

3M Science. Applied to Life.™

3M™ Electrical Insulation and Flame Barrier Solutions

Electrical Markets Division

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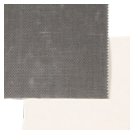
Total Solution in Battery Segment

Barrier Materials in Battery May Provide:

- Flame and torch resistance ✓
- Blast resistance ✓
- Electrical insulation post-thermal runaway ✓
- Mechanical protection ✓
- Conformability ✓
- Thermal stability and isolation ✓
- Easy attachment and automated installation ✓

3M™ Torch Flame Resistant Barrier - TFRB-SE1 ◊

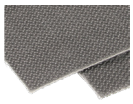
Venting Path Barrier



- Inorganic based paper reinforced on one side for improved mechanical properties
- Could be combined with flame resistant 3M™ VHB™ Tape or double coated tape (DCT) for attachment to battery lid
- Average Dielectric breakdown voltage: 4.1 kV
- Average Material thickness: 34.5 mil (0.88mm)
- Average Basis weight: 1011 g/m2
- High temperature and flame resistant up to 1000°C (1832°F) for at least 10 min

3M™ Torch Flame Resistant Barrier - TFRB-SE3 ◊

Venting Path Barrier



- High temperature and flame resistant up to 1000°C (1832°F) for at least 10 min
- Inorganic based paper reinforced on both sides for improved mechanical properties
- Could be combined with flame resistant 3M™ VHB™ Tape or double coated tape (DCT) for attachment to battery lid
- Average Dielectric breakdown voltage : 4.6 kV Average Material thickness: 49.3 mil (1.25 mm)
- Average Basis weight: 1496 g/m2

3M™ Flame Barrier FRB-NT Series ◊

Above Cell Barrier | Rupture Layer | Bus Bar Protection



- An inorganic-based, halogen-free* material
- UL 94 V0, 5VA flame rating at low thickness UL File E65069
- Excellent ignitability resistance
- Excellent arc and track resistance
- Good dielectric strength
- Dimensionally stable (low moisture absorption and low shrinkage at high temperature)
- Good convertibility -material is easily slit, cut, formed and die cut

** Halogen Free defined as both 1) no halogen compounds are intentionally added to the product or used in the manufacturing process for the product and 2) any impurities present are less than 900 ppm bromine, less than 900 ppm chlorine, and/or less than 1500 ppm total bromine and chlorine. The latter are the levels set for thin certain industry standards, such as the International Electrotechnical Commission (IEC) 61249-2-21 standard.*

◊ Electrical Insulation Materials Intended Use

These products are intended for use within a high voltage lithium-ion battery pack to help prevent the unintended contact of electrically charged surfaces of cells and pack components operated at standard temperature conditions 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.

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