Soldering And Cleaning Processes

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This application note is designed to provide step-by-step processing recommendations. It covers the popular SMC soldering processes currently in use and provides recommendations and cautions for each step. Since many variations of temperature, time, processes, cleaning agents and board types are found in the electronics industry, you'll want to test and verify your own system.

The process steps, recommendations and cautions are based on Bourns Trimpot surveys of SMC users, equipment manufacturers and materials suppliers. Also, comments reflect results of Bourns' testing. Our findings suggest the following soldering and cleaning processes:

1. SOLDERING - Forced Hot Air, Convection, IR, Vapor Phase (In-Line), Wave (Single and Dual)
2. CLEANING - Solvent, Aqueous, Semi-Aqueous, No-Clean On the facing page are the common methods, materials and maximum temperature/time parameters for soldering and cleaning processes.

1 Solder Paste Printing

Reflow

GENERAL
Use the optimum solder paste for the pattern, printing process, solder paste density and solder joint quality.

RECOMMENDED
Use solders with melting points of 215 °C or less. Solder zone profile of 245 °C for 5 seconds.

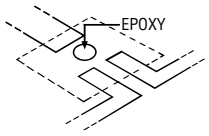
CAUTION
Since solder paste usually contains a high percentage of activators, you must ensure adequate cleaning to remove all residues, unless no-clean (low solids) paste is used.

2 Adhesive Application

Flow (Wave)

GENERAL
The adhesive must hold the SM Component (SMC) in correct orientation upon placement and maintain correct trimmer position during physical handling before final solder processing.

RECOMMENDED
To assure positional stability, place a single dot of epoxy under the SMC.



CAUTION
Stability after placement is a direct function of the volume of adhesive used. Use enough epoxy to assure stability through the cure process.

Avoid overflow of epoxy to solder pad and terminal areas.

3 SMC Placement

GENERAL
Use pick-and-place equipment with vacuum nozzle ID size that allows adequate suction to pick the SMC out of the embossed cavity.

RECOMMENDED
The nozzle inside diameter (ID) should not exceed .100 in. (2.54mm) to ensure adequate suction and part alignment.

CAUTION
Assure parts are placed so that all terminals are equidistant (<4 mils) from the solder pads.

Align terminals with solder belt direction of travel to avoid body shadowing effects during flow soldering.

4 Adhesive Cure

Flow (Wave)

GENERAL
Use heat/time cure method with either convection oven or infrared radiation.

RECOMMENDED
Cure using the temperature and times recommended by the adhesive manufacturer.

CAUTION
Use enough cure time to assure complete adhesive transition from fluid to solid.

5 Flux Application

Flow (Wave)

GENERAL
Use the correct flux to remove surface oxides, prevent reoxidation and promote wetting.

RECOMMENDED
- RMA
- No-clean SRB (Synthetic resin based)
- OA (Organic Acid) (See caution)

CAUTION
Avoid highly activated fluxes. Consult factory before using OA.

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SOLDERING/CLEANING METHODS

	REFLOW								FLOW				
Process Step	**Hot Air; Infrared** (Solvent)	**Hot Air; Infrared** (Semi-Aq)	**Hot Air; Infrared** (Aqueous)	**Hot Air; Infrared** (No-Clean)	**Vapor Phase** (Solvent)	**Vapor Phase** (Semi-Aq)	**Vapor Phase** (Aqueous)	**Vapor Phase** (No-Clean)	**Wave** (Solvent)	**Wave** (Semi-Aq)	**Wave** (Aqueous)	**Wave** (No-Clean)	**Material**
1. Solder Paste Printing	X	X	X	X	X	X	X	X					
2. Adhesive Application									X	X	X	X	
3. Component Placement	X	X	X	X	X	X	X	X	X	X	X	X	
4. Adhesive Cure									X	X	X	X	
5. Flux Application									X				Rosin
5. Flux Application										X			Rosin
5. Flux Application											X		Organic Acid
5. Flux Application												X	Synthetic Resin Based
6. Solder (Reflow)	X	X		X	X	X	X	X					63/37 Sn/Pb
7. Solder (Flow)									X	X	X	X	63/37 Sn/Pb
8. Wash (Solvent)	X				X				X				ODS Free
8. Wash (Semi-Aqueous)		X				X				X			Terpene, Hydrocarbon Based
8. Wash (Aqueous)			X				X				X		DI H20; Surfacant; Saponifier
High Pressure Fluids			X				X				X		(See Caution)
Max. Temp. (°C)/Time (Secs)	235/40	235/40	235/40	235/40	215/180	215/180	215/180	215/180	260/5	260/5	260/5		
Min. Temp. (°C)	215	215	215	215	215	215	215	215	215	215	215		

6 Solder

Reflow; Hot Air, IR and Vapor Phase

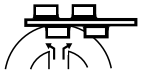
GENERAL
Preheat sufficiently using both time and temperature to vaporize all solder paste solvents and moisture, leaving only solder and flux as component enters solder reflow phase.

RECOMMENDED
Solder zone profile of 230°C for 20 seconds.

CAUTION
Do not exceed time and temperature reflow profile of 235°C for 45 ± 5 seconds for hot air/IR reflow and 215°C for 3 minutes for vapor phase reflow. Use 215°C as minimum reflow temperature.

Minimize thermal shock by limiting temperature rise rate to 3°C/sec and by stabilizing board and components temperature during preheating.

7 Solder



Flow (Wave)

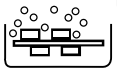
GENERAL
For maximum component reliability and performance, minimize the time of temperature exposure above 200°C.

RECOMMENDED
Use SN 63% Pb 37% solder. Solder zone profile of 245°C for 5 seconds.

CAUTION
Do not exceed 260°C peak temperature for dual wave solder process with a flow zone totaling 5 seconds.

Minimize thermal shock by limiting temperature rise rate to 3°C/sec and by stabilizing board and components temperature during preheating.

8 Wash



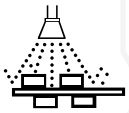
Solvent

GENERAL
Use solvent cleaning primarily for nonpolar contaminants such as rosin based flux residues.

RECOMMENDED
Use any suitable washing solvents that meet ODC requirements.

CAUTION
Limit excessive direct spray pressure to 60 psi or below for optimum reliability.

9 Wash



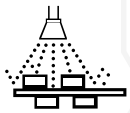
Semi-Aqueous

GENERAL
Use semi-aqueous for nonpolar contaminants such as rosin based flux residues.

RECOMMENDED
Use terpene or hydrocarbon based for pre-wash. Use water for final wash.

CAUTION
Limit excessive direct spray pressure to 60 psi or below for optimum reliability.

10 Wash



Aqueous

GENERAL
Use aqueous cleaning primarily for polar contaminants such as organic flux residues.

RECOMMENDED
Use any of these aqueous wash materials:
- Deionized water
- Surfactants
- Saponifiers

CAUTION
Limit excessive direct spray pressure to 60 psi or below for optimum reliability. Ultrasonics may cause component damage or failure.

11 No-Wash

GENERAL
No-wash is an option when no-clean (low solids) flux is used for solder operations.

Board Rework Technique

GENERAL
Excessive and/or repeated high temperature heat exposure may affect component performance and reliability.

RECOMMENDED
Hot air reflow technique is preferred.

CAUTION
Avoid use of a soldering iron or wave soldering as a rework technique.