

Electric vehicle (EV) cooling system hoses and tubes benefit using TPV



Reasons to specify Santoprene TPV



Weight reduction

- Up to **60% less weight** due to lower density and thinner walls
- Extends battery range



System cost reduction

- **10-30% lower costs** based on design
- About **50% less energy use**
- Less waste



Abrasion protection

- Protective sleeves eliminated



Increased durability

- Outstanding chemical resistance
- High stability against hydrolytic degradation



Conductivity

- Inherently non-conductive
- Insulating material



Sustainability

- Recyclable: in-process scrap and end-of-part life
- Less waste versus EPDM

As car manufacturers and system suppliers are transitioning away from traditional internal combustion engine (ICE) vehicles, creating innovative material design solutions for new energy vehicles (NEV) has become an urgent reality.

As an alternative to EPDM rubber, PA and PPS, Santoprene® thermoplastic vulcanizate (TPV) is being used to manufacture electric vehicle (EV) coolant system hoses and tubes as it offers **increased durability, and lower weight and system costs.**

“Using Santoprene TPV offers cost saving opportunities compared to EPDM, PA material-based systems and PPS. It enables the production of EV cooling system hoses and tubes that are lighter in weight than EPDM. Plus, through in-process and end-of-life recyclability, the use of Santoprene TPV has clear sustainability advantages.”

Create flexible, semi-flexible and stiffer hoses and tubes for NEV internal and external battery external battery systems:

- Internal battery system semi-stiff and stiff tubes and hoses – typically use Santoprene TPV grades that range from **73 Shore A to 50 Shore D.**
- External battery system flexible hoses – typically use Santoprene TPV grades that range from **64 Shore A to 80 Shore A.**



Weight reduction opportunities and lower system requirements

EVs are generally heavier than ICEs, making weight reduction solutions that can extend battery range, critical. Santoprene® TPV can reduce coolant hose weight by up to 60% compared to EPDM. EV coolant hoses operate in lower temperature (30-90°C) and lower pressure under-hood conditions, which also makes Santoprene TPV an ideal replacement for EPDM.

Table 1: TPV, EPDM and PA material comparison

Property		TPV	EPDM	PA12*
Material	Density g/cm ³ ISO 1183	~0.96	~1.20	~1.02
	Hardness ISO 868 ISO 7619	60 A - 40 D	<75 A	>70 D
	Tensile strength, Mpa ISO 37** ISO 527	7-21	>7	~50
	Compression set	⊙	⊙	✘
Hose	Construction	Monolayer / Multilayer TPV / Textile reinforcement / TPV	EPDM / Textile reinforcement / EPDM	Monolayer / Multilayer with adhesive
	Temperature range, °C	-40 ~ 120	-40 ~ 160	-40 ~ 120
	Wall thickness, mm	~2.4	~3.5	~1.2
	Weight	Weight reduction ~50% to EPDM	100%	/
	Hydrolysis insulation	⊙	⊙	○
	NVH	⊙	⊙	△
	Electrical insulation	⊙	○	○
	Flexibility	⊙	⊙	✘
Other	Recycle	Recyclable	Non recyclable	Recyclable
	Connector	Clamps, quick connectors, etc.	Clamps	Quick connectors only
	Configuration	No vulcanization Mandrel shaping / thermoforming	Vulcanization Mandrel shaping	No vulcanization Thermoforming

Indicative directions only ⊙ Excellent ○ Good △ Fair ✘ Poor

* Hydrolysis resistant

**Where applicable, test results based on fan gated, 2.0 mm injection molded plaques. Tensile strength, elongation and tensile stress are measured across the flow direction. Test results are generated by company test methods that may not fully conform to the ASTM and/or ISO methods. Test methods are available upon request.

Table 2: Typical design and material selection

Hose/tube system*	Requirements	Material Recommendation
Inner Layer	Long-term sealing function Long-term resistance to cooling liquid Good extrusion processing	Santoprene® 101-xx TPV xx 64 to 87 Shore A
Outer Layer	Increase of burst pressure (potential impact flexibility) Long term durability Abrasion resistance Good extrusion processing	Santoprene® 101-3-xx TPV xx 64 to 50 Shore D
Fiber reinforcement	Further increase of burst pressure for very flexible hoses	e.g. PA 6.6, PET, Armit fibers

* Depending on the application needs different material combinations are possible

Table 3: Typical manufacturer specifications

Characteristic	Typical value	Santoprene® TPV 101-64 / 101-73 101-80 / 101-87
Fluid temperature (max.)	100°C	✓
Hose outer diameter (max.)	20mm*	✓
System pressure	3 bar	✓
Burst pressure	10 bar	✓
Cooling liquid resistance	Water/glycol (50/50)	✓
Long-term ageing (functional test)	3 x (950h at 90°C + 50h at 100°C)	✓
Abrasion resistance	Oscillating steel wedge, > 150.000 cycles without damage or cracks	✓
Flexibility	Vibration Dampening Assembling	✓

*Larger diameter under test

Source: ContiTech Mobile Fluid Systems

Table 4: Santoprene TPV grades for EV cooling system hoses and tubes – flexible, semi-stiff and stiff

Property	Santoprene TPV 101-64	Santoprene TPV 101-73	Santoprene TPV 101-80	Santoprene TPV 101-87	Santoprene TPV 103-40	Santoprene TPV 103-50
Hardness, shore A(D)	70	78	87	94	41	50
Density, g/cm ³	0.970	0.970	0.960	0.950	0.950	0.950
Tensile strength at break, Mpa	6.47	7.98	10.4	15.6	20.7	20.7
Elongation at break, %	450	480	530	600	610	610
Tensile at 100% elongation, Mpa	2.83	3.44	4.61	6.93	9.00	12.46
Compression set, %						
70°C 22hrs	25	27	36	37	54	59
125°C 70hrs	44	41	52	52	61	54



More cost effective and quicker

Santoprene TPV processing can **reduce capital investment by about 33% compared to EPDM** processing and, because no mixing of ingredients or curing is required, can be much quicker.

Based on the design, Santoprene TPV can deliver 10-30% lower system costs. During production, energy consumption can be reduced by about 50% and potentially less waste is generated, and any that is can be recycled.

Value through collaboration

Through value chain collaboration, Santoprene TPV has been fulfilling the needs of the global automotive industry for over 40 years. With global support ranging from material selection and design assistance to tooling recommendations and local processing support, Celanese can help elevate your electric vehicle (EV) cooling system hose and tube products to the next level.

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Contact us for more information:

santoprene.com

santoprene.answerperson@celanese.com