



EXTREME CONDITIONS. EXTREME PERFORMANCE.

DuPont Performance Lubricants
SOLUTIONS FOR THE AUTOMOTIVE INDUSTRY



The miracles of science™

DuPont Performance Lubricants

POWERED BY DUPONT SCIENCE

Over the last fifty years, DuPont™ Krytox® lubricants have helped customers outpace the competition by bringing customized and innovative solutions into an increasingly competitive automotive industry.

Whatever your engineering challenge – longer part life, extreme temperatures, reduced failures – DuPont Performance Lubricants can help. At DuPont, we put our science to work to produce lubricants that can stand up under the extremely demanding conditions of today's engineering design standards.

ADVANCED SOLUTIONS FOR THE AUTOMOTIVE INDUSTRY

DuPont Performance Lubricants offers a wide range of high quality, high performance lubricants to address the most challenging and complex requirements of Original Equipment Manufacturers ("OEMs") and world-class Tier One suppliers.

Our family of oils, greases and coatings will provide long-term operational excellence and high performance lubrication in extreme operating conditions.

Automotive design engineers have learned that specifying Krytox® lubricants during the design phase can provide OEMs with significant cost savings. By lengthening the life of critical components and improving consumer satisfaction, Krytox® lubricants help reduce repair costs and potentially save millions in warranty claims.



Longer Lasting Lubrication

Automakers are striving for extended warranties, expecting longer intervals between vehicle service visits and very limited relubrication operations. DuPont™ Krytox® lubricants have provided state-of-the-art performance for mechanical systems such as gearboxes, bearings and chains, seals, actuators, valves and other components. Krytox® lubricants don't oxidize; they provide excellent lubricity and a high viscosity index through a broad range of viscosity grades. Most applications where Krytox® lubricants are specified are considered by OEMs to be lubricated for the expected lifetime of the vehicle.

Noise, Vibration and Harshness

In addition, OEMs are increasingly conscientious about their reputation as quality manufacturers. In an automobile's interior, there are several places where different materials contact each other, such as metal on plastic, leather on leather, and weather-stripping against glass or metal surfaces. Movement between these surfaces often results in a series of noises described as squeak, itch, or judder. DuPont™ Krytox® lubricants can eliminate these noises. They are easy to apply, have low volatility and can remain in place over the vehicle's entire lifetime.

THE RIGHT CHOICE FOR YOUR DESIGN CHALLENGE

DuPont™ Krytox® oils and greases are based on perfluoropolyether (“PFPE”) oils, with a full range of viscosities available. These synthetic fluorinated lubricants are used in extreme conditions such as continuous high temperatures up to 288 °C (550 °F) and higher temperatures for shorter periods, depending on product grade limits.



THE RIGHT CHOICE FOR OUR ENVIRONMENT...

Protection of the environment and people is a core value of DuPont. Our sustainability goals go beyond traditional footprint reduction to include goals that tie our business growth to the development of safer and environmentally improved new products and sustainable solutions.

DuPont™ Krytox® lubricants provide longer lasting lubrication, which lowers the frequency of relubrication, therefore reducing the use of materials and reducing waste - important steps in helping to reduce product impact on the environment.

DuPont™ Krytox® lubricants have properties that reduce impact on the environment:

- Krytox® products are fully synthetic – not petroleum-based – and totally inert, so Krytox® oils and greases do not react with anything in the environment. Unlike other lubricants, at temperatures under 350 °C, Krytox® oil does not oxidize or break down into other substances that could be harmful.
- Krytox® lubricants do not contain any volatile organic compounds (VOCs), according to the U.S. EPA definition. Our fully fluorinated lubricants are made of fluorine, oxygen, and carbon only.
- Krytox® products have a very long service life. This means that products do not have to be replaced and disposed of frequently, which reduces waste.
- Because the Krytox® molecule stays intact, the oils can be recycled if they become contaminated. The recycled products can then be returned to the customer for reuse.
- Krytox® oils and greases are not considered hazardous wastes as manufactured under the U.S. EPA Resource and Recovery Conservation Act guidelines. However, treatment, storage, transportation, recycling and disposal of these products must be in accordance with applicable federal, state/provincial, and local regulations.

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EFFECTIVE OVER A WIDE TEMPERATURE RANGE

DuPont™ Krytox® greases typically last 5-50 times longer than standard greases. One common bearing test that demonstrates the extreme performance of various grades of Krytox® grease is the ASTM D-3336 test method, where heating/cooling test cycles are continued until failure or the completion of a specified number of hours of running time. Test results have shown that Krytox® greases can continue to perform beyond thousands of hours and at temperatures beyond the range specified for most applications - even outlasting the tester itself.



Ball Bearing Grease Performance Test with Krytox® Greases

	Recommended Temp range	Viscosity 40°C/100°C	Test temperature	Life, hours
Krytox® GPL 224	-51 °C to +179 °C	60 / 9	180 °C / 356 °F	4900+
Krytox® AUT 2245	-40 °C to +200 °C	100 / 12.3	200 °C / 392 °F	5500+
Krytox® GPL 225	-36 °C to +204 °C	160 / 18	200 °C / 392 °F	5000+
Krytox® XHT AC	-20 °C to +300 °C	500 / 47	250 °C / 482 °F	2000+

COMPATIBILITY WITH ELASTOMERS AND PLASTICS

DuPont™ Krytox® performance lubricants are compatible with the following common elastomers and plastics, as well as many more:

- Fluorosilicone
- Ethylacrylate
- Methyl Silicone
- Viton® A Fluoroelastomer
- Urethane
- Hypalon® Synthetic Rubber
- Hytrel® Polyester Elastomer
- Butyl 325
- Neoprene WRT
- Nycar 100 (Buna N)
- EPT Peroxide Cure
- Hydrocarbon Rubber
- Delrin® Acetal
- Kalrez® Fluoroelastomer*
- Zytel® Nylon
- Vespel®
- Teflon® Fluoropolymer

*For higher temperature use with Kalrez® perfluoroelastomer, the user should ask for guidance on the proper grades.

COMPATIBILITY WITH METALS

Because of their low surface tensions, DuPont™ Krytox® oils and greases easily lubricate metallic surfaces. Krytox® lubricants are chemically inert and therefore have no adverse effect on metals when the temperature is below 288 °C (550 °F). Above this point, DuPont™ Krytox® lubricants will be the best-in-class choice for many alloy steels, stainless steels, titanium alloy, nickel alloy, and cobalt alloy.

ROBUST ELECTRICAL PROPERTIES

DuPont™ Krytox® oils are good insulators due to fundamental properties. Our synthetic fluorinated lubricants are chemically inert, insoluble in most common solvents and non-flammable.



ADVANCED RUST AND CORROSION PROTECTION FROM ENVIRONMENTAL CHALLENGES

DuPont™ Krytox® lubricants are not sensitive to aggressive weather conditions, such as rain, snow, ice, dust, or grit, and they are extremely resistant to the harsh underhood chemical environment of fuel, coolant, brake fluid, engine oil and washer solvent.

COST EFFECTIVE

DuPont™ Krytox® lubricants provide Original Equipment Manufacturers (OEM) with significant cost savings when specified for use during the design phase. By lengthening the life of critical components, DuPont™ Krytox® lubricants reduce repair costs and potentially saves millions in warranty claims.

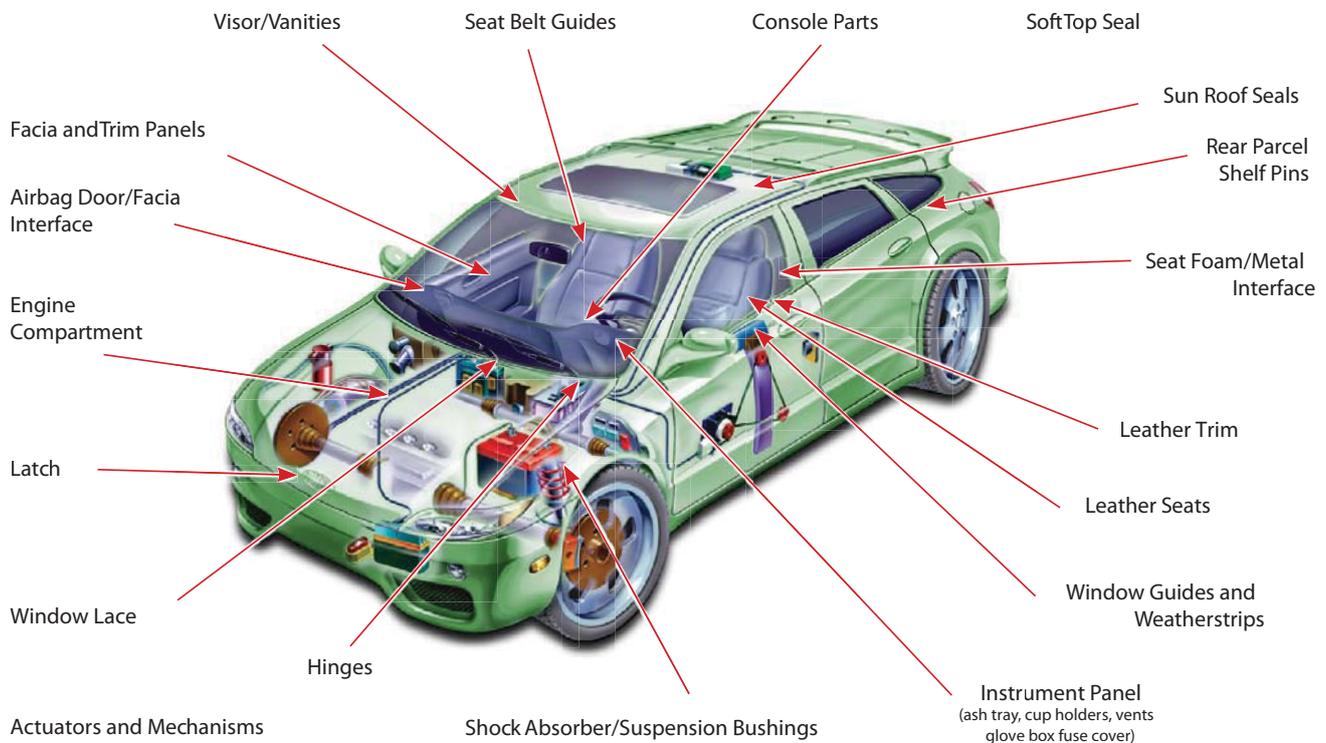
PRODUCT RANGE

Typical Automotive Grades	Description	Base Oil Viscosity, cSt	Useful Temperature Range, °C
Krytox® GPL 104	Clear, colorless oil	60	-51 to +179
Krytox® GPL 105	Clear, colorless oil	160	-36 to +210
Krytox® AUT 1045	Clear, colorless oil	100	-40 to +200
Krytox® GPL 204	White, buttery additive-free grease	60	-51 to +179
Krytox® GPL 214	Grease with extreme pressure additive	60	-51 to +179
Krytox® GPL 224	White, buttery grease with sodium nitrite anti-corrosion additive	60	-51 to +179
Krytox® GPL 294	Grease with extreme pressure and anti-corrosion additives	60	-51 to +179
Krytox® GPL 2E4	Grease with sodium nitrite-free anti-corrosion additive	60	-51 to +179
Krytox® XP2A4	Grease with soluble additive corrosion inhibitor	60	-51 to +179
Krytox® AUT 2045	White, buttery additive-free grease	100	-40 to +200
Krytox® AUT 2245	White, buttery grease with sodium nitrite anti-corrosion additive	100	-40 to +200
Krytox® AUT 2E45	Grease with sodium nitrite-free anti-corrosion additive	100	-40 to +200
Krytox® AUT 2A45	Grease with soluble additive corrosion inhibitor	100	-40 to +200
Krytox® GPL 205	White, buttery additive-free grease	160	-36 to +210
Krytox® GPL 215	Grease with extreme pressure additive	160	-36 to +210
Krytox® GPL 225	White, buttery grease with sodium nitrite anti-corrosion additive	160	-36 to +210
Krytox® GPL 295	Grease with extreme pressure and anti-corrosion additives	160	-36 to +210
Krytox® GPL 2E5	Grease with sodium nitrite-free anti-corrosion additive	160	-36 to +210
Krytox® XP2A5	Grease with soluble additive corrosion inhibitor	160	-36 to +210
Krytox® XP2C5	Grease with anti-corrosion and anti-fretting additives	160	-36 to +210

DuPont Performance Lubricants

DuPont™ Krytox® Lubricants for Noise, Vibration and Harshness (NVH - Squeak elimination)

Within an automobile's interior, there are several places where different materials contact each other. Some examples include metal on plastic, leather on leather, and weather-stripping. Movement between these surfaces often results in a series of noises described as squeak, itch, or judder. DuPont™ Krytox® lubricants can permanently eliminate these noises. They are easy to apply, have low volatility and can remain in place over the vehicle's entire lifetime. Furthermore, DuPont™ Krytox® oils and greases are compatible with a wide variety of materials, and have the frictional and long-life characteristics that make them ideal lubricants in these applications.



DuPont™ Krytox® Lubricants for Automotive Underhood Applications

Fan clutch

A thermostatically-controlled fan clutch typically drives the cooling fan. The bearings that support the drive shaft for this clutch regularly experience high temperatures. If these bearings wear and begin to fail, the cooling fan runs less efficiently. When this occurs, the engine can overheat, and any resistance in fan clutch rotation can drain valuable power from the engine's drive shaft, further reducing overall performance. DuPont™ Krytox® lubricants have low volatility and a high viscosity index, providing long-life and excellent lubrication to the fan clutch bearing under these high temperature conditions.

O-ring lubrication/Assembly lube

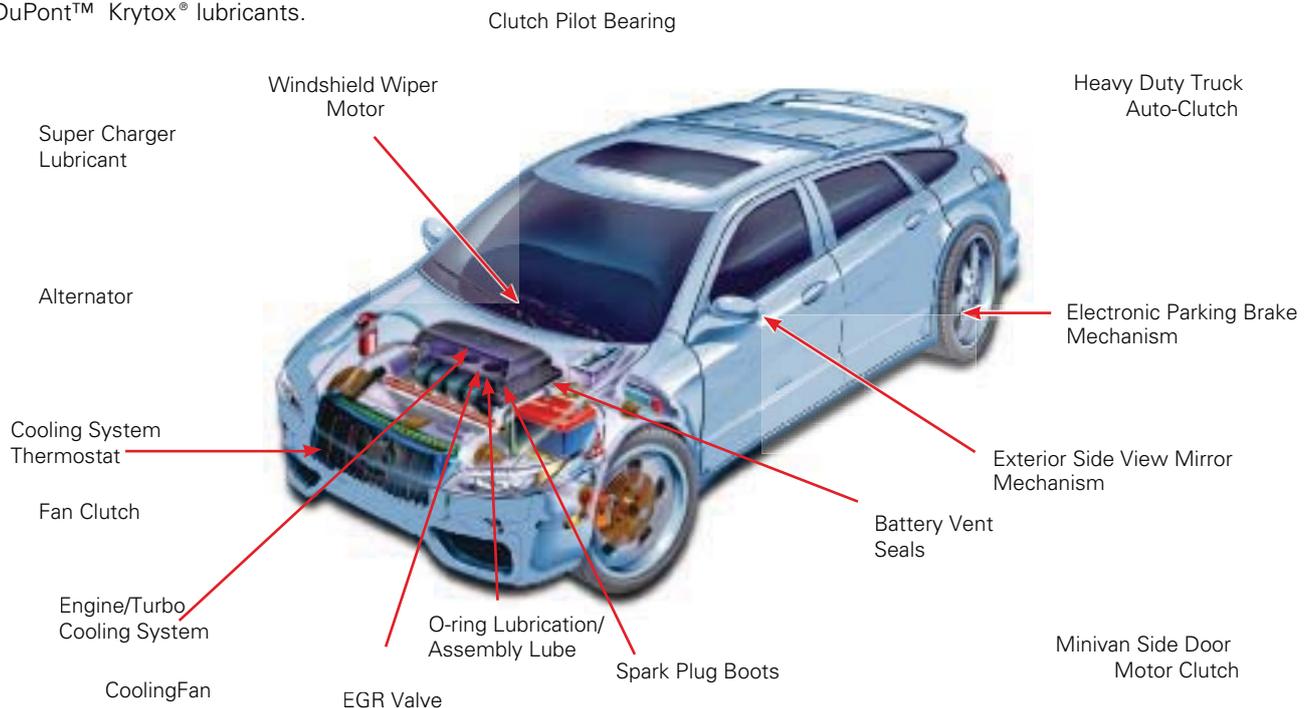
O-rings effectively seal many interfaces in an automobile. A lubricant is often applied to keep seals in place during assembly, and to allow them to assemble without damage. Choice of lubricant is critical: if the wrong lubricant is used for a given seal material, the seal could degrade, prematurely causing serious damage. DuPont™ Krytox® lubricants are the preferred choice because they are compatible with all seal materials. Furthermore, DuPont™ Krytox® lubricants do not contribute to seal degradation because they do not oxidize and they have greater temperature stability than the seals.

Alternator

The alternator is usually belt-driven by the engine and supplies electricity to basic automobile functions (headlights, radio, etc.) while recharging the car battery. As the electricity is being generated, the alternators, and hence the bearings, get very hot. Standard lubricants volatilize in the extreme high temperature environment of the alternator, leading to alternator bearing failure. As the bearings wear and begin to fail, they can increase the alternator's resistance to rotation. This reduces the alternator's performance, and robs performance from the rest of the automobile. Perhaps more critically, if the alternator bearings fail, the alternator will fail and the vehicle will stop running. The higher output alternators used in today's vehicles generate a tremendous amount of heat, demanding the advanced and reliable performance and heat stability of DuPont™ Krytox® lubricants.

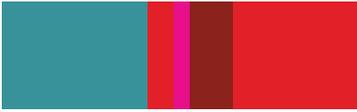
EGR Valve

The exhaust gas re-circulating (EGR) valve reduces NO_x formation by re-circulating some of the exhausted gas back into the engine cylinders. This lowers the peak temperatures inside the cylinder, thus reducing the rate of NO_x formation. If the valve does not open enough, insufficient re-circulation takes place, and excess pollution is created. If, however, the valve sticks open, the temperature inside the cylinder can drop too much, decreasing engine performance and fuel mileage. DuPont™ Krytox® lubricants are an ideal choice, since they withstand the high temperatures and exhaust fumes experienced by the EGR valve.



Spark Plug Boots

The spark plug boot protects the spark plug from weather and prevents the unintentional grounding of the spark energy. The boot is made of a silicone rubber, which, over time, can bond with the silicon ceramic of the spark plug, fusing the boot and the spark plug together. Once this occurs, the only way to remove the boot is by force, which can cause enough damage to require replacement of the entire assembly. DuPont™ Krytox® lubricants can prevent this fusion from taking place. Krytox® lubricants are ideal in this application because they are stable, non-reactive, and are long-lasting. They can also withstand the high temperatures and energies of the spark plug environment.



**For more information or for technical assistance, please call us
at 1-800-424-7502 or contact us at krytox@usa.dupont.com.**

**For international sales and support contacts, visit us at
www.lubricants.dupont.com**

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