TECHNICAL BULLETIN

alpha ASSEMBLY SOLUTIONS™

ALPHA® PV-300 Dispensing Solder Paste

DESCRIPTION

PV-300 is a no-clean, dispensable, Pb free solder paste. This solder paste has outstanding wetting strength and wide process window. It is designed for high speed automated or manual dispensing through a wide range of needle sizes. The post soldering residues are clear and colorless, ideal for solar panel assembly applications.

FEATURES & BENEFITS

- Processed and packaged void-free to assure consistent dispensing results.
- Clear, colorless, tack-free residue.
- Reliable, non-clogging dispensing. From >21 gauge down to 25 gauge needles available depending on the dispense volume requirements.
- Rheology to provide continuous, high speed dispensing (thousands of dispenses per hour) in modern positive displacement dispensers.

PRODUCT INFORMATION

Alloys:	SAC305 (96.5%Sn/3.0%Ag/0.5%Cu) Sn/Ag (96.5%Sn/3.5%Ag) For other alloys, contact your local Alpha Sales Office.
Powder Size:	Types 2 and 3 available (45-75µm and 25-45µm per IPC J-STD-005)
Residues:	Approximately 5% by (w/w)
Packaging Sizes:	10cc and 30cc dispense syringes, 500 gram jars, 6” & 12” cartridges
Flux Gel:	PV-300 Flux Gel is available in 10cc and 30cc syringes for rework applications.
Lead Free:	Complies with RoHS Directive 2002/95/EC.
Metal Percent:	84%

APPLICATION

Formulated for high speed dispensing with manual, time/pressure machines and automatic, positive displacement equipment. This solder paste will provide excellent results for high speed tabbing and stringing operations.

SAFETY

While the **PV-300** flux system is not considered toxic, its use under typical heating conditions will generate a small amount of reaction and decomposition vapors. These vapors should be adequately exhausted from the work area. Consult the SDS for safety information. The most recent version of the SDS is available from alphaassembly.com.

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STORAGE

PV-300 is shipped in thermally controlled boxes and should be stored under refrigeration upon receipt at 32°-46°F (0°-10°C). This will be sufficient to maintain a nominal shelf life of six months although a 30 day room temperature shelf life can also be achieved. PV-300 should be permitted to reach room temperature (usually two hours) before unsealing tip and end closures prior to use.

TECHNICAL DATA

RELIABILITY DATA AND PHYSICAL PROPERTIES

CATEGORY	*RESULTS*	*PROCEDURES/REMARKS*
CHEMICAL PROPERTIES		
Activity Level	ROL0 = J-STD Classification	IPC J-STD-004A
Halide Content	Halide free (by titration & IC)	IPC J-STD-004A
Ag Chromate Test	*PASS*	IPC J-STD-004A
Copper Mirror Test	*PASS*	IPC J-STD-004A
Copper Corrosion Test	**PASS**	IPC J-STD-004A
	PASS	JIS Z 3197-1986
Talc Test	**PASS**	JIS Z 3197
ELECTRICAL PROPERTIES		
IPC SIR (168 hours @ 85° C/85% RH)	**PASS**, 1.8 x 10^{10} ohms	IPC J-STD-004A {Pass ≥ 1 x 10^{8} ohm min}
Bellcore SIR (96 hours @ 35°C/85%RH)	**PASS**, 1.9 x 10^{12} ohms	Bellcore GR78-CORE {Pass ≥ 1 x 10^{11} ohm min}
Bellcore Electromigration (65°C/85%RH 10V 500 hours)	**PASS**, Initial = 7.8 x 10^{8} ohms Final = 8.2 x 10^{9} ohms	Bellcore GR78-CORE {Pass = final > initial/10)
JIS Electromigration (1000 hrs @ 85°C/85%RH 48V)	Final Reading > 1.0 X 10^{10} ohms No migration after 1000 hrs **PASS**	JIS-Z-3197-1999
PHYSICAL PROPERTIES		
Color	Clear, Colorless Flux Residue	

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Tack Force vs. Humidity (t=8 hours)	**PASS,** <10% change Over 100 gf after 24 hours when stored at 25±2°C and 50±10% R.H.	JIS Z3284 Annex 9
Viscosity	84.0% metal designated M04 for Type 3 89.0% metal designated M16 for Type 4	Malcom Spiral Viscometer; JIS Z3284 Annex 6
Solder Ball	**Acceptable** (SAC 305 alloy) Tested after 4 hours storage @ 25%, 50% and 85% RH.	IPC TM-650 2.4.43/JIS Z3284 Annex 11
Stencil Life	> 6 hours	25°C (77°F)
Spread	> 80 %	JIS-Z-3197: 1999 8.3.1.1
Hot Slump	**PASS**	IPC J-STD-005 (10 min 150°C)
	PASS No bridge for 0.2mm space	JIS-Z-3284-1994 Annex 8

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PV-300 Processing Guidelines for Solar Applications
(The following is a review of general application notes and precautions)

STORAGE-HANDLING	*DISPENSING*	HEATING	CLEANING
• *Refrigerate to guarantee stability @ 0-10°C (32-46°F)* • *Shelf life of refrigerated paste is six months.* • *Paste can be stored for 1 month at room temperatures up to 25°C (77°F) prior to use.* • *When refrigerated, warm-up of paste container to room temperature for up to 4 hours. Paste must be ≥19°C (66°F) before processing. Verify paste temperature with a thermometer to ensure paste is at 19°C (66°F) or greater before setup.* • *Printing can be performed at temperatures up to 29°C (84°F).* • *Do not remove worked paste from stencil and mix with unused paste in jar. This will alter rheology of unused paste.* • *These are starting recommendations and all process settings should be reviewed independently.*	*Before setup, continuously dispense until the paste has filled the needle insides and paste is flowing freely.* • *Time/pressure dispensers should be set up with manufacturer's guidelines. Pressures of 10-20 lbs are recommended without using vacuum suckback. Read the applications notes following regarding needle gap, stringing, and paste volume.* • *More sophisticated dispense systems usually have specific setup and running recommendations. The "needle map" contained in the PV-300 Applications Notes recommends dispense volumes scientifically.* • *The insides of dispense mechanisms and needles can be cleaned and lubricated with "purge compounds" or PV-300 paste flux available also in syringes. PV-300 should be run through the dispense mechanism to wet the walls and exclude any foreign material prior to dispensing.*	• Use convection, IR, or combination ovens, hot - plate, vapor phase, hot gun, heat bar or laser equipment • Clean-dry air or nitrogen atmosphere. <u>PROFILE (for oven heating)</u> • A heating profile with a a preheat soak or a stramp profile and straight ramp down to room temperature of all joints being soldered. This is a general statement given the various methods to reflow dispensed paste and the varied equipment used in dispensing processes.	For cleaning unsoldered paste use – IPA – Bioact SC-10 – Bioact SC-10E – Bioact SC-10E Plus – Bioact EC7-MT1 – ALPHA SM-110 – ALPHA SM-110E – ALPHA PV-300 Residue is designed to remain on the cell after soldering. If post soldering residue cleaning is required use: – Hydrex LF (Petroferm) – ALPHA BC-2400 – ALPHA BC-2200 – Aquanox A4520 (Kyzen) – Aquanox A4630 (Kyzen) – WS2104/2107/WS1942 /WS1863 (Kaken Solvent) – Bioact EC7-M – ALPHA BC-3300 – Bioact SC-10 – Bioact SC-10E – Bioact SC-10E Plus – ALPHA SM-110 – ALPHA SM-110E

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Applications Notes for Solar Applications

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1. What are the variable parameters affecting dispensing?

1.1 Product (paste) Parameters: Viscosity, flow behavior, wetting behavior, temperature stability, homogeneity, and voids.

1.2 Machine Parameters: Nozzle distance to substrate, dwell time between dispenses, "Z" height return, I.D. of needle, dispensed dot diameter, pressure, dispense time.

2. What parameters affect the volume and shape of dispensed paste?

2.1 Surface Tension: The ability of a material to adhere to a surface. For instance, material and needle nozzle; material and substrate. It should be greater between the material and the substrate (board).

2.2 Shot Size: The time a valve or pressure is actuated and as related to the nozzle gap ("Z" height from nozzle tip to substrate).

2.3 Nozzle Gap: Dictates shot size. A rule of thumb is that the nozzle or needle gap = ½ needle I.D.

2.3.1 Footed Nozzles: A fixed distance "foot" is appended to the needle body and extends a distance below the needle tip, allowing the same gap between tip and substrate when the needle "bottoms out" on the substrate at each dispense.

2.3.2 Unfooted Nozzles: Gap is determined manually, with a camera, by touch probe or by laser sensor.

2.3.3 Consequences of gap too high: Insufficient shot size, lowers surface tension, results in intermittent dispenses.

2.3.4 Consequences of gap too low: Shot size is too large resulting nozzle contamination, tailing of material and dot defects.

2.4 Nozzle Gauge: Determines smallest dot (1.5 x Needle I.D.).

2.5 Dwell Time: Set in milliseconds on automated equipment or by trial and error on manual equipment. What happens within these milliseconds of the dispense portion of the cycle? The needle remains in the down position after dispensing to allow the material to wet sufficiently for the proper surface tension. When tension between material and substrate is achieved, the needle lifts up, and the tension allows the material to part from the needle tip and material within the needle and stay on the substrate. Manipulating the dwell will affect throughput and the dot profile.

2.6 Up Height: The distance the needle moves up after a dispense. Modern dispensers can be adjusted by .001" increments to optimize clean paste snapoff from the needle.

3. Addressing Common Defects:

3.1 Tailing is caused by: Insufficient shot size; Nozzle gap too high; Up-height too low; paste chemistry.

3.2 Bulging Paste Bump: Insufficient nozzle gap; Shot size too large.

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4. What about the Nozzles (needles)?

4.1 Types: Plastic, stainless steel, conical walled, straight walled, chamfered tips, footed and non-footed needles, luer lock and set screw locked**.**

4.2 Nozzle Selection Criteria: Dot size (1.5 x I.D. needle); For larger dots, increase shot size or use a larger needle; Too small a nozzle may result in excessive shot size if pressure is allowed to rule.

5. What are the types of dispensing methods? The 3 most common are : time/pressure, positive displacement piston and positive displacement rotary pump.

5.1 Time/Pressure: Proven technology where you can discard used needles and syringes It is difficult to set up, not suitable for reproducing very small volumes, and is subject to volume variation with changes in temperature and syringe volume (bubble effect).

5.2 Positive Displacement (Piston): Consistent dots, low air pressure, but each piston pump is made for a specific dot size and must be removed and recalibrated for a new size.

5.3 Positive Displacement (Rotary): Consistent dots, infinite dot size flexibility, ambient temperature dispensing, simple setup and process control. Speed is dependent on needle size, and requires more cleaning than time/pressure equipment.

6. Does the plunger (follower) in the syringe have an effect on dispensing?

6.1 Plungers are available in rubber, compounds, metal and plastic. They are either straight or concave walled. On PV-300, Orange plastic, straight walled followers (plungers) in the syringes provide best results in the widest range of applications. These plungers work best with high speed, automated equipment and require proper setup on time/pressure systems providing optimum results.

7. Summary:

7.1 Surface tension plays a key roll in dispensing. Set up to optimize surface tension.

7.2 Nozzle gap must be balanced with shot size and speed.

7.3 Nozzle gauge and shot size control dot profile.

7.4 Investment in correct method and process optimization ensures success.

7.5 A “needle guide” is attached below (Courtesy Speedline CAMALOT)

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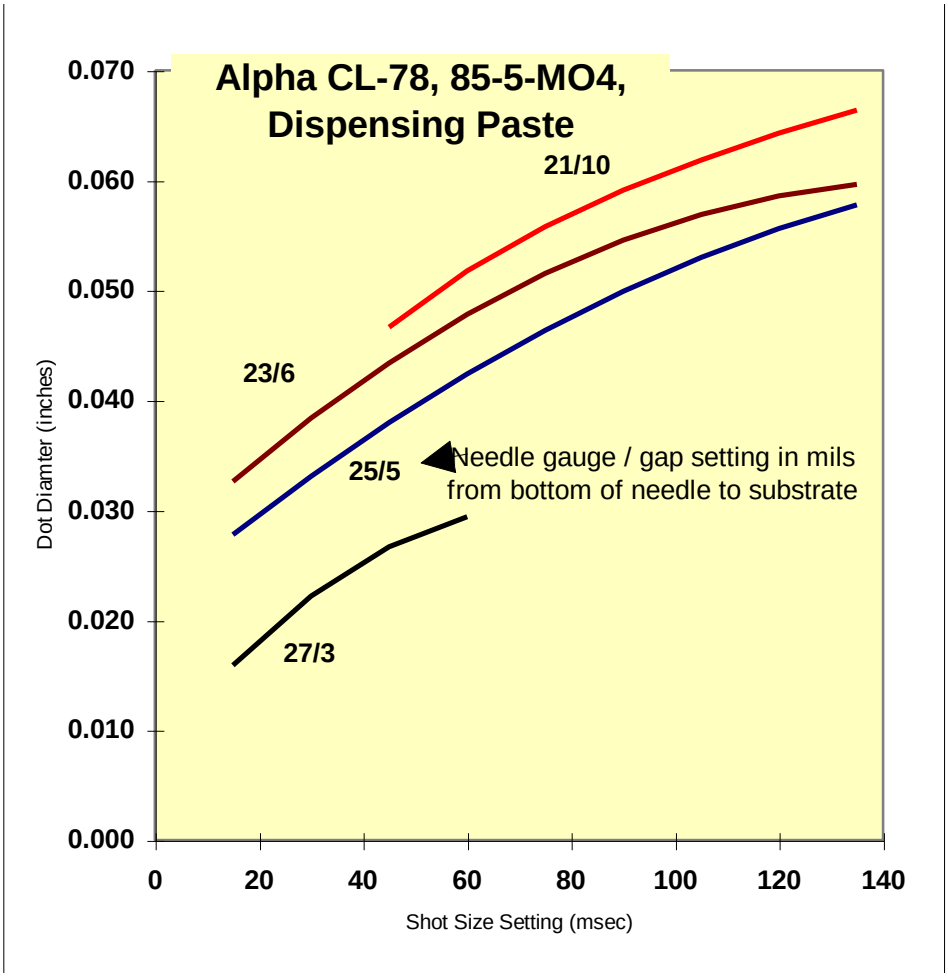

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Also read carefully warning and safety information on the Safety Data Sheet. This data sheet contains technical information required for safe and economical operation of this product. READ IT THOROUGHLY PRIOR TO PRODUCT USE. Emergency directory assistance Chemtrec 1 - 800 - 424 - 9300.

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