3M™ Thermal Barrier 5000 Series (3M TB5000)

Application Guidelines

Note: Customer is responsible for selecting and validating any use of dispensing equipment to apply the 3M product. It's important that the application process variables (e.g. viscosity, temperature, pressure, etc.) do not alter the material properties of the 3M product in a way that is not intended. Application processes and equipment should be verified and validated by customer to ensure that the safety features of the battery cells and pack are not compromised. For large-scale automation equipment applications, please work with your 3M Application Engineer. 3M is not responsible for customer's selection and use of dispensing equipment. All information and recommendations in these application guidelines are derived from manual application using a cartridge.

Product Description

3M™ Thermal Barrier 5000 Series is a dispensable, lightweight silicone-based solution that helps protect neighboring cells from the energy given off from a failed cell by creating a fire retardant, electrically and thermally insulating barrier layer. Tack free time at 25°C: 50-100 minutes and open time at 23°C: 45-65 minutes. Shore A hardness of the room temperature cured solution can range from 10-60.

The following application guidelines outline the proper handling of 3M TB5000. Materials must be stored and applied at 23°C. Surface for dispensing must be clean and dry. 3M TB5000 is two-part silicone that is recommended to be dispensed at a 1:1 volume ratio or weight ratio.

The typical material properties in the table below are indicative of the intended product performance characteristics. Customers should note that dispensing process parameters can negatively affect these properties and result in material properties being outside of the desired customer design specification. Please contact your 3M Application Engineer for more information.

Typical Product Performance Characteristics*	Results
Density (ASTM D1056)	0.55-0.8g/ml
Thermal Conductivity (ISO22007-2:2015)	~0.14 W/m-K
Thermal Diffusivity (ISO22007-2:2015)	~0.19 mm^2/sec
Volumetric Heat Capacity (ISO22007-2:2015)	~0.68 MJ/m3-K
Specific Heat (ISO22007-2:2015)	~1 J/g K
Dielectric Breakdown Voltage (ASTM D149)	>5.5 KV/mm AC
Viscosity at room temperature Brookfield, T93#, 15 rpm (ASTM D2196-20)	Part A: 30-300 Pa.s Part B: 30-300 Pa.s
VOC Content (cured product) (GBT/28112-2011/CES method)	0.5% max
Limited Oxygen Index (LOI) (ISO 4589)	LOI>26%

*All values are approximate unless otherwise stated.

Physical Properties

When product is correctly mixed and dispensed, it should form a uniform bead without sagging. Sag limits should be verified and established for the customer specific design. Please contact 3M Application Engineer for further information.

Excessive sagging

Correctly mixed and dispensed

Application and Curing
Note: The following curing guidelines are applicable for manual cartridges, and pails and drums in automated dispensing.

Open time and cure conditions for 3M TB5000 depend on the manufacturing environment, especially temperature.

Cure Speed*

Curing Parameters	10°C	23°C	35°C
Sealant Extrudable Time / Nozzle dwell time	<200 min	<120 min	<17 min
Open time for FRB paper to bond*	~180 min	~55 min	15-16 min
Tack-free Time	~200 min	~80 min	~20 min
Handling time (clean peel from the PET film)	>220 min	>100 min	>22 min

*Cure speed can be adjusted per customer request. Please contact your local 3M representative.

Note: It is important that the application process variables (e.g. viscosity, temperature, pressure, etc.) do not alter the material properties of the 3M product in a way that is not intended.

Manual Application Method
Dispensing from cartridge in 1:1 ratio by hand-held manual or pneumatic dispenser is viable for limited volumes. It is recommended to dispense a small amount of material before fitting the nozzle to ensure both components are flowing.


A & B materials in cartridge


Dispensing A & B components

Manual Handling Process
1. Open a new cartridge
2. Unscrew collar and remove protective bung from cartridge
3. Insert cartridge into pneumatic gun
4. Press trigger until both yellow and blue components are dispensing
5. Wipe excess adhesive from top of cartridge and align nozzle to top of cartridge
6. Attach new nozzle and screw collar back onto cartridge
7. Press trigger on pneumatic gun
8. Use pneumatic gun to dispense adhesive and purge until color stabilizes to consistent and homogeneous green
9. After dispensing, release pressure in the pneumatic gun for the intervening time until the next application. Exposure to pressure for an extended period of time could influence the product rheology.*
10. If the cartridge is finished, withdraw the plungers and remove the cartridge

***Note**: the product will cure in the tip of the nozzle, therefore if the nozzle dwell time is exceeded (see table above) a new nozzle will be required, and return to point #4 above

Automatic Dispensing Process
For large-scale automation equipment applications, please work with your 3M Application Engineer. 3M is not responsible for customer's selection and use of dispensing equipment.

Application processes and equipment should be verified and validated by customer to ensure that the safety features of the battery cells and pack are not compromised.

Purging
Note: The following purging guidelines are applicable for manual cartridges, and pails and drums in automated dispensing.

Purging in new mixing nozzle depends on type of nozzle:

- MCH 13/18T (diameter 13mm, with 18 elements): purge initial 20 grams (recommended)
- MCH 10/18T (diameter 10mm, with 18 elements): purge initial 15 grams (back-up solution)

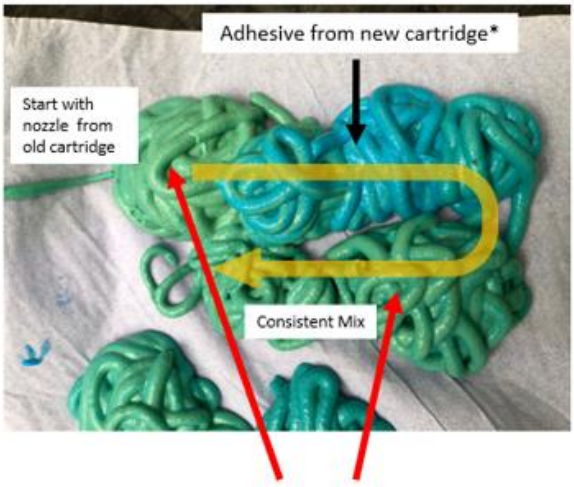
Before applying material to the assembly, it should be a consistent green homogeneous color. Striped material indicates poor mixing. An excess of either blue color or yellow color indicates incorrect mixing ratio.


Excess of blue component


Excess of yellow component

Best practice is to use a new nozzle when replacing cartridges, pail or drum. If a new nozzle is not used, it is recommended to purge the nozzle until a homogeneous green color is achieved, which indicates correct mixing ratio.

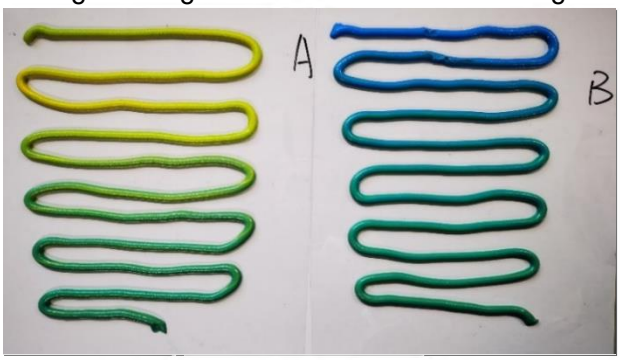
(Note: color may vary slightly between batches).

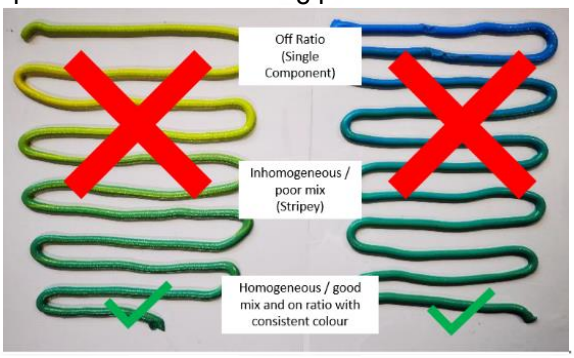


Homogeneous green color indicating correct mix ratio and good mix

Mixing Ratio – Visual Indication
Note: The following mixing guidelines are applicable for manual cartridges, and pails and drums in automated dispensing.

Consistent color should be achieved before applying to application. Two components need to be mixed to achieve a homogeneous green color. An incorrect mixing ratio can produce incorrect curing process.





If the material applied to the battery has an inconsistent color this should flag a potential issue with mix quality that could produce incorrect curing and low performance.

Shelf Life
Standard shelf life for drums, cartridges and pails of 3M™ Thermal Barrier 5000 Series is 6 months from date of manufacturing when stored between 5°C to 27°C. An expiration and lot date will identify product. Contact your 3M Application Engineer for more information.

Handling: Observe proper handling precautions as outlined in the SDS. Please consult with your 3M Application Engineer for application methods.

Shipping:

Standard 55GL	Standard 5GL	Cartridge
1. 3M TB5000 is packaged in an aluminum bag sealed in a drum 2. Drum dimensions are: 580 x 580 x 890 mm 3. Drums stacked on the pallet. Three drums per pallet. 4. Check SDS before use. 5. Check temperature storage recommendations.	1. Barrels are sealed with transparent tape 2. Product is delivered into an aluminum bag sealed in the drum 3. Barrel dimensions are: 285 mm x 285 mm x 400 mm 4. Barrels are stacked with 18 pails per pallet 5. Check SDS before use. 6. Check temperature storage recommendations.	1. Packed in dual pack (1:1) cartridge 2. Supplied in box of 10 3. Check SDS before use. 4. Check temperature storage recommendations.

Regulatory Information
Please refer to the product label and Safety Data Sheet (SDS) for health and safety information before using. Observe proper handling precautions as outlined in the SDS, which is available on request or at www.3M.com/msds.

The product is published as a material entry and is available for access on www.mdsystem.com. For product IMDS I.D. number, email requests to 3M-IMDSrequest@mmm.com.

Contact Information
The information provided in this technical document is intended as a guide for these products. For more information or help in selecting a 3M product for an application, please contact your 3M technical service representative or call 1-800-328-1684.

Intended Use: These products are intended for use within a high voltage lithium-ion battery pack to help address the heat and potential debris released from the cell that occurs during thermal runaway propagation in automotive, off-highway, industrial and marine battery applications. Since there are many factors that can affect a product's use, the customer remains responsible for determining whether the 3M product is suitable and appropriate for the customer's specific application and system, including customer conducting an appropriate risk assessment and evaluating the 3M product in customer's application and system.

Restricted Use: 3M advises against the use of this 3M product in any application other than the stated intended use(s), since other applications have not been evaluated by 3M and may result in an unsafe or unintended condition.

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