

	Manufacturing Procedure	Procedure #: <b>MFG011 Rev. C</b>	Date: <b>2/1/2024</b>
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Title: <b>Wave Solder Operation</b>			

Revision	Description of Change	Date Effective	Author
A	Initial Release	3/21/99	Dior Wu
B	Modify 9.2.5	9/18/99	Dior Wu
C	Removed 7.2, 8.1, 8.2, 8.3 & 7.3, 9.1.3, 9.2.2 Modified 9.3.3, 9.1.3, 6.1, 4.6 & 4.8 Added 3.5, 3.4	2/1/2024	Mario Baltier

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Originator

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**Wave Solder Operation****1.0 Purpose**

- 1.1 The purpose of this procedure is to provide a uniform guideline for the Wave Solder Area. This is a special process.

**2.0 Scope**

- 2.1 This procedure provides detailed information on how to Wave Solder printed circuit boards.

**3.0 References**

- 3.1 SOP11 First Articles  
3.2 SOP22 ESD Control Procedure  
3.3 IPC-A-610 Acceptability of Electronic Assemblies  
3.4 The Electro Vert Vectra (+) Operation and Maintenance Manual  
3.5 PDOC025 Master Forms Listing

**4.0 Definitions**

- 4.1 Solder: A tin and lead mixture, which is used to attach a component to a printed circuit board.
- 4.2 Solder Dross: Something dirt like contaminant that is produced in the wave solder pot.
- 4.3 Preheater: The preheaters are a group of infra-red heating elements which are used to heat the circuit boards before they reach the molten solder in the solder pot.
- 4.4 Flux: This chemical will remove contaminants from the printed circuit board and accelerates soldering.
- 4.5 Hydrometer: A glass tube with a float inside that is used to measure the flux specific gravity.
- 4.6 Isopropyl alcohol is used to dilute the flux.
- 4.7 Solder wave: The solder pot contains a pump assembly, which creates a wave of solder over which the printed circuit boards pass.
- 4.8 Foam Fluxer: This unit contains a synthetic stone that is connected to compressed air. A pool of flux kept inside the foam-fluxing unit. When compressed air is applied to the stone, a foam head is created that coats the bottom side of the assemblies when they pass over the stone.
- 4.9 PCA: Printed Circuit Assembly.
- 4.10 Air knife: A plastic tube with a line of holes drilled into it. Compressed air is applied to the air knife creating a wall of air used to blow off any excess flux left on the board.

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**Wave Solder Operation****5.0 Responsibilities**

- 5.1 Engineering establishes the Wave Solder Process and profiles.
- 5.2 It is the responsibility of the Wave Solder supervisor and lead to follow this procedure and train Operators to this procedure.

**6.0 Equipment**

- 6.1 Electrovert Vectra (+) Wave Solder Machine
- 6.2 Hydrometer
- 6.3 IR temperature measurement gun
- 6.4 Slotted Spoon
- 6.5 High Temperature Gloves
- 6.6 Dross Can with lid
- 6.7 Wire Brush
- 6.8 Glass cleaner (Windex or similar cleaner)
- 6.9 Solder Oxide Reducing Powder- Kleenex
- 6.10 Safety Glasses
- 6.11 Dust Mask
- 6.12 Metal spatula
- 6.13 Wave Solder Fixtures

**7.0 Materials**

- 7.1 Flux (Alpha 857 and EF-8300)
- 7.2 Bar Solder (Kester Sn63/Pb37) and AIM SN100C
- 7.3 Hazardous Waste Label

**8.0 Records**

- 8.1 Electrovert Vectra (+) Wave Profile Form (PMFG020)
- 8.2 Chemicals/solder bar wire log (PMFG249)

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**Wave Solder Operation****9.0 Procedure****9.1 Wave Machine Set-up:**

- 9.1.1 General: If at any time during this procedure you do not know where a particular button, key, indicator, switch is you should consult the appropriate wave machine operations/maintenance manual or ask your supervisor.
- 9.1.2 Solder Dross: Once per week or as required, the solder dross must be removed from the surface of the solder. This cleaning should be done at least once every 10 hours of operation, for example, at the end of a shift or the beginning of a shift depending on production demands. Move the solder pot out from inside the machine to gain easy access to the solder pot. Add approximately a 1/4-cup of solder oxide reducing powder to the surface of the solder. Use the scraper to work the powder into the solder bath. With the slotted spoon remove any solder dross that has accumulated on the top and carefully put it in the dross cans. Using the spatula and wire brush remove any dross from the sump components and move the solder pot back into place inside the machine. Fill the solder pot with bar solder if necessary.
- 9.1.3 Viewing windows and machine covers: With the glass cleaner and a dry towel wipe the windows and the exterior of the machine weekly.
- 9.1.4 Preheaters: Clean the preheater glass covers with the glass cleaner and a dry towel (top and bottom). This should be done weekly and only when the preheaters are off.
- 9.1.5 Conveyor Fingers: If a finger is found to be bent, it should be immediately straightened or replaced.

**9.2 Wave Machine Operation:**

- 9.2.1 Profile Settings: Find the profile of the assembly you are going to run in the profile logbook. Change the settings on the control panel following the appropriate profile and turn on the conveyor. If there is no wave solder profile for the assembly you are planning to wave, then notify Engineering to have one made. Do not run production without a profile or Engineering instructions.
- 9.2.2 Conveyor Width: Open the conveyor to the same width as the assembly you are going to wave solder. If the assembly goes into a wave solder fixture, then adjust the conveyor to the same width as the fixture.
- 9.2.3 Load assembly: Insert the assembly into the conveyor fingers. Ensure that the fingers don't get caught on the assembly or fixture. As the board passes over the foam flux the flux bubbles should completely cover the underside of the assembly and the air knife (located directly behind the fluxer) should blow off any excess flux left on the assembly before going into the preheaters.
- 9.2.4 PCA Soldering: The assembly goes through the preheaters then is soldered and removed from the conveyor fingers by the operator at the end of the machine. The PCA is inspected per First Articles SOP 11 and recorded on the hand load first article inspection form. If there is a problem found by the inspector, stop the run, and notify the Supervisor or Engineer. If the assembly is found to be acceptable then continue wave soldering PCA's.

**9.3 Wave Solder Machine Shut Down:**

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**Wave Solder Operation**

- 9.3.1 Shutdown: Ensure there are no PCA's still in the machine's conveyor then turn off the machine by turning off the solder pump and preheaters. Wait until preheaters cool down and turn off the conveyors and the. Only the solder pot power indicator should remain on. Ensure that all the covers are on the machine and the glass windows are closed.
- 9.3.2 Wave Solder Fixtures: Any wave fixtures used during your shift must be washed.
- 9.3.3 Engineering Department, Supervisors and Technician are responsible for logging in all chemicals such as flux, solder bar/wire and masking glue used in the wave solder department.
- 9.4 Solder Maintenance:
- 9.4.1 Sump Cleaning: In addition to the daily dross removal, the internal components of the solder pot need to be cleaned at least once every month. Remove the entire sump (see safety note under "Lifting") and use a wire brush and/or spatula to remove the dross attached to the inside and outside of the sump. When the solder dross has been removed from all of the sump components, reassemble the sump and reinstall it into the solder pot.
- 9.4.2 Solder Analysis: The solder in the solder pot must be analyzed at least once every year. Take the sample using the ladle or spoon from the flowing solder. Allow to cool to the touch then remove and place in mailing envelope. Mark the outside of the envelope with the name of the particular wave machine the sample was taken. Fill out the mailing form for the analytical laboratory and mail the sample in the mailing envelope with the mailing form. When the result of the test sample is received from the analytical lab, Engineering will review the results and save the analysis report M drive /wave solder analysis folder.
- 9.5 Safety:
- 9.5.1 General: Please follow all safety precautions as indicated in the operation and maintenance manuals. If there are any problems or questions, please call Engineering.
- 9.5.2 Machine Operation: Keep your face away from solder pot and preheater areas during machine operation. The operator removing PCA's from the machine shall wear protective gloves.
- 9.5.3 Solder and Solvents: Solder is a very dangerous product when not handled correctly. Always wear safety equipment (i.e. gloves, safety glasses) when handling bar solder or molten solder. Flux and thinner are very volatile substances and can be very dangerous. When handling these products avoid breathing fumes for a prolonged period and repeated contact with the skin. Wash hands thoroughly after handling flux, thinner and solder. Know where the nearest fire extinguisher is located and how to use it.
- 9.5.4 Maintenance: If any problem should occur with the machine, immediately contact maintenance or your supervisor. Only a qualified maintenance will work on the machine unless otherwise specified.
- 9.5.5 Material Safety Data Sheets: There are original MSDS sheets in Document Control and copies found in the manufacturing area. Each operator should be familiar with these forms and the warnings found in them.
- 9.5.6 Personal Cleanliness: Before going to break or lunch wash your hands. The chemicals and solder are very toxic and the residue could be on your hands.

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**Wave Solder Operation**

- 9.5.7 Housekeeping: Always follow good housekeeping rules (i.e. do not leave boxes, fixtures around the wave solder area).
- 9.5.8 Lifting: Some of the components found on the wave solder machines are very heavy. When lifting heavy objects, wear your back support belt and ask for assistance from another wave solder operator.
- 9.5.9 Safety Glasses: All wave solder operators must wear safety glasses while operating the wave solder equipment.
- 9.6 Process Control:
  - 9.6.1 Production Start-up: Take the reading of solder pot temperature and make sure flux specific gravity is correct. If this condition cannot be met shut down the line and notify process engineering.
  - 9.6.2 Process Monitor: Read and record solder pot temperature before running PCA's.