TECHNICAL BULLETIN

alpha ASSEMBLY SOLUTIONS™

ALPHA® Vaculoy SAC305,300,350,405,400,387,380

Lead Free Wave Solder Alloy

DESCRIPTION

Sn96.5Ag3Cu0.5, Sn95.5Ag4Cu0.5, Sn95.5Ag3.8Cu0.7 and their replenishment alloys Sn97Ag3Cu0, Sn96.5Ag3.5Cu0, Sn96Ag4Cu0 and Sn96.2Ag3.8Cu0 are lead-free alloys suitable for use as a replacement for Sn63 alloy. The replenishment alloys are sometimes used to stabilize / reduce the copper content in the wave solder bath, this requirement will depend on process conditions. As with all Alpha Assembly Solutions bar solder, Alpha's proprietary Vaculoy® alloying process is used to remove certain impurities, particularly oxides.

FEATURES & BENEFITS

Features

- Yield – Best in class yield, out performs all Sn/Cu based materials
- Wetting speed – fast wetting, in back to back tests 0.65s compared to 1.00s, for Sn/Cu based materials
- Dross generation – Low dross generation delivered by Vaculoy alloy conditioning

Benefits

- Excellent solderability due to fast wetting speed
- Very good drainage, has lower levels of bridging compared to Sn/Cu alloys
- Delivers excellent performance across a wide range of Flux technologies

The proprietary Vaculoy process is a highly effective method for removing included oxides from solder. This is extremely important because included oxides generate excessive drossing and increase the viscosity of the solder. Solder with higher viscosity can result in increased soldering defects (i.e solder bridging)

APPLICATION

Sn96.5Ag3Cu0.5, Sn95.5Ag4Cu0.5, Sn95.5Ag3.8Cu0.7 are suitable for wave soldering and surface mount applications for electronic assemblers interested in implementing a lead-free process. A solder pot temperature of 255 - 265°C (491-509°F) is recommended. For suitable wave solder fluxes, please see our selector guide. Lead Free Reclaim services including dedicated lead free containers are also available. Please consult your local sales office.

AVAILABILITY

Vaculoy is available in 1 kg (2.2lb) Bars, feeder Ingots and autofeed wire. Most products are shipped strapped and palletized or packed in corrugated cardboard box with no remarkable damages in appearance.

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TECHNICAL DATA

Complies with all requirements of RoHS Directive (Article 4.1 of the European Directive 2011/65/EU). Alloy specification for maximum Lead (Pb) Content = 0.07%. SAC alloy is also available in Ultra Low Lead (ULL) version which contains a maximum of 0.05% Pb. All alloy properties remain the same for SAC ULL.

Element	Specification %						
	SAC 305	***SAC 405***	***SAC 387***	SAC 300	SAC 350	SAC 400	SAC 380
Sn	Balance	Balance	Balance	Balance	Balance	Balance	Balance
Ag	3.0 ± 0.2	4.0 ± 0.2	3.8 ± 0.2	3.0 ± 0.2	3.5 ± 0.2	4.0 ± 0.2	3.8 ± 0.2
Cu	0.5 ± 0.1	0.5 ± 0.1	0.7 ± 0.1	0.05 max	0.05 max	0.05 max	0.05 max
Pb	0.07 max	0.07 max	0.07 max	0.07 max	0.07 max	0.07 max	0.07 max
Sb	0.10 max	0.10 max	0.10 max	0.10 max	0.10 max	0.10 max	0.10 max
Zn	0.001 max	0.001 max	0.001 max	0.001 max	0.001 max	0.001 max	0.001 max
Fe	0.02 max	0.02 max	0.02 max	0.02 max	0.02 max	0.02 max	0.02 max
As	0.03 max	0.03 max	0.03 max	0.03 max	0.03 max	0.03 max	0.03 max
Ni	0.01 max	0.01 max	0.01 max	0.01 max	0.01 max	0.01 max	0.01 max
Bi	0.10 max	0.10 max	0.10 max	0.10 max	0.10 max	0.10 max	0.10 max
Cd	0.001 max	0.001 max	0.001 max	0.001 max	0.001 max	0.001 max	0.001 max
Al	0.001 max	0.001 max	0.001 max	0.001 max	0.001 max	0.001 max	0.001 max
In	0.05 max	0.05 max	0.05 max	0.05 max	0.05 max	0.05 max	0.05 max

All figures are in % for impurity limits per alloy in relation to J-STD-006C.

MATERIAL CHARACTERISTICS

Characteristic	Data		
	SAC 305	SAC 405	SAC 387
Melting Point	217-219ºC (423-426ºF)	217-219ºC (423-426ºF)	217-219ºC (423-426ºF)
Density	7.37 g/cm³	7.44 g/cm³	7.44 g/cm³
TCE (Range 20-100ºC) micrometers / M / ºC	21.9	21.4	21.4
Specific Heat Capacity	0.232 J/g K	0.236 J/g K	0.236 J/g K
Hardness	14.1 HV	14.9HV	14.9HV

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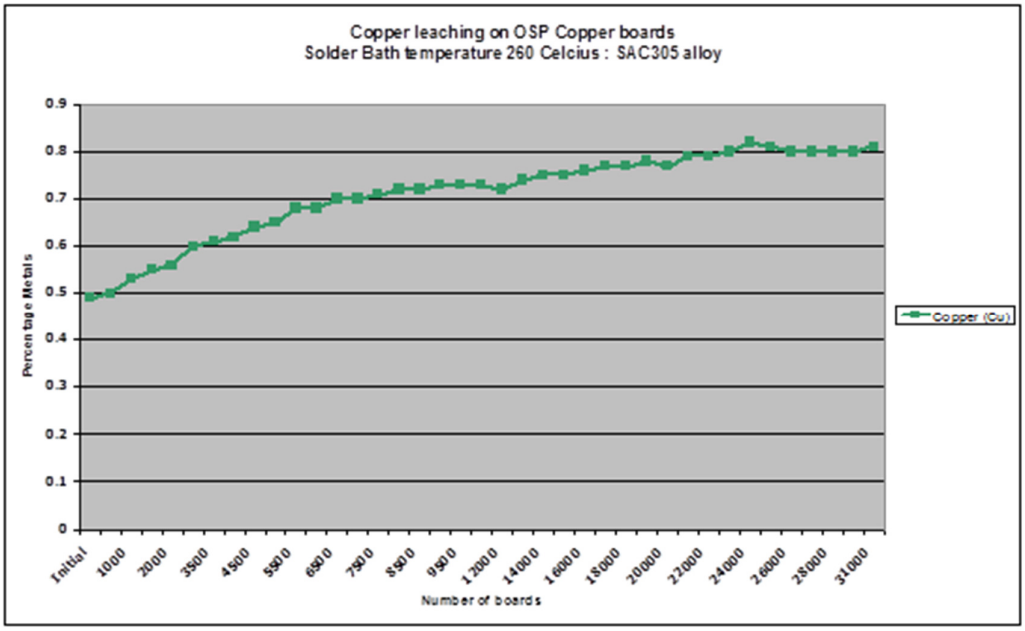
MANAGEMENT OF COPPER LEVELS IN THE SOLDER BATH

Management of the copper level in the wave solder bath is critical to ensure low defects in the soldering process. There is a tendency for the copper levels of the SAC305/405/387 materials to increase due to the leaching effect of the solder wave on the board and components. This effect is at its most severe when using an OSP Copper finish on the PCB. A typical copper level increase is shown on the chart below:



This shows an average leaching rate of **0.01% Cu per 1000 boards**. Each process is unique this is an indication only of the leaching rate (based on actual data).

It is recommended that the copper is controlled at between 0.5% and max 0.95% for SAC305/405/387 alloys. If the copper levels are higher than 1.0% then this will increase the liquidous temperature which in turn may mean that the solder bath temperature has to be increased to maintain the process yields.

The copper levels in the bath can be controlled by means of adding **SAC300 (Sn97%/Ag3.0%Cu0%)** to the wave solder pot. It may be the case that equilibrium can be attained by continuing with SAC300 additions as the only means of solder top up, however each process is unique and we would recommend regular analysis of the solder bath so that good control of copper can be maintained.

This analysis service is available from Alpha Assembly Solutions, contact your local office for details.

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RECOMMENDED ACTION LEVELS FOR WAVE SOLDER IMPURITIES

Please find below a list of recommended action levels for wave solder bath impurities. For information of specific action plans to bring your solder bath back to an acceptable condition please contact your local sales office.

Aluminium*: As little as 0.005% may increase dross rate without affecting joint formation.

Arsenic: Above 0.03% can cause dewetting.

Bismuth: Levels of 1.0% are added to some wavesolder alloys to improve wetting, joint cosmetics and thermal fatigue resistance. At this level care should be taken over lead contamination as there is some evidence that this may increase the chances of fillet lifting. Lead at<0.1% (RoHS) should not cause any problems.

Cadmium*: At levels of 0.002% joint formation will be noticeably affected. At 0.005% there will be a high incidence of bridging and icicling, together with a reduction in joint strength.

Copper: Copper levels will increase in many cases due to pick up from board surfaces. This causes the liquidus of the bath material to increase slightly. Generally systems are tolerant to levels up to 0.95% Cu, but in some cases it may be necessary to increase bath temperatures by a few degrees, or to correct the bath composition at an earlier stage.

Gold: At levels of 0.1% and quite often less, the solder becomes sluggish and dull joints are formed.

Iron: 0.02% of iron can make joint formation gritty.

Lead: The current RoHS directive (restriction of certain hazardous substances) states a maximum of 0.1% Pb in the solder joints. The lead contamination level should be kept below this level to comply with legislation. If this level is exceeded please consult with your local Alpha Assembly Solutions contacts for advice on how to rectify this problem.

Silver: Silver is used as an alloying element in lead-free solders that enhances wetting speed and thermal fatigue resistance.

Zinc*: The presence of zinc can cause dulling and create bridging and icicling. 0.005% can also cause lack of adhesion and grittiness.

Note: *The effects of Al, Cd and Zn are cumulative. If more than one element is present the following lower maxima are suggested: 0.0005%, 0.002% and 0.001%

SAFETY

Please refer to the Safety Data Sheet as the primary source of health and safety information. The most recent version of the SDS is available from AlphaAssembly.com.

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CONTACT INFORMATION

To confirm this is the most recent issue, please contact Alpha Assembly Solutions

AlphaAssembly.com

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Also read carefully warning and safety information on the Safety Data Sheet. This data sheet contains technical information required for safe and economical operation of this product. READ IT THOROUGHLY PRIOR TO PRODUCT USE. Emergency directory assistance Chemtrec 1 - 800 - 424 - 9300.