

**Technical  
Bulletin**

**1999-08-017c**

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

**NO-CLEAN SOLDER PASTE**

**Senju  
Sparkle Paste  
OZ AT-221CM5-42-10**

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**Distributor**

## **SENJU SOLDER PASTE SPECIFICATION**

Name: Sparkle Paste OZ AT-221CM5-42-10

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## **1. Application**

This specification specifically covers Senju solder paste for joining electrical devices such as component leads and PCB.

2-1 Solder material  
Type: Sn62, Ag0.4, Sb0.2, Pb37.4

2-1-1 Solder alloy composition                      Test method SMT-9

<b>Item</b>	<b>Specification</b>
Sn	61-63%
Pb	Balance
Ag	0.30-0.50%
Sb	0.10-0.30%
Bi	Under 0.05%
Cu	Under 0.05%
Fe	Under 0.02%
Zn	Under 0.002%
Al	Under 0.002%
As	Under 0.03%
Cd	Under 0.002%

2-1-2 Melting Temperature                      Test Method STM-10

Liquid line temp	185 $\pm$ 5°C
Solid line temp	178 $\pm$ 5°C

## 2-2-1a Visual Appearance, Specification, Character

Item	OZ AT-221CM5-42-10 Specification	Test method
<u>Solder Powder</u>		
Alloy Composition	Sn62 Ag0.4Sb0.2Pb37.4	J-STD-006
Elemental Impurities	Pass	
Melting Temperature	178-185°C	
Powder Shape	Spherical	J-STD-005-3.3.3
Powder Size	25 - 45 micron meter	
<u>Flux</u>		
Flux Composition	RO	J-STD-004-3.2.2
Flux Activity	RMA	
Water Solution Resistance	1000 ohm-m	QQ-S-571E
Copper Mirror Test	PASS	J-STD-004-3.2.4.1
Silver Chromate Test	PASS	J-STD-004-3.2.4.2.1
Fluoride Test	PASS	J-STD-004-3.2.4.2.2
pH	5.0	Bell Spec
<u>Solder Paste</u>		
Appearance	Smooth paste style	STM-1
Fluidity	200Pa.s±50Pa.s	J-STD-005-3.5
Characteristic(Viscosity) Thixotropic Index	0.70+0.10	Malcom
Slump in Heating	Under 0.3mm	J-STD-005-3.6
Metal Content (Flux Content)	90.0± 0.5wt% (10.0± 0.5wt%)	J-STD-005-3.4 (JIS Z 3197 /STM-5)
Printability	0.4mm Pitch	JIS Z3284
Tackiness	Over 100gf	J-STD-005-3.8
Tack Time	24hrs	JIS Z3284
<u>Reflowability</u>		
Tackiness test of residue after reflow	PASS (No Tackiness)	JIS Z3284
Solder Ball	Acceptable or better	J-STD-005-3.7.1
Wetting Effect and de-wetting	Pass	J-STD-005-3.9
Spreadability	over 90%	JIS Z3197
Corrosively test(copper plate)	Pass(No corrosion)	J-STD-004-3.2.4.4

## 2-2-1b Visual Appearance, Specification, Character

Item	OZ AT-221CM5-42-10 Specification	test method
Surface insulation resistance Normal condition After entering humidity chamber	1 x 10 <sup>13</sup> over 1.0 x 10 <sup>12</sup> over	JIS Z 3197 STM-30-1
Surface Insulation Resistance  Normal condition  After 168hr 1.)Measure in the room temperature 2.)Measure in the humidity chamber	1 x 10 <sup>13</sup> over  1.0 x 10 <sup>12</sup> over 1.0 x 10 <sup>9</sup> over	J-STD-004-3.2.4.5 (IPC-SF-818)  85°C/85%RH Voltage applied DC 50V in the humidity chamber.  Measuring voltage DC 100V
Electro Migration Resistance Test fixture in Humidity chamber with 85°C,85%RH after 500hr	No visible migration	Bellcore TR-NWT-000078 Keep test fixture in the humidity chamber at 500hr with applied DC 10V.
Surface Insulation Resistance  Normal Condition In Humidity Chamber Initial after 24 hr after 168 hr after 336 hr	1.0 x 10 <sup>13</sup> over  1.0 x 10 <sup>12</sup> over 1.0 x 10 <sup>12</sup> over 1.0 x 10 <sup>12</sup> over 1.0 x 10 <sup>12</sup> over	Bell core TR-NWT-000078 35°C,90%RH, DC 50V  Measuring voltage DC 100V

## 2-2-2 Flux Chemical Composition

Senju does not openly disclose chemical components to the customer. However, if customer must have information chemical information of the paste material, please contact Senju Manufacturing (Europe) Ltd.

### **3. Inspection Report**

Senju does not routinely include solder paste inspection report with the delivery of the solder paste to the customer. Therefore, please requests Senju distributor for the inspection report giving the product name and lot number.

Our standard inspection report covers the following items:

- (1) Alloy composition
- (2) Flux content
- (3) Melting Range
- (4) Viscosity
- (5) Grain Size Distribution
- (6) Slumping test (Class 1,2)
- (7) Solder Balling
- (8) Halide content

### **4. Packaging and Label**

#### 4-1 Container

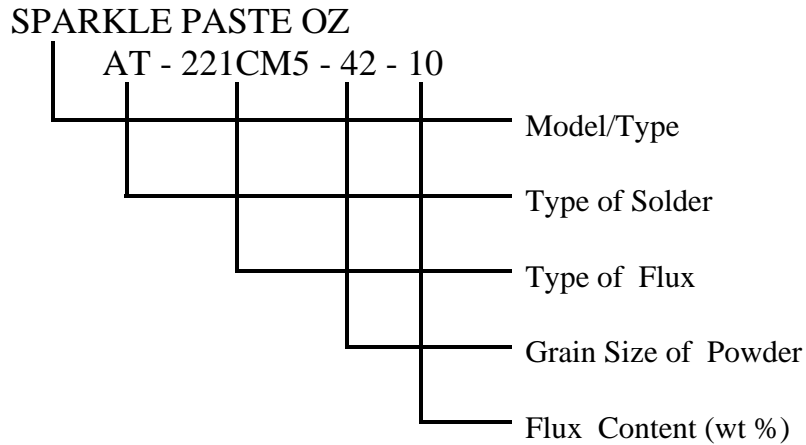
Senju's standard for solder paste packaging is a polyethylene container which can hold 500g weight of solder paste. Senju also delivers this material in a larger 1.4kg cartridge.

#### 4-2 Label

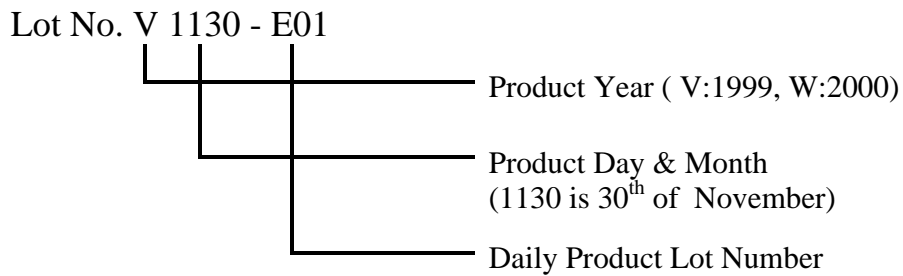
The following items are printed on every solder paste label:

- (1) Product name
- (2) Net weight
- (3) Product lot number
- (4) Validity
- (5) Manufacturer's Name
- (6) Safety caution

**5. Product Type Identification System (EXAMPLE)**



**6. Product Lot Number System (EXAMPLE)**



## **7. Warranty**

This solder paste's warranty is 6 months from the day of production (unless the container is opened) and when it is maintained in a storage condition of 0°C to 10°C.

## **8. Usage Instructions**

- (1) Avoid skin contact. If contact with skin, wash thoroughly with alcohol..
- (2) Do not take internally, avoid eye contact, and prolonged or repeated contact by breathing vapors.
- (3) Please wash hand after working with paste (to avoid ingestion paste that may be on your hands during eating).
- (4) Please provide fume extraction around area where paste will be used.
- (5) Recommended paste storage is 0°C to 10°C in a refrigerator.
- (6) Do not use paste immediately after removal from refrigerator. Allow 2 hours for paste to reach room temperature.
- (7) Please remove the minimum amount of paste needed for the application. Do not return used paste into a container that still has unused/new paste, when work is finished. Old paste should be thrown away into an area or container set-aside for that purpose.
- (8) Please mix paste at least 20-30 times before using ,or knead 2-3 times on the stencil.
- (9) Please use paste as soon as possible after opening .
- (10) Paste should be used in an area that has a controlled/constant room temperature of about 25 °C , and below 50% relative humidity.



## **9. Test Methods**

### **STM-1 Appearance**

Visible check for smooth type paste and gray color.

### **STM-2 Weight**

Check weight by gram scale balance.

### **STM-5 Flux Content** Refer to JIS Z 3197-6.1.

This test method is defined by JIS Z 3197:

Take approximately 30 g of sample from an evenly mixed solder paste and measure accurate mass as W1(g). Next, put into glycerol to melt by heating in order to separate solder from flux completely, and leave it for cooling and solidifying. Take out solidified solder, and wash it in water. After re-washing it in alcohol and drying, measure the accurate mass as W2(g), and calculate the flux content from the following formula.

$$\text{Flux content (\%)} = (W1-W2) \times 100/W1$$

### **STM-9 Solder Alloy Composition**

Refer to JIS Z 3910 or JIS K 0116

### **STM-10 Melting Temperature**

Differential Scanning Calorimeter

### **STM-12 Powder Shape and Particle Distribution**

Load solder powder on the container of the scanning electron microscope (SEM) with shape of OD 30 mm, 1mm thickness. Inspect the photographs with magnification of x200 to x1000. Measure the length to width ratio of the particle noting the largest length to width ratio.

Particle distribution is determined by inspecting the output of the laser analyzer, which indicates the weight percentage of each particle size range.

**STM-28-1 Copper Plate** Refer to JIS Z 3197

This test method is defined by JIS Z 3197

A clean steel plate of about 0.3 x 50 x 150 mm SPCC size is specified in JIS G 3141 shall be plated by electric current of 110 mA for 80 seconds in the copper plating bath as indicated below:

Copper sulfate	20 g/l
Ammonium sulfate	30 g/l
Potassium sodium tartrate	30 g/l
Aqueous ammonia or sulfuric acid	5 to 10%
pH	7.7

Drop approximately 0.05ml of sample onto the test plate as described above and dry it a normal temperature for about 5 minutes to obtain the test plate.

The test piece is then put into a constant temperature and humidity bath with temperature of  $23 \pm 2^{\circ}\text{C}$  and with humidity of  $50 \pm 5\%$  for 24 hours. Remove the flux with isopropyl alcohol and visually compare the degree of corrosion on the test piece with that of the corrosion when the flux is removed by isopropyl alcohol solution with 35 mass % of rosin (WW rosin).

**STM-29-1 Copper Mirror** Refer to QQ-S-571E 3.6. JIS Z 3197

This test method is defined by JIS Z 3197:

To obtain the test plate a glass plate is taken from a photographic dry plate of about 1.5 x 50 x 100mm and is metallized with copper by evaporation until the degree providing the permeability of  $10 \pm 5\%$  against a regular incident ray of 5000 Å.

Drop approximately 0.05ml of sample onto the test plate described above and dry it a normal temperature for about 5 minutes to obtain the test plate.

Put the test piece into a constant temperature and humidity bath with temperature of  $23 \pm 2^{\circ}\text{C}$  and with humidity of  $50 \pm 5\%$ , for 24 hours. Remove the flux with isopropyl alcohol and visually compare the degree of corrosion on the test piece with that of the corrosion when the flux is removed by isopropyl alcohol solution with 35 mass % of rosin(WW rosin).

**STM-30-1 Insulation Resistance** Refer to the JIS Z 3197 or IPC-818

Test method is defined by JIS Z 3197 6.8. (Different than IPC).

Insulation resistance mentioned here includes surface insulation of the test piece.

1) Test piece: comb type electrode which has the glass fiber-based epoxy resin (FR-4), copper clad laminated plate GE-4 (the insulation resistance of test piece should be larger than  $10^{13}$  ohm.)

Dimension of comb type electrode:

Width of conductor:	0.318 mm
Space between conductors:	0.318 mm
Overlap length:	15.75 mm
Test piece dimension:	50 mm x 50 mm

2) Paste printing: Paste should be printed through the metal mask with the opening of the same pattern of comb shape electrode and with 100-micrometer thickness.

3) Reflow: (reflow oven)  
150 - 160 °C, 10 - 70 sec / Peak 130 °C  
(hot plate)  
150 °C, 120 sec/260 °C, 30 sec.

4) Test method: Measure the insulation resistance of the above test piece under the normal condition and after 96 hours in a constant temperature and humidity chamber regulated at the temperature of  $40 \pm 2$  °C and relative humidity of 90 - 95%. Put the test piece into the condition which is specified in JIS C 0010 5.4.

Take it out within 1 hour, and under the condition in 4.1, measure the insulation resistance with an insulation resistance tester of working voltage DC 500 V for type 1 electrode and DC1000V for type 2 electrode after 1min.

Temperature:	Test room temperature $\pm 1$ °C Between 15°C and 35°C
Relative humidity:	73 - 77 %RH
Atmospheric pressure:	860 - 1060m bar

Each terminal of a test piece should be measured 4 times and the average from the data should be used.

**SMT-34-1 Reflow test**

Apply solder paste to the copper plate with in a circular pattern 10mm diameter and 0.3mm thick.

Then reflow under the following condition with the pre-heat temperature profile at least 30°C under the solid line temperature for 20 seconds. Reflow temperature profile must be over 50 °C from liquid line temperature for 40 seconds.

Check above test piece visually for cold solder joints and wetting.

### **STM-32-1 Water moisture content in the flux**

Refer to QQ-S-571E, JIS Z 3197

This test method is defined by JIS 3197-4.9.

Test shall be carried out to determine the resistance of water solution of the solder paste with the flux containing the solid portion equivalent to  $0.05 \pm 0.005$  g as the sample.

Put the sample into a beaker with 50 ml of water, next cover the beaker with a watch glass, heat it for about 5 minutes for boiling, and continue further heating for 1 minute. Cool the beaker for about 10 seconds at normal temperature, put it in a water bath of 20 °C to obtain the test solution, and immediately measure the resistance of water solution.

Measurement shall be made by a conductivity meter, and the cell of 0.1 cell constant shall be used.

Further, the pure water used shall have more than 500,000 ohm of specific resistance at 20°C.

### **STM-27-1 Halide Content**

Refer to QQ-S-571E 4.7.3.2, JIS Z 3197

This test method is defined by JIS Z 3197.

Measure the halogen content by the direct titration method. Indicate data as the equivalent of chlorine ion content. For flux measurement, a flux sample of 0.3g to 1.0g should be used to measure its weight accurately. Chlorine ion content in flux(%)=(AB-BC)x100/mass of flux(g)

A: Consumption of solution of N/20 nitrate of silver (ml)

B: Equivalent chlorine ion per 1ml of solution of N/20 nitrate of silver. (g)

C: Consumption of solution of N/20 nitrate of silver for correlation. (ml)

Equipment: Potentiometric Automatic Titrator model AT-400

Manufactured by Kyoto Electronics

Sampling: IPA solution of flux of 0.5g to 1.0g.

### **SMT-7 Viscosity**

Refer to JIS Z 3284

Test equipment: MALCOM PCU-5 (or PCU-2) Mix the paste in the container and install in the Malcom unit. Rotate screw at 10 rpm till the paste comes up to top of screw. Leave until the temperature of paste reaches test temperature. Measure the viscosity in the following sequence.

<u>Screw rotating speed</u>	<u>Time</u>
10 rpm	3 min
3 rpm	6 min
4 rpm	3 min
5 rpm	3 min
10 rpm	3 min
20 rpm	1 min
30 rpm	1 min
10 rpm	1 min

Take data and submit inspection report for each different lot's paste at 10 rpm 10 minutes after starting measurement with 25°C temperature.

## 10. Safety

The Following warning is printed on all Senju solder paste labels:

"Harmful by inhalation, in contact with skin and swallowed.

May cause sensitisation by skin contact.

Wear suitable protective clothing and gloves.

Do not breathe fumes or vapour.

In case of accident or if you feel unwell, seek medical advice immediately."

### **Recommended printing condition**

Printing speed: 50mm/sec.(30-100mm/sec.)

Printing pressure: 1.5kg/cm<sup>2</sup> (21.4psi.)

Temperature: 25 ±2degree C

Snap Off: On contact

Squeegee type: Metal Squeegee(60 degree angle from horizon)  
or 90degree hardness flat rubber blade(60 degree angle from horizon)

Stencil thickness: 0.12mm(0.4mm device lead pitch)/5mils(16mils pitch)  
0.15mm(0.5mm device lead pitch)/6mils(20mils pitch)  
0.20mm(0.65mm device lead pitch)/8mils(25mils pitch)

Recommended Temperature Profile:

### **Recommended Reflow Temperature**

