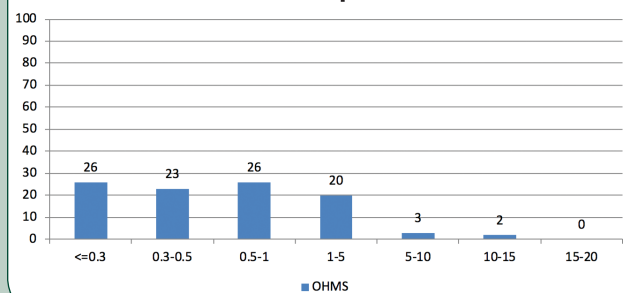
Probe Testability

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

WF-9946-NP Chisel Tip Pb-Free Process



WF-9946-NP Crown Tip Pb-Free Process



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.

62mil-thick Circuit Board Process Recommendations

Flux Deposition Rate µg/in ² solids	Preheat Temp		Preheat Time (sec)	Alloy	Contact Time (sec)	Pot Temp (°C)
	Top (°C)	Bottom (°C)				
500–2,000	80–145	80–145	60–100	Pb-free	3.5–5.5	265–275
500–1,000	60–110	60–120	50–75	SnPb	1.5–3.0	245–260

93mil-thick Circuit Board Process Recommendations

Flux Deposition Rate µg/in ² solids	Preheat Temp		Preheat Time (sec)	Alloy	Contact Time (sec)	Pot Temp (°C)
	Top (°C)	Bottom (°C)				
750–2,000	80–145	80–145	90–130	Pb-free	4.5–6.5	265–275
500–1,000	60–110	60–120	50–75	SnPb	1.5–3.0	245–260

Shelf Life

The shelf life for this product is **2 years** in an unopened container stored at less than 35°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 Surface Insulation Resistance and Electrochemical Migration 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 employed. However, when establishing a new process or desiring confirmation of process recommendations, please contact Indium Corporation's Technical support staff. We are always pleased to be of assistance.

Contact our engineers: askus@indium.com

Learn more: www.indium.com



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Indium Corporation Compatible Products

- **Solder Paste:** Indium8.9HF
- **Cored Wire Fluxes:** CW-807
- **Rework Fluxes:** FP-500

Indium Corporation has a long history of testing soldering product compatibility and has designed its solder pastes, wave fluxes, cored wires, and rework fluxes so that they are compatible with each other. Based on our experience, we have learned that Indium Corporation products that have been individually designed to meet the requirements of a certain specification, such as IPC J-STD-004B, will yield test results meeting the same requirements when combined, as typically determined by Surface Insulation Resistance (SIR) and Electrochemical Migration (ECM) testing. It is also possible that competitors' products and those that cross different specification revisions, such as an Indium Corporation solder paste tested to J-STD-004, a competitor wave flux tested to J-STD-004A, and an Indium Corporation cored wire tested to the requirements of J-STD-004B, will also be compatible when tested under one of the above versions, but it is not as certain. In these cases, where there is doubt, we prefer to run actual testing to confirm compatibility. Indium Corporation maintains a small library of these test results, which are made available to its customers. While the safest way to ensure product compatibility is by using a complete line of Indium Corporation compatible products, if you have questions regarding the compatibility of a specific set of products not listed below, please contact Indium Corporation's Technical Support Engineers.

Health, Safety, Environmental, and Shipping

RoHS

This product complies with the requirements set under the EU Directive 2002/95/EC. This product does not contain any metals or flame-retardants.

Hazard Label



DOT Classification

Transport in accordance with applicable regulations and requirements. UN1274, n-propanol, 3, PG II North American Emergency Guide Book #129

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 electrochemical migration (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.

This product data sheet is provided for general information only. It is not intended, and shall not be construed, to warrant or guarantee the performance of the products described which are sold subject exclusively to written warranties and limitations thereon included in product packaging and invoices. All Indium Corporation's products and solutions are designed to be commercially available unless specifically stated otherwise.

Contact our engineers: askus@indium.com

Learn more: www.indium.com



ASIA +65 6268 8678 • CHINA +86 (0) 512 628 34900 • EUROPE +44 (0) 1908 580400 • USA +1 315 853 4900



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