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CORE 230-RC

No-Spatter, No-Clean, REACH-Compliant Robotic Soldering Wire

Introduction

Indium Corporation's **CORE 230-RC** is a formula developed to meet the demanding requirements of robotic and laser soldering. It incorporates a highly effective activator package with new "no-spatter" technology in a high-reliability flux media. **CORE 230-RC** is fully REACH-compliant, containing no REACH substance of very high concern (SVHCs). **CORE 230-RC** is not used solely for robotic and laser soldering since it also performs exceptionally well in hand soldering applications. The no-spatter feature eliminates flux spatters that can burn operators' hands.

Features

- Low-spatter formulation
- Light-colored residue
- Compatible with Pb-free and SnPb alloys
- Available within Indalloy®292C alloy
- Compatible with HASL, Immersion Silver, ENIG, and OSP surface finishes

Physical Properties

IPC J-STD-004B Classification	REL1
Spatter %	0.09%
Acid Value (mgKOH/gram of flux)	165
Rosin-Containing	No
Halide Content %	0.48
Smoke	Minimal
Odor	Mild
Color	Clear, light
IPC J-STD-006 Compliance	Indium Corporation impurity levels conform to or exceed IPC J-STD-006
Compatible Alloys	All common and specialty alloys†
Copper Mirror IPC J-STD-004B	See Copper Mirror section
Copper Corrosion IPC J-STD-004B	See Copper Corrosion section
SIR J-STD-004B*	Pass
Electromigration J-STD-004B*	Pass

† Common Alloys: SAC305; SACm®0510; Sn995; SAC105; SAC0307; SAC387; 96.5Sn/3.5Ag; 95Sn/5Sb; Indalloy®227; Indalloy®254; 63Sn/37Pb; 60Sn/40Pb; 93.5Pb/5Sb/1.5Ag; 43Sn/43Pb/14B, and all similar alloys.

** Data available upon request.*

Process Recommendations

- Match the tip size to the part to be soldered
- Apply the solder wire to the joint, not to the soldering iron tip
- Use the lowest temperature possible
- 610–700°F (320–370°C) for SnPb and Pb-free
- Surface mount (SMT) soldering should be completed in 1–2 seconds
- Plated through-hole (PTH) soldering should be completed in 1–3 seconds
- The robotic soldering process set-up is highly customizable and depends on the assembly being soldered
- A smooth solder joint appearance requires the correct amount of temperature and time; fine-tuning the process parameters may be required to achieve the best possible outcome
- During robotic soldering, flux build-up and charring may occur; to avoid build-up, increase the iron tip cleaning frequency or reduce the iron tip temperature

Wetting

	Spread Area (mm²)		
Spread Test	Copper	Brass	Nickel
SAC305 — 10% Solution	48	36	34

Two Robotic Soldering Strategies Using CORE 230-RC

Board Thickness	**0.062"/1.58mm**	**0.093"/2.36mm**
Wire Used	SAC305, 0.020"/0.5mm	SAC305, 0.020"/0.5mm
Formula and Flux %	CORE 230-RC, **3%**	CORE 230-RC, **4%**
Robot Speed	400–700mm/sec	400–700mm/sec
Iron Wattage	130 watt	130 watt
Tip Temperature	320–370°C	320–370°C
Tip Size	**1.6 x 0.6mm**	**2.4mm diameter**
Process Parameters:		
Solder Feed + Iron Tip Down	4.0–4.8mm @ 25–30mm/sec	2.9–6.2mm @ 25–30mm/sec
Preheat		0.1–5.2 seconds
Solder Feed		1.4–2.2mm @ 12–15mm/sec
Preheat	0.2–0.5 seconds	0.1–0.2 seconds
Solder Feed	1.4–3.2mm @ 12–15mm/sec	1.4–2.2mm @ 12–15mm/sec
Solder Retract	3.0mm @ 30mm/sec	3.0mm @ 30mm/sec
Post Heat/Dwell Time	0–1.0 seconds	0–0.2 seconds
	IRON TIP UP	
Amt. of Solder Used (mm/joint)	2.4–6.2	4.5–6.2
Solder Time (seconds/joint)	0.6–1.7	1.0–6.2
Tip Cleaning Frequency @ 320°C @ 370°C	Each 400–600cm of wire @ 320°C Each 100–250cm of wire @ 370°C	Each 400–550cm of wire @ 320°C Each 20–70cm of wire @ 370°C

Cleaning is best accomplished using sponge rollers or similar method.

Silver Chromate Free Halide

CORE 230-RC was tested per the IPC-TM-650 method 2.3.33, halide content in soldering fluxes and pastes. Silver chromate test paper will turn white if there is more than 0.05% free halide in the flux test solution. **CORE 230-RC** does not turn the paper white, passing the test as having less than 0.05% free halide.

10% Solution

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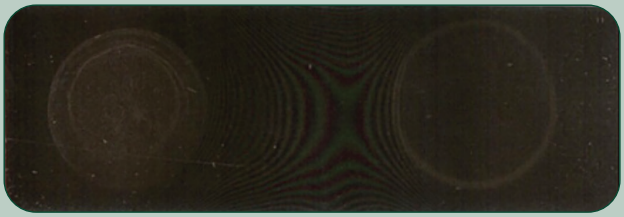
Test Data

Copper Mirror

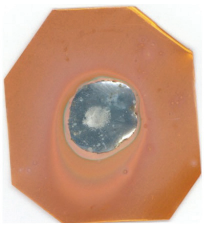
The J-STD-004B copper mirror test is performed per IPC-TM-650 method 2.3.32. To be classified as an "L" type flux, there should be no complete removal of the mirror surface. **CORE 230-RC** shows almost no removal of the mirror surface, therefore, can be classified an "L" type flux.



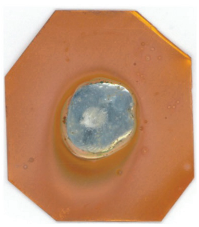
CORE 230-RC 10% Solution | Standard Rosin

Copper Corrosion

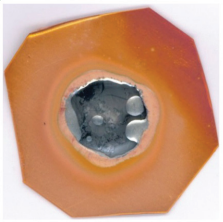
Copper corrosion is tested per IPC-TM-650 method 2.6.15. This test gives an indication of any visible reactions that take place between the flux residue after soldering and copper surface finishes. In particular, green copper corrosion (formed as copper-chloride) should not be seen. With **CORE 230-RC**, some of the residue darkens over time, but no corrosion is observed.



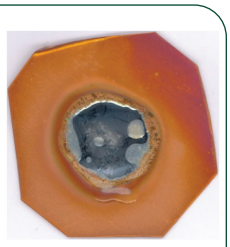
CORE 230-RC SAC305 0 Hours



CORE 230-RC SAC305 240 Hours



CORE 230-RC SnPb 0 Hours

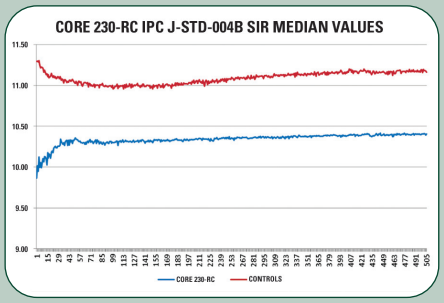


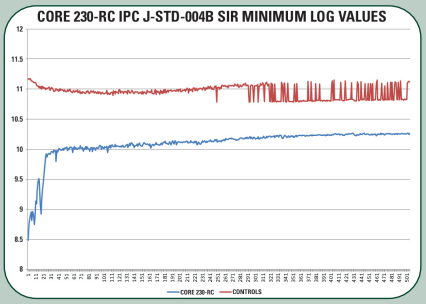
CORE 230-RC SnPb 240 Hours

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 **CORE 230-RC** 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 presented on the 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.

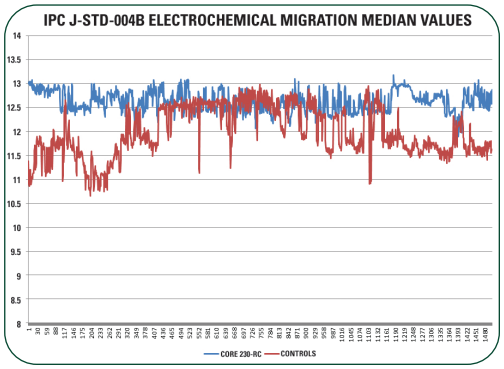
SIR Minimum Values		
	24 Hours	All Data
CORE 230-RC	9.95	8.49
Control	10.78	10.78





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. Indium Corporation's **CORE 230-RC** easily passes the ECM requirements of IPC J-STD-004B.



Minimum Values		
	Initial	Final
CORE 230-RC	9.71E+12	6.25E+12
Control	1.89E+11	9.27E+11

Contact our engineers: askus@indium.com

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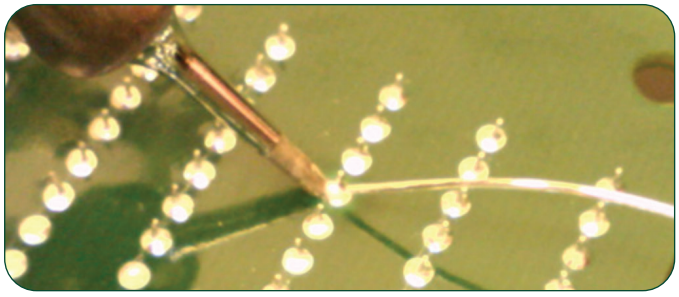
General Application Recommendations



Cored Wire for Robotic and Laser Soldering

Indium Corporation specializes in making fine-diameter wire, typically between 0.008" (0.2mm) and 0.015" (0.381mm) diameter for robotic and laser soldering. To make robotic and laser soldering most effective and eliminate peaking and bridging, it is easiest to use an active flux such as **CORE 230-RC** at 4.0–4.5% flux by weight.

Shelf Life

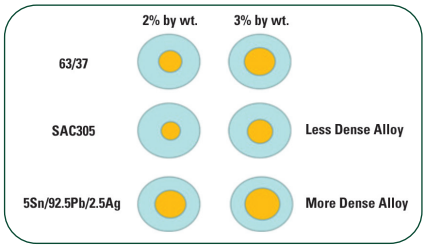
	Warranted	Practical*
Tin-Lead Alloys	10 years from DOM	Indefinite
Lead-Free Alloys	10 years from DOM	Indefinite
>85% High-Lead	2 years from DOM	Indefinite

**When stored at less than 40°C and less than 80% RH*

Always store cored wire in a cool, dry environment. The main causes of degraded cored wire reflow performance are the buildup of a thick oxide layer on the surface of the wire, caused by prolonged exposure to higher than normal temperature and humidity conditions, or the buildup of lead carbonate on high-lead (>85%) alloy cored wire shipped or stored under very high-humidity conditions.

Cored Wire Flux Percent

Indium Corporation is capable of coring wire in a variety of flux percents. Flux cores are typically determined by weight percent of flux compared to weight percent of solder. As can be seen by the graphic below, 1% more flux by weight adds considerably more flux by volume. The trade-off: higher flux contents make soldering faster, easier, and reduce defects, but increase the amount of residue that can be seen cosmetically and that may interfere electrically. The most common nominal flux contents are 2% by weight and 3% by weight.



Soldering Iron Temperature		
Alloy Family	**Alloy Melting Range**	**Soldering Iron Temperature**
Tin-Lead	170–190°C (338–374°F)	320–370°C (608–698°F)
Lead-Free	210–250°C (410–482°F)	320–370°C (608–698°F)
>85% High-Lead	280–320°C (536–608°F)	400–425°C (752–797°F)

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 Engineers for assistance.

Indium Corporation Compatible Products

- **Solder Paste**: Indium8.9, 8.9HFA, 8.9HF-1, and 8.9HF
- **Wave Flux**: WF-9940 (rosin-containing) or WF-9958 (low or no rosin)
- **Flux Pen**: FP-500 (rosin-containing)

Indium Corporation's cored wire has been designed to be fully compatible with our solder paste, wave fluxes, and rework fluxes, and is also expected to be compatible with many of our competitors' products. For example, **CORE 230-RC** flux-cored wire is not only compatible with Indium8.9HF Solder Paste, but also with our 5.2LS, 8.9 series, 92 series, and 10 series products. 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.

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Commonly Available Diameters and Packaging

Diameter	Spool Weight	63/37 Length	SAC305 Length
0.006" ± 0.002"*	1/4lb	2,142ft	2,445ft
0.008" ± 0.002"*	1/4lb	1,366ft	1,560ft
0.010" ± 0.002"	1/4lb	966ft	1,097ft
0.015" ± 0.002"	1/4lb	429ft	487ft
0.020" ± 0.002"	1lb	966ft	1,097ft
0.025" ± 0.002"	1lb	618ft	702ft
0.032" ± 0.002"	1lb	377ft	428ft
0.040" ± 0.002"	1lb	242ft	274ft
0.062" ± 0.002"	1lb	101ft	114ft
0.15mm ± 0.05mm*	113g	653m	745m
0.20mm ± 0.05mm*	113g	416m	476m
0.25mm ± 0.05mm	113g	294m	334m
0.38mm ± 0.05mm	113g	131m	148m
0.51mm ± 0.05mm	454g	294m	334m
0.64mm ± 0.05mm	454g	188m	214m
0.81mm ± 0.05mm	454g	115m	131m
1.02mm ± 0.05mm	454g	74m	84m
1.57mm ± 0.05mm	454g	31m	35m

* This size can only be manufactured using select Pb-free alloys.

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.

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.

Contact our engineers: askus@indium.com
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