**Provisional*

TECHNICAL INFORMATION

Lead Free No-clean Flux Cored Solder Wire

S3X-51M & TX-M51

KOKI COMPANY LIMITED

1. Feature

1) Excellent solderability.
2) Minimum flux spattering, easy separation from a solder bit and low icicling.
3) Applicable for repairing of SnAgBi and SnZnBi based alloys.
4) Very low fume.

2. Specifications

Product		S3X-51M	TX-51M
Composition (%)		Sn96.5, Ag3.0, Cu0.5	Sn99.5, Cu0.5
Solidus / Liquidus point (°C)		217 / 218	228 (eutectic)
Specific gravity		7.4	
Tencil strength (kg/mm^2)		5.2	3.2
Elongation (%)		46	37
Vickers hardness		18.2	17.8
Flux content (%)		3.3	
Halide content (%)		0.13	
Solder spreadability (%)		> 75	
Surface insulation resistance *1 (Ω)	Initial value	$\geq 1 \times 10^{13}$	
	After humidification	$\geq 1 \times 10^{11}$	
Voltage applied SIR *2 (Ω)	Initial value	$\geq 1 \times 10^{13}$	
	After humidification	$\geq 1 \times 10^{11}$	
	Electromigration	No evidence of electromigration	
Copper corrosion *5	Copper plate	Passed	
Flux residue stickiness (by chalk powder)		No attachment	
Wire diameter (mm)		0.5, 0.6, 0.8 1.0, 1.2	

In accordance with JIS-Z-3197.
1. SIR..... Type-II comb type electrode, 40°C×90%×RH×96Hr
2. Voltage applied SIR..... Type-II comb type electrode, 40°C×90%×RH×DC100V×96Hr

3. Flux content

Take about 30g of sample and measure its accurate mass as W_1 (g) after cleaning the surface with special/grade acetone specified in JIS-K-8034, put the sample into glycerin specified in JIS-K-3351 to melt by heating and, after removing the flux from the resin flux cored solder completely, leave it to cool and solidify.

Next, take out the solidified solder and wash it with water. And after immersing in alcohol for about 5 min., rewashing and drying at ordinary temperature, measure the accurate mass as W_2 (g), and calculate the flux content from the formula (1).

$$\text{Flux content (wt\%)} = \frac{W_1 - W_2}{W_1} \times 100 \quad \text{.....(1)}$$

Wire diameter >1.0mm

n	1	3.38
	2	3.32
	3	3.30
Average		3.33

4. Halogen content (Chloride content)

Wash the surface of solder with special/grade acetone specified in JIS-K-8034, take an amount of solder wire approx. 50g and cut it into chips of 2 to 3mm in length and measure the accurate mass as W_1 (g). Put the solder chips in a 300ml beaker. Add 50ml of the mixture of pure alcohol and benzene (alcohol 10 volume + benzene specified in JIS-K-8858 1 volume), cover it with a watch glass, and shake for about 15min at ordinary temperature to elute the flux. After eluting the flux completely, gently pour the supernatant portion of the eluate into a 300ml beaker. Wash solder chips with 30ml of the above solution 3 or 4 times and add the washing to the flux solution to obtain about 200ml of the test solution.

Solder chips from which the flux has been extracted shall be weighed accurately after drying for an hour at the temperature of approx. 100°C to obtain the mass as W_2 (g), and the difference (W_1 - W_2) in mass between the resin flux cored solder previously measured and these flux-extracted solder chips shall be determined as the mass of the flux.

Then transfer the test liquid in a potentiometric titration equipment and titrate it with N/20 silver nitrate standard solution until the end point where electric potential changes drastically.

Carry out the blank test through the entire process and calculate the chlorine content in the flux from following formula (2).

$$\text{Chlorine content in flux (\%)} = \frac{(AB - CB)}{\text{Mass of flux (g)}} \times 100 \quad \text{.....(2)}$$

A : Quantity of N¥20 silver nitrate used (ml)
B : Chlorine equivalent to 1ml of N/20 silver nitrate (g)
C : Quantity of N/20 silver nitrate solution used in the blank test (ml)

[Result]

n	1	0.128
	2	0.130
	3	0.131
Average		0.129

5. Copper plate corrosion

Polish the surface of a copper plate of 0.3×30×30mm in size with metal abrasive, or polish and remove the oxide film with No. 500 abrasive paper specified in JIS-R-6252 while bathed in organic solvent such as xylene, and after washing out the soil adhering to the surface with alcohol, etc., leave it in the air to dry completely.

Place the sample of approximately 0.3g on the copper plate, melt it by heating for about 5 sec. at a temperature 40 to 50°C higher than the liquidus temperature of the solder (max. 270°C) and cool it at ordinary temperature to obtain the test piece.

Prepare four test pieces and use three of them as the corrosion test pieces and preserve the remaining one as the reference test piece in dried condition at ordinary temperature.

At 250°C and cool it at room temperature to obtain the test pieces.

Put three test pieces in a thermohygrostat of temperature 40 ± 2°C and humidity 90% for 96 hours consecutively and compare them with the reference test piece for the evidence of corrosion.

[Result]

n	1	No corrosion
	2	No corrosion
Average		No corrosion / Passed

6. Insulation resistance

As a test piece, use the comb type electrode of the glass fiber-based copper-clad, epoxy resin GE-3 and GE-4, both specified in JIS-C-6480. After cleaning with alcohol and thoroughly drying the surface, uniformly apply a specific quantity (JIS type-II=0.05ml) of flux onto the electrode and dry it at about 100°C for 30min. and solder a lead wire onto each terminal to obtain the test piece.

Prepare three pieces of the above test piece and measure the insulation resistance (initial value = DRY) under the above-specified condition.

Put all the test pieces in a thermohygrostat and connect each lead wire with the terminals outside of the thermohygrostat.

Raise the temperature to a specific temperature first, then increase the humidity up to a specific humidity.

After a specific time,

(1) Measure the insulation resistance keeping the test pieces in the thermohygrostat

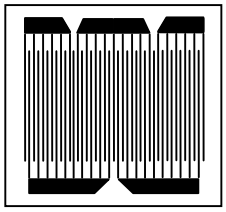
(2) Take the test pieces out of the thermohygrostat, and measure the insulation resistance under the normal temperature and humidity.

Voltage to apply shall be DC100V for measurement.

Measurement shall be conducted at 4 points between each terminal pair per test piece and be expressed as a mean value.

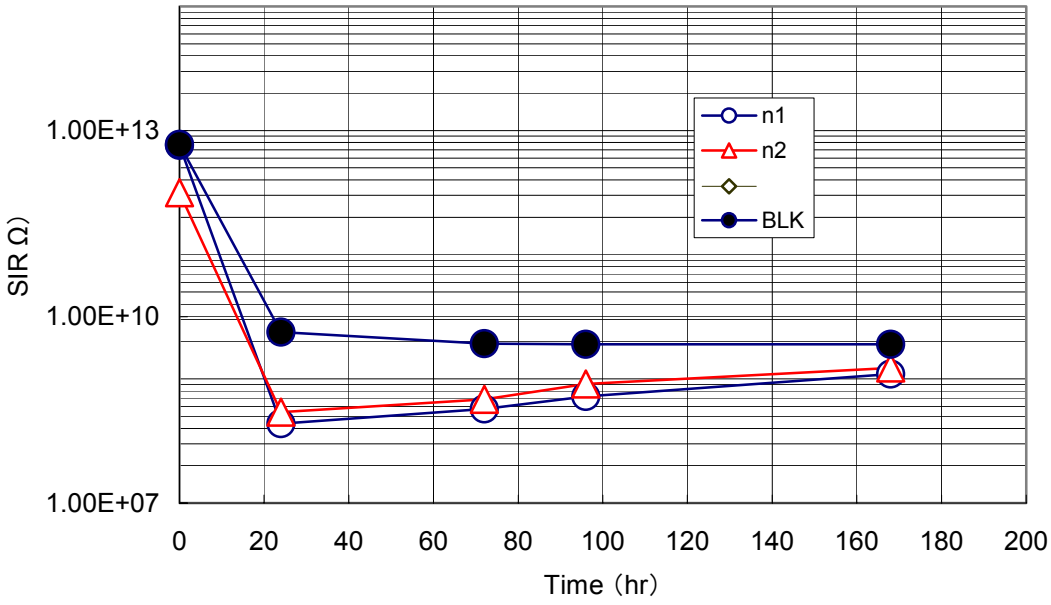
* Test conditions : 85°C×85%RH

Comb electrode type-II



Conductor width	0.318
Conductor interval	0.318
Lamination	15.75

[Result]



7. Voltage applied insulation resistance

As a test piece, use the comb type electrode of the glass fiber-based copper-clad, epoxy resin GE-3 and GE-4, both specified in JIS-C-6480. After cleaning with alcohol and thoroughly drying the surface, uniformly apply a specific quantity (JIS typeII=0.05ml) of flux onto the electrode and dry it at about 100°C for 30min. and solder a lead wire onto each terminal to obtain the test piece.

Prepare three pieces of the above test piece and measure the insulation resistance (initial value = DRY) under the above specified condition.

Put all the test pieces in a thermohygrostat and connect each lead wire with the terminals outside of the thermohygrostat.

Raise the temperature to a specific temperature first, then increase the humidity up to a specific humidity, and apply DC50V.

After a specific time,

(1) Measure the insulation resistance keeping the test pieces in the thermohygrostat.

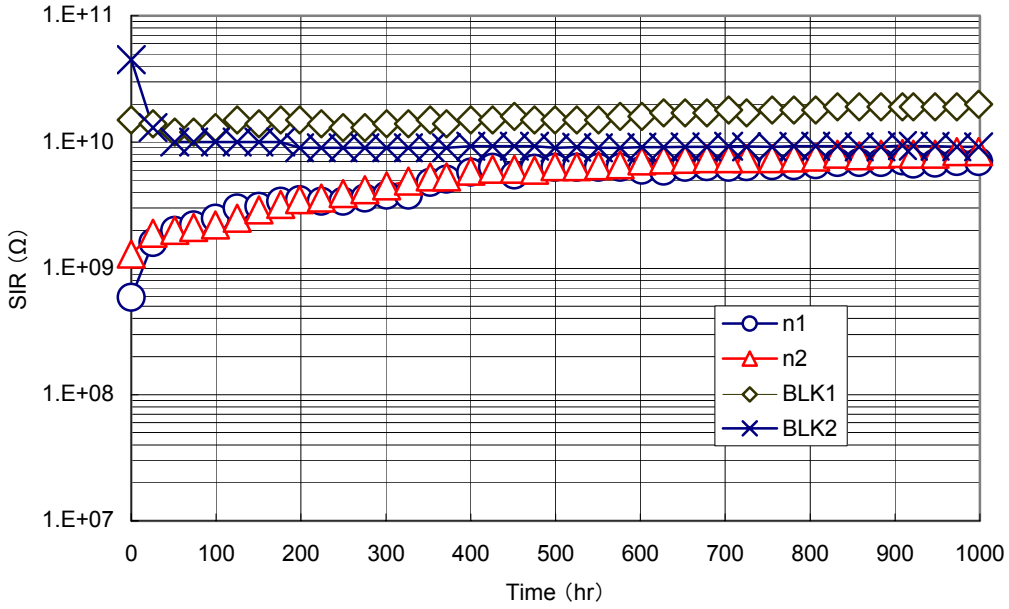
(2) Take the test pieces out of the thermohygrostat, and measure the insulation resistance under the normal temperature and humidity.

Voltage to apply shall be DC100V for the measurement.

Measurement shall be conducted at 4 points between each terminal pair per test piece and be expressed as a mean value.

* Test conditions : 85°C×85%RH

[Result]



8. Solder spreadability

Wind one turn in a ring form the resin flux cored solder, which has been washed with special grade acetone specified in JIS-K-8034, around a bar with a diameter 2 times the outer diameter of the solder to obtain the sample.

Use as test plate a phosphor deoxidized copper plate C 1201P or C 1220P specified in JIS-H-3100, 0.3×50×50mm in suze, and, after surface treatment by the method specified in 5., subject it to oxidizing treatment in and electric furnace maintained at about 150°C for 1 hour.

Place the test piece on the solder wave at the temperature of 250°C for 30 seconds.
After cooling it at ordinary temperature, remove the residual flux with alcohol, and measure the area covered by solder with a planimeter or measure the height of solder and calculate the rate of spread from the formula (3).

The height of solder shall be measured with a micrometer specified in JIS-B-7502 or with a measuring apparatus equivalent or superior to it.

$$\text{Rate of spread (\%)} = \frac{D - H}{D} \times 100 \quad \text{.....(3)}$$

H : Height of spread (mm)
D : Diameter when the solder used assumed to be a sphere 8mm)

$$D = 1.24V^{1/3}$$

V : Mass/specific gravity

[Result]

n	1	77.9
	2	77.4
	3	77.0
Average (%)		77.4