HANDLING GUIDELINES

Handling Guidelines for:

LOCTITE TCP 4000PM

Revision 1 – March 2016

Content

1 Product Description

LOCTITE TCP 4000PM is a Phase Change Thermal Interface Material in paste form and is a blend of metallic fillers and different chemical compounds with specific functions.
This blend gives rise to a product sensitive to the humidity and temperature change, which has to be handled with great care, in order to prevent a defect rate increase. It is therefore advisable, compatibly with the existing process, to carefully follow the below mentioned handling guidelines.

LOCTITE TCP 4000PM is a reworkable and repeatable phase change thermal interface material suitable for use between a heat sink and a variety of heat generating components. This material offers the enhanced performance and reliability of a phase change thermal interface material with the application ease of thermal grease.

This product is supplied as a paste that can be stenciled, needle dispensed, screen printed, or applied manually onto a heat sink or other surfaces. Once the compound is applied, it will dry to a solid phase change material.
Drying is required for optimal thermal performance. The material then flows at the phase change temperature and conforms to the surface features of the heat sink and component. Upon flow, air is expelled from the interface, reducing thermal impedance and the material performs as a highly efficient thermal transfer material.

2 Health and Safety

2.1 Material Safety Data Sheet (MSDS)

Henkel provides MSDS for TCP 4000PM. The MSDS should always be reviewed prior to use the material by anyone that may be exposed to it.

2.2 Safe Handling

It is important that users are familiar with the safety information on the MSDS. Different PCTIM pastes have widespread and successful use throughout many industries, however, as with all industrial chemicals, we strongly recommend operator exposure is controlled. ALL PCTIM Pastes have possible hazards and avoidance of these hazards through proper control is the best solution.

Potential hazards of TCP 4000PM Pastes are:

- Skin irritation (after prolonged and repeated unprotected use)
- Eye irritation (after prolonged and repeated unprotected use)

The cartridge packages we supply help to minimize skin contact, but in addition to familiarity with the MSDS, operators should know the recommended protective/preventive measures that may be obtained through a variety of sources:

- Read the label on the cartridge.
- Speak to your supervisor.
- Follow good personal hygiene: wash hands, use personal protective equipment.

3 Supply chain

3.1 Packaging

LOCTITE TCP 4000PM is mainly packed in 12OZ Cartridges but can be supplied in other packaging as well.

3.2 Transportation

No special transportation requirements are needed.

3.3 Inspection of shipment

Packages should be inspected immediately upon receipt.
Any physical damage to the packaging should be noted on the delivery note. In case of concerns, please inform immediately your local Henkel representative.
Do not return material directly back to Henkel as this causes problems with traceability & investigation. If necessary, Henkel will arrange collection.

3.3 Storage

It is recommended to store TCP 4000PM pastes in the unopened container in a dry location at 20-25°C. A minimum Shelf Life of 12 months can be expected.
Tests have shown that storage should best be done while keeping cartridges in a vertical position to limit the risk of separation.
Material removed from containers may be contaminated during use. Do not return product to the original container. Henkel Corporation cannot assume responsibility for products which have been contaminated or stored under conditions other than those previously indicated.

4. Instructions for use

4.1 Surface preparation

No special surface preparation is needed. Make sure the surface is clean and free of any dirt or other contaminants like greases etc.
Therefore a cleaning step with suitable solvents (acetone and/or IPA) can be done.

4.2 Pot life and work life

TCP 4000PM pastes perform best when used in a controlled environment. Maintaining an ambient temperature between 20°C and 25°C at a relative humidity of less than 55% will ensure consistent performance and maximum life of the paste.

When defining the pot life of the material, as the time to increase the viscosity by 100% at 25°C, then the pot life for TCP 4000PM is set at 8 hours

4.3 Processing:

4.3.1. Prior to processing:

TCP 4000PM pastes dispensed from a cartridge do not require stirring as the rheology is restored during the extruding process. Should you experience any minor separation visible after extruding it, it is recommended to perform 2 to 4 kneading squeegee strokes on the printer in order to re-homogenize the paste.

The TCP 4000PM can be applied to a substrate using a variety of methods. When screen or stencil printed, thin layers of the material can flash dry rapidly. Therefore, when using these methods, frequent changing/cleaning of the screen or frequent cleaning of the stencil may be required.

4.3.2. Dispensing

Using manual or automated dispensing, dispense the required amount of material onto the substrate.
Ideal performance will be achieved by having the thinnest possible layer of material.
Recommended maximum thickness is 10 mils (254 microns) to ensure complete drying (solvent evaporation) under normal conditions.

The ideal dispense pattern should be tested for each individual project but following guidelines can help in improving the dispensing process:

- Use a 14 gauge needle or larger to produce the dispensing pattern.
- Use a low dispense gap (500-600µ) to produce a wide flat bead and minimal tailing.
- Use a combination of flow rate and line-speed to produce the desired coverage and bead width.
- If needed, use a check-valve to minimize dripping and/or tailing.
- If long, unpredictable tailing is an issue, lower the dispense gap and/or increase the dispense weight to produce a wider bead.

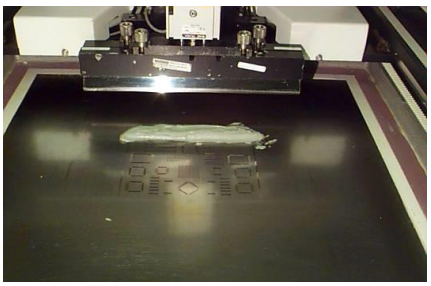
4.3.3. Printing

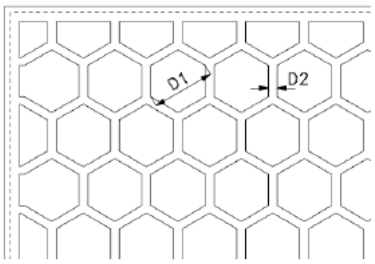
Keep jars closed tightly when not in use. Open jars will evaporate solvent affecting the performance of the material.
Place a small amount of material onto the stencil, with the substrate under the stencil, draw the material down, applying the material onto the substrate.

For TCP 4000PM a stencil life of 4hrs at 20-25°C / 55%HR can be expected but is depending on the effective operating and environmental conditions.
Do not mix used paste with fresh paste unless adding more to the printer itself.
Avoid adding thinners to restore the used TCP 4000PM pastes. Adding such products will alter the paste rheology. This new “blend” can adversely affect the reliability and the thermal performance of the device.

Some printing guidelines and material selections can be found in the table below but will have to be optimized for every individual project.

Printing Process			Stencil Design	
Squeegee speed	Slow – max 30mm/sec		**Stencil type**	Stainless steel
Squeegee pressure	Medium to high		**Stencil thickness**	70-100µm
Squeegee type	Metal Blade 60°		**Stencil pattern**	Honeycomb
Separation Speed	Slow – 0.5mm/sec		**D1 – dimension** **D2 – spacing**	3.5mm 0.5mm





It is recommended to put more material in the location of possible hot spots and less material around the connection screws. This can be done by a denser honeycomb pattern in the locations where more material is required.

4.4 Drying Schedules

Make absolutely sure that all the solvent is evaporated from the material (material dried) prior to assembly.
Drying time is dependent on thickness and temperature and some guidelines can be found in the following table:

Product	Thickness	Dry Time at 22°C	Dry Time 60°C	Dry Time at 125°C
TCP 4000PM	2 mil / 50µ	30 hours	22 minutes	3 minutes
	6 mil / 150µ	50 hours	50 minutes	4½ minutes
	10 mil / 250µ	65 hours	65 minutes	8 minutes

Drying times at the temperatures mentioned in the table are temperatures measured at the substrate. Therefore, drying time on a heat sink may be longer due to the heat sink taking longer to reach that temperature under these conditions.
Be aware that high relative humidity levels can extend the drying times.
Once the material is dried, assemble heat sink and component.

For best performance, the bond between the component and heat sink should be assembled at 10 psi or greater. This can be achieved by assembly with e.g. screws or spring clamps.
Once the device has been heated above the phase change temperature (45°C) and the material is better wetted in the surface texture, optimal thermal performance will be achieved.
After the phase change when using a screw- like assembly a re-torque could be beneficial.

4.5 Cleaning of undried LOCTITE TCP 4000PM

Always use specific cleaning solvent/detergent in combination with specific wipes. A poor cleaning process (either manual of automatic) with non-proper tools is often cause of defect on the printing process. The preferred solvents are hydrocarbon or isoparaffinic solvents. These are readily available on the consumer market as Odourless Mineral Spirits or VM&P Naphtha, or from many industrial chemical suppliers under trade names such as Isopar, ShellSol or Solvesso. These will all be listed under the same CAS #64742-47-8. These same solvents can be used when manually cleaning parts or equipment, however a more 'technical' approach that can be used involves Cybersolv PW3412 wipers from Kyzen Corp. These are pre-wetted, non-aqueous wipers that are normally used for screen or stencil cleaning in the electronics or solder paste industries. Kyzen also makes cleaning fluids that may offer a solution in case you are not able to use the listed hydrocarbon solvents.

Following cleanup with either material approach above, you can clean and dry the stencils/equipment with a faster solvent such as Acetone or Isopropanol. Note that in clean-up or re-work type situations with the fully dried TCP 4000PM material, the material is best removed from solid surfaces simply by wiping with a lab wiper (Kimwipe). The cold, solidified compound readily wipes off as a stiff putty and allows the bulk of the material to be removed without having to use solvents. Once removed, you can then wash the surface with the solvent to remove the resins/oils which have wetted down into the surface texture of the surfaces.

5. Handling/Storage of pre-applied products

TCP 4000PM can be pre-applied and stored before the assembly in a dry and controlled environment of 20-25°C at a relative humidity of less than 55%. Avoiding dust, dirt and other contamination is necessary to ensure the material can thin to its minimum bond line in its intended application without restriction. When TCP 4000PM is printed and dried on surfaces other than aluminum or conventional IGBT base plates, stored longer than 12 months and/or under different conditions than listed above, we strongly recommend to evaluate and verify the thermal performance is acceptable before use.

Disclaimer Note:

The information provided in this Application Note including the recommendations for use and application of the product are based on our knowledge and experience of the product as at the date of this Application note. The product can have a variety of different applications as well as differing application and working conditions in your environment that are beyond our control. Henkel is, therefore, not liable for the suitability of our product for the production processes and conditions in respect of which you use them, as well as the intended applications and results. We strongly recommend that you carry out your own prior trials to confirm such suitability of our product. Any liability in respect of the information in the Application Note or any other written or oral recommendation(s) regarding the concerned product is excluded, except if otherwise explicitly agreed and except in relation to death or personal injury caused by our negligence and any liability under any applicable mandatory product liability law. In case products are delivered by Henkel Belgium NV, Henkel Electronic Materials NV, Henkel Nederland BV, Henkel Technologies France SAS and Henkel France SA please additionally note the following: In case Henkel would be nevertheless held liable, on whatever legal ground, Henkel's liability will in no event exceed the amount of the concerned delivery. In case products are delivered by Henkel Colombiana, S.A.S. the following disclaimer is applicable: The information provided in this Application Note including the recommendations for use and application of the product are based on our knowledge and experience of the product as at the date of this Application Note. Henkel is, therefore, not liable for the suitability of our product for the production processes and conditions in respect of which you use them, as well as the intended applications and results. We strongly recommend that you carry out your own prior trials to confirm such suitability of our product. Any liability in respect of the information in the Application Note or any other written or oral recommendation(s) regarding the concerned product is excluded, except if otherwise explicitly agreed and except in relation to death or personal injury caused by our negligence and any liability under any applicable mandatory product liability law. In case products are delivered by Henkel Corporation, Resin Technology Group, Inc., or Henkel Canada Corporation, the following disclaimer is applicable: 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. Trademark usage: [Except as otherwise noted] All trademarks in this document are trademarks and/or registered trademarks of Henkel and its affiliates in the U.S. and elsewhere.