

# ALPHA EF-6100

## Low-Solids, High-Reliability, Alcohol-Based Wave Soldering Flux for Lead-Free and Tin-Lead Applications

**ALPHA EF-6100** was specifically developed to deliver high reliability and excellent soldering performance combined with outstanding board cosmetics and pin-testability. **ALPHA EF-6100** exhibits a low tendency for solder ball generation over a wide variety of solder masks during wave soldering and Selective Soldering operations. **ALPHA EF-6100** should be considered for use by any assembler who has board designs which require high reliability, good through-hole-fill, reduced component bridging and reduced skips.

### GENERAL DESCRIPTION

**ALPHA EF-6100** is a high-reliability, IPC, Bellcore, and JIS compliant, 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. **ALPHA EF-6100** is formulated with a proprietary mixture of organic activators to give more thermal stability, thereby reducing the occurrence of solder bridging during lead-free dual wave soldering.

### FEATURES & BENEFITS

- Exhibits exceptional electrical reliability for a low-solids wave soldering flux. Complies with IPC-J-STD-004 SIR, Bellcore SIR, Bellcore ECM, JIS ECM, and JIS SIR.
- Thermally stable activators provide minimized solder bridging in a low-solids, no-clean flux for wave soldering and Selective Soldering in lead-free and tin-lead applications.
- Reduces the surface tension between solder mask and solder to resist solder ball formation
- Very low level of non-tacky residue to reduce interference with pin testing and exhibit no visible residue.
- IPC-J-STD-004 Classification: ORLO

### 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, IPA or other commercial Solvent Cleaners to eliminate residues on the assembly edges.

**FLUX APPLICATION** – **ALPHA EF-6100** 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 pH sensitive paper matching the footprint of the assembly over the spray fluxer.

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## GENERAL "GUIDELINES" FOR MACHINE SETTINGS

OPERATING PARAMETER	SAC305 / SACX0307	63/37 Sn-Pb
Amount of Flux Single Wave: applied by Spray	1200 – 1800 $\mu\text{g}/\text{in}^2$ (190 - 280 $\mu\text{g}/\text{cm}^2$ ) of solids	1000 – 1400 $\mu\text{g}/\text{in}^2$ (155 – 220 $\mu\text{g}/\text{cm}^2$ ) of solids
Amount of Flux Dual Wave: applied by Spray	1600 – 2000 $\mu\text{g}/\text{in}^2$ (250 – 310 $\mu\text{g}/\text{cm}^2$ ) of solids	1500 – 1800 $\mu\text{g}/\text{in}^2$ (230 – 280 $\mu\text{g}/\text{cm}^2$ ) 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 22.8 and 25.2, 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-6100** is a no-clean flux and the residues are designed to be left on the board. However, if desired, **ALPHA EF-6100** residues can be easily removed with various cleaning products including ALPHA BC-2200 aqueous board cleaner, ALPHA 2110 saponifier, IPA 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-6100** 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.

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## TECHNICAL SPECIFICATION

Parameters	Typical Values	Parameters/Test Method	Typical Values
Appearance	Clear, colorless to pale-yellow liquid	SIR: Bellcore, JIS, IPC ECM: Bellcore, JIS	PASS PASS
Solids Content, wt/wt	3.8 %	pH (5% aqueous solution)	3.3
Acid Number (mg KOH/g)	24.0 ± 1.2	Recommended Thinner	425 Thinner
Specific Gravity @ 25°C (77°F)	0.794 ± 0.003	Shelf Life	12 Months
Pounds Per Gallon	6.6	Container Size Availability	1, 5, and 55 Gal.
Flash Point (T.C.C.)	53°F (12°C)	IPC J-STD-004 Designation	ORL0

## CORROSION AND ELECTRICAL TESTING

### CORROSION TESTING

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

### 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	2.3 x 10 <sup>10</sup>
IPC-J-STD-004 Comb-Up – Un-cleaned	1.0 x 10 <sup>8</sup> minimum	2.2 x 10 <sup>10</sup>
IPC J-STD-004 Control Board	2.0 x 10 <sup>8</sup> minimum	2.3 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
Bellcore "Comb-Up" Un-cleaned	9.3 x 10 <sup>9</sup>	2.3 x 10 <sup>11</sup>	SIR (Initial)/SIR (Final) < 10	PASS	PASS
Bellcore "Comb-Down" Un-cleaned	7.2 x 10 <sup>9</sup>	6.6 x 10 <sup>9</sup>	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-25 B Pattern (12.5 mil lines, 12.5 mil spacing). All values in ohms.					



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## BELLCORE SURFACE INSULATION RESISTANCE

Test	Conditions	Requirements	Results
"Comb-Down" Un-cleaned	35°C/85% RH, 5 days	$1.0 \times 10^{11}$ minimum	$1.1 \times 10^{12}$
"Comb-Up" Un-cleaned	35°C/85% RH, 5 days	$1.0 \times 10^{11}$ minimum	$3.6 \times 10^{11}$
Control Boards	35°C/85% RH, 5 days	$2.0 \times 10^{11}$ minimum	$7.8 \times 10^{11}$
Belcore Test Condition (per GR 78-CORE, Issue 1: 48 Volts, measurement @ 100V/25 mil lines/50 mil spacing. All values in ohms.			

## JIS STANDARD SURFACE INSULATION RESISTANCE

Test	Conditions	Requirements	Controls	Results
Initial	Ambient	$1.0 \times 10^{11}$ minimum	$5.5 \times 10^{11}$	$5.8 \times 10^{11}$
After 168 Hours	40°C / 93% RH	$1.0 \times 10^{10}$ minimum	$5.9 \times 10^{11}$	$1.4 \times 10^{11}$
Recovered	35°C/85% RH, 5 days	$1.0 \times 10^{11}$ minimum	$1.1 \times 10^{12}$	$4.5 \times 10^{11}$
All Measurements @ 100V, JIS Boards (0.32mm lines, 0.32 mm spacing, same as IPC B25 Boards). All values in ohms				

## JIS STANDARD ELECTROMIGRATION

Electrical and visual requirements of JIS standards: Pass

Geometric Mean SIR value:  $4.9 \times 10^{10}$  ohm (@85 degC/85%RH/48VDC/1000hrs)

Migration: No evidence of electrochemical migration