Electrical Insulation | EV Battery Solutions

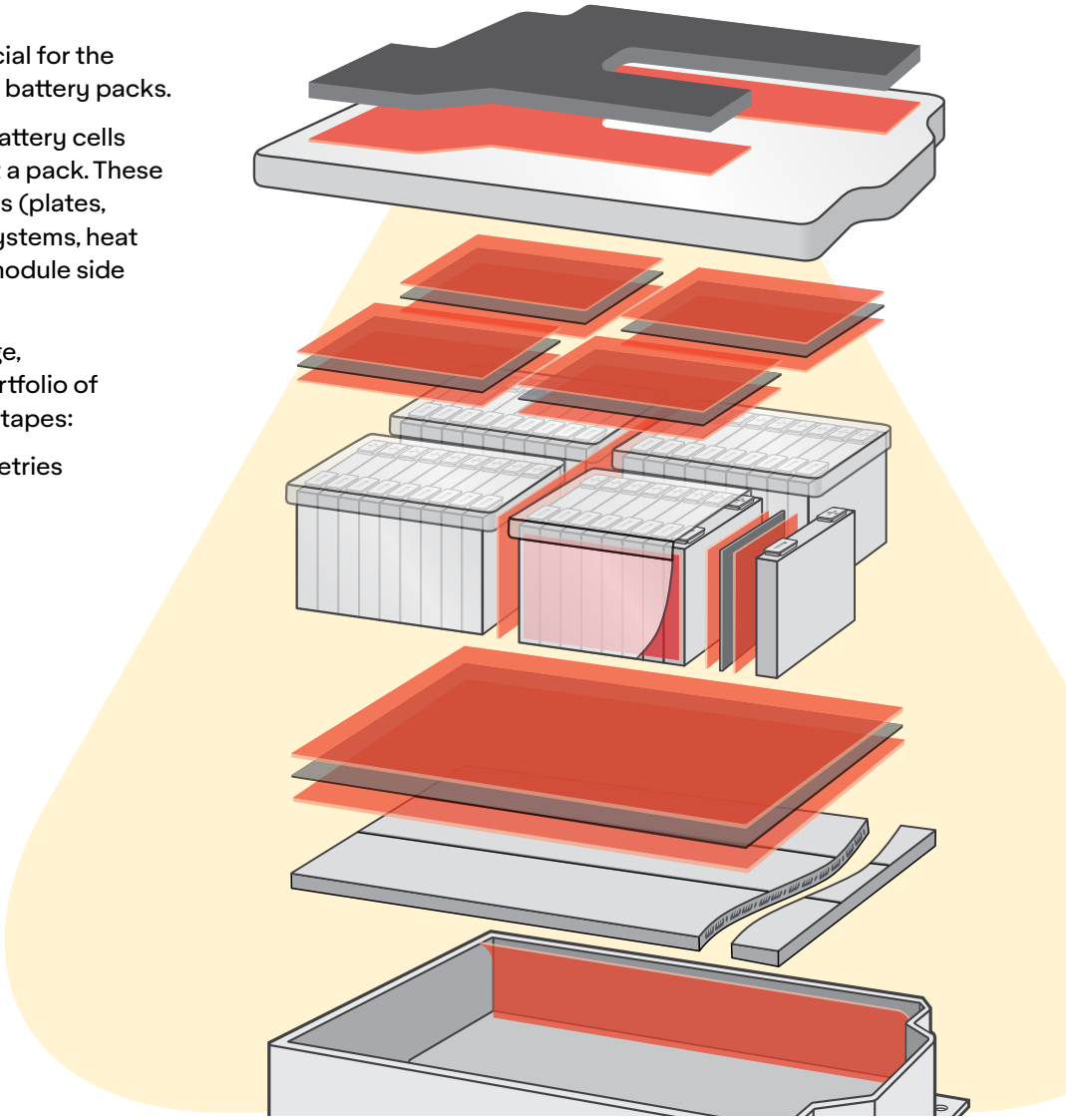
Electrical insulation products for cooling components, structural components, busbar and cell connection systems, and heat spreaders featuring Volt Tough™ products

The prevention of electrical arcing is crucial for the performance, durability and safety of EV battery packs.

Arcing can occur between high voltage battery cells and conductive components throughout a pack. These components include cooling components (plates, fins, ribbons), busbars, cell connection systems, heat spreaders and structural components (module side plates, pack enclosure).

To help address this engineering challenge, Avery Dennison offers its Volt Tough™ portfolio of electrically insulative, single-sided filmic tapes:

- Conformable options for curved geometries
- High abrasion-resistant options
- Various color options for vision inspection systems
- Flame-retardant options for UL® 94 and other flame requirements
- Dielectric breakdown strength options ranging from 3kV to 10+kV



Electrical Insulation: Cooling and Structural Components

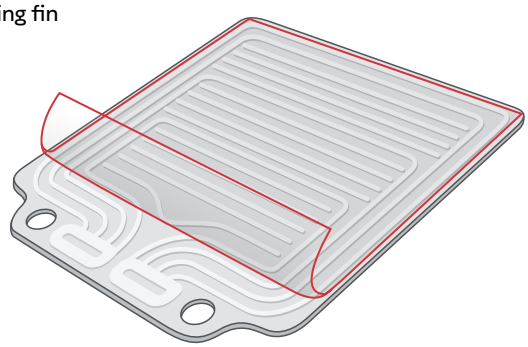
Aluminum cooling plates, fins and ribbons are positioned between, alongside or below battery cells to prevent them from overheating. Structural components made of metal, such as module side plates and the pack enclosure, are designed to support and protect the batteries.

Cooling and structural components are electrically conductive and thus may present risks for electrical arcing and shorting. To address these risks, Avery Dennison offers its Volt Tough™ portfolio of electrically insulative, single-sided filmic tapes with the following features:

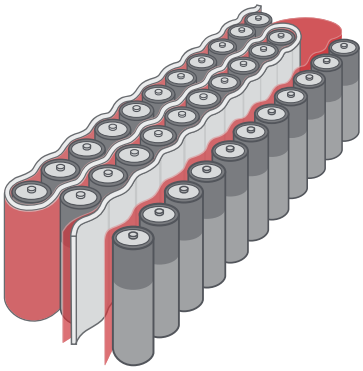
- Conformable options that can handle curved geometries
- High abrasion-resistant options
- Various colors for vision inspection systems
- Varying degrees of dielectric breakdown strength from 3kV to 10+kV

COOLING COMPONENTS

Cooling fin

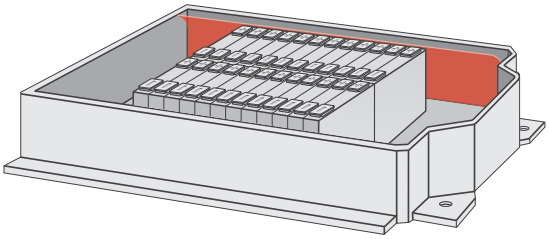


Cooling ribbon



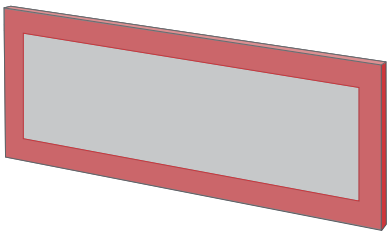
STRUCTURAL COMPONENTS

Electrical insulation



Stampable and formable

Edge insulation



Electrical Insulation: Busbars, Cell Connection Systems and Heat Spreaders

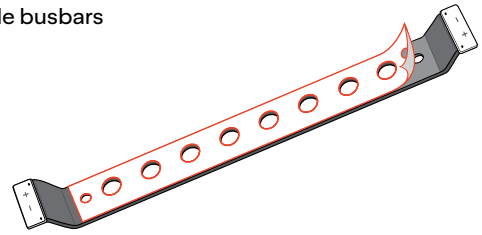
Busbars and cell connection systems ensure current flows between the battery cells and Battery Management System. These components need electrical insulation and joining methods for combining multiple layers. Thermally conductive heat spreaders reduce high temperature concentrations in pouch or prismatic cells. Often made of graphite or copper, heat spreaders are also electrically conductive and thus may present risks for arcing and shorting.

To address both these risks and electrical insulation needs, the Avery Dennison Volt Tough™ portfolio of electrically insulative, filmic tapes offers the following features:

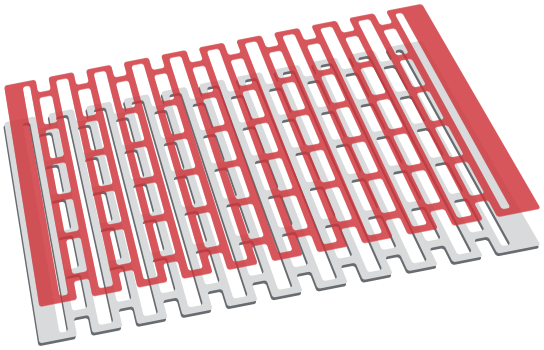
- Varying degrees of dielectric breakdown strength from 3kV to 10+kV
- Thin calipers to accommodate narrow design interfaces between cells
- Ecomonical, linerless options
- Flame-retardant options for UL® 94 and other flame requirements
- Single- or double-sided options for bonding busbars and cell connection systems, and bonding directly to pouch cells or module side plates

BUSBARS AND CELL CONNECTION SYSTEMS

Flexible busbars

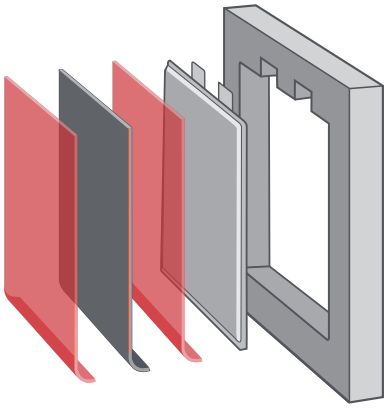


Cell connection systems



HEAT SPREADERS

Heat spreaders



AVERY DENNISON | Performance Tapes

Electrical Insulation Product Portfolio

		Total Construction (minus liner)					Key Benefits
Family	**Product**	**AC Breakdown Voltage (kV)**	**Caliper, mils (micron)**	**Color**	**Relative Cost**	**Linerless**	
Volt Tough™ PET	FT 0011	3.2	1.0 (25)	Clear	$	•	Very thin, linerless
	FT 0012	5.0	1.5 (38)	Clear	$	•	Thin, medium tensile strength, linerless
	FT 0013	10.0	2.7 (69)	Clear	$$	•	High-voltage breakdown, linerless
	FT 0021	5.1	2.0 (51)	Clear	$		Thin, medium tensile strength, good adhesion to self
	FT 0022	8.5	4.0 (102)	Clear	$$		High tensile strength, good adhesion to self
Volt Tough™ UHMW	FT UHMW LTB 527 PET	14.0	7.0 (178)	Light Blue	$$$$		Blue, abrasion resistance, high-voltage breakdown
Volt Tough™ Stretch	FT 0031	11.2	4.1 (104)	Blue	$$		Conformable, high dielectric strength, excellent bond to metallic pack components
	FT 0074	6.1	4.9 (125)	Clear	$$$		Stretch properties for conforming to difficult geometries
Flame Tough™ PET	FT 0065	6.4	3.6 (92)	White	$$$		Flame-retardant, easy processing
	FT 0333	4.0	2.0 (51)	White	$$		Thin, flame-retardant

Avery Dennison EV Battery Tape Product Portfolio

The Avery Dennison EV Battery Portfolio includes a wide range of functional bonding and protection tapes, built on multiple pressure-sensitive adhesive technologies. These are engineered to make EV batteries safer, more efficient and easier to assemble.

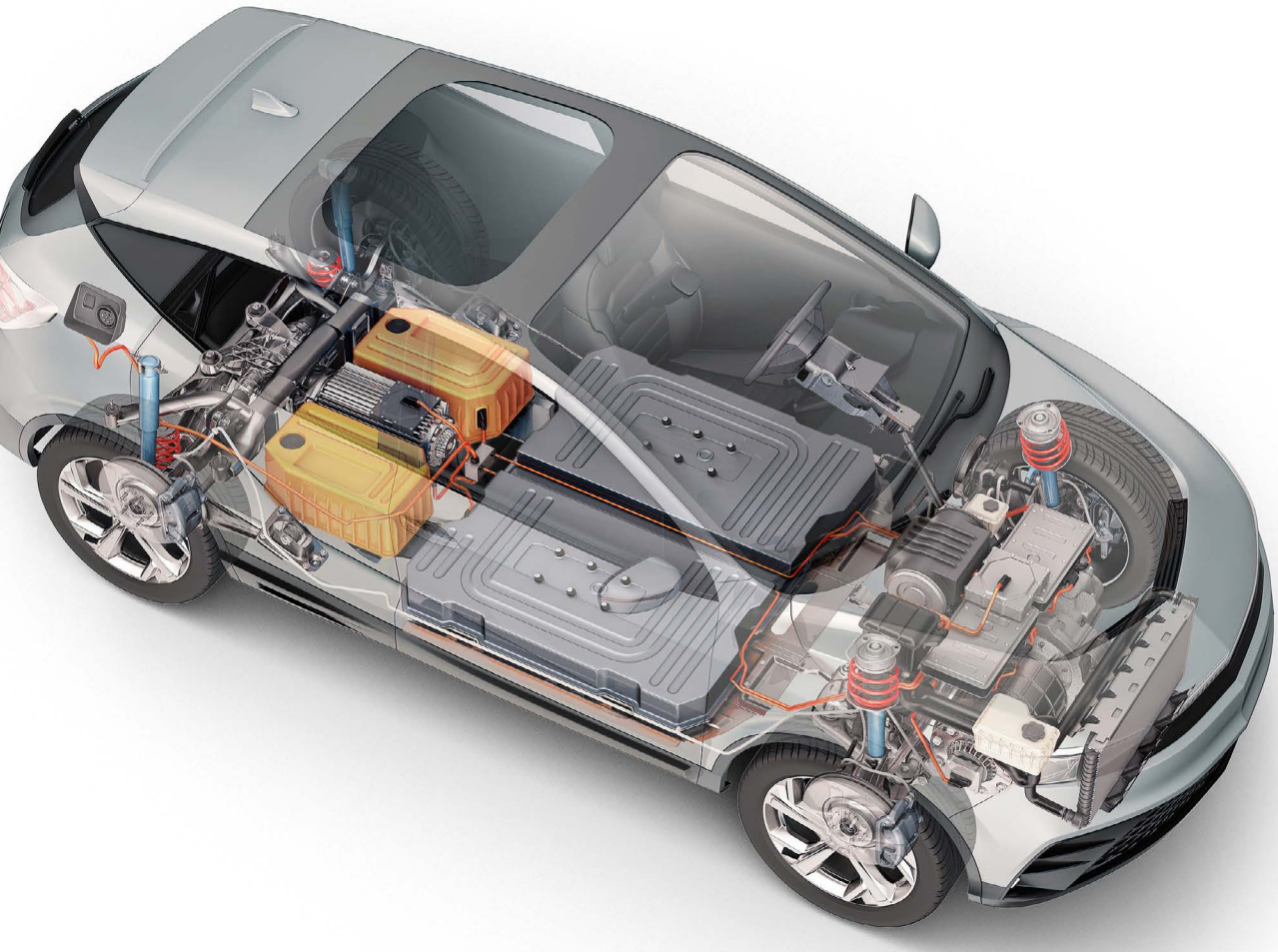
The portfolio can help you solve for some of the most common challenges in battery design and construction.

Reducing flammability
Acrylic- and silicone-based adhesives with Flame Tough™ flame-retardant adhesive properties allow composites and materials to meet UL® 94 V-0 and other flame requirements.

Boosting dielectric strength
Single-coated Volt Tough™ tapes and double-coated tapes which incorporate dielectric films. Our materials and adhesives are tested for breakdown voltage and dielectric strength requirements using GB/T 1408.1-2016 and ASTM D3755 test methods.

Optimizing design and assembly
Functional tapes can replace mechanical fastening methods while offering a thinner profile, lighter weight, repositionability and instant bond.

Visit tapes.averydennison.com/evbattery to review the full breadth of EV Battery Tape Portfolio solutions.



Go beyond bonding with Avery Dennison: Expansive product selection, plus customization and testing capabilities

The Avery Dennison EV Battery portfolio offers multi-functional solutions that draw from our expansive portfolio of pressure-sensitive tapes and adhesives. We have a long track record in the automotive segment and are relied upon by OEMs and tier suppliers across the industry. Our products meet OEM specifications for a wide range of applications.

Beyond bonding means we also welcome the opportunity to collaborate with automotive OEMs and tier suppliers to develop custom tape solutions. You'll enjoy access to testing facilities and pressure-sensitive adhesive experts who understand the challenges engineers face. We can work together to produce one-of-a-kind products that give you the advantage you seek.

Collaboration

- Global reach
- New product development for custom solution applications
- Business development and specification support for emerging applications
- Application engineering and technical support

Testing

- ISO 17025 certified laboratory
- Online tool offering easy access to our database of OEM certifications
- Industry-standard and custom application testing
- Traditional pressure-sensitive adhesive bulk property testing (peel, tack and shear)
- Environmental conditioning (temperature, humidity, UV, chemical and more)
- Flame performance and dielectric strength testing at the tape and composite level

05/2024

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