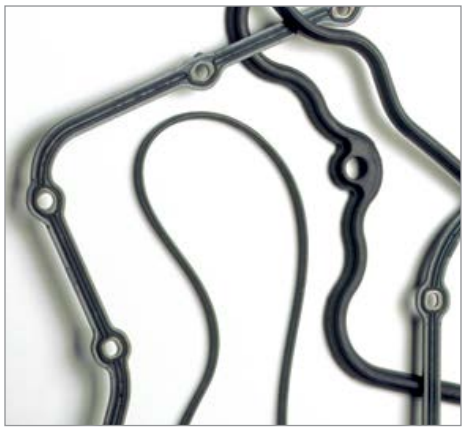
Product Specification Guide

DuPont™ Vamac® Elastomer (AEM) – The Perfect Fit for Seals, Ducts, and Wire & Cable Applications in E-mobility



Key Properties of Vamac®

- Temperature range: - 40 °C to +175 °C (and up to +190 °C for VMX5000 series)
- Very good resistance to new fluids for electric vehicles
- Good resistance to water-based coolants
- Outstanding ozone/weather resistance
- Excellent compression set and compressive stress relaxation resistance (CSR)
- Good flex fatigue resistance
- Vibration damping consistency
- Halogen-free, non-toxic, and low-smoke density emissions
- Excellent bonding to metal and other substrates
- Insulating or conductive compounds
- Electrical & Electronics Friendly

DuPont™ Vamac® ethylene acrylic elastomers (AEM) can be made into cured compounds that have excellent resistance to high temperatures, and good resistance to automotive fluids such as transmission fluids, engine oils, coolants, acidic condensates, urea solution, greases, and new E-fluids.

Low-Temperature Performance

The low-temperature performance of Vamac® surpasses that of most other heat- and oil-resistant polymers. Typical compounds meet OEM specifications for performance at –40 °C. Vamac® compounds can be designed to meet end-use requirements as low as –50 °C.

Resistance to Fluids

End products based on Vamac® have excellent resistance to hot oils and hydrocarbon- or glycol-based lubricants, transmission fluids, and power steering fluids. Low oil swell can be obtained with proper Vamac® grade selection and compounding. Vamac® shows good retention of properties and low permeation in new fluids for E-mobility (E-motor, E-transmission, power electronics) and with dielectric fluids used to cool batteries.

Vamac® is not recommended for use in components immersed in gasoline, esters or highly aromatic fluids.

Performance Property	Typical Range
100% Modulus[1], MPa	2 to 10
Tensile Strength[1], MPa	7 to >20
Elongation[1], %	100 to 600
Hardness[2], Durometer Shore A	40 to 90
Tear Strength[3], N/mm	15 to 45
Compression Set[4], % (168h at 150 °C, 25% compressed)	15 to 30

[1] ASTM D412, [2] ASTM D2240, [3] ASTM D624 (Die C), [4] ASTM D395 (Method B)

Vamac® can be compounded without plasticizer and with very low levels of volatile ingredients that could possibly be washed out by fluids used in EVs.

Excellent NVH Vibration Damping

The high vibrational damping characteristic of Vamac® compounds remains nearly constant over broad ranges of temperature, frequency, and amplitude.

NHFR Compounds

Vamac® is not inherently resistant to burning. However, when properly compounded with non-halogenated flame retardants (NHFR), a Vamac® compound will pass the demanding UL-94 V0 protocol. These Vamac® NHFR compounds exhibit a combination of good oil resistance, good heat resistance, and good low-temperature properties and can be used for sealing elements, tubes, hoses, flooring, and wire & cable applications such as Automotive T4 150 °C continuous class temperature.

High-Temperature Durability

Parts made with Vamac® retain elasticity and remain functional after continuous air oven exposures. Conventional filled Vamac® compounds can meet heat requirements of six weeks (1,000 h) at 165 °C, 18 months (13,000 h) at 121 °C or five days (120 h) at 204 °C. VMX5000 series pre-compounds provide superior high-temperature performance (up to six weeks at 180 °C, and three weeks at 190 °C).

Compressive Stress Relaxation

Vamac® compounds perform exceptionally well in seal and gasket applications and have good CSR performance in oils up to 5,000 hours at 150 °C. VMX5000 series pre-compounds provide a step change for CSR (in hot air) sealing force retention at +15 to 20 °C higher temperature than conventional filled Vamac®.

Select DuPont™ Vamac® for Seals, Gaskets, Tubes, Hoses, and Wire & Cable Applications

Grade Selection Criteria:

Basic Heat and Oil Swell Characteristics

Compounds based on the Vamac® G family (Vamac® G, GXF, Ultra IP, and Ultra HT) and the Vamac® dipolymers (DP and Ultra DX) typically exhibit IRM903 oil swell of 40–60%. Appropriately compounded, Vamac® can withstand three weeks of continuous use at 175 °C, retaining 50% of initial elongation. Compounds based on the Vamac® G family are generally rated as EE or EF by ASTM D2000/SAE J200.

Reduced Oil Swell

For reduced oil swell, compounds based on the Vamac® GLS family (GLS, Ultra LS, Ultra HT-OR, VMX3123) exhibit about one half the IRM903 oil swell of its G counterpart. The improved oil swell of Vamac® GLS results in tradeoff of low-temperature flexibility (7 °C Tg increase). Compounds based on the Vamac® GLS family are rated as EG and EH by ASTM D2000.

Extrusion

Vamac® GXF was designed for the demanding requirements of turbo charger hose, having improved physical properties, and dynamic fatigue resistance compared to Vamac® G. Compounds of Vamac® GXF demonstrate improved extrudability with lower head pressure, and less scorch, resulting in hose with smoother surface appearance.

Vamac® Ultra HT and Ultra HT-OR compounds have the best combination of processability, compression set, and dynamic properties for high-temperature hoses. The Ultra HT-OR compounds have lower volume swell in fluids while the Ultra HT compounds have better low-temperature properties.

Vamac® Ultra XF and VMX3123 offer intermediate viscosity between Vamac® GXF and Ultra HT, respectively between Vamac® GLS and Ultra HT-OR, allowing an excellent combination of good extrusion at moderate extruder head pressure of Shore 70A compounds and good green strength.

Molding

Vamac® Ultra IP and Ultra LS compounds can vastly improve productivity in the rubber molding process through reduced mold fouling, scrap, improved hot tear resistance, and cycle time compared with the standard Vamac® G compounds. With higher viscosity, Vamac® Ultra IP provides superior compound dispersion with a one pass mix. Vamac® compound can be processed via 2K rubber plastic molding technology.

Low-Temperature Performance

The combination of Vamac® Ultra LT and a low volatility plasticizer can be used to make compounds with a Tg of –50 °C. These compounds can be used in automotive hoses and tubes as well as in damping elements where functional performance is required throughout a thermal range as wide as –50 °C to 160 °C. Ultra LT can also be chosen to improve low-temperature properties of compounds when a plasticizer shall not be used, to avoid negative impacts on fluids in contact with seals or other rubber parts.

Bright/Colored Compounds

Vamac® Ultra & VMX5000 series allow fabrication of bright/colored molded parts with good mechanical properties and processing performance. DuPont can provide starting formulation/recipe.

Curing Method

Most grades of Vamac® are curable with diamine and require a post cure for the best properties. If a post-cure step is impractical or undesirable, Vamac® DP or Vamac® Ultra DX peroxide-cured dipolymers can be used.

Vamac® invites opportunities to help you formulate compounds to meet specific processing needs.

DuPont™ Vamac® Grades

Grade	ML (1+4) at 100 °C	Tg (by DSC) °C[1]	Key Feature
Vamac® G	16.5	-30	General purpose
Vamac® GXF	17.5	-30	Dynamic fatigue resistance
Vamac® GLS	18.5	-23	Low oil swell
Vamac® Ultra IP	29	-30	Improved performance grade for molding & extrusion
Vamac® Ultra XF	23	-30	Intermediate viscosity
Vamac® Ultra HT	29	-30	High temperature
Vamac® Ultra LS	33	-23	High viscosity / Low oil swell
VMX3123	24	-25	Intermediate viscosity, low swell extrusion grade
Vamac® Ultra HT-OR	31	-24	High temperature / Oil resistance
Vamac® Ultra LT	12	-42	Low temperature
Vamac® DP	22	-29	Peroxide curable dipolymer
Vamac® Ultra DX	28	-29	Improved processing peroxide curable dipolymer

DuPont™ Vamac® Pre-Compounds for High Heat Resistance

Grade	ML (1+4) at 100 °C	Tg (by DSC) °C[1]	Key Feature
VMX5015	67	-30	Compression molding pre-compound[2]
VMX5020	53	-30	Injection molding pre-compound[2]

[1] Tg of compounds with Vamac® may be extended typically -10 °C lower with addition of plasticizer.
[2] Not suitable for steam autoclave cure.

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