ALPHA EF-5601

ALPHA

APPLICATION BULLETIN

Rev. 01

SM1004

This application bulletin is designed to provide more specific guidance than our standard TB to our field application personnel for assisting customers interested in using a low solids, rosin free, water based wave solder spray flux. **ALPHA EF-5601** is Cooksons new Lower VOC, high performance, high reliability wave solder spray flux that is designed to deliver the same performance as similar class 100% alcohol fluxes while being safer to use (higher flash point) and better for the environment (lowers VOC's). It has demonstrated excellent hole fill and low bridging, solder balls and icicles in lab tests and at beta sites and it passes JIS SIR.
Guidelines provided herein are the result of testing done during product development and from our findings during beta site evaluations. These are general guidelines, which have proven to yield excellent results; however, depending upon the customer's equipment, components and circuit boards, their optimal settings may be different.

General 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 solder ability and ionic cleanliness. It is suggested that assemblers establish specification on 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 is **5** microgram/ in-square maximum and components is **3** microgram/ in-square 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 or better use clean, lint-free gloves are recommended.

ALPHA Autoclean 40 is recommended for the proper cleaning of wave solder equipment parts such as conveyors and fingers and is also excellent for cleaning pallets. For faster cleaner evaporation ALPHA SM-110 can be used on wave equipment.

Flux System Maintenance

ALPHA EF-5601 is formulated to be applied by spray method. When changing to a new flux, it is always advisable to clean and purge the entire system prior to use.

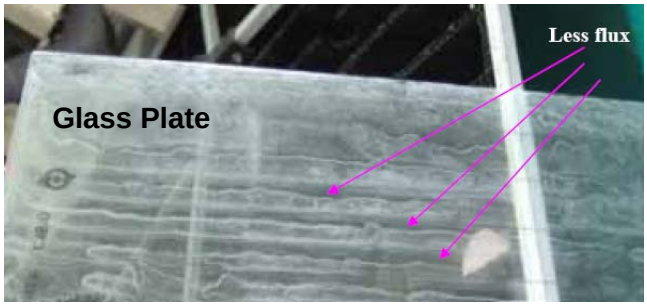
1 Drain the old flux from the system.
2 Refill it with IPA or other thinner.
3 Operate the fluxer for 10 – 15 minutes minimum.
4 Drain the thinner from the system.
5 Refill system with the new flux, operate for a few minutes before processing boards.
Note:
Keep the spray nozzles / aerators clear at all other times. Never let them dry out in the presence of flux. This will lead to clogging and deterioration of the aerator.

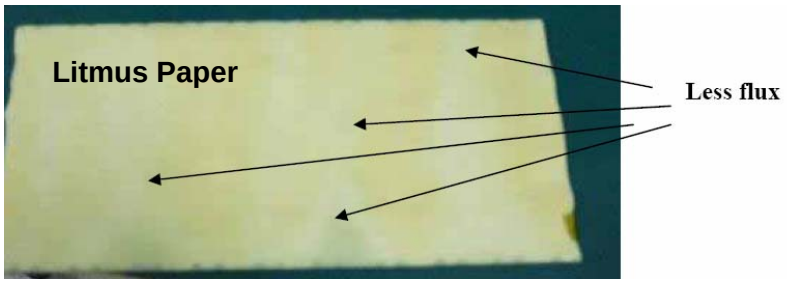
Cookson Electronics ASSEMBLY MATERIALS

Fluxer System Maintenance and Set-Up

Fluxers should be regularly maintained according to the manufacturers recommendations. This should include proper leveling of the machine and rails, cleaning of all areas exposed to molten metal, dross or flux and regular monitoring of temperature control modules.
There are several key areas of the flux application system itself that, when optimized, contribute to yielding excellent soldering results:

1. **Spray Nozzle Height**: recommended to be set at **6-8 cm** below the PCB surface
2. **Sprayer Coverage**: should apply consistent, even spray patterns. This can be visually checked by running a board sized piece of litmus paper over the spray fluxer or by processing a board-sized piece of tempered glass though the spray fluxer.

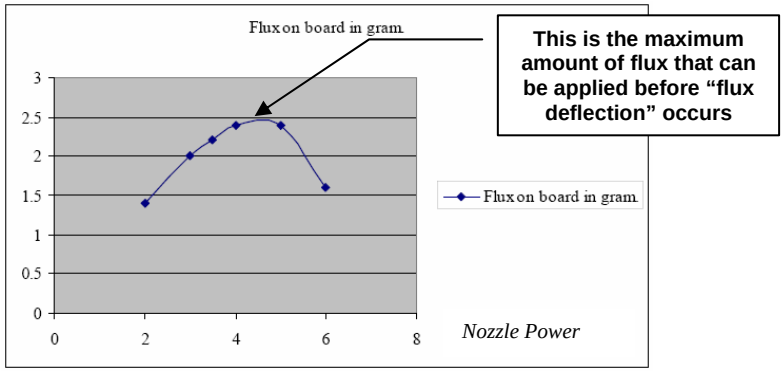




3. **Spray Pressure**: should be sufficient to apply a consistent amount of flux but not so high as to cause flux deflection (flux being sprayed off the board), excessive overspray or top side flux contamination due to the high pressure blowing flux through holes in the board. There are two methods for measuring sprayer performance:
   a. Sprayer Output: measures the amount of flux that is actually output by the spray system. Best systems output a predictable amount of flux as pressure is adjusted up or down.
   b. Deposited Flux Amount: measures the amount of flux actually deposited on the board by spraying the board and quickly weighing it.

   Using the above measurements you can determine the optimal spray pressure and eliminate flux loading variability from your process.

Nozzle Power in Watt	Flux on board in gram.
2	1.4
3	2
3.5	2.2
4	2.4
5	2.4
6	1.6



Cookson Electronics ASSEMBLY MATERIALS

Optimizing the Process for EF-5601

ALPHA EF-5601 is designed to have a wide process window in order to deliver excellent results over a broad spectrum of application and process conditions. However, through lab and beta site testing, we have found that EF-5601, like most fluxes, has a particular process window where it performs consistently well. Below are our recommendations for achieving this high level of performance. These guideline should provide a good starting point but, depending on the customers equipment, materials and PWBA, they may need to run some additional tests to determine their own optimal process setting range for ALPHA EF-5601.

Step 1 - Flux Loading

For most PWBA's apply enough flux to deposit **325 - 375 µg of solid content/ cm² or 2000-2400 µg/in²** of solids**.** Use lesser amounts on assemblies with metallized pad finishes (ImSn, ImAg, NiAg) with 1 or less prior reflow. For OSP finishes and more than 1 prior reflow, use a higher amount. Thicker boards (> 2.4 mm) generally require slightly higher flux loading.

It is always preferable to measure the amount of flux that has been deposited on the board rather than try and determine the amount through spray vessel weight loss. Unfortunately this is not always possible and depends on the fluxer unit/wave solder machine used, measurement systems available and to some extent personal preference. Regardless, any method used should result in flux loading being expressed as flux solids/unit area (ie. µg/cm² or µg/in²).

Measurement Methods

1. **Wet Gravimetric - loss from vessel**
   - 1.0 Measure the weight loss directly from the flux storage vessel during the spraying operation.
     - 1.1 This is normally done by either weighing the vessel before and after applying the flux.
     - 1.2 Depending on the size of the vessel you may need to apply flux to several boards.
   - 2.0 Calculate the flux solids applied to board by multiplying the solids content percentage (4%) by the flux weight applied (lost from vessel) and dividing by board area (length x width).
     - 2.1 Requires scale with 0.1g minimum resolution.

     Note: Be sure to consider overspray. Try and measure the entire size of the spray pattern and deduct the board size to estimate overspray.

2. **Wet Gravimetric - flux on board**
   - 1.0 Weigh the PWBA before and immediately after fluxing.
     - 1.1 With alcohol fluxes it's a good idea to turn off pre-heaters and immediately place the sprayed PWBA into a plastic, sealable bag before weighing in order to minimize weight loss from alcohol volatilization.
   - 2.0 Calculate the flux solids applied to board by multiplying the solids content (4%) by the flux weight applied (weight increase of board) and dividing by board area (length x width).
     - 2.1 Requires scale with 0.1g minimum resolution.

3. **Dry Gravimetric - flux on board**

1.0 Weigh test coupon, spray, dry over pre heat or in oven and weigh again.

2.0 Calculate the flux solids applied directly by dividing the flux weight applied (weight increase of coupon) by the surface area of coupon.

2.1 Require scale with 0.001g minimum resolution.

2.2 Coupon must not come in contact with the wave.

2.3 Pre-heat settings must be high enough to dry the panel but not to 'burn off' flux solids.

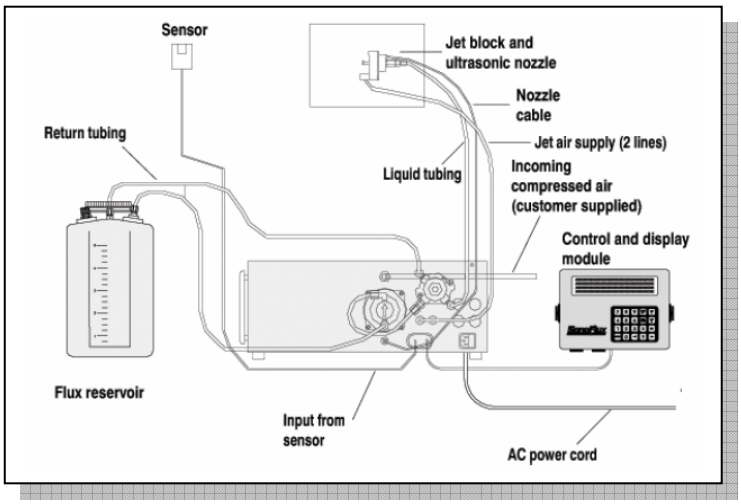
2.4 Test coupon must be dry and stable, suggest using Aluminium foil.

4. **Volumetric - loss from vessel**

1.0 Flux is sprayed from either a graduated cylinder or via an intermediate holding vessel on the wave solder machine.

1.1 The change in the flux volume is measured over typically 5 to 10 boards and the solids applied calculated by converting the average flux volume per board into a weight by multiplying by the specific gravity (1.015 ±.0003) of the flux.

1.1.1 Calculate the flux solids applied to the board by multiplying the solids content percentage (4%) by the flux weight applied (weight increase of board) and dividing by board area (length x width).



Note: Be sure to consider overspray. Try and measure the entire size of the spray pattern and deduct the board size to estimate overspray.

5. **Volumetric - collected**

1.0 Flux is sprayed into a vessel by either disconnecting the flux feed pipe to the nozzle or detaching the nozzle from the moving mechanism.

2.0 Flux application is then measured for typically 5 to 10 boards and the solids applied calculated by converting the average flux volume per board into a weight by multiplying by the flux SG from the data sheet.

3.0 Calculate the flux solids applied to the board by multiplying the solids content percentage (4%) by the flux weight applied (weight increase of board) and dividing by board area (length x width

Note that the lack of 'back pressure' in disconnected flux feed pipe generally gives higher than standard feed rates.

Pre-Heating

As with all Low – No VOC fluxes pre-heating is a critical step in driving off excess water prior to contact with the wave. While Alpha EF-5601 can perform in a wide pre-heat profile it performs especially well with a longer, hotter process.

Board Side	Peak Temperature	Peak Temp. Exposure Time
Top	**85-100°C**	**15-25 seconds**
Bottom	**100-110°C**	

A straight ramp to the recommended peak temperatures should be used to avoid board and component damage. PWBA's with the ALPHA EF-5601 applied should have a total pre-heat exposure time between **60 and 90 seconds**.

Conveyor Angle

The conveyor angle has a direct impact on the draining (peel-off) of the solder from the PCB during exiting the wave. This angle therefore has there for a direct effect on the amount of solder defects.
A setting of **6-7°** should be used.

Contact Time

This is the amount of time the PWBA is actually in contact with the molten solder wave. If the process has both a Chip Wave and a Main (Lambda) Wave you need to add the amount of time that the PWBA is in contact with both to arrive at the Total Contact Time. The widths of both the Chip Wave and Main Waves vary from machine to machine. Contact time is controlled by the width of these waves and the speed of the conveyor that is processing the boards. For lead-free processing it is preferred that the distance between the chip wave and main wave be no greater than **9cm's** to avoid solder "freezing" between the waves. If distance between chip and main wave is > 9cm, use the main wave only for best results.

Recommended Total Contact Times

Board Thickness	Pad Finish	
	Metalized (HASL, ImSn, ImAg, NiAu)	OSP
1.6 mm	**4 seconds**	**4 seconds**
2.4 mm	**5 seconds**	**6 seconds**
3.2 mm	**7 seconds**	**8 seconds**

Conveyor Speed

The conveyor speed should be set to allow the recommended pre-heat and contact times to be achieved.

Solder Pot Temperature

Solder pot temperatures should be set at **255 - 260°C** for optimum performance of ALPHA EF-5601.