PRODUCT DATA SHEET

WS-575-C-RT

Halogen-Free Ball-Attach Flux

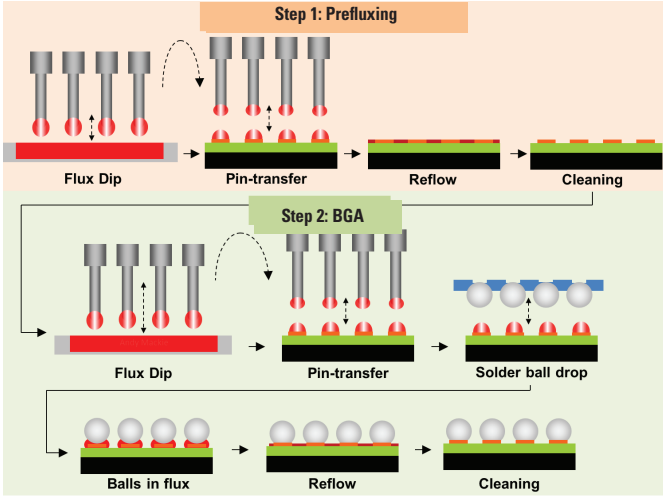
Introduction

Indium Corporation's **Ball-Attach Flux WS-575-C-RT** allows customers to use a completely halogen-free (NIA = no intentionally added halogens) single-step ball-attach process to eliminate the costly, wasteful, and warpage-inducing effects of prefluxing. The "Standard Ball-Attach Process" diagram shows the typical two-step flux processing that is needed to create reliable, ball-to-pad joints from final BGA balling. The prefluxing step can only be eliminated if the flux has sufficient activity to overcome the extent of the oxidation on copper, and create strong solder joints. **WS-575-C-RT** is customer-proven to be able to eliminate the need for multiple fluxing steps before final ball-attach.

Features

- **Halogen-free – no intentionally added (NIA) halogens**
  - NIA means that the flux is formulated to be free of halogens
- **Eliminates process costs and warpage due to "prefluxing"**
  - No extra fluxing, reflow, cleaning, and substrate warpage (see right)
- **Reflows in air or nitrogen**
  - Can eliminate the cost of nitrogen
- **No "missing ball"**
  - Tack during heating and fast soldering ensure balls stay in place during reflow
- **Excellent solderability on a wide range of surfaces**
  - Good results on AuNi and even on oxidized Cu-OSP (up to 0.3mm thick OSP)
- **Uniform pin transfer over extended periods**
  - Avoids changes of joint quality over time and uneven deposit sizes, which can lead to "missing ball"
- **Low-voiding**
  - Increases joint strength
- **Designed for Pb-free applications**
  - Suitable for all high-tin solders: SAC105, SAC305, SAC38, SAC405
- **Cleanable with room temperature DI water only**
  - Saves money on water heating
- **No "white residue"**
  - Cleaning the flux residues at lower temperatures avoids the formation of white residues
- **Stable at room temperature**
  - Ease of storage and use without crystals or gel balls
  - Ready to use, straight from the jar or cartridge

Standard Ball-Attach Process



Flux Properties

Property	Value	Test Method
Flux Type Classification	ORH0	J-STD-004 (IPC-TM-650: 2.3.32 and 2.3.33)
Typical Viscosity	20kcps (5mins)	Brookfield HB DVII +-CP (5rpm)
SIR (Ohms, after cleaning)	Pass (>10^8 after 7 days @ 85°C & 85% RH)	J-STD-004 (IPC-TM-650: 2.6.33 IPC-B-24)
Typical Acid Number	95mg KOH/g	Titration
Typical Tack Strength	360g	J-STD-005 (IPC-TM-650:2.4.44)
Shelf Life	0-30°C for 6 months	Viscosity Change/ Microscope Examination

All information is for reference only. Not to be used as incoming product specifications.

From One Engineer To Another®

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Pin Transfer

Viscosity Test Method

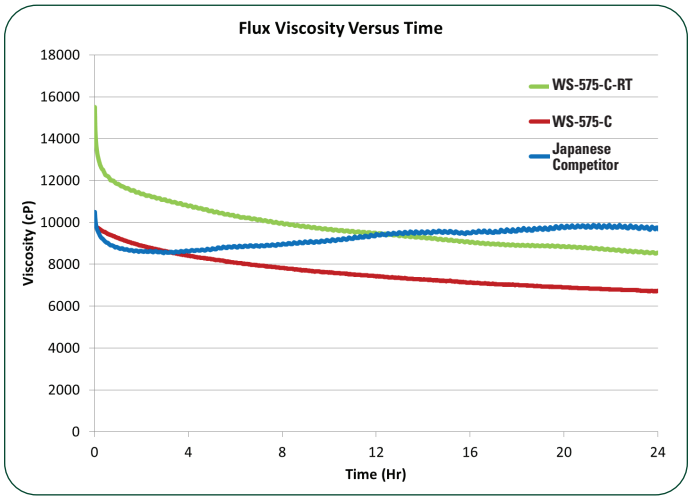
- **Equipment**
  - Brookfield Cone and Plate
  - Model: DV3THBCB
- **Parameters**
  - Spindle: CP-51
  - Temperature: 25°C
  - RPMs: 20RPM

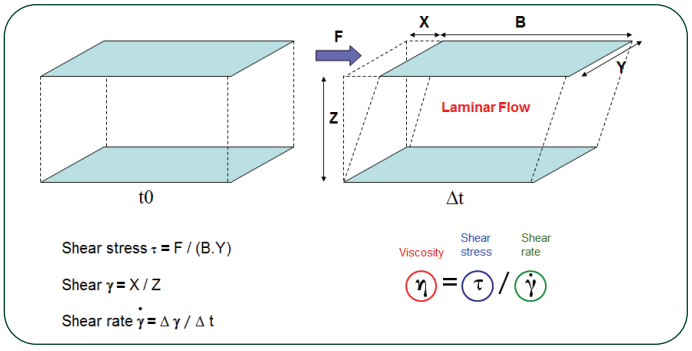
Tack Test Method

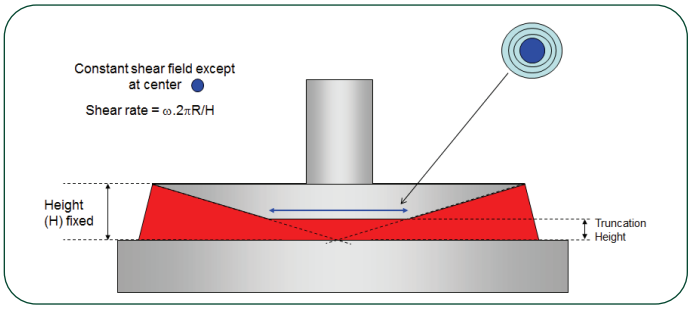
- **Equipment**
  - Texture Technologies TA.XT2
- **Parameters**
  - Ambient Conditions
  - Humidity: 50% ± 3%
  - Room Temperature: 21.5°C ± 2°C

Comparative Viscosities as a Function of Time

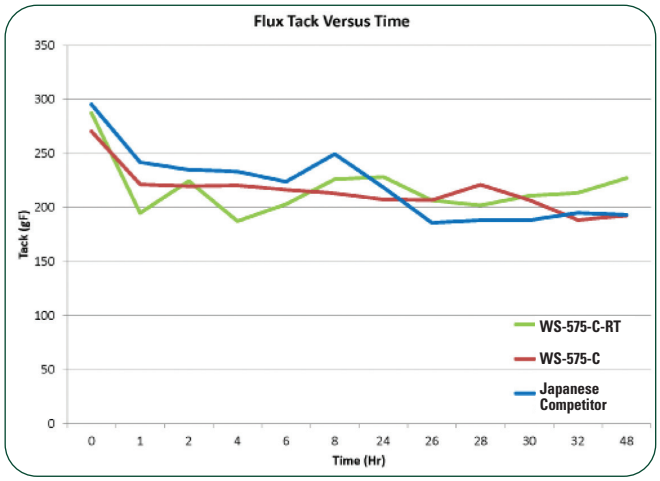
Viscosity Controls







Tack as a Function of Time



Consistent Flux Deposition

WS-575-C-RT's consistent viscosity and tack ensure consistent flux deposit sizes and eliminate missing ball before reflow.

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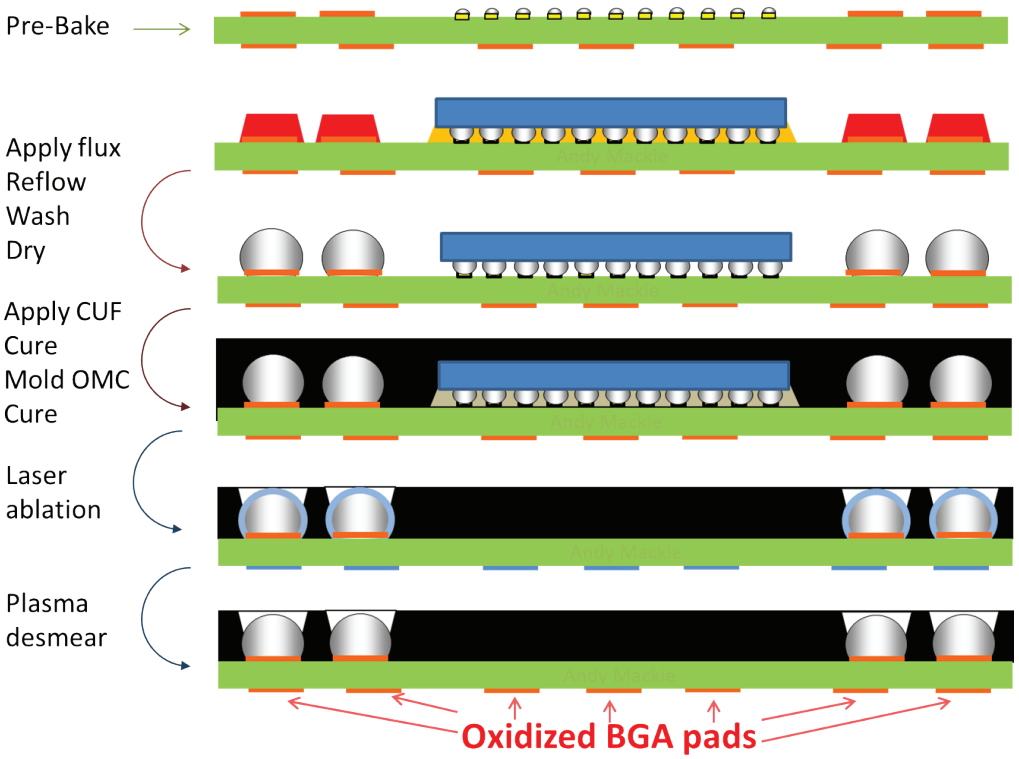
Reflow

OSP Degradation From FCBGA Substrate Treatment Before BGA Balling



Test Materials and Reflow

- **Solder Spheres**
  - SAC305, 28mil
  - 7-hour bake @ 130°C
- **Reflow**
  - Soak (preheat) reflow profile
  - Air reflow
- **Substrates**
  - OSP substrates

Simulated Preconditioning

- **None**
- **Bake**
  - 2-hour bake @ 170°C
  - 7-hour bake @ 130°C
- **Bake and Cleaner**
  - 2-hour bake @ 170°C
  - Cleaned with aggressive aqueous flux cleaner @ 96°C
  - 7-hour bake @ 130°C
- **Double Bake and Cleaner**
  - 2-hour bake @ 170°C
  - Cleaned with aggressive aqueous flux cleaner @ 96°C
  - 7-hour bake @ 130°C
  - 2-hour bake @ 170°C
  - Cleaned with aggressive aqueous flux cleaner @ 96°C
  - 7-hour bake @ 130°C

Eliminate Extra Costs and Warpage

For flip-chip BGA, bottom pads can become extremely oxidized. **WS-575-C-RT** eliminates the need for a prefluxing step, which reduces:

– Process cost
– Package warpage
– UPH

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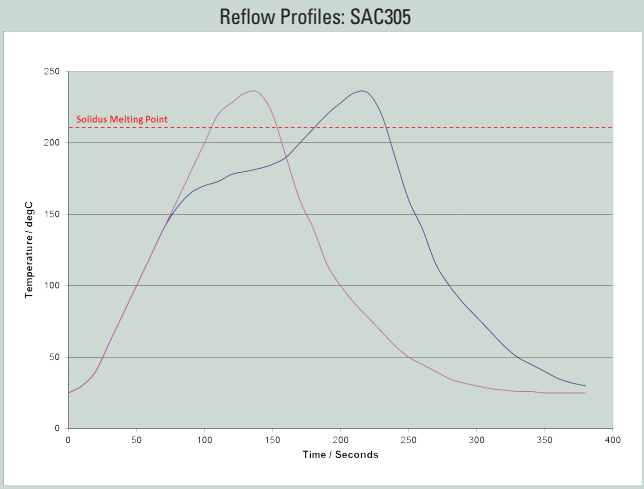
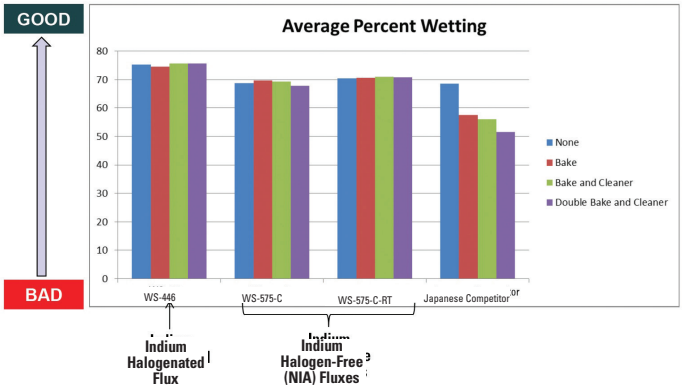
Reflow

Reflow Profile

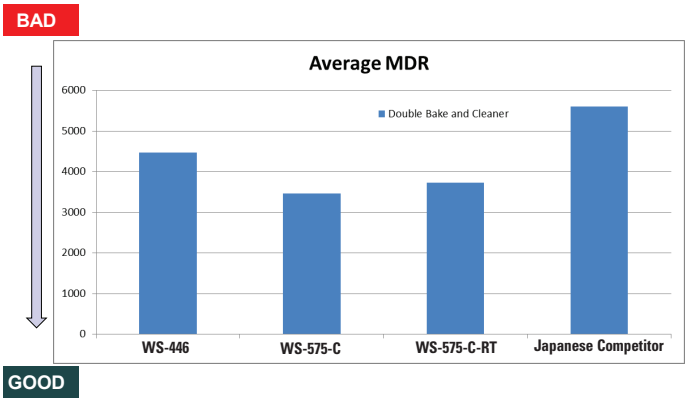


WS-575-C-RT is suitable for air and nitrogen reflow, and can work well in a variety of reflow profiles.

Wetting Comparison

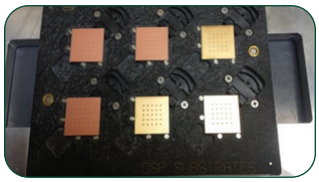


MDR for Different Fluxes



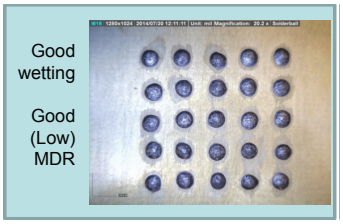
Movement During Reflow (MDR) and Solderability Test Method

- Print flux onto metallized surface
- Place spheres onto flux deposit
- Reflow (air or N_2 [typical])
- Measure reflowed height deposit
- Calculate percent spread (wetting)
- Calculate mean sphere center movement (MDR)

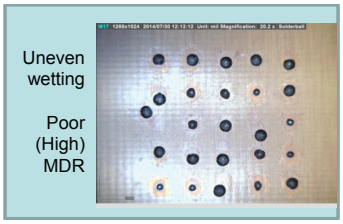


Copper OSP Substrates

MDR Correlates with Missing Ball



Low MDR



High MDR

Eliminate Missing Ball and Increase Joint Strength

WS-575-C-RT's eliminates missing ball during reflow by high viscosity and rapid soldering. Joint strength is high due to good wetting.

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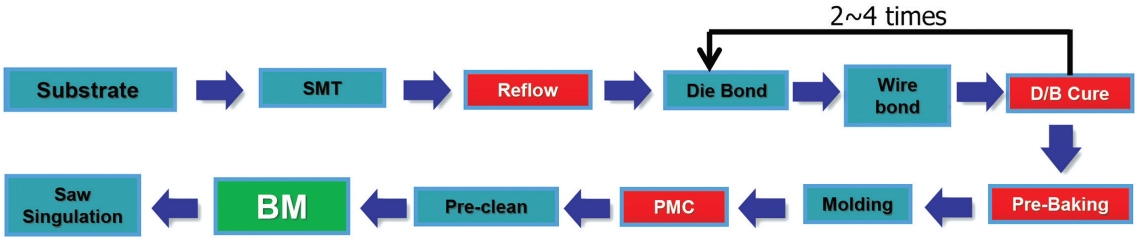
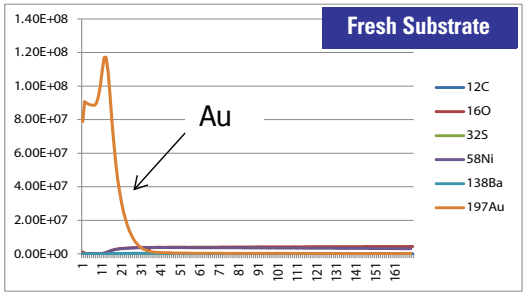
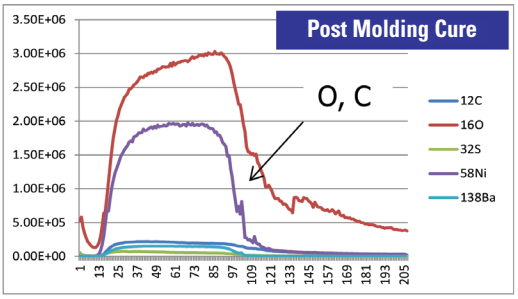
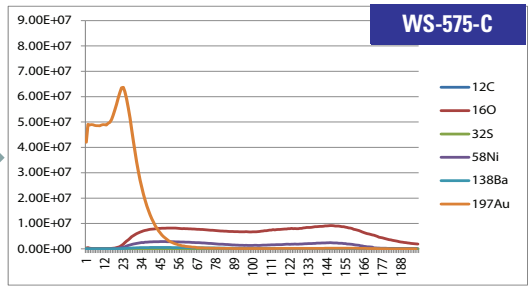
Cleaning

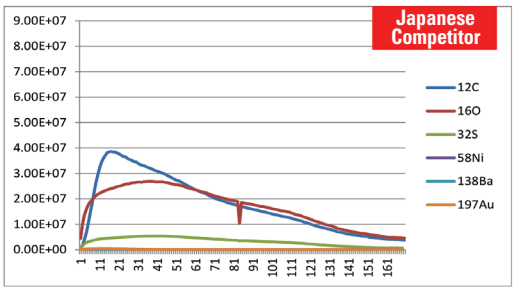
Secondary Ion Mass Spectrometry (SIMS) Shows Species at the Surface





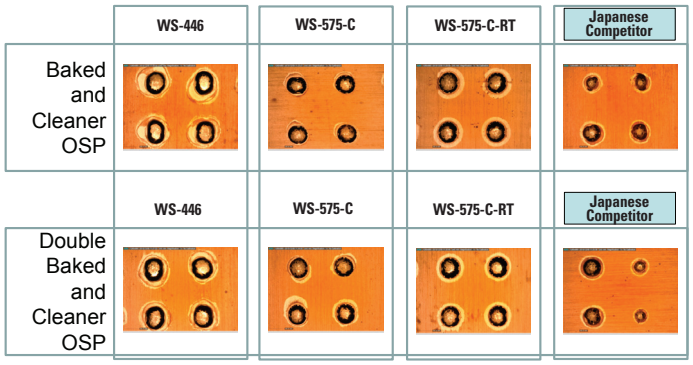






Cleaning Test

- **Very mild (forcing) condition**
  - – Deionized water temperature: 36°C
  - – Deionized water conductivity ≤1.00µS/cm
  - – Zero pressure
  - – Flow rate 5cc/minute
  - – Time of cleaning: 1 minute



Simplified, Low-Cost Cleaning

WS-575-C-RT is cleanable with room temperature deionized (DI) water only, eliminating chemical cleaning costs and costs of heating water.

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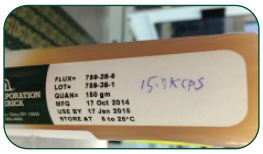
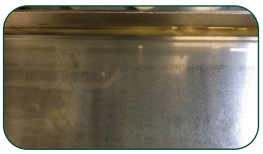
Final Test

Customer and Process Validation

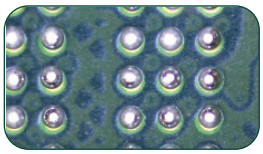


Flux



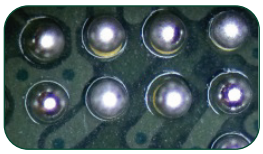
Flux on Flux Tray

Flux is normal on flux tray



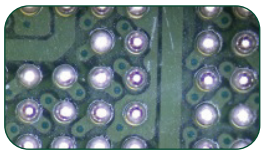
Ball Mount

After ball mount, flux and ball position are good



Post Reflow

No missing ball and flux residue is clear



Post DI W Clean

No missing ball and no flux residue

Recommended Semiconductor Fluxes and Solder Pastes

Material Group	Material Type	Material Name	Flux Type	Halogen-Free	Application	Comments
FLUX	Wafer Bumping Flux	SC-5R	Solvent-clean	Yes	Spin coating	High Pb, Sn/Pb Eutectic and SnAg solder bumps
		WS-3543	Water-wash	Yes	Spin coating	High viscosity for taller copper-pillars and larger bumps (>40 microns)
		WS-3401	Water-wash	Yes	Spin coating	Low viscosity for smaller pillars and bumps
	Wafer-Level or Panel-Level Packaging Flux	WS-676	Water-wash	Yes	Printing	0.5mm and smaller pitch wafer-level or panel level package
		WS-759				
		WS-829				
	Flip-Chip Flux	WS-575-SP	Water-wash	Yes	Jetting/Spraying	Sn/Pb Eutectic and SnAg onto SOP for logic flip-chip
		FC-NC-HT-A1	No-clean	Yes	Jetting/Spraying	Mass reflow flux compatible with CUF
		WS-446	Water-wash	No	Dipping	Best flux for poor solderability
		WS-688	Water-wash	Yes	Dipping	General purpose for multi-core logic flip-chip
		WS-641	Water-wash	Yes	Dipping	For chip-on-wafer, high-density Cu-pillar application
		NC-26-A	Ultra-low residue no-clean	Yes	Dipping	Best compatibility with CUF/MUF
		NC-26S	Ultra-low residue no-clean	Yes	Dipping	Avoids capillary flow up to die surface for fine-pitch devices
		NC-699	Near-zero residue	Yes	Dipping	Controlled solderability, compatible with wide variety of CUF/MUF
	Ball-Attach Flux	WS-446-AL	Water-wash	No	Pin Transfer	Best flux for poor solderability
		WS-823	Water-wash	Yes	Pin Transfer	Best all-around halogen-free ball-attach flux, easily cleaned
		WS-829	Water-wash	Yes	Printing and pin transfer	For sphere size <0.25mm and fine-pitch high-density ball-attach, best cleanability
		NC-585	No-clean	Compliant	Pin Transfer	Good wetting onto bare nickel for 0.5mm pitch or lower BGA/PGA
		WS-575-C-RT	Water-wash	NIA	Pin Transfer	Best ball-attach flux for missing ball Eliminates the prefluxing step for OSP
	Flip-Chip and Ball-Attach Flux	NC-809	Ultra-low residue no-clean	Yes	Dipping	Enhanced wetting, compatible with wide variety of CUF/MUF
					Printing and pin transfer	Suitable for no-clean process, good wetting onto gold surface
		WS-446HF	Water-wash	Yes	Dipping	Best all-around halogen-free flip-chip flux, easily cleaned
					Pin Transfer	Suitable for one-step Cu OSP process for sphere size 0.25mm and above
SOLDER PASTE	Jetting Paste	PicoShot® WS-5M	Water-wash	Yes	Jetting	For dot jetting of 300µm diameter and above, and fine-line dispensing for metal lid-attach
		PicoShot® NC-5M	Solvent- or aqueous-based chemistry or no-clean	Yes	Jetting	For dot jetting of 300µm diameter and above, and fine-line dispensing for metal lid-attach
		Indium12.8HF			Jetting and Microdispensing	For dot jetting down to 80µm diameter and above, and fine-line dispensing for metal lid-attach
	SiPaste® Solder Paste	SiPaste® 3.2HF	Water-wash	Yes	Printing	Type 6, Type 7, and Type 8 solder paste suitable for ultrafine-pitch printing
		SiPaste® C201HF	DI water + saponifier or semi-aqueous chemistry			
		SiPaste® SMQ77	No-clean			
OTHER	Adhesive Solution	NC-702	Minimal to no residue	Yes	Dipping/Dispensing/ Jetting	Holding die, chip, and preform in place, for formic acid reflow

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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