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3M™ Sealant SZ1000 for EV Enclosure Sealing

Dispensing Guide

Note: The purpose of this guide is to provide basic information to product users for use in evaluating, processing, and troubleshooting their use of certain 3M products. The information provided is general or summary in nature and is offered to assist the user. The information is not intended to replace the user's careful consideration of the unique circumstances and conditions involved in its use and processing of 3M products. The user is responsible for determining whether this information is suitable and appropriate for the user's particular use and intended application.

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. temperature, pressure, etc.) do not alter the material properties of the 3M product.

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General Description

This document is a general instruction guide for the application of 3M Sealant SZ1000 in EV battery pack sealing applications while using an automated dispensing process. These guidelines contain typical features of 3M Sealant SZ1000 and basic information about the use of the 3M material in automated applications.

3M Sealant SZ1000 is primarily used in EV battery pack sealing or for other similar box sealing and should be used in fully-automated production. The customer is responsible for determining and verifying correct equipment process parameters and settings based on their selected dispensing equipment.

Product Features

3M™ Sealant SZ1000 for EV Enclosure Sealing is a two-part, cure-in-place, flame retardant, foam, sealing solution designed for sealing EV enclosures such as battery packs in EVs and hybrids. This solution should be dispensed automatically and provides protection against water ingression, allows battery pack serviceability, and offers good aging durability.

3M Sealant SZ1000 is a liquid expandable silicone solution that is typically used in between the battery pack housing tray and the upper cover of the battery pack box. The customer is responsible for confirming the substrate and sealant compatibility and that the required bond strength requirements are met prior to application. Surface treatment or priming of the substrate may be required for optimal performance.

The product features and benefits:

- Cure-in-place, and offers a reusable seal to enable battery serviceability
- Enables an automated and robust sealing process for the EV battery case
- Cures at room temperature or at elevated temperatures
- Meets flammability requirements
- Meets specification IPX8 for water protection
- Provides good aging durability and compression set

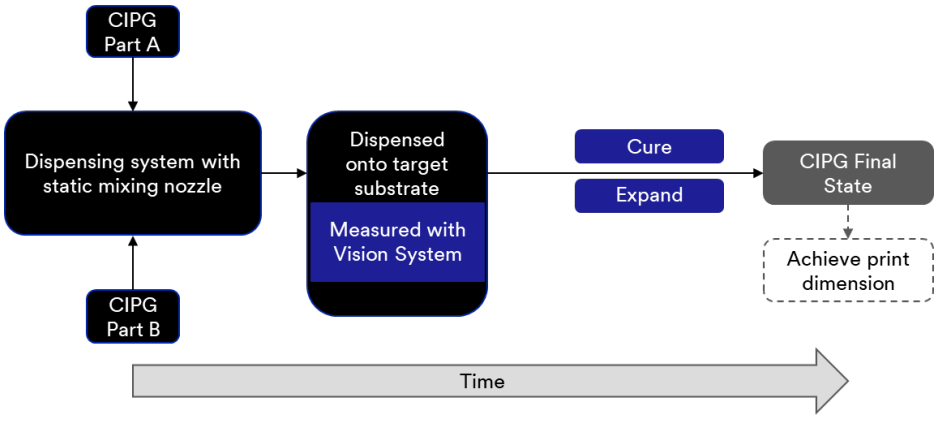
In addition to the product features and benefits, 3M offers a global presence and numerous services including testing and process consulting.

Application Process Environment Requirements

Typical 3M Sealant SZ1000 application processing and temperature requirements during dispensing are as follows below. Environmental temperatures should be tested and verified by customer to optimize curing conditions. Exposure of the Cure in Place Gasket (CIPG) material to elevated temperatures up to 100°C may shorten the cure time, however dwell time is required prior to exposure to elevated temperatures.

1. Sealant Dispensing Environment

It is always recommended to control work production environment temperature during automatic dispensing process, drums should be allowed to come to ambient conditions (23°C ± 2°C) prior to dispensing. The sealant is recommended to be dispensed at ambient room temperature (23°C ± 2°C) Please work with your 3M Application Engineer to optimize dispense parameters and environmental conditions.



Prior to dispensing, ensure the substrate is free from dust or other contaminants. Cleaning the surface before application with 50/50 IPA or equivalent cleaners (50/50 mixture of isopropyl and de-ionized water) is recommended. At the same time, the workplace area should be kept clean, and there should be no dust, oil, water stains or other substances on the surface of the work piece.

2. Curing Environment for CIPG

After the cure-in-place gasket dispensing is completed, care should be taken to avoid twisting or warping of the substrate during handling process to prevent inconsistency in gasket height and width.

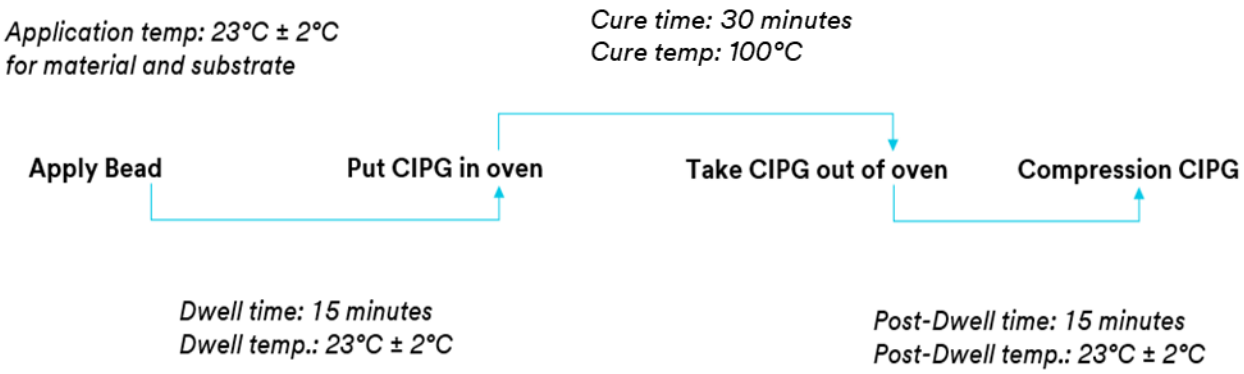
The substrate and 3M Sealant SZ1000 should be at an ambient temperature (23°C ± 2°C) to initiate expansion of the bead and promote handling strength. Please work with your 3M Application Engineer to optimize curing conditions.

If the cure in place gasketexpansion curing environment is different from the above temperature, the dwell/curing time to form the solid gasket will be extended or shortened according to the decrease or increase of the ambient temperature, this may impact compression set, tack free time, foam density and bead geometry. The same attention should be paid to contamination protection in the curing environment.

There are two recommended ways to cure the sealant after dispensing before compression of the cure in place gasket:

- Room temperature curing: dispense and store undisturbed at ambient temperature (23°C ± 2°C) for a minimum of 6 hours
- Elevated temperature curing: after the bead solidifies, heat cure for 30 minutes at 100°C in an oven.

Potential Elevated Temperature Curing Conditions



3. Material Shelf-Life, Storage and Handling

Both Part A and Part B materials should be used within twelve (12) months from manufacturing date. It is recommended that products with an expired shelf life be discarded. Material should be stored in unopened drums at standard ambient conditions (23°C).

Handling: Observe proper handling precautions as outlined in the SDS (Safety Data Sheet), which is available on request or at www.3M.com/msds.

Recommended Dispensing Equipment and Process Parameters

1. Equipment (Customer Responsibility to specify and validate)

Automation solutions include: 6-axis robot, material dispensing equipment, material dispensing platforms, heating/cooling equipment (optional for process control) and optional vision platform. The recommended material dispensing equipment includes: Part A and Part B bulk unloading pumps (5-gallon/55-gallon drums), independent servo driven positive rod displacement metering system and controls, 2K dispense valve with static mix tube (13MMX24). If you need to change the static mixer specifications for the 3M Sealant SZ1000, please contact the 3M Application Engineer for compatibility confirmation.

The 2K dispense valve can be mounted as an end of arm tool on the 6-axis robot or mounted to a fixed pedestal with robot moving the substrate to the dispensing valve.

Fixturing of substrate to maintain flatness orientation is required while dispensing CIPG. Flexing of substrate during curing can cause inconsistent bead heights.

2. Setting of process parameters

The bead geometry of 3M Sealant SZ1000 is specified according to the customer's design, dispensing equipment and workpiece sealing requirements.

Example process parameters related to the dispensing equipment are highlighted here for initial reference (the actual setting will be adjusted accordingly based on customer design settings of sealant dispense equipment manufacturers):

- Bead geometry is dependent on a number of variables including, but not limited to the following:
    - Flow rate
    - Nozzle size
    - Robot tip speed
    - Distance of nozzle to substrate
    - Viscosity of material*
    - Ambient environmental temperatures
        - Part A and part B material temperature
        - Dispense
        - Dwell
        - Cure
    - Meter pre-pressure/dispense pressure
    - Hose diameter/length

* Viscosity increases over time which is normal over the shelf life of this product. Customers should adjust their dispensing parameters accordingly. Customer should take care that the dispensing equipment and parameters do not cause damage to the material.

Example Bead Geometry Dispensing Parameters

An example of process parameters settings utilized in the dual servo positive rod displacement metering system that produced a 5 mm tall bead:

- Robot tip speed = 100 mm/s
- Quantity of mixing elements = 24
- Nozzle tip opening = 0.0157” [4.0 mm]
- Volume Flow Rate = 1.75 cc/s
- Cure temp = Production intent cure temperature

These parameters should first be confirmed in the production intent process by the customer that they produce cured beads (beads that have been cured for a minimum of 6 hours at room temperatures) that meet the assembly print. Any changes to these parameter inputs will affect the product performance.

Recommended Requirements for Cleaning Substrates

The substrate surface area where the CIPG is to be applied should be clean of any lubricants, mold release, airborne dust, etc., that can contaminate the substrate and reduce the adhesion performance of the CIPG to the part.

Suggested Cleaning Method: Clean the surface of substrate prior to dispensing of the CIPG. The best practice is to clean the substrate using a 50/50 mixture of isopropyl alcohol and deionized water with a clean, non-abrasive cloth. The cleaning process should remove all contaminants and leave no residue.

After cleaning, allow adequate time for the substrate surface to dry prior to dispensing.

The customer is responsible for the selection of substrates and the appropriate cleaning process.

Material Ratio Quality check before starting the production process

The CIPG material is a 2-part mixture of part A and part B intended to be applied with a 1:1 ratio. The correct ratio is required to achieve the functional characteristics desired.

Contact Information

The information provided in this technical document is intended as a guide for this product. For more information or help in selecting a 3M product for an application, please contact 1-800-328-1684. For additional assistance with 3M Sealant SZ1000 issues, contact your 3M representative. For dispensing troubleshooting contact your equipment provider.

Intended Use: These products are intended for use in general bonding and joining assembly, structural bonding assembly, bonding of dissimilar materials, and battery enclosure sealing in automotive, off-highway, industrial and marine 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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