PRODUCT DATA SHEET

WF-1098

Halogen-Containing, Water-Wash, Neutral pH, Wave Soldering Flux

Introduction

WF-1098 is an alcohol-based, halogen-containing, water-wash wave soldering flux developed to comply with the latest J-STD-004, version B, for soldering through-hole, bottom-side surface mount, and mixed-technology circuit boards. It performs well with both Pb-free and SnPb soldering processes and is compatible in both wave soldering and selective soldering applications. **WF-1098** contains halogens which give the flux additional activity and heat stability. The residue left by **WF-1098** is highly water-soluble, allowing easy post-soldering removal in both batch and in-line cleaning processes.

Features

- Compatible with Pb-free and SnPb alloys including, but not limited to: SAC305, SAC105, Sn995 (and similar silver-free alloys), SAC0307, 63Sn/37Pb, 60Sn/40Pb, 60Sn/38Pb/2Ag, Sb5
- Cleans easily in water
- Produces shiny solder joints
- **Residue removal can be delayed for up to 48 hours without affecting circuit board reliability**
- Compatible with Hot Air Leveled (HASL), Immersion Silver, Electroless Nickel Immersion Gold (ENIG), and Organically Solder Preserved (OSP) Copper Surfaces
- Compatible with all tested solder masks
- Conforms to J-STD-004B Flux Type ORM1

Physical Properties

Test	WF-1098	WF-1090-T Thinner
Color:	Pale	Clear
Specific Gravity: @25°C (77°F) @15°C (60°F)	 0.889 0.898	 0.826 0.833
Acid Value: mg KOH/g flux mg KOH/g flux solids	 14.9 144.2	 N/A N/A
Solids Content	10.33	N/A
Flash Point (°F TCC)	54°F (12°C)	54°F (12°C)
J-STD-004 Flux Type	ORM1	N/A

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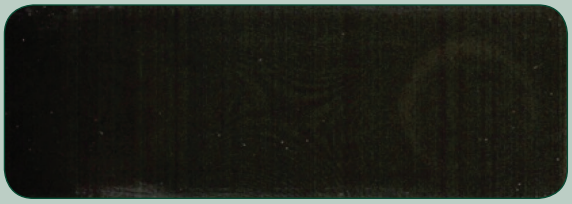
Test Data

Copper Mirror

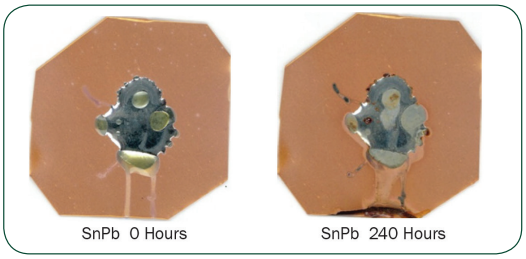
The J-STD-004B copper mirror test is performed per IPC-TM-650 method 2.3.32. To be classified as an "L" type flux there should be no complete removal of the mirror surface. **WF-1098** shows almost no removal of the copper mirror and so it would be classified as an ORL1 flux if it was not for the level of halogens it contains, >0.5%. The halogen content requires that the flux be classified as Type ORM1.



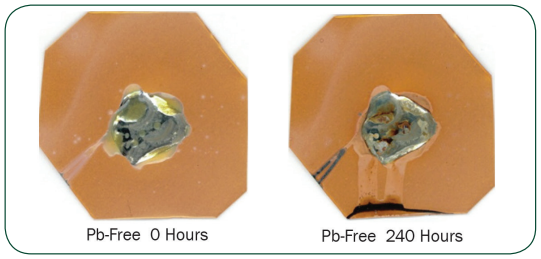
WF-1098 Standard Rosin

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. The copper corrosion test is not particularly useful in differentiating water-wash fluxes, since post-soldering residue must be removed after soldering.



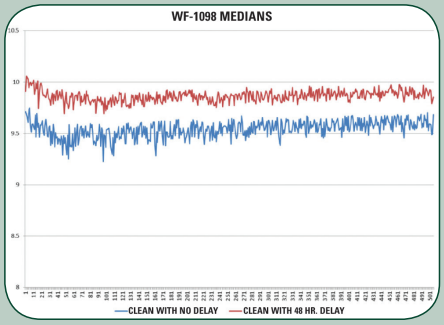
SnPb 0 Hours SnPb 240 Hours



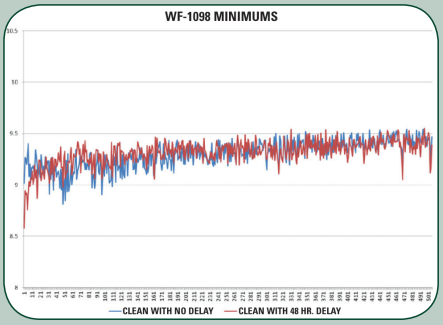
Pb-Free 0 Hours Pb-Free 240 Hours

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-1098** pass the requirements of having exhibited no dendritic growth, no visible corrosion, and a minimum insulation resistance of 100 megohms (1 x 10^8). The values shown on the two graphs below 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.



SIR Medians



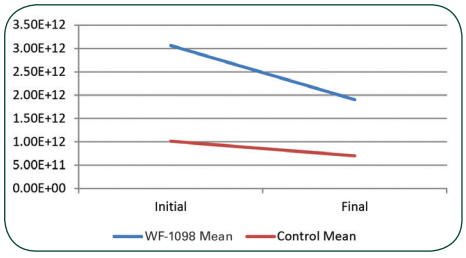
SIR Minimums

J-STD-004B SIR Minimum Values No-Delay Clean		
	24+ Hours	All Data
Pattern Down*	8.90	8.81
Control	10.85	10.80

*Water-wash fluxes are only tested pattern down

Electromigration (ECM)

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°C ± 2°C and 88.5% ± 3.5% 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.



	Initial	Final
WF-1098 Mean	3.06E+12	1.09E+12
Control Mean	1.01E+12	7.00E+11
Result	PASS	

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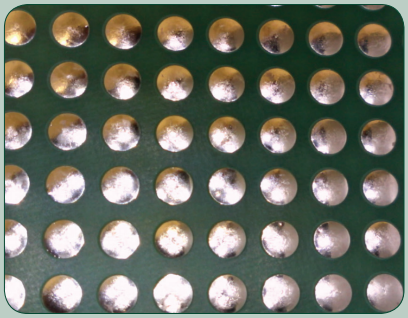
Performance and Process Data

Hole Fill



Hole fill test board.

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.

Soldering Performance 0.062"-Thick Test Board *		
	Pb-Free	SnPb
100% PTH Fill Yield	99%+	99%+

*7 to 20mil diameter plated through-holes

Soldering Performance 0.093"-Thick Test Board*		
	Pb-Free	SnPb
100% PTH Fill Yield	98%+	99%+

*7 to 20mil diameter plated through-holes

Process Recommendations

- Can be applied by spray or foam
- When using with Immersion Silver and Immersion Tin, limit topside flux deposition to reduce staining

Foam Application

- Stone should be 1½–2 inches below flux surface
- Adjust air pressure to 1–3psi
- Adjust air knife pressure to 5psi to remove excess flux
- Use WF-1090-T Thinner with the adjustment charts to maintain the flux density

62mil-Thick Circuit Board Process Recommendations

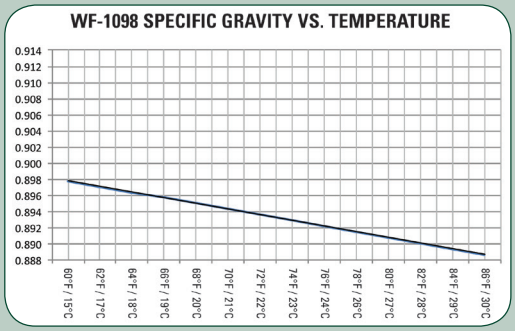
Flux Deposition Rate µg/in² solids	Preheat Temp Top (°C)	Preheat Temp Bottom (°C)	Preheat Time (sec)	Alloy	Contact Time (sec)	Pot Temp (°C)
≤4,500	100–145	100–145	60–100	Pb-Free	3.5–5.5	265–275
≤4,500	80–125	80–125	50-75	SnPb	1.5-3	245–260

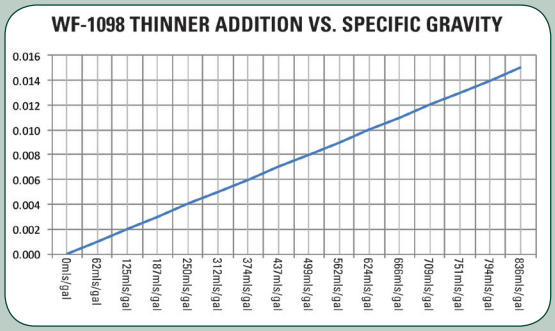
93mil-Thick Circuit Board Process Recommendations

Flux Deposition Rate µg/in² solids	Preheat Temp Top (°C)	Preheat Temp Bottom (°C)	Preheat Time (sec)	Alloy	Contact Time (sec)	Pot Temp (°C)
≤7,000	85–100	85–100	3–4	Pb-Free	10–12	270–275
≤7,000	80–100	80–100	1.5–3	SnPb	3–5	255–260

Instructions for Adding Thinner to WF-1098 When Foam Fluxing

- Determine the specific gravity and temperature of flux
- Find the flux temperature on the Specific Gravity vs. Temperature chart
- Subtract the correct specific gravity from the specific gravity of the flux
- Use the Thinner Addition vs. Specific Gravity chart to determine the mls/gal of thinner to add





Ionic Cleanliness Testing

Ionic cleanliness testing was developed at a time before no-clean fluxes became practical and popular. In those days, virtually ALL flux residues were removed from circuit boards as a means of ensuring both electrical integrity and a clean cosmetic appearance. The most common ionic testing specification used at the time was MIL-P-28809. To perform the test, an already-cleaned subject circuit board is immersed in an ion-free circulating alcohol/water bath for a set period of time. The electrical conductivity of the alcohol water solution is then measured to determine how much residual ionic material, as expressed as equivalent "µg NaCl/in²," is transferred from the circuit board to the bath. The more residual ionic material, the less effective the cleaning and the more danger existed for future electrical failure. The amount of ionic residue varies by flux type, cleaning method, and board complexity.

Ionic Cleanliness	
Cleaning Performance	< 10µg NaCl/in²
Pass/Fail Limit	37.0µg NaCl/in²
WF-1098 passes with very low ionic residue	

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Water-Soluble Flux Residue Removal

Water-wash fluxes are designed to have their post-soldering residues removed from the circuit board. This is because even though the residues may not be corrosive, they can be conductive, especially in humid environments. Some very aggressive water-wash fluxes must be removed immediately after soldering to prevent damage to the circuit board. However, washing boards soldered with **WF-1098** may be delayed for up to 48 hours. While the exact method of cleaning, batch or inline, is not important, what is important is ensuring that the equipment used is capable of complete flux removal.

Cleaning Recommendations	
Water Temperature	20–50°C (68–122°F)
Cleaning Delay	≤48 hours

Indium Corporation Compatible Products

- Solder Paste: Indium6.4R
- Cored Wire: CW-301 or CW-305
- Flux Pen: FP-300

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, when combined will yield test results meeting the same requirements, as typically determined by Surface Insulation Resistance (SIR) and Electromigration (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 combination testing to confirm compatibility. Indium Corporation maintains a small library of these test results, which are made available to its customers. The safest way to ensure product compatibility is by using a complete line of Indium Corporation compatible products; however, if you have questions regarding the compatibility of a specific set of products, please contact Indium Corporation's Technical Service Department.

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 user's need for information.

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