

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, contact your local sales representative. 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.



Issue: 05 August 2022



Material Characteristics

Chavaataviatia	Data				
Characteristic	SAC305	SAC387	SAC405		
Melting Point	217 to 219 °C (423 to 426 °F)	217 to 219 °C (423 to 426° F)	217 to 219 °C (423 to 426° F)		
Density	7.37 g/cm ³	7.44 g/cm ³	7.44 g/cm ³		
TCE (Range 20 to 100 °C) micrometers / M / °C	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		
	Pot Temperature	255 to 265 °C (491 to 509 °F)		
	Conveyor Speed	1.0 to 1.5 m/min (3.3 to 5 ft/min)		
Single Ways	Contact Time	2.3 to 2.8 seconds		
Single Wave	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		
	Pot Temperature	255 to 265 °C (491 to 509 °F)		
	Conveyor Speed	1.0 to 1.5 m/min (3.3 to 5 ft/min)		
Dual Wave	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. 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.).

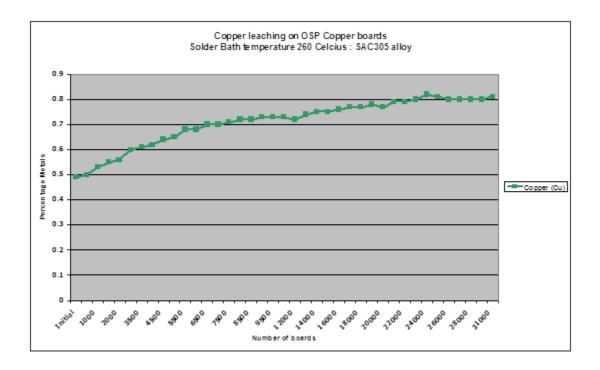


Issue: 05 August 2022



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 must 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.



Issue: 05 August 2022





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 AI, 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%.





RECYCLING SERVICES

We provide safe and efficient recycling services to help companies meet their environmental and legislative requirements and at the same time, maximize the value of their waste streams. Our service collects solder dross, solder scrap, and various forms of solder paste waste. Please contact your local sales representative for recycling capabilities in your area or <u>link here</u>.



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

www.macdermidalpha.com

North America 109 Corporate Blvd. South Plainfield, NJ 07080, USA 1.800.367.5460 **Europe**Unit 2, Genesis Business Park
Albert Drive
Woking, Surrey, GU21 5RW, UK
44.01483.758400

Asia 8/F., Paul Y. Centre 51 Hung To Road Kwun Tong, Kowloon, Hong Kong 852.3190.3100

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

DISCLAIMER: All statements, technical information and recommendations contained herein are based on tests we believe to be reliable, but the accuracy or completeness thereof is not guaranteed. No statement or recommendation shall constitute a representation unless set forth in an agreement signed by officers of seller and manufacturer. NO WARRANTY OF MERCHANTABILITY, WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR ANY IMPLIED WARRANTY IS MADE. The following warranty is made in lieu of such warranties and all other warranties, express, implied, or statutory. Products are warranted to be free from defects in material and workmanship at the time sold. The sole obligation of seller and manufacturer under this warranty shall be to replace any noncompliant product at the time sold. Under no circumstances shall manufacturer or seller be liable for any loss, damage or expense, direct, indicental or consequential, arising out of the inability to use the product. Notwithstanding the foregoing, if products are supplied in response to a customer request that specifies operating parameters beyond those stated above, or if products are used under conditions exceeding said parameters, the customer by acceptance or use thereof assumes all risk of product failure and of all direct, indirect, incidental and consequential damages that may result from use of the products under such conditions, and agrees to exonerate, indemnify, defend and hold harmless MacDermid, Incorporated and its affiliates therefrom. No suggestion for product use nor anything contained herein shall be construed as a recommendation to use any product in a manner that infringes any patent or other intellectual property rights, and seller and manufacturer assume no responsibility or liability for any such infringement.

© 2019 MacDermid, Inc. and its group of companies. All rights reserved. "(R)" and "TM" are registered trademarks or trademarks of MacDermid, Inc. and its group of companies in the United States and/or other countries.





