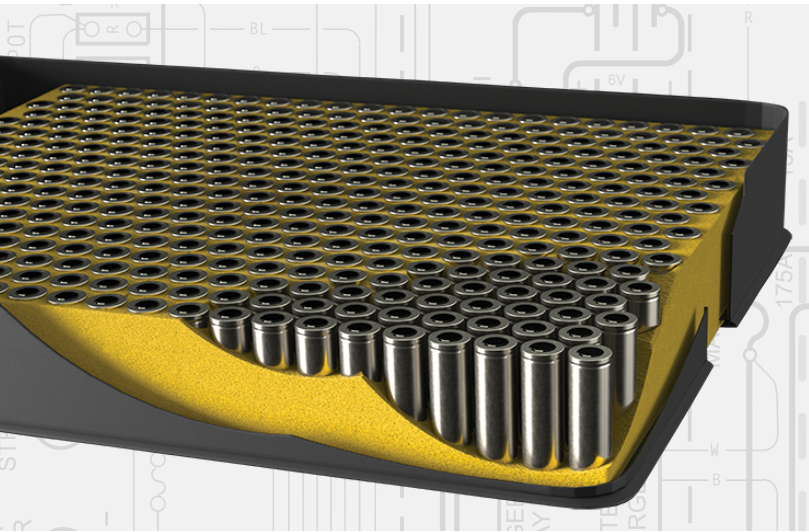




# EV Protect 4006 SFR



## Technical Data Sheet



### Flame Retardant Encapsulation Foam

#### PATENTED

EV Protect 4006 SFR is a liquid applied, two-component flame retardant, low density polyurethane foam material designed for potting and encapsulation of battery cell in EV battery modules. EV Protect 4006 SFR offers battery design engineers the ability to increase the power density of their modules while ensuring safety and protection from thermal propagation. The ultra lightweight nature of the EV Protect 4006 SFR minimizes the weight impact to the battery modules. The semi-structural properties of the material also provide noise, vibration, and harshness benefits to the battery system by unitizing the battery module and absorbing external environmental impacts.

Technology / Base:	Polyurethane Foam
Type of Product:	Encapsulant
Components:	Two Component
Curing:	Room Temperature Cure
Appearance / Color:	Light Amber
Consistency:	Low Viscosity Liquid

#### General Information

EV Protect 4006 SFR is generally dispensed using a high speed dynamic mixer head directly into the battery module. The low viscosity liquid is easily able to flow and self level at the bottom of the enclosure. Once leveled, the material will foam and rise to approximately 5 times volumetric expansion. After rising, the foam will crosslink and cure creating a semi-structural interconnected foam that encapsulates all components within the module. In the event of a thermal event, the foam will absorb, isolate, and insulate the cells to mitigate thermal propagation.

## Features and Benefits

- ✓ Prevents Thermal Propagation
- ✓ Ultra Lightweight
- ✓ Low Viscosity & Self Leveling
- ✓ Great Vibration and Impact Resistance
- ✓ Outstanding Insulation Properties
- ✓ No outgassing of Hydrogen gas during curing
- ✓ Meets UL94 V0 Certification
- ✓ Up to 5 Times Expansion Rate
- ✓ Cost Effective - Low Volume Usage
- ✓ Fast Processability



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## Technical Data

Typical Uncured Properties			
Property	4006-ASFR	4006-BSFR	Blend
Color	Off-white	Clear Amber	Lt. Amber
Specific gravity D792/D1475	1.17	1.25	
Viscosity at 25°C (cPs)	500	160	
Mix ratio by weight	100	86	
Mix ratio by volume	100	81	
Working time at 25°C (sec)			120
Cream time at 25°C (sec)			180-240
Tack Free time at 25°C (min)			~ 60

Cured Properties	
Operating Temperature Range (°C)	-60 - 120
Hardness at 24 / 48 hours (Shore A)	20 - 30 / 35 - 45
Foam Density – Free Rise (g/cm <sup>3</sup> )	0.16 – 0.19
Foam Density – Free Rise (pcf)	10 - 12
Thermal Conductivity (W/m-K)	0.05

Electrical Properties		
Property	Test Method	Value
Dielectric Strength (kV/mm)	ASTM D149	3.0
Dielectric Constant at 1MHz	ASTM D-0150	1.40
Dissipation factor at 1MHz	ASTM D-0150	0.029
Volume resistivity (ohm-cm)	ASTM D-0257	5.1 x 10 <sup>11</sup>
Surface resistivity (ohm)	ASTM D-0257	7.7 x 10 <sup>12</sup>

## Hand Mixing Instructions for Foams

1. Per the stated mix ratio, measure out (either by weight or volume) the appropriate portions of Part A and Part B as into a flat sided container.
2. The mixing container should be larger than the amount of total material being mixed to allow for vigorous mixing. For example, for 75 grams of total material we suggest a minimum size of 150 ml container for mixing. For larger amounts, adjust container size appropriately.
3. Generally it's recommended to add the higher density part into the flat sided mixing container first and then add the other part gently on top of the first part. This helps limit pre-reaction of the materials to just the interphase. Scrape the side and bottom of the individual parts container's to ensure nearly all the measured materials are added to the mixing container.
4. Start timer and immediately mix vigorously for 20-30 seconds with a spatula or flat sided stir stick. Thoroughly scraping the sides and bottom of cup while mixing. Mixed material should be homogeneous and uniform in appearance.
5. At end of mixing time, immediately pour mixed material into mold.
6. Immediately clean all tools used in preparations that you wish to reuse with solvent.

## General Instructions

EV Protect 4006-A SFR / 4006-B SFR is a two-component material. Hand mixing may be difficult. It is recommended that an automated dispensing unit be used with dynamic mixer to mix material. Prior to use, stir the individual parts to ensure they are uniform and homogeneous. Mixing the 4006-A-SFR prior to use for 5 minutes is essential to achieve a consistent foam density and cell structure. Check the container bottom for sediment after mixing to ensure filler is mixed in. If an extended shutdown or break in production has occurred (> 1 hour) re-mix part A side prior to use. Note: Pail or Drum size containers may require longer mixing times. Surface must be clean, dry, and free from grease, oil, wax and other surface contaminants.

## Handling and Clean-Up

For cleanup of EV Protect 4006 SFR, Methyl Ethyl Ketone, Acetone, Dibasic Ester, Ethyl Acetate, or Mineral Spirits are recommended. Confirm with equipment supplier for compatibility of recommended solvents in dispensing equipment. Mineral oil can be used to flush uncured materials from lines. To clean uncured material from tabletops, tools or spatulas, additional cleaning solvent options are Isopropanol and Denatured Alcohol.

## Typical Packaging

5 gal Pails  
55 gal Drums  
300 gal Totes

## Safety and Disposal

For safe handling information on this product, consult the Safety Data Sheet (SDS)

Note:  
The values noted in this data sheet are typical properties only and are not intended to be used as material specifications.  
For assistance in writing a material specification please contact H.B. Fuller for future details.

## Storage and Shelf Life

EV Protect 4006 SFR should be stored in a cool, dry place above 15°C (60°F). Purge open containers with dry nitrogen. Shelf life is a minimum of one year in unopened containers when stored at 25°C.

**IMPORTANT:** The information, specifications, procedures and recommendations provided (information) are based on our experience and we believe this to be accurate. No representation, guarantee or warranty is made as to the accuracy or completeness of the information or that use of the product will avoid losses or damages or give desired results. It is users sole responsibility to test and determine the suitability of any product for the intended use. Tests should be repeated if materials or conditions change in any way. The user is advised to review the specific context of the intended use to determine whether the users intended use violates any law or infringes upon any patent(s). No employee, distributor or agent has any right to change these facts and offer a guarantee of performance.

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