

# ALPHA EF-6000

## No-Clean Flux for LEAD-FREE & Sn-Pb WAVE SOLDERING

**ALPHA EF-6000** was specifically developed to deliver outstanding board cosmetics and to eliminate the tendency for solder balling and solder bridging, two types of defects which are normally associated with the use of the chip wave. Of all low solids (< 4% solids), no-clean fluxes, **ALPHA EF-6000** exhibits the lowest tendency for solder ball generation over a wide variety of solder masks during wave soldering and Selective Soldering operations. **ALPHA EF-6000** should be considered for use by any assembler who has board designs which are sensitive to solder bridging, performs pin testing, or whose specification requires an extremely low frequency of solder balls.

### GENERAL DESCRIPTION

**ALPHA EF-6000** is an active, low solids, no-clean flux. It has been designed with a wide thermal process window enabling best-in-class productivity with lead-free wave soldering applications, and is an excellent choice for remaining tin-lead production lines. It is formulated with a proprietary mixture of organic activators. Several proprietary additives are formulated into **ALPHA EF-6000** to reduce the surface tension between the solder mask and the solder; thereby, dramatically reducing the tendency of solder ball generation. The formulation of **ALPHA EF-6000** is also more thermally stable, thereby, reducing the occurrence of solder bridging during lead-free dual wave soldering.

### FEATURES & BENEFITS

- Thermally stable activators provide the lowest solder bridging in a low-solids, no-clean flux for wave soldering and Selective Soldering in tin-lead and lead-free applications.
- Reduces the surface tension between solder mask and solder to provide the lowest solder ball frequency of any low solids, no-clean flux.
- Very low level of non-tacky residue to reduce interference with pin testing and exhibit no visible residue.
- Cleaning is not required which reduces operating costs.
- IPC-J-STD-004 compliant for long term electrical reliability.

### 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  $5\mu\text{g}/\text{in}^2$  ( $0.77\mu\text{g}/\text{cm}^2$ ) maximum, as measured by an Omegameter with heated solution.

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. When switching from one flux to another, the flux reservoir, flux tank and lines of the spray fluxer assembly should be purged with IPA. Conveyors, fingers and pallets should be cleaned periodically with DI Water, IPA or other commercial Solvent Cleaners to eliminate residues on the assembly edges.

**FLUX APPLICATION** – **ALPHA EF-6000** is formulated to be applied by spray methods. A uniform coating of flux is essential to successful soldering. 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.

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## GENERAL “GUIDELINES” FOR MACHINE SETTINGS

| OPERATING PARAMETER   | SAC305 / SACX0307  | 63/37 Sn-Pb  |
|---|--|--|
| Amount of Flux Applied by Spray   | Single Wave: 500 – 800 µg/in <sup>2</sup><br>(78 - 124 µg/cm <sup>2</sup> ) of solids<br>Dual Wave: 850 – 1400 µg/in <sup>2</sup><br>(132 – 217 µg/cm <sup>2</sup> ) of solids | Single Wave: 200 – 600 µg/in <sup>2</sup><br>(31 – 93 µg/cm <sup>2</sup> ) of solids<br>Dual Wave: 600 – 1000 µg/in <sup>2</sup><br>(93 – 155 µg/cm <sup>2</sup> ) of solids |
| Topside Preheat Temperature   | 105°C – 120°C (221°F – 248°F)  | 75°C -100°C (167°F - 212°F)  |
| Bottom side Preheat Temperature   | about 35°C (95°F) higher than topside  | about 35°C (95°F) higher than topside  |
| Maximum Ramp Rate of Topside Temperature (to avoid component damage)  | 2°C/second maximum   | 2°C/second maximum   |
| Conveyor Angle  | 4°- 7° (6° typical)  | 4°- 7° (6° typical)  |
| Conveyor Speed  | 3 - 6 ft./min. (0.9 – 1.8 m./min.)   | 3 - 6 ft./min. (0.9 - 1.8 m./min.)   |
| Contact Time in the Solder (includes Chip Wave and Primary Wave)  | 1.5 - 3.5 seconds (2.5 - 3 seconds most common)  | 1.5 - 3.5 seconds (2.5 - 3 seconds most common)  |
| Solder Pot Temperature  | 255°C – 265°C (491°F – 509°F)  | 240°C - 250°C (464°F – 482°F)  |
| 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 designed experiment, optimizing the most important variables (amount of flux applied, conveyor speed, topside preheat temperature, solder pot temperature and board orientation). |  |  |

**FLUX SOLIDS CONTROL:** As with any flux with less than 5% solids content, specific gravity is **not** an effective measurement for assessing and controlling the solids content. Monitoring and controlling the acid number is recommended for maintaining the solids content. The acid number should be controlled to between 16.5 and 18.5. Alpha's Flux Solids Control Kit #3, a digital titrator, is suggested. Request Alpha's Technical Bulletin SM-458 for details on the kit and titration procedure.

**RESIDUE REMOVAL – ALPHA EF-6000** is a no-clean flux and the residues are designed to be left on the board. However, if desired, **ALPHA EF-6000** residues can be removed with hot DI Water, Alpha 2110 Saponifier or commercial solvent cleaners.

**TOUCH-UP/REWORK** - Use of the Cleanline Write Flux Applicator with ALPHA NR-205 flux and Telecore Plus cored solder is recommended for hand soldering applications.

### HEALTH & SAFETY

Please refer to the Material Safety Data Sheet as the primary source of health and safety information. Inhalation of the flux solvent and volatilized activator fumes, which are generated at soldering temperatures, may cause headaches, dizziness and nausea. Suitable fume extraction equipment should be used to remove the flux from the work area. An exhaust at the exit end of the wave solder machine may also be needed to completely capture the fumes. Observe precautions during handling and use. Suitable protective clothing should be worn to prevent the material from coming in contact with skin and eyes.

**ALPHA EF-6000** flux contains a highly flammable solvent with a flash point of 53°F (12°C). The flux must not be used near open flames or near non-flameproof electrical equipment.



## TECHNICAL SPECIFICATION

| Parameters                     | Typical Values            | Parameters/Test Method      | Typical Values    |
|--------------------------------|---------------------------|-----------------------------|-------------------|
| Appearance                     | Clear, pale-yellow liquid | pH (5% aqueous solution)    | 3.3               |
| Solids Content, wt/wt          | 2.2 %                     | Recommended Thinner         | 425 Thinner       |
| Acid Number (mg KOH/g)         | 17.5 ± 1.0                | Shelf Life                  | 12 Months         |
| Specific Gravity @ 25°C (77°F) | 0.790 ± 0.003             | Container Size Availability | 1, 5, and 55 Gal. |
| Pounds Per Gallon              | 6.8                       | IPC J-STD-004 Designation   | ORL0              |
| Flash Point (T.C.C.)           | 53°F (12°C)               |                             |                   |

## CORROSION AND ELECTRICAL TESTING

### CORROSION TESTING

| Test                       | Requirements for ORL0         | Results |
|----------------------------|-------------------------------|---------|
| Silver Chromate Paper Test | No Detection of Halide        | PASS    |
| Copper Mirror Test         | No Complete Removal of Copper | PASS    |
| IPC Copper Corrosion Test  | No evidence of corrosion      | PASS    |

### J-STD-004 SURFACE INSULATION RESISTANCE

| Test Condition   | Requirements                  | Results                |
|--|-------------------------------|------------------------|
| IPC J-STD-004 Comb-Down – Un-cleaned   | 1.0 x 10 <sup>8</sup> minimum | 1.7 x 10 <sup>10</sup> |
| IPC-J-STD-004 Comb-Up – Un-cleaned   | 1.0 x 10 <sup>8</sup> minimum | 1.5 x 10 <sup>10</sup> |
| IPC J-STD-004 Control Board  | 2.0 x 10 <sup>8</sup> minimum | 2.7 x 10 <sup>10</sup> |
| IPC Test Condition (per J-STD-004): 85°C/85%RH/7days/-50V, measurement @ 100V/IPC B-24 board (0.4mm lines, 0.5mm spacing). All values in ohms. |                               |                        |

### BELLCORE ELECTROMIGRATION

| Test Condition  | SIR (Initial)          | SIR (Final)            | Requirement                    | Result | Visual Result |
|---|------------------------|------------------------|--------------------------------|--------|---------------|
| Belcore "Comb-Up" Un-cleaned  | 7.8 x 10 <sup>9</sup>  | 1.7 x 10 <sup>11</sup> | SIR (Initial)/SIR (Final) < 10 | PASS   | PASS          |
| Belcore "Comb-Down" Un-cleaned  | 1.6 x 10 <sup>10</sup> | 1.4 x 10 <sup>11</sup> | SIR (Initial)/SIR (Final) < 10 | PASS   | PASS          |
| Belcore Test Condition (per GR 78-CORE, Issue 1): 65°C/85%RH/500 Hours/10V, measurement @ 100V/IPC B-25 B Pattern (12.5 mil lines, 12.5 mil spacing). All values in ohms. |                        |                        |                                |        |               |