ALPHA® VACULOY® SAC300,305,350,380,387,400,405

High Silver Alloy for Wave and Selective Soldering

DESCRIPTION

SAC305, SAC387 and SAC405 and their replenishment alloys SAC300, SAC350, SAC380 and SAC400 are lead-free alloys suitable for use as a replacement for Sn63Pb37 alloy. The replenishment alloys are sometimes used to stabilize and reduce the copper content in the wave solder bath, although, this requirement will depend on process conditions. As with all Alpha's bar solder, the proprietary Vaculoy alloying process is used to remove certain impurities, particularly oxides.

READ ENTIRE TECHNICAL DATA SHEET BEFORE USING THIS PRODUCT

FEATURES AND BENEFITS

Features

- Yield – Best in class yield, outperforms 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 Alpha's proprietary Vaculoy manufacturing process

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 GUIDELINES

SAC305, SAC387 and SAC405 are suitable for lead free wave soldering and selective soldering. A solder pot temperature of 255 to 265 °C (491 to 509 °F) is recommended for wave soldering application. If used for selective soldering, a solder pot temperature of 280 to 320 °C (536 to 608 °F) is recommended. N_2 environment (<1000ppm O_2) can be considered for further oxidation reduction.

For suitable 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.

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 %						
	SAC305	SAC387	SAC405	SAC300	SAC350	SAC380	SAC400
Sn	Balance	Balance	Balance	Balance	Balance	Balance	Balance
Ag	3.0 ± 0.2	3.8 ± 0.2	4.0 ± 0.2	3.0 ± 0.2	3.5 ± 0.2	3.8 ± 0.2	4.0 ± 0.2
Cu	0.5 ± 0.1	0.7 ± 0.1	0.5 ± 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

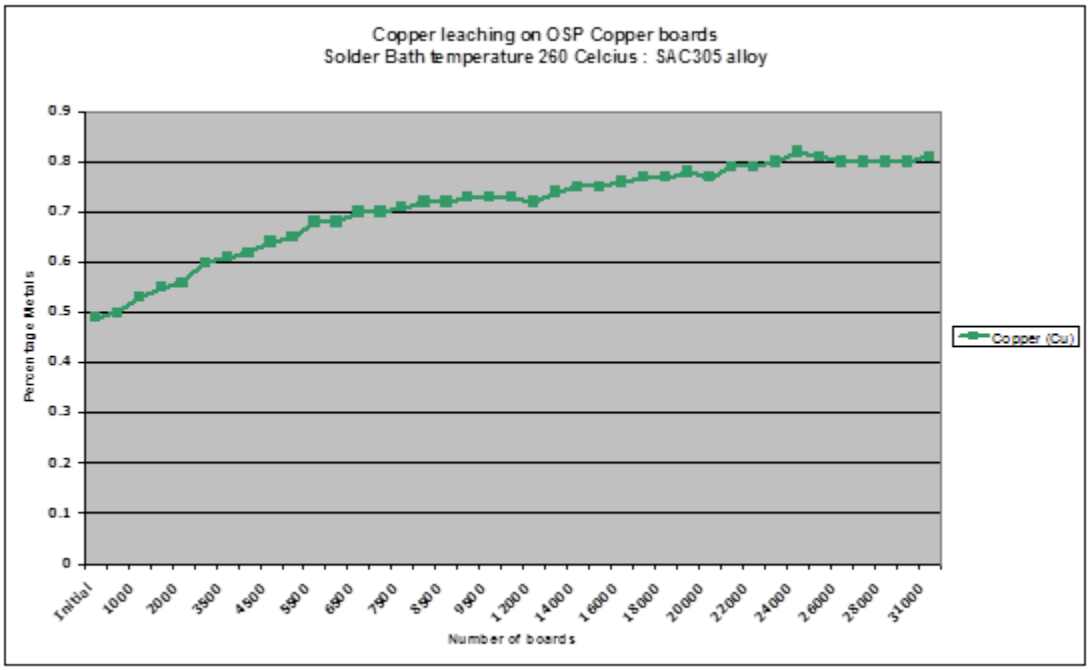
Characteristic	Data		
	SAC305	SAC387	SAC405
Melting Point	217 to 219 ºC (423 to 426 ºF)	217 to 219 ºC (423 to 426º F)	217 to 219 ºC (423 to 426º F)
Density	7.37 g/cm^3	7.44 g/cm^3	7.44 g/cm^3
TCE (Range 20 to 100 ºC) micrometers / M / ºC	21.9	21.4	21.4
Specific Heat Capacity	0.232 J/g K	0.236 J/g K	0.236 J/g K
Hardness	14.1 HV	14.9 HV	14.9 HV

RECOMMENDED WAVE SOLDER PROCESS SETTINGS

Wave Configuration	Process Parameter	Suggested Process Settings
Single Wave	Pot Temperature	255 to 265 ºC (491 to 509 °F)
	Conveyor Speed	1.0 to 1.5 m/min (3.3 to 5 ft/min)
	Contact Time	2.3 to 2.8 seconds
	Wave Height	1/2 to 2/3 of board thickness
	Dross Removal	Once per 8 hour run time
	Copper Check	Every 8,000 boards until 40,000
Dual Wave	Pot Temperature	255 to 265 ºC (491 to 509 °F)
	Conveyor Speed	1.0 to 1.5 m/min (3.3 to 5 ft/min)
	Contact Time	3.0 to 3.5 seconds
	Wave Height	1/2 to 2/3 of board thickness
	Dross Removal	Once per 8 hour run time
These are general guidelines which have proven to yield excellent results. However, depending upon your equipment, components and circuit boards, your optimal settings may be different. In order to optimize your process, it is recommended to perform a design experiment, optimizing the most important variables (i.e. amount of flux applied, conveyor speed, topside preheat temperature, solder pot temperature, board orientation, etc.).		

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 SAC305/387/405 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 and 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 SAC305/387/405 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 the relevant replenishment alloy to the wave solder pot. It may be the case that equilibrium can be attained by continuing with replenishment alloy additions as the only means of solder top up. However, each process is unique, and we recommend regular analysis of the solder bath so that good control of copper can be maintained.

Alpha offers solder pot analysis services. Contact your local office for details.

RECOMMENDED ACTION LEVELS FOR WAVE SOLDER IMPURITES

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.

Aluminum*: 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 wave-solder 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 Customer Technical Service engineer 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%.

AVAILABILITY

ALPHA SAC305/387/405 is available in 1 kg (2.2lb) Bars, feeder Ingots and auto feed wire. Most products are shipped strapped and palletized or packed in corrugated cardboard box. Inspect shipment to make ensure there is no apparent significant damage to shipping materials.

SAFETY & WARNING

It is recommended that the company/operator read and review the Safety Data Sheets for the appropriate health and safety warnings before use. **Safety Data Sheets are available at MacdermidAlpha.com/assembly-solutions/knowledge-base**

CONTACT INFORMATION

To confirm this document is the most recent version, please contact Assembly@MacDermidAlpha.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 safety directory assistance: US 1 202 464 2554, Europe + 44 1235 239 670, Asia + 65 3158 1074, Brazil 0800 707 7022 and 0800 172 020, Mexico 01800 002 1400 and (55) 5559 1588