

# ALPHA<sup>®</sup> EF-9301

## Wave Soldering Flux for Tin-Lead and Lead-Free Applications

### DESCRIPTION

**ALPHA EF-9301** is a rosin-containing full dulling flux that provides the unique attributes of excellent solderability and reliability in both Lead-Free and Tin-Lead processes. It is designed to have best in class bridging on bottom side SMT components as well as superior performance in hole fill and solderballing. Additionally, it provides dull joints with an evenly spread, low-tack flux.

READ ENTIRE TECHNICAL DATA SHEET BEFORE USING THIS PRODUCT

### FEATURES & BENEFITS

#### Best-In-Class Features for Lead-Free and Tin-Lead Processes

- Low bridging performance on connectors and bottom side SMT components
- Excellent hole fill demonstrated by >95% yield on 10 mil holes.
- Low solderballing performance

#### Benefits

- Smooth solder joints with full dulling
- Evenly spread, low tack, flux residue
- Capable for Tin-Lead and Lead-Free processes
- Can be applied via spraying or foaming

### APPLICATION GUIDELINES

**PREPARATION:** In order to maintain consistent soldering performance and electrical reliability, it is important to begin the process with circuit boards and components that meet established requirements for solderability and ionic cleanliness. It is suggested that assemblers establish specifications on these items with their suppliers and that suppliers provide Certificates of Analysis with shipments and/or assemblers perform incoming inspection. A common specification for the ionic cleanliness of incoming boards and components is 5µg/in<sup>2</sup> maximum, as measured by an ionic contamination tester.

Care should be taken in handling the circuit boards throughout the process. Boards should always be held at the edges. The use of clean, lint-free gloves is also recommended. Conveyors, fingers and pallets should be cleaned. ALPHA SM-110 Solvent Cleaner has been found to be very useful for these cleaning applications.

**FLUX APPLICATION:** ALPHA EF-9301 can be applied by spraying or foaming. When spray fluxing, the uniformity of the coating can be visually checked by running a piece of cardboard over the spray fluxer or by processing a board-sized piece of tempered glass through the spray and then through the preheat section.

**FLUX SOLIDS CONTROL:** The solids content of ALPHA EF-9301 should be maintained by the addition of thinner to compensate for evaporation losses. Only ALPHA 425 Thinner should be used for this purpose, to ensure consistency of flux foaming and soldering characteristics. Flux solids content is readily controlled by simple hydrometer measurement. After emptying the flux, the reservoir should be thoroughly cleaned with IPA.

**RESIDUE REMOVAL:** ALPHA EF-9301 is a no-clean flux and the residues are designed to be left on the board. If their removal is required, ALPHA 2110 and saponifiers are recommended.

| Operating Parameter  | Recommendation  |
|--|---|
| Flux application   | Spray   |
| Amount of Flux Applied   | Spray: <1500 µg/in <sup>2</sup> of solids/in <sup>2</sup> dual wave, <1200 µg/in <sup>2</sup> of solids/in <sup>2</sup> single wave   |
| Top-Side Preheat Temperature   | 85 to 110 °C for Lead-Free and 75 to 95 °C for Tin-Lead   |
| Bottom side Preheat Temperature  | 0 to +22 °C (0 to +40 °F) vs. Top-Side  |
| Maximum Ramp Rate of Topside Temperature (to avoid component damage)   | 2 °C/second (3.5°F/second) maximum  |
| Conveyor Speed   | 1.5 to 2.2 meters/minute for single wave, 0.8 to 2.0 m/min for Lead-Free. *ALPHA EF-9301 is capable of running at slower conveyor speeds to accommodate certain types of Lead-Free wave soldering processes |
| Contact Angle  | 5 to 8° (6° most common recommended by equipment manufacturers)   |
| Contact Time   | 1.5 to 4.0 seconds (2½ to 3 seconds most common)  |
| Solder Pot Temperature   | Sn63/Pb37 Alloy: 235 to 260 °C, Lead-Free Alloy (SAC305): 255 to 265 °C   |
| <p><i>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 (amount of flux applied, conveyor speed, topside preheat temperature, solder pot temperature and board orientation).</i></p> |   |

**TECHNICAL DATA**

| Physical Properties                 | Typical Values               | Parameters/Test Method | Typical Values |
|-------------------------------------|------------------------------|------------------------|----------------|
| Appearance                          | Clear,<br>Pale Yellow Liquid | Flash Point (T.C.C.)   | 12 °C          |
| Solids Content, wt/wt               | 7.0                          | Recommended Thinner    | ALPHA 425      |
| Specific Gravity @<br>25 °C (77 °C) | 0.798 ± 0.005                | Shelf Life             | 360 days       |
| Acid Number (mg KOH/g)              | 16.0 to 17.0                 | IPC Classification     | ROM1           |
| pH, as is                           | 3.6                          | JIS & Bellcore status  | Compliant      |

**CORROSION & ELECTRICAL TESTING – SAC305 ALLOY**
**CORROSION TESTING**

| Test   | Requirement for ROM1              | Results                               |
|--|-----------------------------------|---------------------------------------|
| Silver Chromate Paper<br>IPC-TM 650 Test Method 2.3.33 | Halides detected                  | Contains halides                      |
| Copper Mirror Tests<br>(IPC/Bellcore Method)           | <50% Breakthrough in test<br>area | No evidence of mirror<br>breakthrough |
| Copper Corrosion Test<br>IPC-TM 650 Test Method 2.6.15 | Minor corrosion acceptable        | No evidence of corrosion              |

**IPC-J-STD-004A SURFACE INSULATION RESISTANCE** (All values shown are in ohms)

| Test  | Conditions           | Requirements            | Results                |
|---|----------------------|-------------------------|------------------------|
| "Comb-Down"<br>Uncleaned  | 85 °C/85% RH, 7 days | > 1.0 x 10 <sup>8</sup> | 6.5 x 10 <sup>9</sup>  |
| "Comb-Up"<br>Uncleaned  | 85 °C/85% RH, 7 days | > 1.0 x 10 <sup>8</sup> | 2.6 x 10 <sup>10</sup> |
| Control Boards  | 85 °C/85% RH, 7 days | >1.0 x 10 <sup>9</sup>  | 1.3 x 10 <sup>10</sup> |
| IPC Test Condition (per J-STD-004A): -50V, measurement @ 100V/IPC B-24 board (0.4mm lines, 0.5mm spacing) |                      |                         |                        |

**JIS STANDARD SURFACE INSULATION RESISTANCE** (All values shown are in ohms)

| Test  | Conditions              | Requirements             | Controls               | Results                |
|---|-------------------------|--------------------------|------------------------|------------------------|
| Initial   | Ambient                 | > 1.0 x 10 <sup>11</sup> | 2.9 x 10 <sup>12</sup> | 1.1 x 10 <sup>12</sup> |
| After 168 Hours   | 40 °C / 90% RH          | > 1.0 x 10 <sup>10</sup> | 3.3 x 10 <sup>10</sup> | 1.8 x 10 <sup>10</sup> |
| Recovered   | 35 °C/85% RH, 5<br>days | > 1.0 x 10 <sup>11</sup> | 1.0 x 10 <sup>12</sup> | 9.0 x 10 <sup>11</sup> |
| All Measurements @ 100V, JIS Boards (0.32mm lines, 0.32 mm spacing, same as IPC B25 Boards) |                         |                          |                        |                        |

**BELLCORE SURFACE INSULATION RESISTANCE** (All values shown are in ohms)

| Test  | Conditions           | Requirements           | Results              |
|---|----------------------|------------------------|----------------------|
| "Comb-Down"<br>Uncleaned  | 35 °C/85% RH, 5 days | $> 1.0 \times 10^{11}$ | $1.0 \times 10^{12}$ |
| "Comb-Up"<br>Uncleaned  | 35 °C/85% RH, 5 days | $> 1.0 \times 10^{11}$ | $2.3 \times 10^{11}$ |
| Control Boards  | 35 °C/85% RH, 5 days | $> 2.0 \times 10^{11}$ | $2.2 \times 10^{12}$ |
| Bellcore Test Condition (per GR 78-CORE, Issue 1): 48 Volts, measurement @ 100V/25 mil lines/50 mil spacing |                      |                        |                      |

**BELLCORE ELECTROMIGRATION** (All values shown are in ohms)

| Test   | SIR (Initial)        | SIR (Final)          | Requirement                      | Result | Visual Result |
|--|----------------------|----------------------|----------------------------------|--------|---------------|
| "Comb-Up"<br>Uncleaned   | $6.1 \times 10^{10}$ | $1.4 \times 10^{11}$ | SIR (Initial)/SIR (Final) $< 10$ | Pass   | Pass          |
| "Comb-Down"<br>Uncleaned   | $4.5 \times 10^{11}$ | $7.3 \times 10^{11}$ | SIR (Initial)/SIR (Final) $< 10$ | Pass   | Pass          |
| Control  | $5.1 \times 10^{10}$ | $8.8 \times 10^{10}$ | SIR (Initial)/SIR (Final) $< 10$ | Pass   | Pass          |
| Bellcore Test Condition (per GR 78-CORE, Issue 1): 65 °C/85% RH/500 Hours/10V, measurement @ 100V/IPC B-25B Pattern (12.5 mil lines, 12.5 mil spacing) |                      |                      |                                  |        |               |

**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](http://MacdermidAlpha.com/assembly-solutions/knowledge-base)**

**CONTACT INFORMATION**

**To confirm this document is the most recent version, please contact**  
**[Assembly@MacDermidAlpha.com](mailto:Assembly@MacDermidAlpha.com)**  
[www.macdermidalpha.com](http://www.macdermidalpha.com)

|   |   |   |
|---|---|---|
| <p><b>North America</b><br/>         109 Corporate Blvd.<br/>         South Plainfield, NJ 07080, USA<br/>         800.367.5460</p> | <p><b>Europe</b><br/>         Unit 2, Genesis Business Park<br/>         Albert Drive<br/>         Woking, Surrey, GU21 5RW, UK<br/>         01483.758400</p> | <p><b>Asia</b><br/>         8/F., Paul Y. Centre<br/>         51 Hung To Road<br/>         Kwun Tong, Kowloon, Hong Kong<br/>         852.3190.3100</p> |
|---|---|---|

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, indirect, incidental 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.