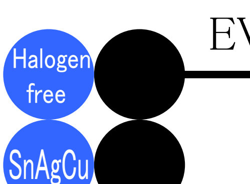
Lead free flux cored solder wire

EVASOL J3-HFC-3



Technical data

Some features

- Halogen free type, Sn-Ag-Cu lead free flux cored wire solder
- Not adding any halogen, Chlorine (Cl) and Bromine (Br)
- Good solderability by not only hand soldering but also a robot, so workability in short time
- Good wettability to make soldering on brass and Ni plated

Test items

A. Test items for some features

1. Chlorine and bromine content by ion exchange chromatography using a combustion chamber
2. Wettability test by the robot; line soldering
3. Wettability test to brass and Ni

B. Basic characteristics

1. Flux content
2. Copper plate corrosion test
3. Copper mirror corrosion test
4. Flux solution resistivity test
5. Dryness test
6. Solder spread test
7. Surface insulation resistance test
8. Electrochemical migration test

Specification

Table. Characteristics of "J3-HFC-3"

Test items			Criteria	Test method	
				JIS	IPC
Solder alloy	Alloy composition		Sn: Remainder Ag:3.0 Cu:0.5	JIS Z 3282	—
	Solidus temperature		217℃		
	Liquidus temperature		220℃		
Flux	Flux type		Halogen free		
	Flux solution resistivity		1685 Ωm	JIS Z 3197 8.1.1	—
	Halogen activator content	Cl (ppm)	less than 50	JPCA-ES01	IPC TM650 2.3.41
		Br (ppm)	less than 100		
	Copper plate corrosion		No corrosion	JIS Z 3197 8.4.1	IPC TM650 2.6.15
	Copper mirror corrosion		No corrosion	JIS Z 3197 8.4.2	IPC TM650 2.3.32
	Dryness test		No viscosity of flux residue	JIS Z 3197 8.5.1	—
Resin flux cored solder	Flux content		3.0 %	JIS Z 3197 8.1.2	IPC TM650 2.3.34.1
	Solder spread test (oxidation copper plate)		74.5%	JIS Z 3197 8.3.1.1	—
	Insulation resistance	Initial	4.0×10^{13} Ω	JIS Z 3197 8.5.3 Condition B	IPC TM650 2.6.3.3
		After 168hr	1.6×10^{10} Ω		
		After 1008hr	4.7×10^{10} Ω		
	Electrochemical migration		No migration	JIS Z 3197 8.5.4	IPC TM650 2.6.14.1

A. Test result for some features

1. Chlorine and bromine content

Test method (Based on JPCA-ES01)

Chlorine and bromine content in flux shall be measured by the ion exchange chromatography using a combustion chamber.

Test result

Table Chlorine and bromine content

Cl(ppm)	less than 50
Br(ppm)	less than 100

Not adding any halogen compound in "J3-HFC-3"

2. Wettability test by the robot; line soldering

Test method (Our company method)

The PCB which set the connector is soldered by a soldering robot; line soldering, and the wettability is checked. Also, it is compared with our conventional product and removing halogen from conventional product.

Fig. Line-soldering

Test method

Test board Land：Cu, single-sided board PCB：glass epoxy Plated of connector：Ni-Sn on brass
Soldering robot：UNIX 401P made by JAPAN UNIX Soldering tip：P1V10-23
Soldering speed：20mm/s Temperature：400℃ Diameter of solder: φ0.8mm
Pre-soldering：20mm, 20mm/s Soldering：80mm, 35mm/s

Test result

J3-HFC-3	Removing halogen from conventional product	Conventional product

"J3-HFC-3" has good wettability, and possible to get good solderability in the point needed that wetting speed is fast, for example line soldering by a robot. Also, that wetting is fast makes working hour shorter.

3. Wettability test to brass and Ni

Test method (Our company method)

0.3g swirled solder is set on brass and Ni plates. Then it is heated and melted on solder bath and wettability is checked. And, solder spread ratio is calculated by the following formula. Also, it is compared with our conventional product and removing halogen from conventional product.

$$S = \frac{D - H}{D} \times 100$$

S : solder spread ratio (%)
H : height of the spread solder (mm)
D : diameter of the solder, when it is assumed to be a sphere (mm)
($D = 1.24V^{1/3}$)
V : density of solder

Test condition

・Wettability on brass
Temperature of solder bath : 270°C　Heat time : 2s、3s、5s
Diameter of solder wire: φ0.8mm

・Wettability on Ni
Temperature of solder bath : 350°C　Heat time : 2s、3s、5s
Diameter of solder wire: φ0.8mm

Test result

Table. Wettability on brass (270°C)

J3-HFC-3	non wet	non wet	77.5%	78.1%
Removing halogen from conventional product	non wet	non wet	non wet	26.1%
Conventional product	non wet	non wet	76.0%	77.0%
Time	0s	2s	3s	5s

Table. Wettability on Ni (350°C)

J3-HFC-3	non wet	57.5%	62.9%	66.2%
Removing halogen from conventional product	non wet	23.6%	39.9%	54.4%
Conventional product	non wet	67.2%	68.9%	72.5%
Time	0s	2s	3s	5s

*Value in photos are soldering ratio.

"J3-HFC-3" has enough wettability to brass or Ni plated which is more difficult to possible to solder than Cu, by using new type activator.

B. Test result for basic characteristics

1. Flux content

Test method (Based on JIS Z 3197 8.1.2)

After preparing the resin cored solder by 30±1g(= W_1) and cleaning it by 2-propanol, it shall be put into 100ml beaker. Also, glycerin shall be prepared by 20ml and after putting it into them, they shall be heated so as to separate flux from solder completely. After separating flux from solder, only solder shall be removed from them and solidified. After drying and cleaning it, it shall be measured in weight (= W_2). The flux content shall be calculated by the following formula.

$$\text{Flux content (\%)} = (W_1 - W_2) \times 100 / W_1$$

Criteria

Flux content shall be 3.0±0.3 (%)

Test result

Flux content (%)	3.0

2. Copper plate corrosion

Test method (Based on JIS Z 3197 8.4.1)

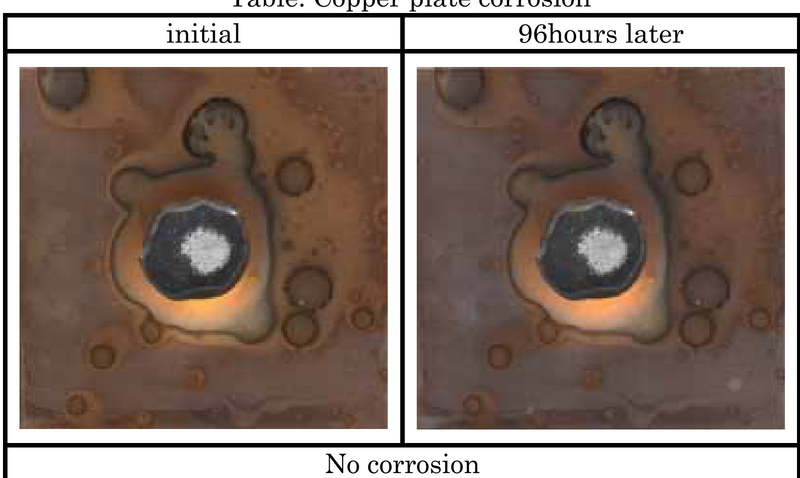
3mm depth hole shall be made at the center of copper plate by using steel sphere of 20mm diameter. After pretreating copper plate, the resin cored solder shall be provided to 3mm depth hole of it and melted. After that copper plate shall be put into the chamber which is adjusted to 40±2℃,90～95% and kept in this condition for 96 hours. 96 hours later, copper plate shall be removed from the chamber and checked about the corrosion condition. After flux residue on copper plate shall be cleaned off by using suitable solvent, the corrosion condition under flux residue shall be checked too.

Criteria

Corrosion shall not be found.

Test result

Table. Copper plate corrosion

initial	96hours later
	
No corrosion	

* Above data is result after 96 hours, but corrosion shall be checked 240 hours later in "TM650"

3. Copper mirror corrosion

Test method (Based on JIS Z 3197 8.4.2)

The test flux and standard rosin (2-propanol solution including flux by 25%) shall be made. 0.05ml of each test solution shall be dropped on a copper mirror test plate. The test copper mirror plate shall be kept in a chamber adjusted 25±2℃, 50±5% for 24 hours. 24 hours later, each flux on the test plate shall be removed by 2-propanol. Corrosion shall be checked.

Criteria

Corrosion shall be not found, in comparison with standard rosin.

Test result

Table. Copper mirror corrosion

<table>
<tr><th>J3-HFC-3</th><th>Standard rosin</th></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">No corrosion</td></tr>
</table>

4. Flux solution resistivity test

Test method (Based on JIS Z 3197 8.1.1)

0.100±0.005ml test flux solution (2-propanol solution including flux by 25%) and 50ml ion exchanged water shall be put into a 50ml beaker. They shall be boiled for 60s on a hot plate, cooled down by flowing water and put into the water bath adjusted 20±2℃. After they shall be reach thermal equilibrium, they shall be measured in resistivity by conductivity meter.

Criteria

Resistivity shall be more than 1000Ωm.

Test result

Table. Flux solution resistivity

<table>
<tr><th></th><th>Resistivity (Ωm)</th><th>Average(Ωm)</th></tr>
<tr><td>No.1</td><td>1712</td><td rowspan="3">1685</td></tr>
<tr><td>No.2</td><td>1695</td></tr>
<tr><td>No.3</td><td>1649</td></tr>
</table>

5. Dryness test

Test method （Based on JIS Z 3197 8.5.1）

3mm depth hole shall be made at the center of copper plate by using steel sphere of 20mm diameter. 1.00±0.05g the resin cored solder shall be provided to 3mm depth hole of it and melted on the solder bath adjusted 270℃, and cooled down for 30 minutes at room temperature. The powder talc shall be sprinkled on the flux residue, and brushed off twice the surface of flux residue. The viscosity of flux residue shall be evaluated by the adhesion extent of talc.

Criteria

The talc shall be brushed off easily.

Test result

Fig Dryness test

After soldering	After brushing off
No viscosity of flux residue	

6. Solder spread test

Test method （Based on JIS Z 3197 8.3.1.1）

The one side of Cu plate （30×30×0.3mm） shall be polished by abrasive paper (No.1000) in alcohol and cleaned, and dried at room temperature. These plates shall be put into a dryer adjusted 150±3℃ for 1 hour to produce uniform oxidate on the plates.

Three pieces of swirled 0.30±0.03g resin flux cored of solder shall be placed at the center of Cu plates. They shall be melted on a solder bath adjusted the liquidus temperature＋50℃ for 30 seconds after starting to melt, and lifted from the bath and cooled at room temperature. Flux residue shall be removed. The height of the spread solder shall be measured by a micrometer and calculated by the following method.

$$S = \frac{D - H}{D} \times 100$$

S：solder spread ratio(%)
H：height of the spread solder (mm)
D：diameter of the solder, when it is assumed to be a sphere (mm)
D： $= 1.24V^{1/3}$
V：density of solder

Criteria

Solder spread ratio shall be more than 70%. (in case of oxidation copper plate)

Test result

	Solder spread ratio (%)	Average (%)
No.1	75.2	74.5
No.2	73.7	
No.3	74.7	

note：diameter of solder is φ0.8mm

7. Surface insulation resistance

Test method (Based on JIS Z 3197 8.5.3)

The test boards specified JIS shall be coated with 2-propanol solution including flux by 25%. They shall be dried for 5 minutes in a dryer adjusted to 100°C. After that they shall be soldered by floating for 3 seconds on solder bath adjusted to 270±3°C. Before putting them into a chamber, the initial value of surface insulation resistance shall be measured. In this case, coaxial cable shall be used for wiring between measurement pad on test board and insulation resistance meter. They shall be put into the chamber adjusted to 85°C 85% being careful for a waterdrop not to drop down on the test pattern and 24, 96, 168, 408, 648, 840 and 1008 hours later, surface insulation resistance shall be measured applying the bias voltage DC100V.

Test result

Table Surface insulation resistance

Time (h)	0	24	96	168	408	648	840	1008
Resistance(Ω)	3.3×10^{13}	1.4×10^{10}	1.1×10^{10}	1.6×10^{10}	4.2×10^{10}	4.4×10^{10}	4.6×10^{10}	4.7×10^{10}

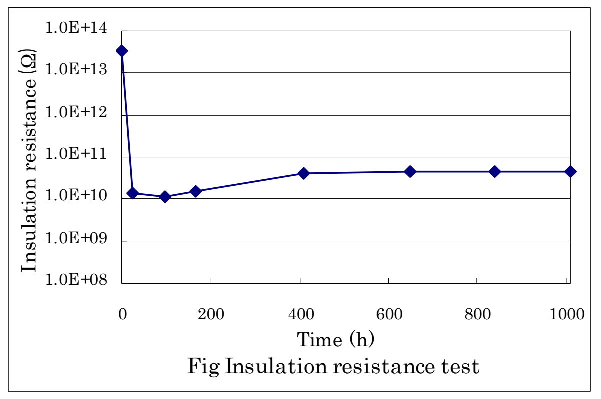


Fig Insulation resistance test

* Using the board "JIS-2type" in this test, but using it "IPC B-24" in IPC-TM650.

*We solder by coating 2-propanol solution including flux by 25% and dipping solder bath, but soldering by iron in IPC-TM650.

8. Electrochemical migration test

Test method (Based on JIS Z 3197 8.5.4)

The test boards specified JIS shall be coated with 2-propanol solution including flux by 25%. They shall be dried for 5 minutes in a dryer adjusted to 100°C. After that they shall be soldered by floating for 3 seconds on solder bath adjusted to 270±3°C. Before putting them into a chamber, the initial value of surface insulation resistance shall be measured. They shall be put into the chamber adjusted to 85°C 85% and applied DC45 to 50V being careful for a waterdrop not to drop down on the test pattern and 24, 96, 168, 408, 648, 840 and 1008 hours later, surface insulation resistance shall be measured applying the bias voltage DC100V. 1008hours later, the test boards shall be taken out from the chamber and confirmed whether there shall be any evidence of migration or not.

Test result

Table. Electrochemical migration test

Time (h)	0	24	96	168	408	648	840	1008
Resistance(Ω)	2.5×10^{13}	1.5×10^{10}	1.6×10^{10}	2.5×10^{10}	4.5×10^{10}	4.8×10^{10}	5.0×10^{10}	5.1×10^{10}

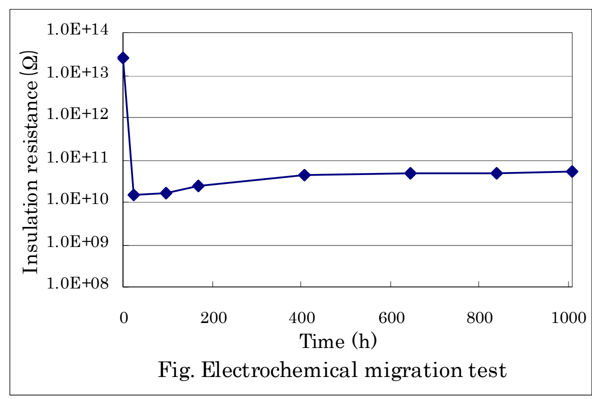


Fig. Electrochemical migration test

* Using the board "JIS-2type" in this test, but using it "IPC B-24" in IPC-TM650.

*We solder by coating 2-propanol solution including flux by 25% and dipping solder bath, but soldering by iron in IPC-TM650.

No migration