

ECO SOLDER®

Environment-friendly Lead-Free Solder

SENJU METAL INDUSTRY CO., LTD.

Lead-Free Initiative™

It is said that the production of electronic equipment starts with the joint and ends with the joint. Modern electronic equipment has evolved towards more microscopic and higher-density components. As a result of this trend, various connecting methods have been developed. However, soldering remains the most popular means of basic jointing.

The history of soldering goes back some 5,000 years, but fundamental soldering has always used Sn-Pb series solder that consists of tin and lead. However, lead pollution ground water has been recognized as an environmental problem and complete elimination of the use of lead is called for.

Realizing that protection of our environment is our task in the 21st century, SMIC has earnestly extended our research in this area and developed Lead-Free "ECO SOLDER."

Please contact us for any problem that relates to Lead-Free soldering. We are thoroughly prepared to introduce Lead-Free soldering system as we have a comprehensive technology base and have constructed support systems in various phases with **ECO Soldering Solution™**.

ECO SOLDER

Lead-Free ECO SOLDER developed by SMIC offers high soldering reliability compared with the Sn-Pb series solder of the past and is available in a wide product lineup according to the required soldering temperature.

E series (antioxident type) and automatic feeding type for solder bath are also available.

Product availability may be limited for certain alloy compositions. Please select the appropriate product from the ECO SOLDER Products Guide at right.



JIS Z 3282, ISO9453 Chemical composition of lead-free solders

Class	Symbol		SMIC Item	Chemical composition mass%													
	1	2		Sn	Pb	Sb	Bi	Cu	Au	In	Ag	Al	As	Cd	Fe	Ni	Zn
Sn 96.5 Ag 3 Cu 0.5	Sn 96.5 Ag 3 Cu 0.5	A30C5	M705	Remain	0.10 max	0.10 max	0.10 max	0.3 ~ 0.7	0.05 max	0.10 max	2.8 ~ 3.2	0.001 max	0.03 max	0.002 max	0.02 max	0.01 max	0.001 max

※SMIC's lead-free alloys are produced impurity less than 0.05%.

ECO SOLDER Product Guide

ECOSOLDER	Alloy composition (wt%)	Temp. (°C)			Form				
		Solidus line	Peak	Liquidus line	BAR	CORE	BALL	PASTE	PRE FORM
M-series: Solidus line temp. 200 - 250°C									
M705	Sn-3.0Ag-0.5Cu	217	219	220	●	●	●	●	●
M30	Sn-3.5Ag	221	223	223	●	●	●	●	●
M31	Sn-3.5Ag-0.75Cu	218	219	219	●	●	●	●	●
M714	Sn-3.8Ag-0.7Cu	217	219	225	●	●	●	●	●
M715	Sn-3.9Ag-0.6Cu	217	219	226	●	●	●	●	●
M710	Sn-4.0Ag-0.5Cu	217	219	229	●	●	●	●	●
M34	Sn-1.0Ag-0.5Cu	217	219	227		●	●	●	●
M771	Sn-1.0Ag-0.7Cu	217	219	224	●	●	●	●	●
M35	Sn-0.3Ag-0.7Cu	217	219	227	●	●	●	●	●
M20	Sn-0.75Cu	227	229	229	●	●	●	●	●
M24MT	Sn-0.7Cu-Ni-P-Ge	228	230	230	●	●			●
M24AP	Sn-0.6Cu-Ni-P-Ge	227	228	228	●	●			●
M40	Sn-1.0Ag-0.7Cu-Bi-In	211	222	222				●	
M47	Sn-0.3Ag-0.7Cu-0.5Bi-Ni	216	228	228				●	
M53	Sn-3.0Ag-3.0Bi-3.0In	198	214	214				●	
M731	Sn-3.9Ag-0.6Cu-3.0Sb	221	224	226	●	●		●	●
M716	Sn-3.5Ag-0.5Bi-8.0In	197	208	214		●		●	
M10	Sn-5.0Sb	240	243	243	●	●	●	●	●
M14	Sn-10Sb	245	248	266	●	●	●	●	●
M709	Sn-0.5Ag-6.0Cu	217	226	378	●				
M760	Sn-5.0Cu-0.15Ni	228	229	365	●				
M711	Sn-0.5Ag-4.0Cu	217	226	344	●				
M60	Sn-2.3Ag-Ni-Co	221	222	225			●		
M770	Sn-2Ag-Cu-Ni	218	220	265			●		
M758	Sn-3Ag-3Bi-0.8Cu-Ni	205	215	215			●	●	●
M84	Sn-3.0Ag-0.5Cu-Ni	219	223	324		●			
M85	Sn-0.3Ag-2.0Cu-Ni	218	231	332		●			
M86	Sn-0.3Ag-0.7Cu-Ni	220	232	330		●			
L-series: Solidus line temp. under 200°C									
L20	Sn-58Bi	139	141	141	●		●	●	
L23	Sn-57Bi-1.0Ag	138	140	204	●		●	●	

Peak temp. : Max. endothermic reaction point on DSC curve.

Some alloy compositions may not be available in certain forms with special product size and grade.

For inquiries regarding alloy compositions not listed, please contact our sales representative.

Solder Paste ECO SOLDER Paste

Lead-Free ECO SOLDER Paste developed by SMIC is a next-generation solder paste that meets environmental requirements. Compared with existing solder paste, ECO SOLDER Paste solves various Lead-Free problems such as preservation stability, supply stability, solder wet-ability, and heat resistance resulting from the higher melting point.

S70G Series

A new generation paste family improving upon the industry standard GRN360 with excellent printing stability, enhanced heat resistance, reduced flux splattering, head-in-pillow elimination and tack power. S70G's enhanced wetting capability significantly reduces BGA joint non-wet failures and improves upon the in-circuit probe pin testing ability of previous generation pastes.

374FS Series

Specially developed for large area die bonding or surface mounting of semiconductor module. Good washability reduce boids generated under bare chip.

TVA Series

Developed for "stackable" 3D component mounting processes and is our most advanced solder paste to date. Consistent volume transfer during dip process.

DSR Series

Newly developed for dispensing excellence, DSR Pastes are compliant with a wide range of applications. Compliant with various heating methods such as reflow ovens, rapid heating laser and hot air convection.

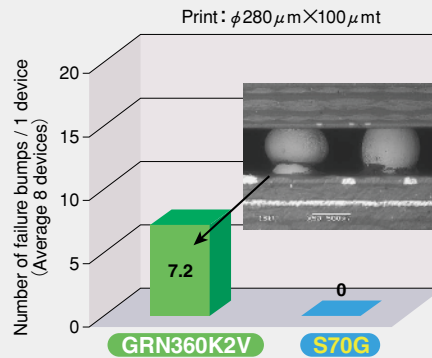
345F Series

The ECO Solder Paste M705-345F Series exhibits excellent post-reflow de-fluxing properties, while maintaining increased thermal resistance, reduced solder balls and very stable viscosity characteristics.

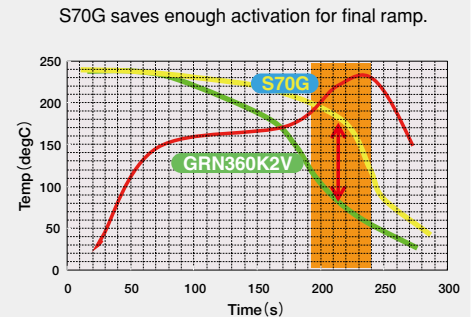
Typical ECO SOLDER Paste products

Products	S70G Series	374FS Series	TVA Series	DSR Series	345F Series
Factor					
Alloy	M705	M705/M34	M705	M705	M705·M34
Flux content (%)	11.5	11.0	20.0	13.0	12.0
Haloid content (%)	0.0	0.2	0.0	0.05	0.20
Powder grain size	Type 3 (25~45 μ m) Type 4 (25~36 μ m) Type 5 (15~25 μ m)	#42 (25 ~ 45 μ m)	K (15 ~ 25 μ m) F (5 ~ 25 μ m) A (5 ~ 15 μ m)	#32 (25 ~ 36 μ m) #21 (15 ~ 25 μ m)	#32 (25 ~ 36 μ m) #21 (15 ~ 25 μ m)
Viscosity (Pa.S)	190	150	30	70	200
Features	Improved SMT quality & productivity	Good washability, reduce voids	Consistent volume transfer for POP	Excellent dispensing & wetting	Excellent finish after cleaning

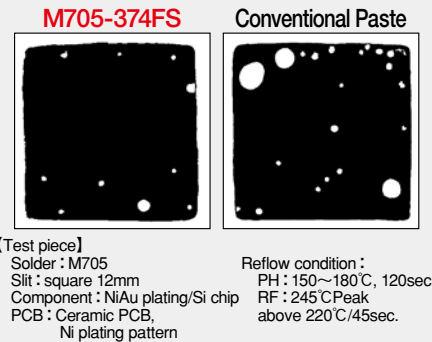
BGA wetting Improvement (S70G & GRN360)



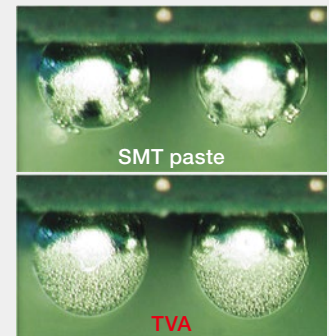
Enhanced flux activation curve



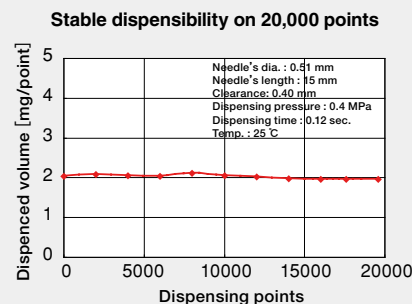
M705-374FS Void Prevention Result (X-Ray picture)



Paste transfer condition



DSR : Result of continuous dispensing



345F : Appearance after cleaning



Flux

Flux chemically removes oxide film from the metal surface to be soldered, thereby exposing the solderable metal surfaces. Flux is therefore indispensable in all soldering processes, including soldering of PC boards and special metals. It requires high reliability and soldering properties that match the application. SMIC has a long experience in developing various types of flux, including PC board flux, all of which provide unrivaled performance.



SPARKLE FLUX ES SERIES

ES series Sparkle Flux is a post-flux developed for the Lead-Free soldering of PC boards. Lead-Free solder has rather poor solder wettability compared with existing Sn-Pb solder. However, solder bridges, icicles, blow holes and other problems in Lead-Free soldering can be reduced to a level equivalent to those of existing Sn-Pb solders with the use of the ES series Sparkle Flux.

Properties of Post-Flux

SPARKLE FLUX ES SERIES

Products	Physical property	Solid content	Chlorine content	Specific gravity (20°C)	Remarks
ES-1061SP-2		15%	0.09%	0.826	Prevents bridging of ES-1061, good finish in through-hole
ES-1077		7%	0.04%	0.804	Low residue
ES-0307LS		15%	0.07%	0.826	Low Ag content, Sn-Cu alloy, good wettability, good lusterless finish.
ES-0307LS-PD		15%	0.07%	0.826	Point soldering

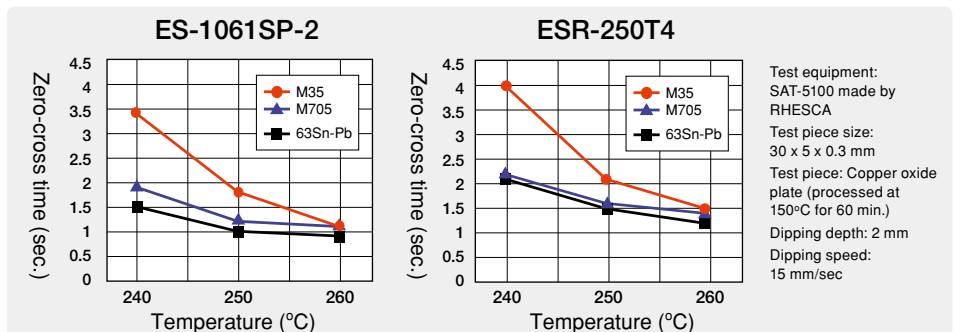
SPARKLE FLUX ESR SERIES

ESR series Sparkle Flux is a highly reliable post-flux. If existing flux for Sn-Pb soldering is used for Lead-Free soldering, a large number of solder bridges, icicles and blow holes may be generated. ESR series Sparkle Flux exhibits the highest degree of wettability among RMA type fluxes and produces excellent soldering results.

SPARKLE FLUX ESR SERIES

Products	Physical property	Solid content	Chlorine content	Specific gravity (20°C)	Remarks
EZR-01S		7%	0.01%	0.086	RMA type, Low residue
ESR-250T4		15%	0.0%	0.822	RMA type, best for both sides P.C.B.
ESR-280		9%	0.012%	0.810	Lower solid content type of ESR-250T4

Comparison of Wettability in Lead-Free Soldering and Zero-cross Time (by Temperature)



Recommended soldering conditions

Flux application

- 1) Flux must be applied by foaming, spraying, etc.
- 2) Use a stainless steel container for storing flux.

Preheating

- 1) Preheating must be implemented in order to ensure the evaporation of solvent, heating of the PC board pad and parts electrode and activation of the flux.
- 2) Recommended preheating temperature is 100 - 130°C (at the soldering surface).

Limit to 100 - 110°C to prevent PC board warping.

If through-hole spreading is poor, set the temperature at around 120 - 130°C (at the soldering surface).

- 3) Although the recommended preheating time is 30 - 60 seconds, solvent can be vaporized with longer preheating. Preliminary heating with hot air is also effective.

Soldering

- 1) Set soldering temperature at 250 - 255°C.
- 2) For the wave soldering bath, set the soldering time between 3 - 5 seconds.

Flux Cored Solder

Since SMIC developed its first flux cored solder SPARKLE SOLDER in 1955 in Japan, we have developed a number of flux cored solders for various alloys and applications.

For our ECO SOLDER alloy, SMIC developed a type of flux cored solder with improved wettability, a drawback peculiar to Lead-Free solder.

ECO SOLDER NEO

Superior Wettability

ECO SOLDER NEO further improves workability over conventional solder. Faster soldering is achieved by refining flux fluidity for rapid initial wetting. Low solder and flux spattering make rework easier, while light yellow residue contributes to better appearance.

ECO SOLDER RMA08

High reliability and clear finish

ECO SOLDER RMA08 is a highly reliable resin flux cored solder that complies with the former U.S.A. standard, QQ-S-571. It exhibits less solder ball spattering and has a transparent and colorless finish. The flux exhibits corrosion resistance and high insulation characteristics.

ECO SOLDER HVP

Excellent heat-resistant flux cored

Newly improved heat resistant flux cored solder for P.C.B. exposed to long time at high-temperature. Very good solderability for the parts of high heat capacity and slide-soldering over a wide temperature range at 300°C to 400°C (approx.), restraint solder ball or flux spattering. Transparent and clear finish makes good appearance after soldering.

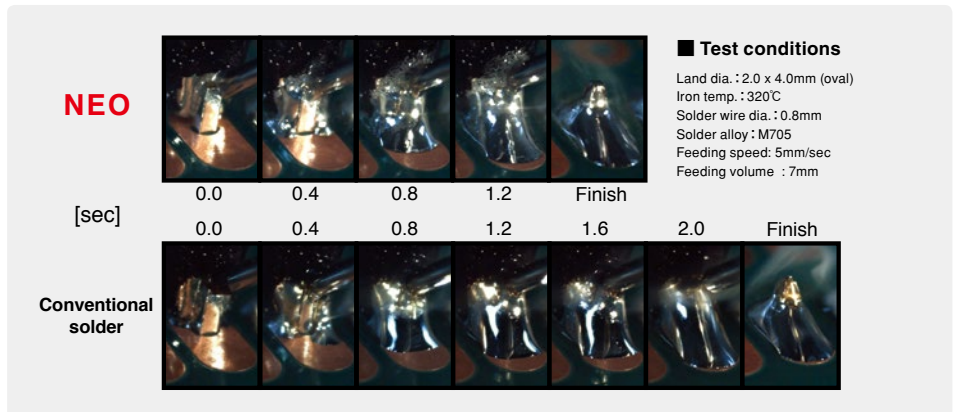
ECO SOLDER MLB

Developed for the non-contact

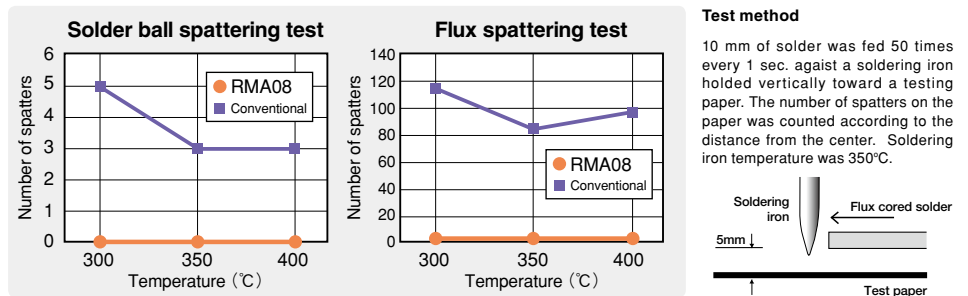
Heating process (Laser/Light Beam) MLB wire has excellent soldering characteristics while reducing flux splatter and lense contamination issues. A clear color residue resistant to thermal cycle cracking remains post-soldering.



Wetting speed of NEO in comparison to conventional solder



Low solder spattering of ECO SOLDER RMA08



Lead-Free flux cored ECO SOLDER: Specification and Features

Products	ECO SOLDER RMA08	ECO SOLDER MLB	ECO SOLDER NEO	ECO SOLDER HVP
Factor				
Alloy	Please refer to the ECO SOLDER Products Guide on page 1.			
Wire diameter	φ 0.3 to 2.0mm			
Flux content	3%, 4%	3%, 4%	3%, 4%	4%
Halide content	0.10% or less	0.10% or less	0.44%	0.44%
Insulation resistance	1 × 10 ¹¹ Ω over	1 × 10 ¹¹ Ω over	1 × 10 ¹¹ Ω over	1 × 10 ¹⁰ Ω over
Spreadability	77% (M705)	75% (M705)	79% (M705)	79% (M705)
Feature	Clear finish and high reliability	Non-contact heating	Excellent workability	Excellent heat-resistant flux

*Less than 0.3 dia. are available on request.

ECO SOLDER Preform

With improvements in the performance and reliability of electronic equipment, the size of components and printed wiring boards are becoming smaller and their density is increasing. Our solder preform helps cope with such high-density technologies.

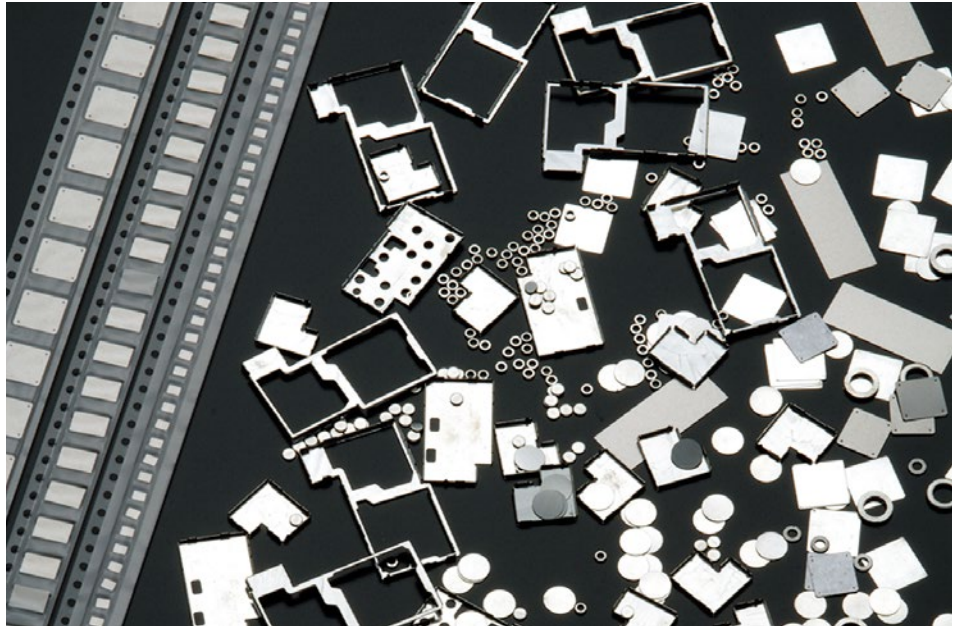
Our ECO SOLDER Preform is available in various forms to match any application such as washer, ring, pellet, chip, disk or ribbon.

Solder Coated Materials

Surface mounted components are becoming downsized for high density on PCB.

Our original coating method makes a solder coating practicable on Kovar or Nickel silver.

We offer you package-sealing material and protective case on components with this new technology.

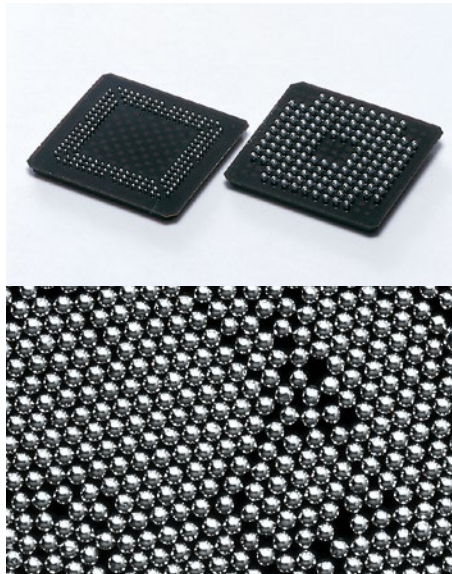


* Please inquire us for your own alloy, form and size specification.

ECO SOLDER Ball

Solder ball requirements include high purity and roundness. ECO SOLDER ball is widely used for soldering microscopic sections of crystal oscillators and diodes, as an electrode bump for hybrid ICs or power diodes in addition to the micro-soldering of BGA, MCM, CSP and flip chips.

Our Lead-Free ECO SOLDER ball exhibits excellent wettability though it contains no lead.



Diameter (mm)	Tolerance (μm)
$\phi 0.02$ to $\phi 0.08$	± 3
$\phi 0.1$ to $\phi 0.25$	± 5
$\phi 0.3$ to $\phi 0.45$	± 10
$\phi 0.5$ to $\phi 0.76$	± 20 <small>$\pm 10 \mu\text{m}$ type is available on request.</small>

*Micro balls less than 0.1 dia. are available on request.

Micro-soldering Fluxes

Micro soldering fluxes ideal for the soldering of our ECO SOLDER Ball. Various fluxes are available to match the method of cleaning and application.

Type Application method Factor	Resin Type			Water-soluble		Thermo setting Resin Type
	Transfer	Transfer	Printing	Transfer	Printing & Transfer	Printing & Transfer
Product	DELTALUX GTN-68	DELTALUX 901K	DELTALUX GTN-68P	SPARKLE FLUX WF-6317	SPARKLE FLUX WF-6307	JOINT PROTECT FLUX JPK-8
Solid Content (%)	67%	8.5%	67%	80%	—	—
Viscosity (Pa · S 25°C)	25	20	90	20	20	15

SMIC Automatic Soldering Machine

New Stable Pressure Flow (SPF) Soldering machine

Features

- Eliminates the use of stabilizing plate for ease of maintenance, but maintains smooth and stable wave for the best soldering process.
- High flow pressure provides sufficient solder in through-holes of multi layer boards and extremely reduces missing solder and bridges.
- Suitable for high thermal capacity devices allowing sufficient heat supply for soldering.
- Flow height can be easily set and maintained at 15mm or above.
- Conveyor handles different types of PCB carriers, pallets, and fixtures in selective soldering or thin PCB support process.
- Soldering process is visible through glass hood for better monitoring purpose.
- Standard touch panel operation allows changing among Japanese, English, or Chinese.

ECOPASCAL SPF2-300

The latest stable pressure flow soldering machine is most suitable for high quality lead-free soldering

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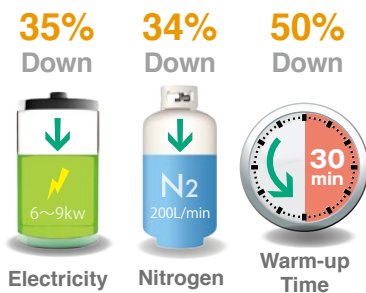


SPF-300 Standard Specification

• Dimensions	4,340mm(L) × 1,330mm(W) × 1,560mm(H)	• Board dimensions	50(W) × 100(L)mm to 300(W) × 450(L)mm
• Conveyor	Angle setting: 5° Variable conveyor width by manual operation	• Controller	PLC / PC controlled touch panel
• Conveyor height	780mm	• Weight	1,800 kg (approx.) solder included
• Preheater	Far infrared rays panel heaters (5kW × 4)	• Power requirement	3-phase 200V 32.5kw
• Solder bath	Heaters : 0.95kW × 12, Anti-splash heater (0.4kW) × 1 Solder (M705E, 390Kg)	• Options	Upper preheating unit, Chiller unit, PCB Warp prevention blade, Automatic solder feeding, High wave nozzle

★ Design and specification are subject to change without notice for improvements of system performance.

Nitrogen Ambient Reflow Oven for Lead-Free Soldering



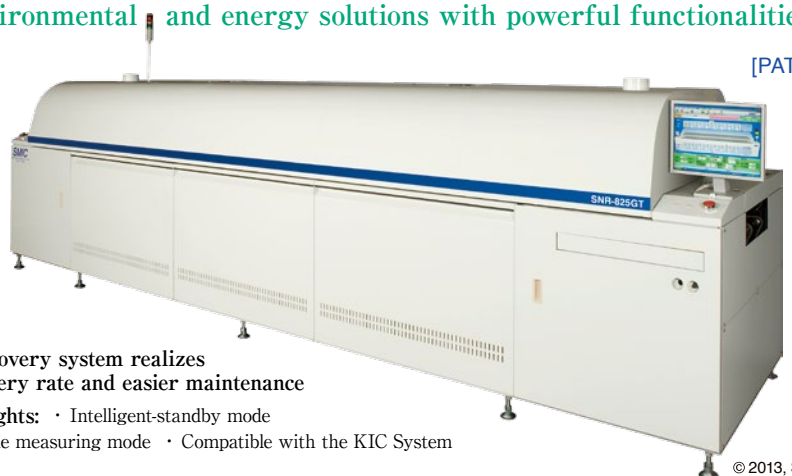
Features

- Equipped with the new Cross-Nozzle
Heating capability is improved, while reducing power consumption.
- Innovative heating structure delivers:
 - Reduced nitrogen consumption
 - Shortened warm-up time
 - Improved cooling capability (chiller not required)
- New flux recovery system realizes higher recovery rate and easier maintenance
- Other highlights:
 - Intelligent-standby mode
 - Reflow profile measuring mode
 - Compatible with the KIC System

ECOREFLOW SNR-825GT

The new Cross-Nozzle reduces power & nitrogen consumption while decreasing warm-up time. SNR-GT series contribute to your environmental and energy solutions with powerful functionalities.

[PAT.P]



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SNR-825GT Standard Specification

• Dimensions	5,300mm(L) × 1,240mm(W) × 1,460mm(H)	• PCB	Width : 50 to 250mm, Length : 100 to 400mm
• Conveyor height	900 ± 20mm	• PCB process clearance	Top side : 20 mm / Bottom side : 10 mm
• Conveyor speed	0.3 to 1.6 m/min.	• Operation control	PLC / PC control
• Heat zones	Hot air blowers, 8 zones	• Options	PCB warp prevention mechanism, automatic conveyor, width adjust, in-out feeder, chiller unit, automatic oxygen concentration control, UPS, top-bottom labyrinth curtain, ECO-mode operation, traceability, conveyor direction made to order
• Power requirement	200VAC, 100A, 3-phase		
• Cooling unit	Top and bottom blast cooling, 1 zone		

★ Design and specification are subject to change without notice for improvements of system performance.

SMIC

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■ Senju Metal (Italia) s.r.l.	Vicenza, Italy	TEL. (39) 0444-380789

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■ Senju Comtek do Brazil Ltda.	Campinas, SP, Brazil	TEL. (55) 19-3254-2572

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■ Senju (Thailand) Co., Ltd.	Bangkok, Thailand	TEL. (66) 2-633-8585
■ Senju Solder (Phils) Inc.	Rozario, Cavite, Philippines	TEL. (63) 46-437-2720
■ Senju Metal (Hong Kong) Limited.	Kowloon, Hong Kong	TEL. (852) 23 76 33 19
■ Senju Solnet Metal Co., Ltd.	Shatin, N.T. Hong Kong	TEL. (852) 26 82-2235
■ Senju Metal (Huizhou) Co., Ltd.	Huizhou, P.R. China	TEL. (86) 752-252-2605
	Shenzhen, P.R. China	TEL. (86) 755-2518-1171
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