

Senju Metal Industry Co., Ltd.
Senju Manufacturing (Europe) Ltd.

ECO SOLDER®

High-Reliability Lead-Free Solder Paste

M31-GRN360-K-V

Manufacturer

European Facility

Senju Metal Industry Co.,Ltd.

Senju Manufacturing (Europe) Ltd.

23 Senju Hashido-cho,
Adachi-Ku, Tokyo, Japan
Phone: +81-33888-5156
Fax: +81-33870-3032

Unit 5, The Gateway Centre, Coronation Road,
Cressex Business Park, High Wycombe,
Bucks HP12 3SU England
Phone: +44 (0) -1494-526000
Fax: +44 (0) -1494-526100

M31-GRN360-K V-Type

Lead-Free solder paste ECOSOLDER M31-GRN360-K V-Type is a further development of the GRN360 K-series and especially designed to meet higher preheat temperatures.

This means users will not only benefit from

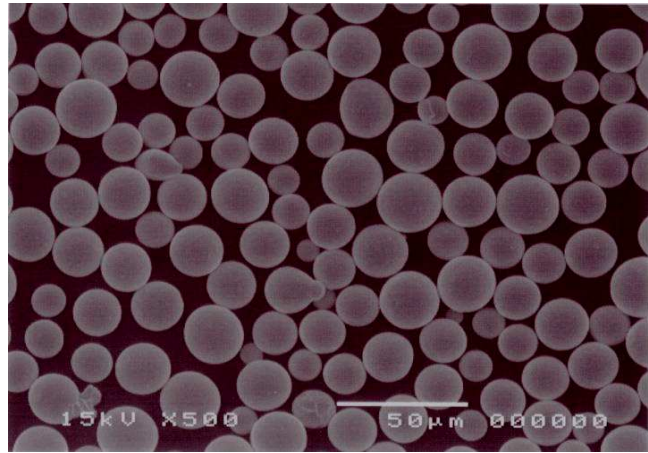
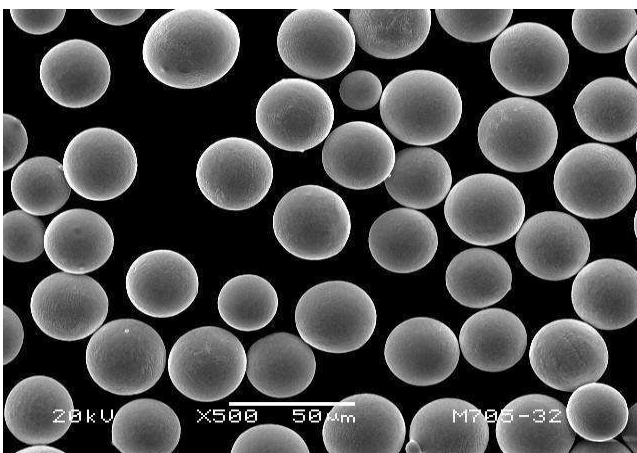
- | | |
|------------------------------------|---------------------------------|
| Very stable solder paste viscosity | Excellent wettability |
| Clear flux residue combined | Reduced flux residue cracking |
| Excellent joint cosmetics | Reduced occurrence of side ball |

that are the features of the GRN360-K series but also from a wide application range due to the improved thermal properties. This includes also high density applications with BGAs, CSPs etc.

Characteristic of M31 alloy compared to eutectic tin-lead alloy

		M31	63Sn-Pb
Alloy Composition(%)		Sn95.75-Ag3.5-Cu0.75	Sn63-Pb37
Specific gravity		7.4	8.4
Melting temperature °C	Solidus	217	183
	Peak	219	
	Liquidus	219	
Tensile strength (Mpa)		53.0	56.0
Elongation(%)		47	59
Young's module (Gpa)		45.1	26.3
0.2% Yield point (Mpa)		39.4	45.8
Coefficient of linear expansion (ppm/C)		21.3	23.5
Vickers Hardness (Hv)		17.9	16.6

SEM Photo of M31 powder



No surface oxidation, spherical lead-free powder is used in all Senju ECOSOLDER paste products .
(The photograph shows type-4 (25-36µm) and type-5 (15-25µm))

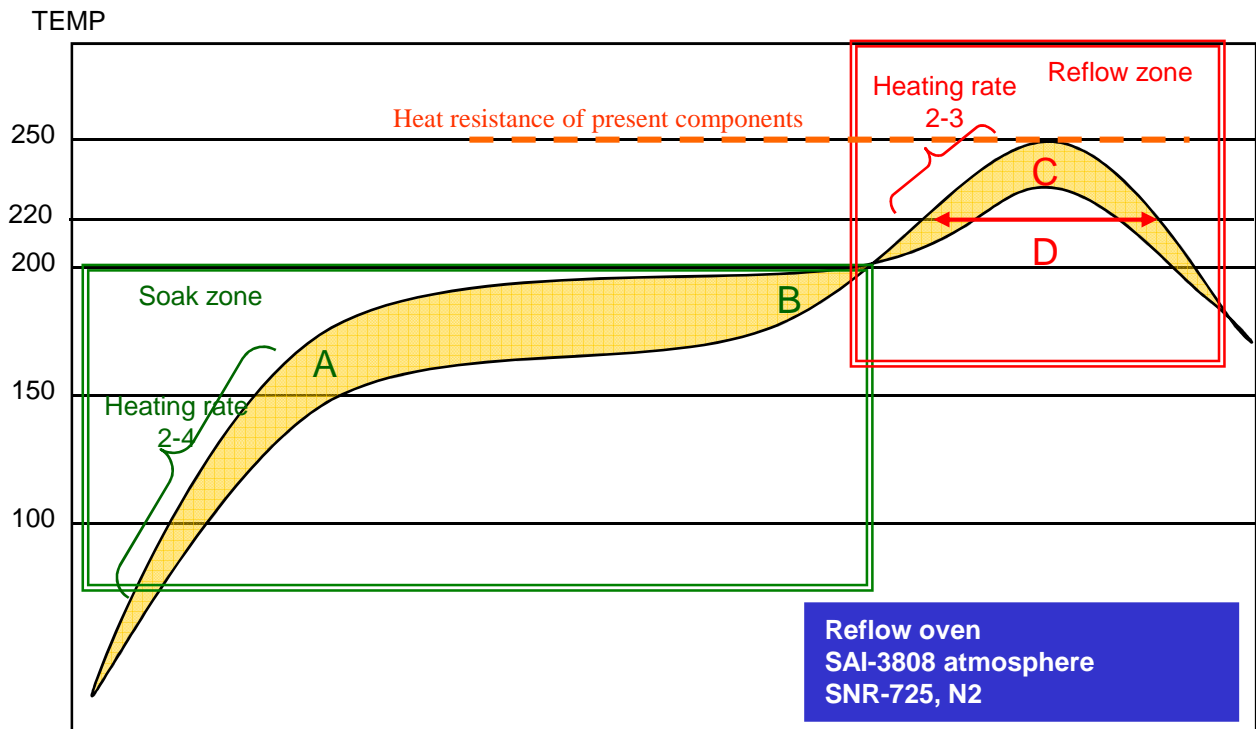
M31-GRN360-K V-Type characteristics

Items	M31-GRN360-K-V (Type 4)	M31-GRN360-K-MK-V (Type 3)	Test method /Remarks
Solder Powder			
Alloy Composition	Sn95.75-Ag3.5-Cu0.75		---
Melting Temperature	217 ~ 219 C		DSC
Powder Shape	Spherical		SEM
Powder size/distribution	25 ~ 36um	25-45 um	SEM & Laser method
FLUX			
Type	RO		J-STD-004
Activity	L0		J-STD-004
Halide	0.0%/Flux *1		Titration method
Surface Insulation Resistance (40C90%RH,168hr)	Over 1.0E+12		JIS Z 3284
Electro-migration Resistance (85C85%RH Bias DC45V, 1000hr)	Over 1.0E+9 No migration		JIS Z 3284
Water resistance	750Ωm		
Copper mirror test	PASS		JIS Z 3197
Fluoride Test	PASS		JIS Z 3197
Solder Paste			
Viscosity	K1:180 Pa.s K2:200 Pa.s		JIS Z 3284
Thixotropic Index	0.6		JIS Z 3284
Flux Content	11.5%		JIS Z 3197
Hot Slump	0.4mm Max.		JIS Z 3284
Tackiness	1.3N		JIS Z 3284
Tackiness Time	Over 24h/1.0N		JIS Z 3284
Spreading	77%		JIS Z 3197
Wetting and dewetting	Rank 1-2		JIS Z 3284
Solder balls	Rank 1-2		JIS Z 3284
Copper plate corrosion test	PASS		JIS Z 3197
Validity (unopened, keep at 0 ~ 10°C)	6 months		---

*1 : This products has a small amount of halide number of this table is for reference (Br)

Recommended Reflow Temperature Profile M31-GRN360-K-V

Recommended reflow temperature profile for M31-GRN360-K-V is shown below.
During reflow not all temperatures on PCB are the same, there will be a variation due to the different thermal mass.
However, all soldering points on the PCB showed go into the following recommendation for the thermal profile.



Recommendation

A: soak start:	150 - 180	C: Peak temp:	230 - 250
B: soak end:	170 - 200	D: time above 220;	30 - 60sec
A - B: soak time:	90 ±30sec	(solidus line)	

Reflowability GRN360-K-V

<p>..... behavior</p> <p>Aperture; 280um Thickness; 120umt Preheat; 180-200 / 120sec Peak; 240 (above 220, 45sec)</p>	Standard Paste (25 - 36um)	GRN360-K -V
	Standard Paste (25 - 45um)	GRN360-K MK-V

Heat resistance

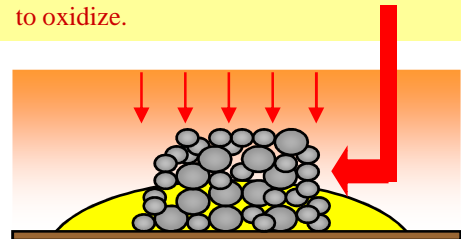
During reflow in atmosphere the oxidation layer is removed by the flux when oxidation increases in the high temperature atmosphere attacking the top surface of the solder powder. If the flux fails to remove the oxidation layer, powder can be left on the surface.



Preheat temp. and time



At the soak zone, the Flux is down to the bottom. Then solder powder is easy to oxidize.



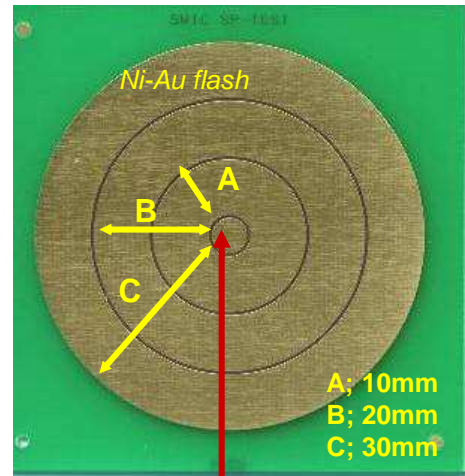
The smaller the surface, grain size and openings the more likely this is to happen and therefore the heat resistance of a solder paste is a very important item.

Solder / Flux spattering –GRN360-K-V

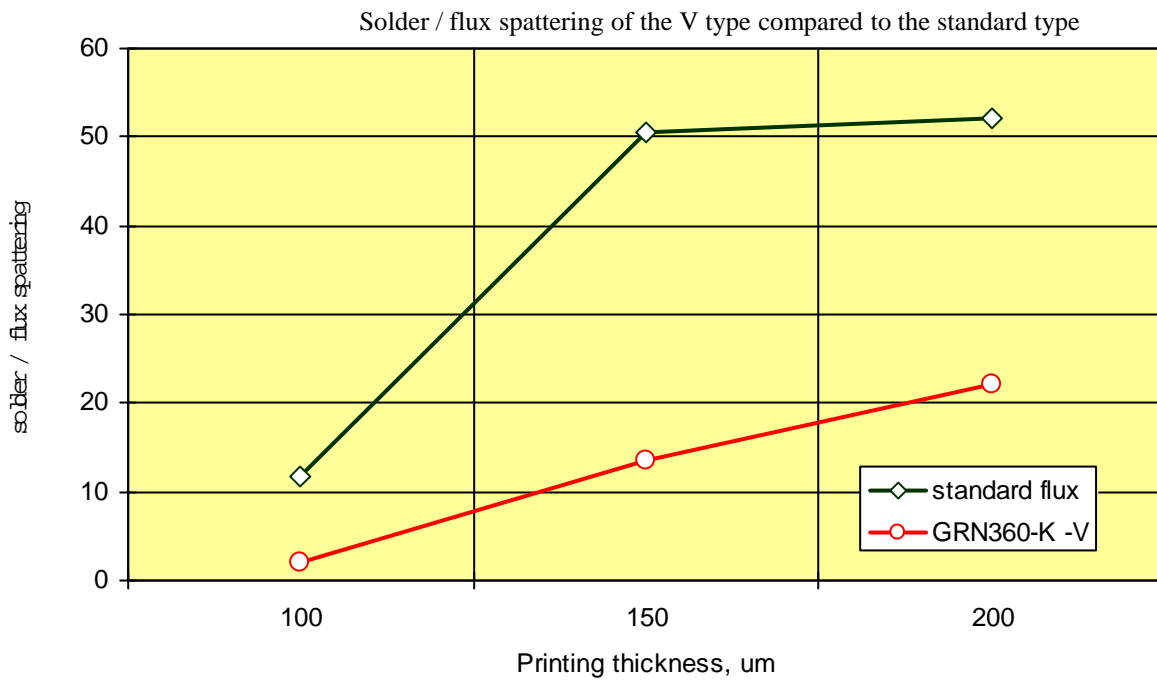
Test board / SMIC SP-TEST

**Solder / Flux spattering -
GRN360-K -V**

Test conditions:
Test board: Ni-Au flash
Printing: 6.5mmφ thickness, 100,150,200um
Preheat: 180-200 / 120sec
Peak temp; 240 (above: 220, 45sec)
Test method, counting of solder / flux spattering points on the reflowed board.



Printed paste: 6.5mmφ

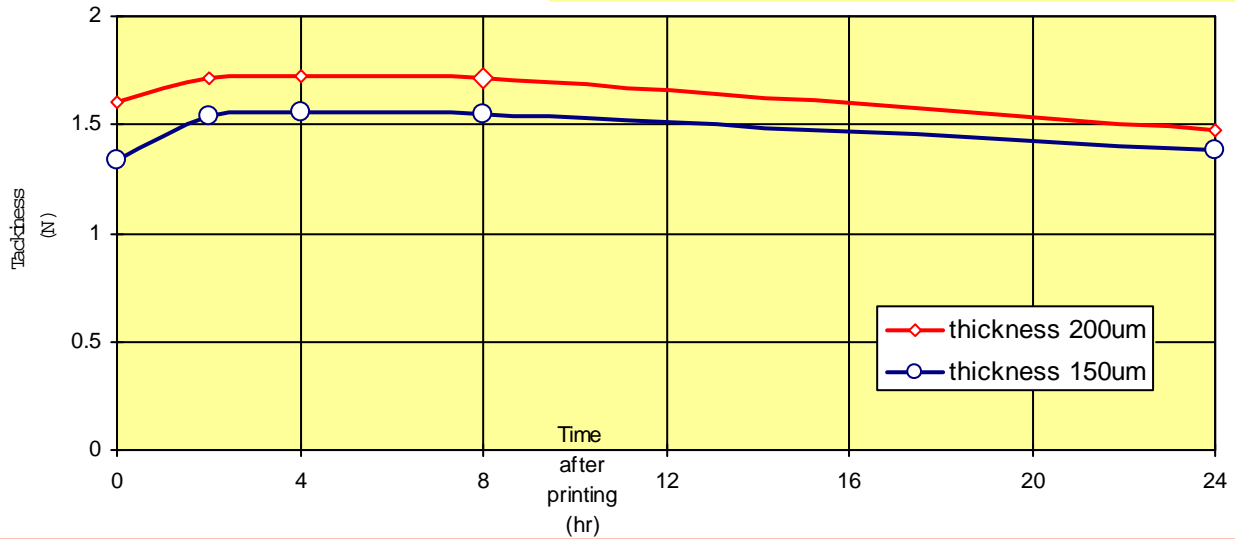


Solder or flux spattering during reflow affects the connections when sticking to gold fingers or other components. Compared to the standard type GRN360-K-V shows less solder / flux spattering. At a printing thickness of 100 ~ 150um it can be reduced up to a fifth. Solder / flux spattering is however also very much influenced by the quality of the PC boards and therefore this side should be also checked carefully.

GRN360-K-V Tackiness and Tackiness time

Tackiness and Tackiness time
GRN360-K -V

Test conditions:
Equipment; Rhesca, Tackiness tester
Immersion speed; 2.0mm/s
Press load; 0.49N
Environment; 25-50%RH
Press time; 0.2s
Test speed; 10.0mm/s

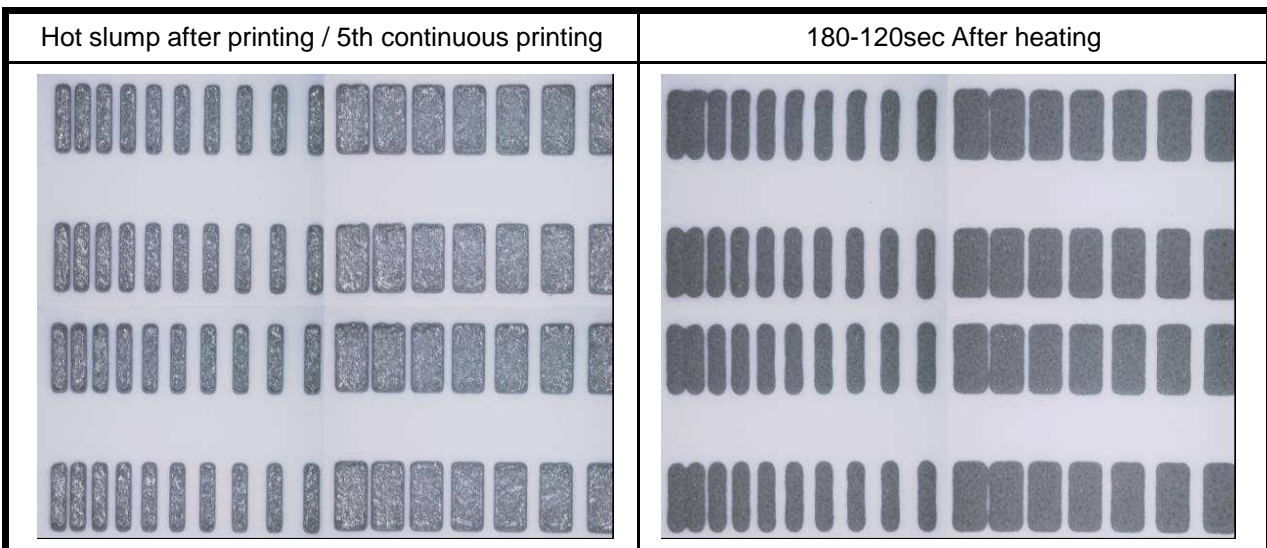


Tackiness force and the tack time of Solder Paste are important characteristics when related to the performance of high speed placement equipment. Tack time affects the defect rate (missing component, tombstone etc.) after machine stops and maintenance. GRN360-K-V has higher initial tackiness and longer tackiness after printing.

Printing; Hot Slumping
GRN360-K -V

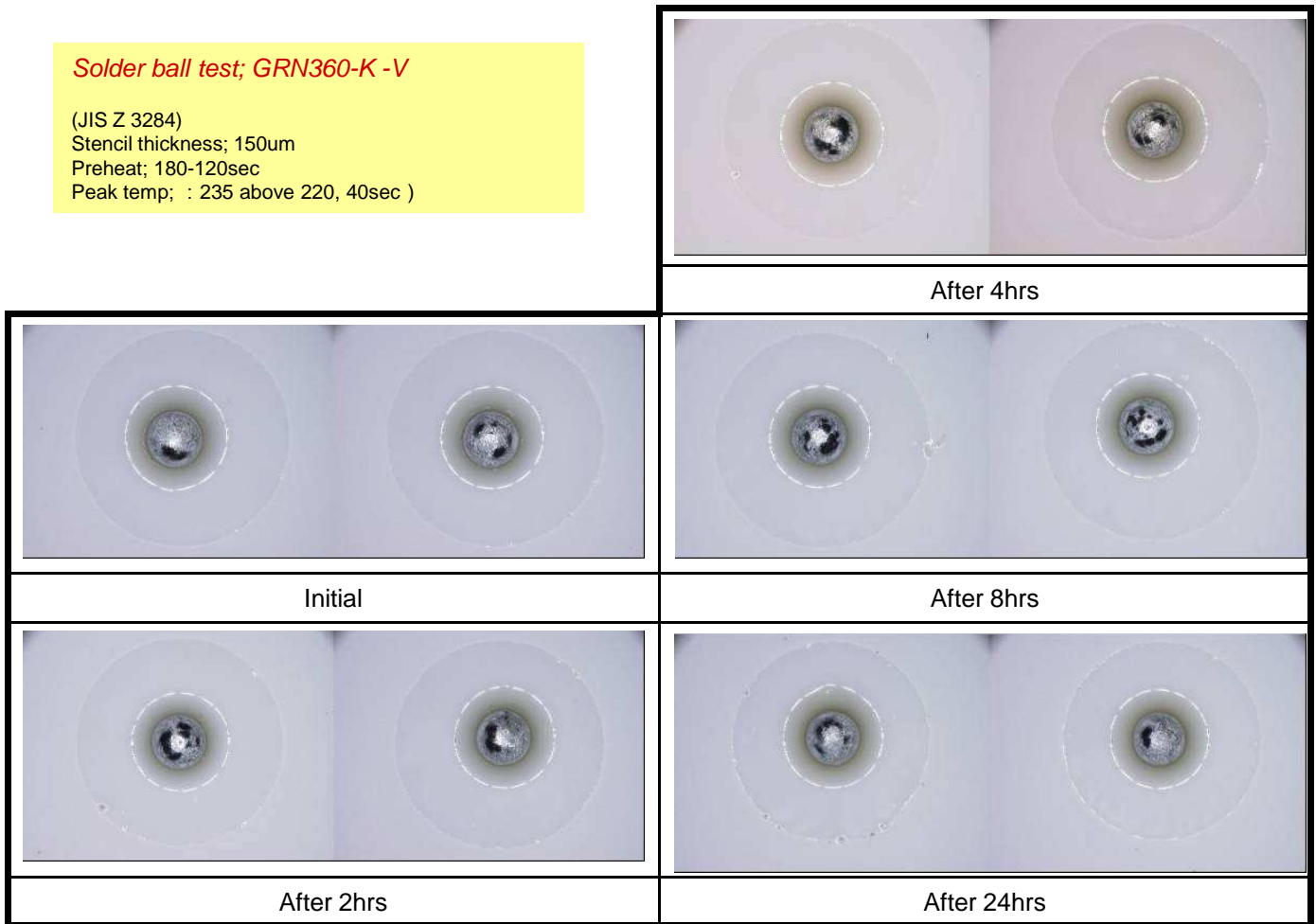
Test conditions;
Stencil thickness; 150um, JIS Z 3284
Heating; 180-120sec

The paste slump correlates with solder balling and bridging for fine pitch applications. GRN360-K-V has no slump and the characteristic also has a big effect in controlling side-ball.



Solder ball test; GRN360-K -V

(JIS Z 3284)
 Stencil thickness; 150um
 Preheat; 180-120sec
 Peak temp; : 235 above 220, 40sec)



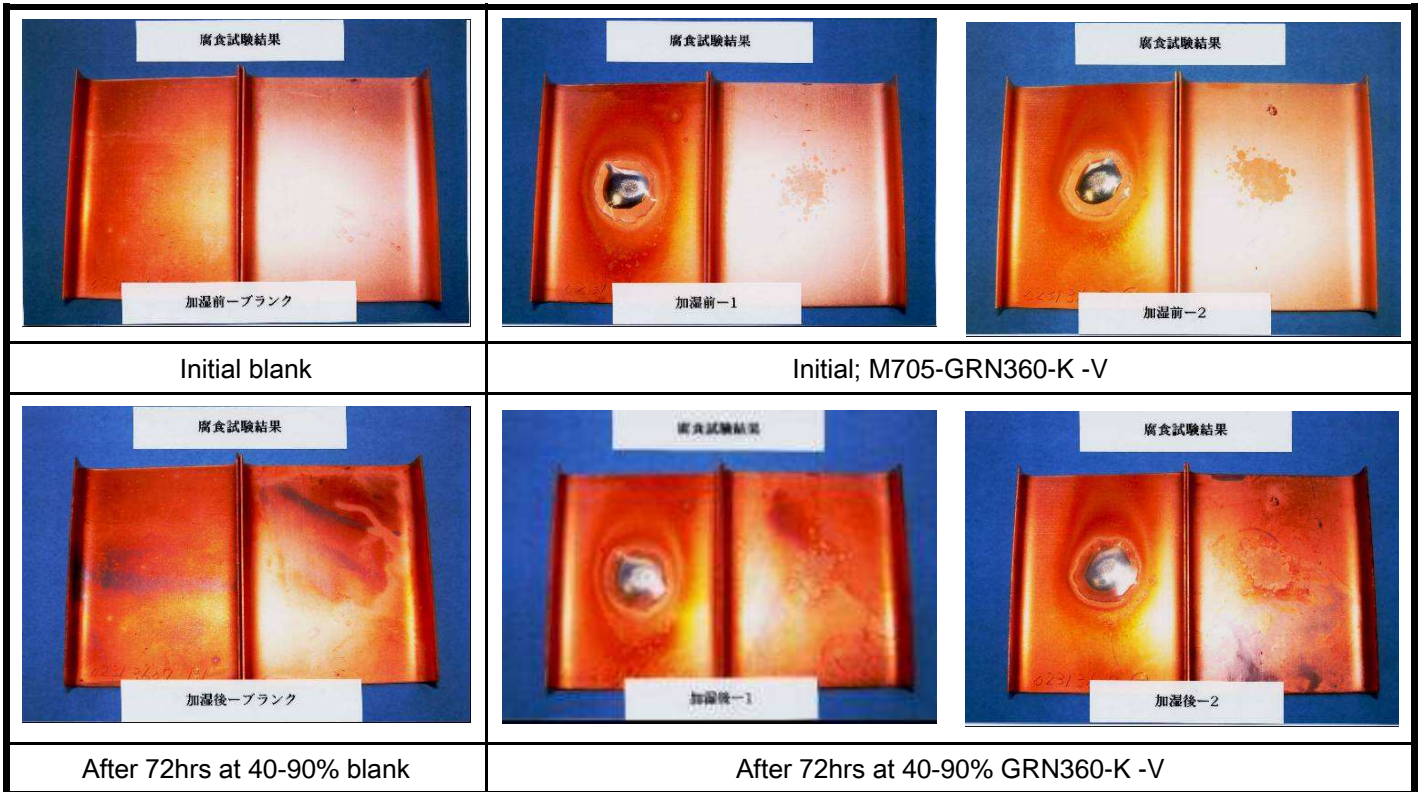
**Wetting and Dewetting
 GRN360-K -V**

(JIS Z 3284)
 Stencil thickness; 150um
 Preheat; 180-120sec
 Peak temp; 235 above 220, 40sec



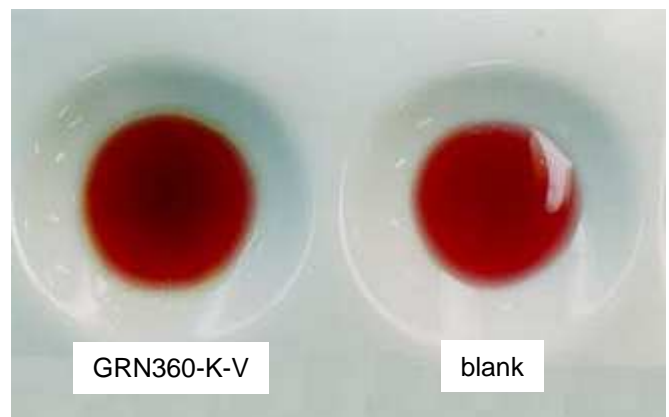
GRN360-K-V Reliability

Copper Corrosion Test
GRN360-K -V
(JIS Z 3197)



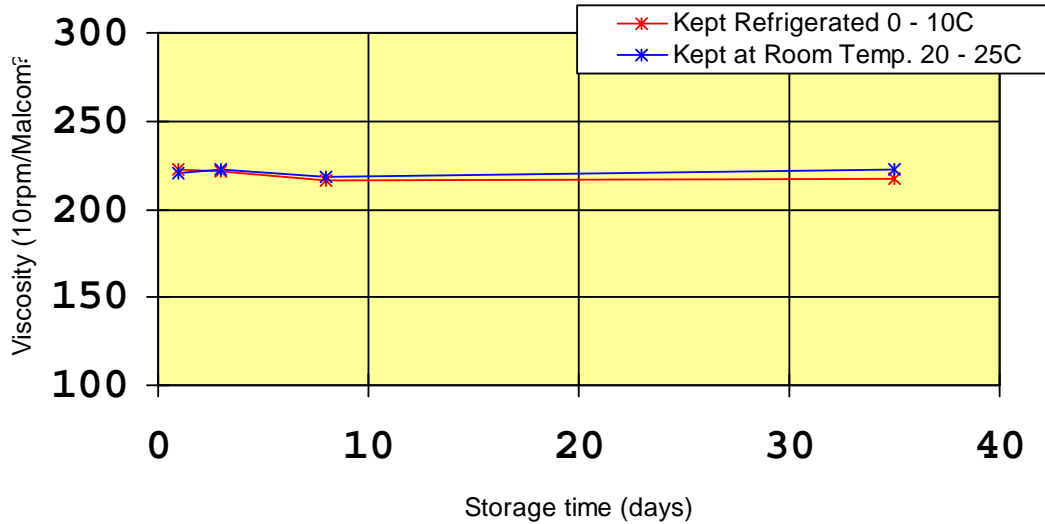
Copper Mirror Test
GRN360-K -V
(JIS Z 3197)

Fluoride Test
GRN360-K -V
(JIS Z 3197)



GRN360-K V Storage stability

Viscosity monitoring results with Storage time (Initial ~ 35 days)



GRN K V-series is very stable paste when stored in a fridge and also room temperature.

Long term stability of the solder paste is a key feature required for stable production, especially for irregular or low volume production. As shown by the above graph GRN360-K V is very stable at room temperature and so it performs exceptionally well during production.

The paste life is six months when the paste is kept unopened and in refrigerated storage (0-10 degrees C).