

KOKI No-Clean **LEAD FREE** Flux Cored Wire Solder

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LINE-UP



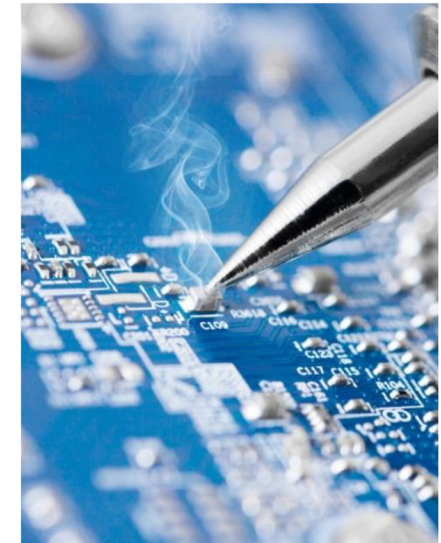
S3X - 72M

S3XCa - 72M

S03X7Ca - 72M

S01X7Ca - 72M

REACH Compliant



Disclaimer

This product information contains product performance assessed based on our own test procedures. Product performance may be different according to the handling at the end-users. Please conduct through investigation to determine optimal process condition before mass production application.



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- **Significantly improved wettability allows faster slide soldering at wider iron tip temperature range**
- **Improved wettability without compromising flux sputtering**
- **Improved wettability to module leads (ex. brass, Ni, etc...)**
- **Helps preventing defects (bridging and insufficient solder feeding), owing to improved surface covering property of the flux**
- **Reduced soldering fume smell, and it is suitable for manual soldering**
- **REACH and RoHS compliant (Free of all substances listed in JIG101 Edition 3)**



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Item		S3X	S3XCa	S03X7Ca	S01X7Ca
Alloy Property	Alloy Composition	Bal. Sn 3.0Ag 0.5Cu	Bal. Sn 3.0Ag 0.5Cu 0.015Co +α	Bal. Sn 0.3Ag 0.7Cu 0.04Co +α	Bal. Sn 0.1Ag 0.7Cu 0.04Co +α
	Melting Point (°C)	217 - 219	217 - 219	217 - 227	217 - 227
Flux Content (%)		3.2 ± 0.3			
Dryness *1		Pass			
Halide Content (%) *1		Less than 0.01			
Copper Plate Corrosion *1,2		Pass			
Copper Mirror Corrosion *1,2		Pass			
Aqueous Solution Conductivity Test (Ωm) *1		Over 750			
SIR (Ω) [85 °C, 85% RH, 168 Hrs] *1		Over 1x10 ⁹			
Migration (Visual) [85 °C, 85% RH, DC 50V, 1000 Hrs] *1		No evidence of migration (Insulation resistance: 1x10 ⁹)			
Flux Classification *2		ROL0			
Shelf Life		3 years			

*1 Per JIS Z 3197

*2 Per IPC J-STD-004

* Data shown here is S3X-72M



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Available Wire Diameters

72M series solder wires are available in following wire diameters

Wire Diameter (mm ϕ)	Weight
0.3	0.2 kg / spool
0.5 0.6 0.8 1.0 1.2	0.5 kg / spool

Other specific wire diameters may be available upon request



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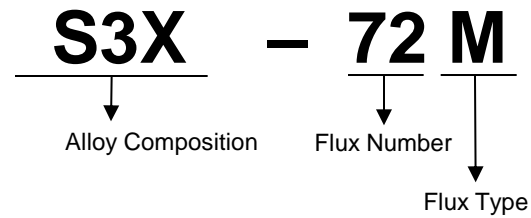
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Alloy Composition (%)	S3X : Sn 3.0Ag 0.5Cu
Flux Type	M : Low or no halide content
Flux Number	Depends on the product

Available alloy: Please refer [page number 2](#)



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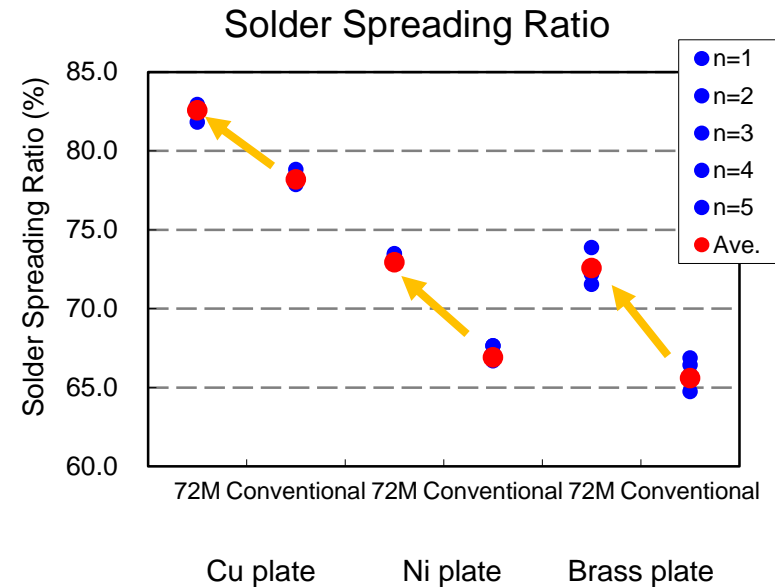
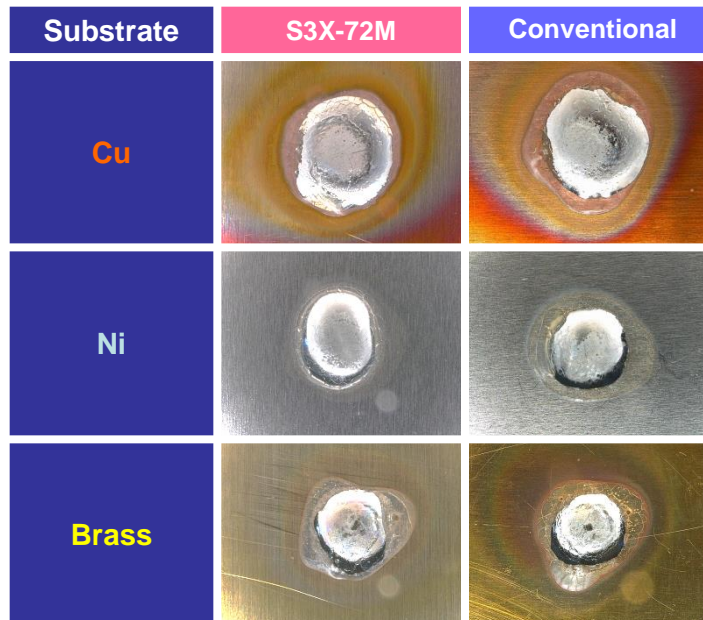
Handling Guide

Wettability

- Test Method: In-house method (Calculation based on JIS Z3197)
- Test Piece: Cu, Ni and Brass plate (degreased surface with organic solvent)
- Wire Diameter: 0.8 mm ϕ (Ring inner diameter: 1.6 mm ϕ) * See the picture on right
- Melt Condition: Melt on the solder bath at 300 °C, holding time is 5 seconds



Solder ring for wettability test



By changing the activator, 72M series can remove oxidized layer better than conventional product.

72M shows faster wetting even on difficult to wet substrate, such as Ni.



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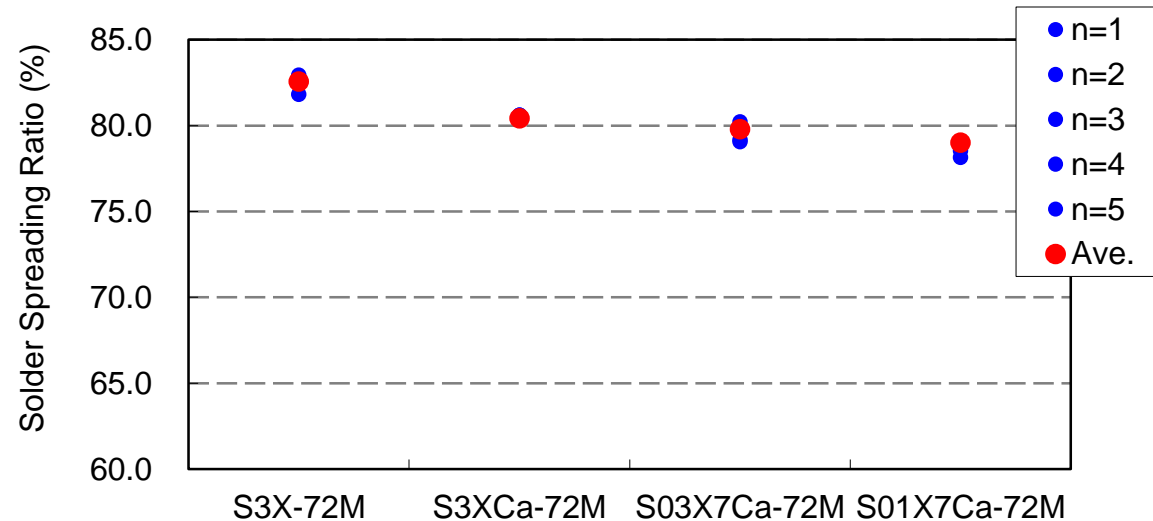
Wettability (72M Series Evaluation on Cu Plate)

- Test Method: In-house method (Calculation based on JIS Z 3197)
- Test Piece: Copper plate (Degreased surface with organic solvent)
- Wire Diameter: 0.8 mm ϕ (Ring inner diameter: 1.6 mm ϕ) * See the picture on right
- Melt Condition: Melt on the solder bath at 300 °C, holding time is 5 seconds



Solder ring for Wettability Test

Solder Spreading Ratio: Cu, 300°C for 5 sec.



Regardless of the solder alloy type, spreading ratio was about 80% on Cu substrate.



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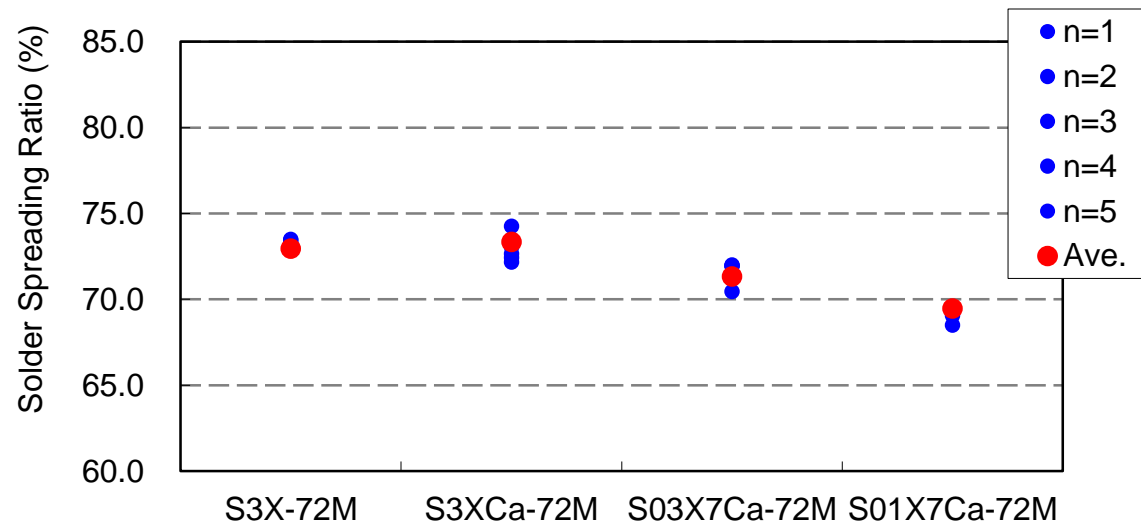
Wettability (72M Series Evaluation on Ni Plate)

- Test Method: In-house method (Calculation based on JIS Z3197)
- Test Piece: Nickel plate (Degreased surface with organic solvent)
- Wire Diameter: 0.8 mm ϕ (Ring inner diameter: 1.6 mm ϕ) * See the picture on right
- Melt Condition: Melt on the solder bath at 300 °C, holding time is 5 seconds



Solder ring for Wettability Test

Solder Spread Ratio: Ni, 300°C, 5 sec.



72M series show about 70~75% spreading ratio toward the Ni, a hard to wet substrate.



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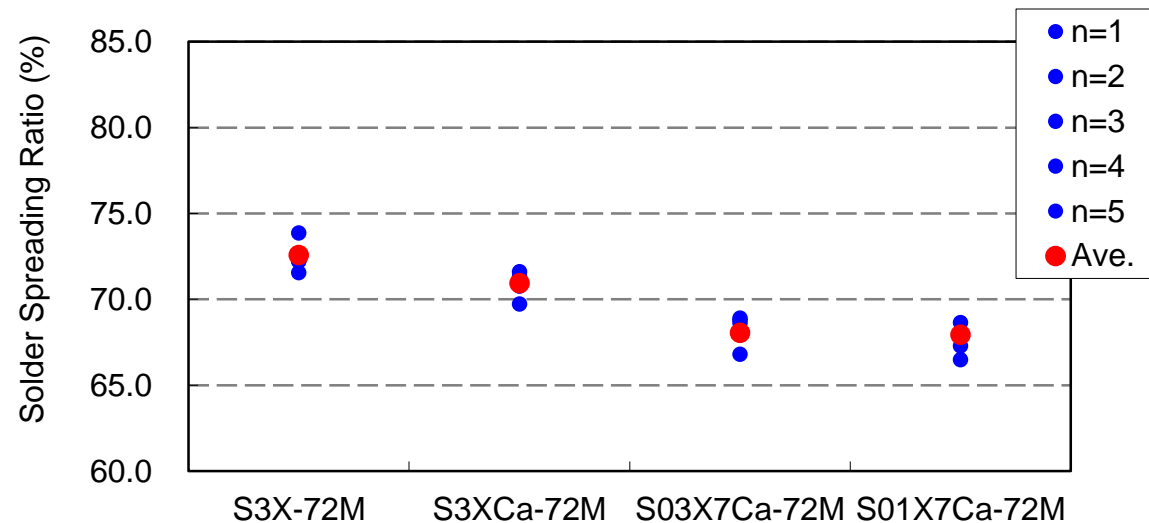
Wettability (72M Series Evaluation on Brass Plate)

- Test Method: In-house method (Calculation based on JIS Z3197)
- Test Piece: Brass plate (Degreased surface with organic solvent)
- Wire Diameter: 0.8 mm ϕ (Ring inner diameter: 1.6 mm ϕ) * See the picture on right
- Melt Condition: Melt on the solder bath at 300° C, holding time is 5 seconds



Solder ring for Wettability Test

Solder Spreading Ratio: Brass, 300C, 5 sec.



72M series show about 65~75% solder spreading ratio toward the Brass.



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Wettability (72M Series Solder Spreading: Results)

- Test Method: In-house method (Calculation based on JIS Z3197)
- Test Piece: Cu, Ni and Brass plate (Degreased surface with organic solvent)
- Wire Diameter: 0.8 mm ϕ (Ring inner diameter: 1.6 mm ϕ) * See the picture on right
- Melt Condition: Melt on the solder bath at 300 °C, holding time is 5 seconds



Solder ring for Wettability Test

Actual pictures of solder spreading Test

Substrate	S3X-72M	S3XCa-72M	S03X7Ca-72M	S01X7Ca-72M
Cu				
Ni				
Brass				

By changing the activator, 72M series can remove oxidized layer better than conventional products and achieved better wettability.



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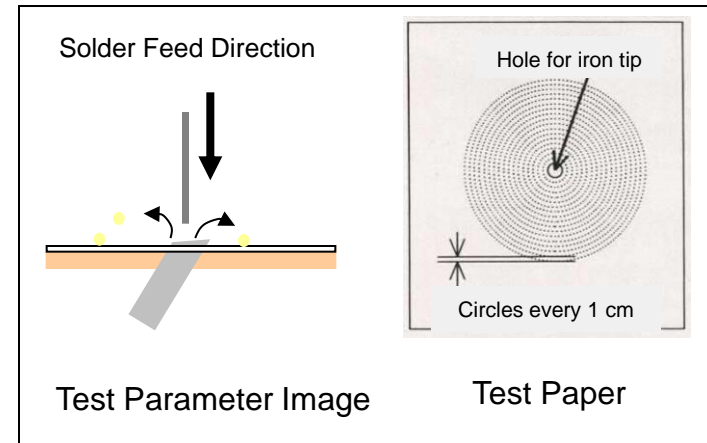
Iron Tip Erosion

Other Properties

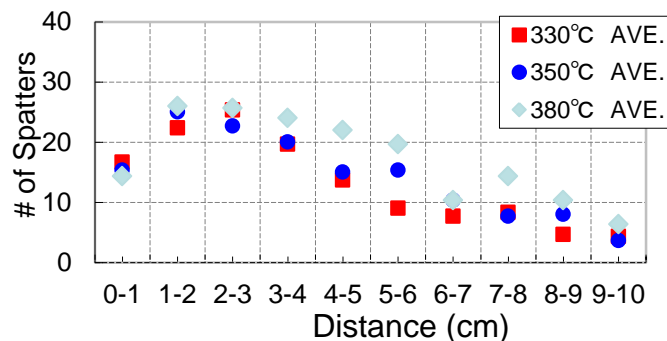
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Flux Spattering

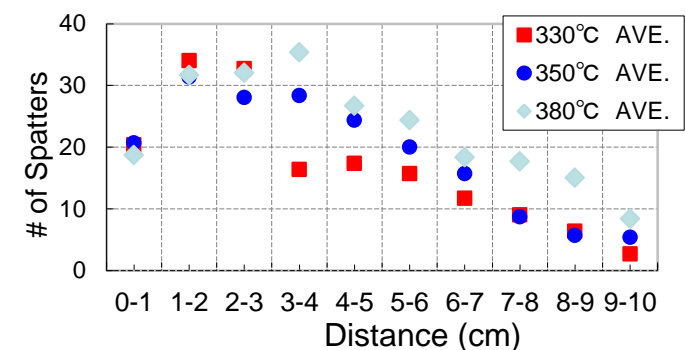
- Test Method : In-house method*
 - Iron Tip Temperature: 330, 350 and 380 °C
 - Test Wire Diameter: 0.8 mm ϕ
 - Wire Feeding Speed: 1cm / 2 Sec. (8 Sec. interval)
 - Wire Feed Amount: 30 shots
 - Sample Size: n=3 (Average of n=3 shown in the graph below)
- *About in-house Flux Spattering Test:
KOKI's in-house Flux Spattering Test is performed as following:
1. Place the test paper level to the iron tip
 2. Feed flux-cored wire solder at right angled to the iron tip at the feeding speed as described above.
 3. After feeding 30 shots, remove test paper and count spattered flux



S3X-72M Flux Spattering Test Result



Conv. Prod. Flux Spattering Test Result



Even though S3X-72M achieved superior wettability than conventional product, flux spattering is successfully reduced. In addition, 72M results are more reproducible irrespective of the temperature at which it is tested.

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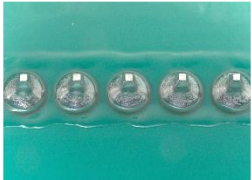
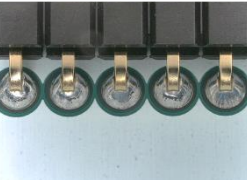



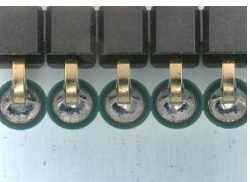

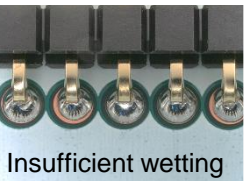

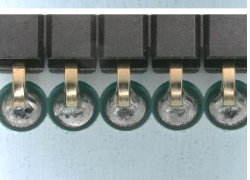

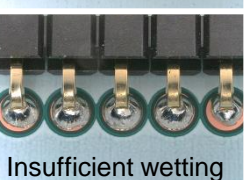
Iron Tip Erosion

Other Properties

Handling Guide

Slide Soldering Test (Regular tip slide speed)

- Equipment: UNIX-412R (Japan Unix)
Iron Tip: P1V10-23
 - Test PCB: FR-4 OSP (TH dia. 1.0 mm ϕ , t=1.6 mm)
 - Connector: 2.54 mm pitch L angled pin header, 20 pins (Misumi)
 - Wire Diameter: 0.5 mm ϕ
- Test Condition
- Slide Speed: **6 mm/s**
 - Wire Feed Speed: 29 mm/s
 - Wire Feed Amount: 300 mm
 - Iron Tip Temp.: 330, 350 and 380 °C
 - Sample Size: n=2 (4 rows of 20 pins, 80 pins total)

Temp.	S3X-72M		Conventional Product	
	Soldered side	Back side	Soldered side	Back side
330°C				 Insufficient wetting
350°C				 Insufficient wetting
380°C				 Insufficient wetting



→ less flux residue cracks



→ major flux residue cracking

Faster wetting than conventional product prevents insufficient wetting as well.

72M series also inhibits flux residue cracking.



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Slide Soldering Test (Faster tip slide speed than regular)

- Equipment: UNIX-412R (Japan Unix)
Iron Tip: P1V10-23
- Test PCB: FR-4 OSP (TH dia. 1.0 mm ϕ , t=1.6 mm)
- Connector: 2.54 mm pitch L angled pin header, 20 pins (Misumi)
- Wire Diameter: 0.5 mm ϕ

Test Condition

- Slide Speed: **13 mm/s**
- Wire Feed Speed: **62 mm/s**
- Wire Feed Amount: 300 mm
- Iron Tip Temp.: 330, 350 and 380 °C
- Sample Size: n=2 (4 rows of 20 pins, 80 pins total)

	S3X-72M		Conventional Product	
Temp.	Soldered side	Back side	Soldered side	Back side
330°C			 Bridging	 Insufficient Wetting
350°C			 Bridging	 Insufficient Wetting
380°C			 Bridging	 Insufficient Wetting



→ less flux residue cracks



→ major flux residue cracking

S3X-72M maintains faster wetting even at a faster slide speed, than conventional product and shows enhanced wetting.

72M series flux residue also inhibits flux residue cracking.



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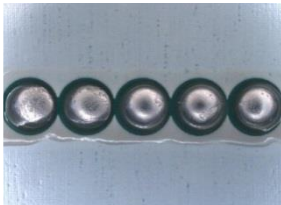



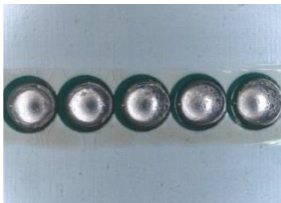





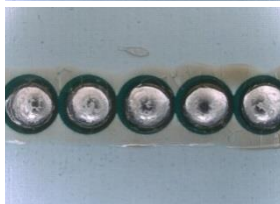
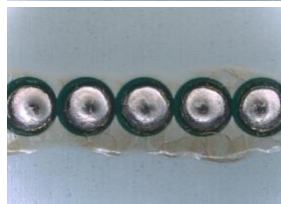
Handling Guide

Slide Soldering Test (Color of flux residue)

- Equipment: UNIX-412R (Japan Unix)
Iron Tip: P1V10-23
- Test PCB: FR-4 OSP (TH dia. 1.0 mm ϕ , t=1.6 mm)
→ Vicinity of land is painted in white for better visual
- Wire Diameter: 0.5 mm ϕ

Test Condition

- Slide Speed: 13 mm/s
- Wire Feed Speed: 62 mm/s
- Wire Feed Amount: 300 mm
- Iron Tip Temp.: 330, 350 and 380 °C
- Sample Size: n=1 (2 rows by 20 TH, 40 TH total)

Item	Temp.	S3X-72M		Conventional Product	
Flux Residue Color	330°C				
	350°C				
	380°C				

The color of flux residue of 72M series are much lighter than that of conventional product at various temperature ranges tested.



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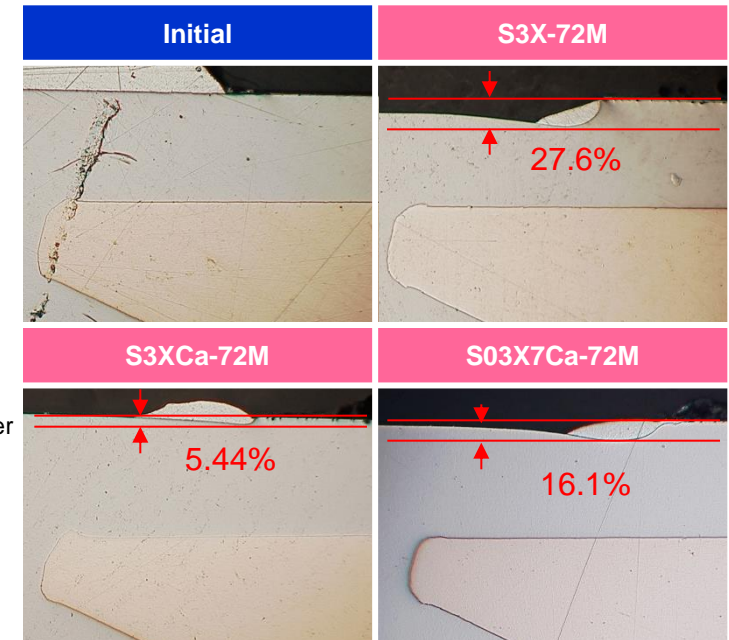
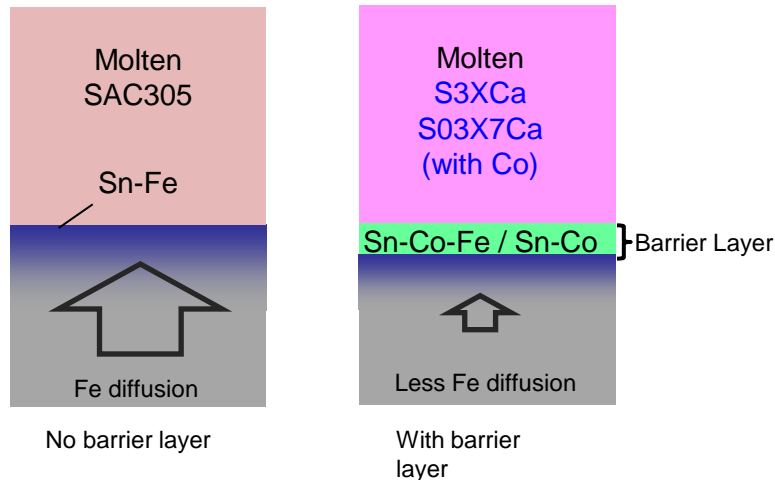
Other Properties

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Iron Tip Erosion (S3XCa and S03X7Ca)

- Equipment: UNIX-412R (Japan Unix)
- Iron Tip Temp.: 400 °C (Iron Tip: P3DR)
- Wire Diameter: 0.8 mm ϕ
- Wire Feed Condition: amount = 5.0 mm/shot, tact = 1.0 mm/sec
- Amount of Wire Feed: 10,000 shots

- Magnified cross-section of iron tip after the test



By adding Co, S3XCa/ S03X7Ca, iron tip erosion is significantly reduced as compared to S3X, one of the typical lead-free solder alloy. Typical lead-free solder wire erodes iron tips quicker, due to the diffusion of Fe from the tip to the solder. Co additive in S3XCa/ S03X7Ca, covers iron tip with 3 barrier layers (from Fe plating on iron tip, Sn-Fe>Sn-Co-Fe-Sn-Co) as the Co replaces Fe in Sn-Fe compound. Barrier layers can prevent iron tip erosion just as lead in leaded solder does, by inhibiting Fe diffusion.

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Other Properties

Test Item	Test Result	Test Standard
Dryness of the Flux Residue	Pass	JIS Z 3197
Solution Resistivity ($\Omega \cdot m$)	805	JIS Z 3197
Halide Content (%)	Less than 0.01	JIS Z 3197
Copper Mirror Corrosion	Pass	JIS Z 3197 IPC J-STD-004
Copper Plate Corrosion	Pass	JIS Z 3197 IPC J-STD-004
SIR (Ω)	$1.2 \times 10^{10} \Omega$	(85 °C, 85 % RH, 168 Hrs in chamber)
Migration	No evidence of migration	(85 °C, 85 % RH, 1000 Hrs, DC 50 V in chamber)

* Data based on test with S3X-72M



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1. Recommended Iron Tip Temperature: 330~380 °C

Adjust the tip temperature according to the wire diameter, specific heat of the component and feeding speed. Extremely high iron tip temperature causes flux to carbonize which inhibits heat conductance of the iron tip.

2. Process Environment: Designed for both manual and automated soldering by robot.

It is compatible to rework by manual soldering and automated soldering by automation. Use of spot ventilation system is recommended to vent out the fumes from the process.

3. Product Life: Product life is 3 years from the date of production.

Flux and the activator in the flux will not significantly degrade during the product warranty period. However oxidation on the product surface may build up and may cause dross in the flux residue. Please store this product in a storage where temperature will be consistent throughout the year and please avoid high temperature/ high humidity condition.

* How to interpret Lot Number

e.g. Lot No. 16 02 100 72

↓ ↓ ↓ ↓

Production number of the flux
 Production number of the alloy
 Month of production (February)
 Last 2 digits of the year (2016)

