ALPHA® HRL3 Solid Solder

Lead-Free, High Reliability, Low Temperature Alloy for Selective and Dip Soldering

DESCRIPTION

ALPHA HRL3 Solid Solder is designed to enable low temperature processes in selective and dip soldering. This alloy is designed to exhibit improved thermomechanical reliability performance versus existing low temperature alloys in the market. With special additives added to the alloy, ALPHA HRL3 demonstrates high mechanical properties, fast wetting and reduced Copper erosion. To ensure optimum soldering performance the Vaculoy® alloying process is used to remove certain impurities, particularly oxides. This is extremely important because oxides generate excessive drossing and increase the viscosity of the solder.

READ ENTIRE TECHNICAL DATA SHEET BEFORE USING THIS PRODUCT

FEATURES & BENEFITS

Features	Benefits
Enables Low Operating Temperature	• Wide processing window • Energy cost savings • Suitable for lead-free low temperature selective and dip soldering
Low Material Cost	Lower material cost vs SAC305
Low Copper Erosion Rate	Low Copper erosion makes it easier to control Copper levels in solder bath
Excellent Solderability	Excellent wetting with high wetting force delivers very good hole fill and low bridging performance
High Reliability	Excellent reliability equivalent or better than SAC305

TECHNICAL DATA

Material Property	Units	ALPHA HRL3
Melting Temperature	°C	138 to 146
Hardness	HV0.5 as received	21.0
Density	g/cm^3	8.6
Thermal Expansion Coefficient	(30 to 100 °C) µm/m °C	19.4
Tensile Stress @ 25 °C	MPa	64.8
Yield Strength @ 25 °C	MPa	54.9
Elongation @ 25 °C	%	54.1

0.10% of Lead (Pb) complies with the requirement of RoHS Directive 2015/863/EU. Alloy specification for maximum Lead (Pb) Content = 0.05%. Please contact your local sales office for the Certification of Assurance of the alloy composition specification.

RECOMMENDED ACTION LEVELS FOR SOLDER BATH CONTROL

Below is a list of recommended action levels for selective and dip soldering pot solder bath controls. For guidance on how to bring your solder bath back to an acceptable condition, please contact your local sales office.

Element	Action Levels	Notes
Sn	**BAL**	No action level.
Pb	**0.07**	RoHS Directive 2015/863/EU states a maximum lead content of 0.1%.
As	**0.03**	Levels greater than 0.03% can cause de-wetting.
Cu	**0.3**	**ALPHA HRL3** is tolerant to Copper levels up to 0.3%. Top-up the bath with HRL3 to reduce the Cu% or to perform pot casting.
Zn	**0.003**	Levels greater than 0.003% may cause higher levels of bridging and icicling, as well as a greater level of surface oxidation in the solder bath.

Element	Action Levels	Notes
Fe	**0.02**	Greater than 0.02% Iron can be an indicator of pot erosion and may cause gritty joint formation and the formation of $FeSn_2$ IMC needles that can cause bridging.
Ag	**4.0**	**ALPHA HRL3** is in low Silver level of ~ 1%. Although there is no detrimental effect of the Silver level increasing, if the Silver level in **ALPHA HRL3** rises above 4% then some investigations should be held to establish the cause.
Sb	**1.3**	**ALPHA HRL3** is in Antimony level of ~ 1%. However, if levels above 1.3% are detected this indicates some contamination issues that should be investigated.
Ni	**0.05**	Levels greater than 0.04% may start to slow the wetting speed and could affect the hole fill performance. If process performance is acceptable then levels up to 0.05% are OK.
Cd	**0.003**	RoHS Directive 2015/863/EU states a maximum Cadmium content of 0.01%. Levels of 0.003% may cause higher levels of bridging and icicling.
Al	**0.002**	Levels greater than 0.002% may cause higher levels of bridging and icicling, as well as a greater level of surface oxidation in the solder bath.
Au	**0.10**	At levels above 0.1%, there may be some problems with joint strength.

AVAILABILITY

ALPHA HRL3 is available in 1kg (2.2lb) Bar, Chunks, Feeder Ingots and Autofeed Wire.

APPLICATION GUIDELINES

ALPHA HRL3 solid solder is suitable for selective soldering and dip soldering applications for electronic assemblers interested in implementing a low temperature lead-free process. A solder pot temperature of ~ 200 to 225 °C is a good starting point. The range of 225 to 250 °C is the recommended best solder pot process window. However, ultimate solder pot temperature will depend on what is being soldered, which flux category is chosen and how thermally demanding the assembly is.

Before using **ALPHA HRL3** solid solder in the soldering process, there are several **important things to consider:**

1. All components and PCB substrates used with **ALPHA HRL3** solid solder must be lead-free to eliminate the formation of tin/lead/bismuth intermetallic which has a melting point under 100 °C.
2. High bismuth containing low temperature solder alloys in the solder pot may expand when they cool. Any assembler using these alloys does so at their own risk. Contact your equipment supplier for more details regarding the machine used.
3. Suitable liquid flux selection in a low temperature dip soldering process is crucial to ensure unburned flux residue does not result in cosmetic issues or electrical reliability issues.
4. If a high boiling solvent flux is used in a very low temperature soldering process (< 230 °C), solder pot contact time may need to be increased to achieve better soldering performance. Or else, increase the solder pot temperature accordingly.

For additional notes concerning low temperature solder alloys in the dip soldering process, please refer to our Reference Bulletin – Using Low Temperature Solders in PTH and Dip Soldering - from our sales personnel.

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 link here.

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.**

STORAGE

Store the solid solder in a cool, dry and non-corrosive environment. Wrap up the solid solder when not in use to reduce exposure to the environment.

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