Multicore® LF300

June 2007

NO-CLEAN LEAD-FREE SOLDER PASTE

Multicore LF300 medium has been formulated for use with lead-free solders as a no clean product for printing and reflow in air or nitrogen atmospheres where process yield is critical. LF300 lead-free solder paste offers excellent open time, and good soldering activity over a wide range of reflow profiles and surface finishes.

- Specially formulated for lead-free alloys
- Effective over a wide range of printer cycle times and print speeds
- Excellent printer open time and "between" print abandon time
- Long component tack time
- Resists solder balling
- Excellent slump resistance
- Compatible with a wide range of solderable surfaces
- Effective over a wide range of reflow profiles in air or nitrogen
- Produces safe residues – eliminates the need for cleaning
- Low colour post reflow residues for easy visual inspection

TYPICAL PROPERTIES

STENCIL PRINTING SOLDER PASTES			
Product Category	LF300		
Alloy Code	96SC, 97SC		
Alloy Melting Temperature	217°C		
Particle Size Distribution Multicore Code ANSI/J-STD-005 Nominal Size Range, µm	AGS Type 3 45-20		
Metal Content, wt%	85.0	88.5	89.5v
Viscosity			
Brookfield, cP[1]	350,000	575,000	700,000
Malcom (10rpm), P[2]	650	1,265	1,665
Thixotropic Index [3]	0.60	0.57	0.58

[1] Measured at 25°C, TF spindle at 5 rpm after 2 minutes.

[2] Measured at 25°C, and a shear rate of 6s-1

[3] Thixotropic index (Ti) = log (viscosity at $1.8s^{-1}$/viscosity at $18s^{-1}$)

[4] The slump data are expressed as the minimum spacing between pads of size shown that does not allow bridging.

Tack data are derived from laboratory tests, and do not necessarily relate to particular user conditions.

RECOMMENDED OPERATING CONDITIONS

Application: Multicore LF300 lead-free solder paste is designed for high volume stencil printing applications with component lead pitches down to 0.4mm with AGS (type 3) powder size. Finer pitches may require that the paste is formulated with a finer powder. Conventional metal blade squeegees may be used with a contact angle of 60° and sweep speeds of 20mm sec^{-1} up to 150mm sec^{-1}. The best printing performance will be obtained under these conditions. The products can in some cases tolerate slow print cycle times because the material resists drying on the stencil and therefore blocking the stencil apertures.

There are various methods for testing the ability of a paste to perform after an extended idle time on the stencil and each can produce different times before printing deteriorates. In a real process environment, the paste has been left idle for more than 1 hour and still produced a perfect first print for 0.3mm pitch pads at 150mm sec^{-1} squeegee speed.

The relatively low print pressure required by LF300 solder paste facilitates second side printing where supporting the board on the populated side may be difficult.

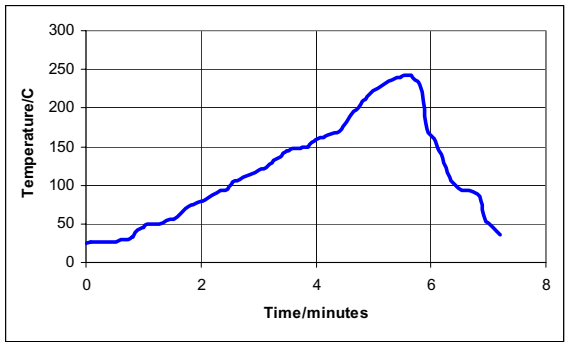
Paste release from stencil apertures is excellent and may even be better than products previously used on the same stencils. LF300 produces deposits with more consistent paste volume and paste height. Stencil aperture size may previously have been optimised to deal with products that have inferior release characteristics and so the volume of LF300 paste deposited may be slightly greater. Normally this will be within the printing process window but it may produce a greater risk of mid-chip solder balling. Reducing aperture openings will compensate for this effect.

Misprinted boards and stencils may be cleaned with normal proprietary cleaning solvents, including Multicore SC-01 and SC-02 solvent cleaners.

Component Placement: The paste shows good tack behaviour and is capable of holding components in place before reflow. Components may be placed several hours after printing, although this is naturally dependent on the ambient conditions. Once components are placed, the boards may be left for several hours before reflow without impact on the defect levels, depending on the previous history of the printed board.

Reflow Profile: LF300 solder paste has been formulated for lead-free reflow in air over a wide range of temperature profiles. A minimum peak temperature of 235°C is required. The diagram below shows a reflow profile that has been used successfully with the 96SC alloy. Other profiles may also give good results, depending on board design factors.

NOTE: If boards and/or component leads carrying tin/lead finishes are reflowed with this lead-free solder paste, reflow profiles with lower peak temperatures may possibly be used. The resulting joints will have the same solidification temperature and similar reliability performance as the Sn62 alloy. This combination of materials is perfectly acceptable but of course does not yield a lead-free assembly.



Due to the higher melting point of the 96SC alloy relative to Sn62/63, lead free reflow places increased demands on paste thermal stability during the reflow process. High air flow rates, intended to give as even a temperature distribution as possible across the board, may contribute to exhaustion of paste activity before reflow. LF300 has been formulated to combine excellent printing characteristics with tolerance of hot profiles and high air flow rates, but extreme (long & hot) profiles may still give sub-optimal reflow in some oven types.

As with all solder pastes, reflow may be carried out in nitrogen if this is installed and this is likely to lessen the effects of long hot profiles and high gas circulation rates.

Soldering: The flux in LF300 is formulated to give excellent wetting on all common board and component lead finishes, including OSP copper that may have been passed through multiple reflow processes in air.

The surface tension of molten lead-free solder alloys is significantly higher than the surface tension for tin/lead alloys and this can reduce the spread of solder during reflow. In some circumstances, this may restrict the areas wetted only to where the paste was printed and the extremities of copper pads may be visible after reflow. This is a cosmetic effect only and may require review of visual inspection standards used by operators.

If lead-free solder paste is reflowed onto tin/lead board or component lead finishes, the resulting joints may be slightly dull due to the solidification characteristics of the alloy. Joints produced from a lead-free alloy soldered onto lead-free finishes tend to have a slightly frosted appearance. Also, a lead free solder paste has a very low tendency to solder balling during reflow and the presence of micro-balls on a finished assembly is a strong indication of a process related problem.

Residues: The residues from LF300 solder paste are intended to be left on completed assemblies without cleaning. They are designed to pass the normal industry Surface Insulation Resistance, Electromigration and Ionic Contamination tests, as well as specific customer Accelerated Life tests. They also have very low colour after reflow and this provides a pleasing appearance for finished assemblies and may be beneficial for auto-inspection equipment.

Where cleaning is required, good results are likely to be achieved with popular cleaning materials and effective process equipment. It is always advisable to evaluate the compatibility of cleaning material and cleaning process. However, if electrical circuit testing is to be carried out, the residues of LF300 are easily penetrated and non-conductive so the residues of LF300 may be probed.

The residues from LF300 may be conformally coated but it is recommended that specific materials and process combinations be fully evaluated first.

GENERAL PROPERTIES

Solder Powder: The solder powders for Multicore LF300 solder paste are produced by atomising alloys conforming to the purity requirements of related alloys in J-STD-006 and EN 29453. The lead-free alloys 96SC and SN96 have been accepted for inclusion in these specifications.

Careful control of production processes ensures that the solder powder is at least 97% spherical (aspect ratio <1.5) and contains less than the minimum acceptable level of contaminants. The maximum oxide contamination level is equal to, or better than, 80ppm (expressed as oxygen in the solder).

Solder Paste Medium: Multicore LF300 contains a stable resin system and includes solvents with high boiling ranges.

The flux has been formulated to meet the requirements of the IPC type LR3CN and the Bellcore specification.

Test	Specification	Results
Copper Mirror Corrosion	J-STD-004	Pass
Chromate Paper Test	J-STD-004	Pass
Surface Insulation Resistance (without cleaning)	J-STD-004 Bellcore GR-78-CORE	Pass
Electromigration (without cleaning)	Bellcore GR-78-CORE	Pass

Solder Paste: The properties of a solder paste depend on the metal content, the solder alloy and the solder powder particle size range. In general terms increasing metal content reduces the tendency to slump, and reduces the tack life of the solder paste, while the solder balling performance improves.

Typical properties of selected Multicore LF300 solder paste /alloy combinations are as follows. Full details of test methods are available on request.

PACKAGING

Containers: Multicore LF300 solder paste solder paste is supplied in:

- 1kg, 500g or 250g plastic jars with an air seal insert
- 1kg or 500g vacuum filled cartridges for direct application.
- 10ml, 25g syringes

Other forms of packaging are available on request.

Shelf life: Provided that Multicore LF300 solder pastes are stored at 5-10°C tightly sealed in the original container, a minimum shelf life of six months can be expected. Air shipment is recommended to minimise the time the containers are exposed to higher temperatures.

Multicore LF300 solder pastes have been formulated to reduce separation on storage to a minimum but should it occur, gentle stirring for 15 seconds will return the products to the correct rheological performance.

GENERAL INFORMATION

For safe handling information on this product, consult the Material Safety Data Sheet, (MSDS).

Note

The data contained herein are furnished for information only and are believed to be reliable. We cannot assume responsibility for the results obtained by others over whose methods we have no control. It is the user's responsibility to determine suitability for the user's purpose of any production methods mentioned herein and to adopt such precautions as may be advisable for the protection of property and of persons against any hazards that may be involved in the handling and use thereof. In light of the foregoing, **Henkel Corporation specifically disclaims all warranties expressed or implied, including warranties of merchantability or fitness for a particular purpose, arising from sale or use of Henkel Corporation's products. Henkel Corporation specifically disclaims any liability for consequential or incidental damages of any kind, including lost profits.** The discussion herein of various processes or compositions is not to be interpreted as representation that they are free from domination of patents owned by others or as a license under any Henkel Corporation patents that may cover such processes or compositions. We recommend that each prospective user test his proposed application before repetitive use, using this data as a guide. This product may be covered by one or more United States or foreign patents or patent applications.

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