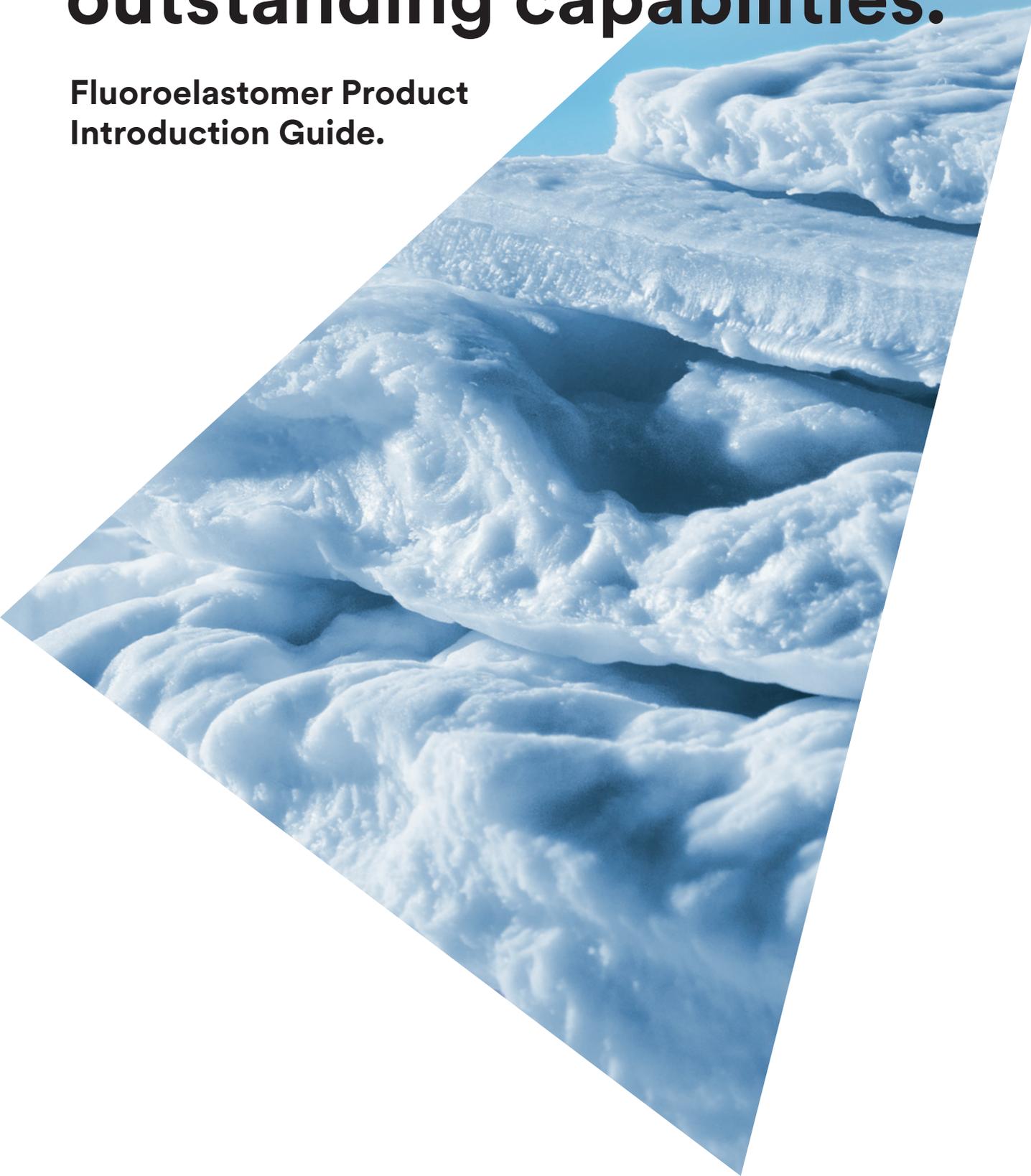


**3M** Science.  
Applied to Life.™

► 3M™ Dyneon™ Fluoroelastomers

# Inherent strength for outstanding capabilities.

Fluoroelastomer Product  
Introduction Guide.



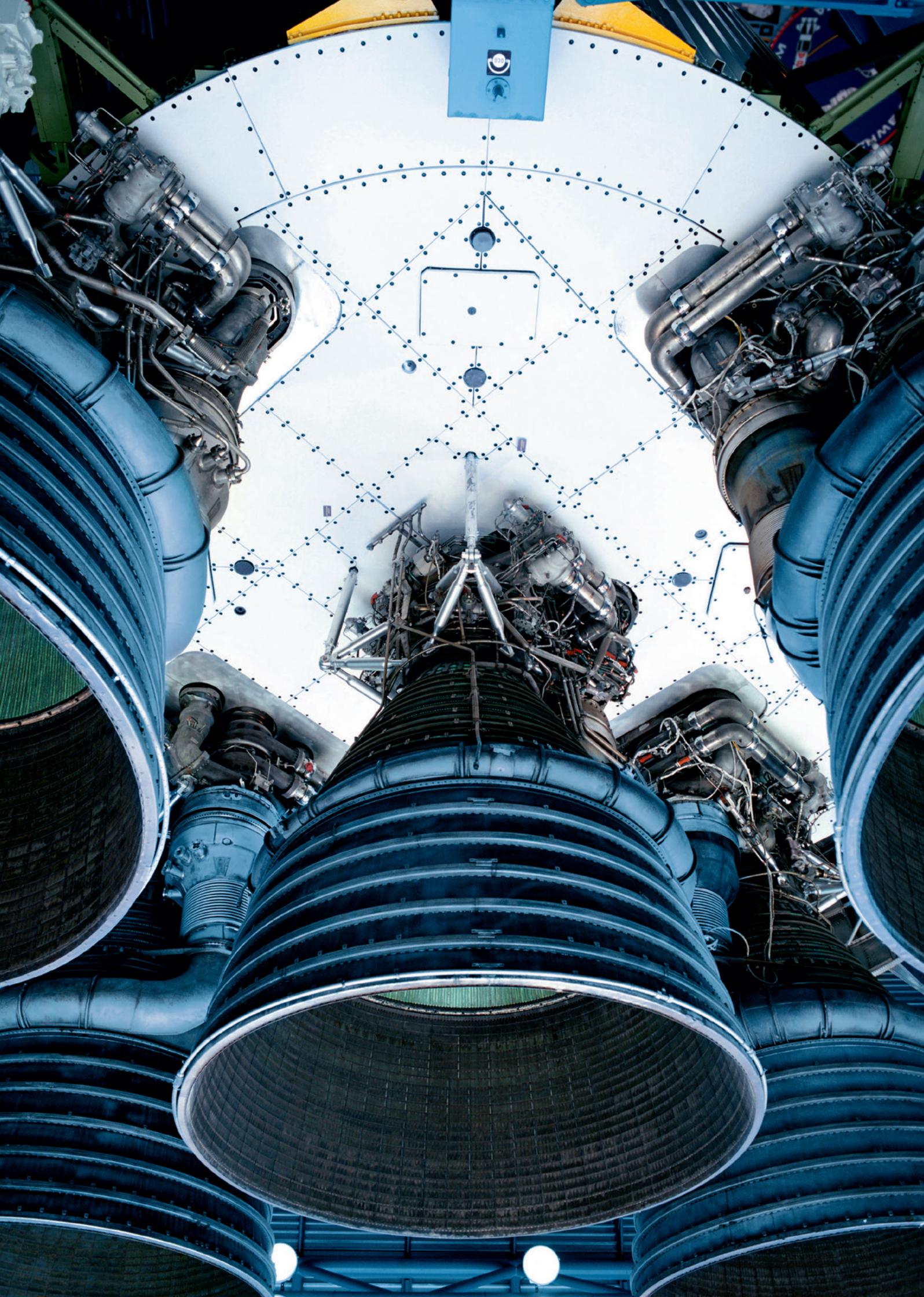
# Expanding horizons to overcome limitations.

Discover the world of our 3M™ Dyneon™ Fluoroelastomers – high performance polymers specially designed to withstand most extreme chemical and thermal conditions in a broad range of industries. With over 50 years of innovation and development, 3M is one of the leading pioneers in fluoroelastomer history.

Setting industrial benchmarks has been our top priority ever since. Our track records include the first incorporated cure fluoroelastomer as well as the first material with a low temperature performance of -40 °C (TR 10). And did you know that the fluoroelastomers from 3M accompanied the astronauts all the way to the moon?

But it's not only the polymer that counts. Our job is only done when our products perform in the scope of our customer's projects. Therefore our technical service team is more than happy to support 3M customers with their expertise. Whether it is the development of the polymer, the designing of appropriate compounds, or the final processing in injection moulding, compression moulding, or extrusion.

This brochure guides you through all relevant aspects regarding the characteristics, possible applications, and of course the benefits of our range of fluoroelastomers.



In an ever changing world, the performance requirements for sealing applications also constantly change. In all major industries 3M™ Dyneon™ Fluoroelastomers help to enable technologies and to reduce the cost of ownership.

## Transportation.

The world is moving fast and mobility is a major requirement in the world of today. This goes along with increasing efficiency of modern vehicles resulting also in higher temperatures and tightening emission legislation. In cars and trucks as well as in heavy duty, marine, and aerospace applications Dyneon Fluoroelastomers withstand the toughest challenges.

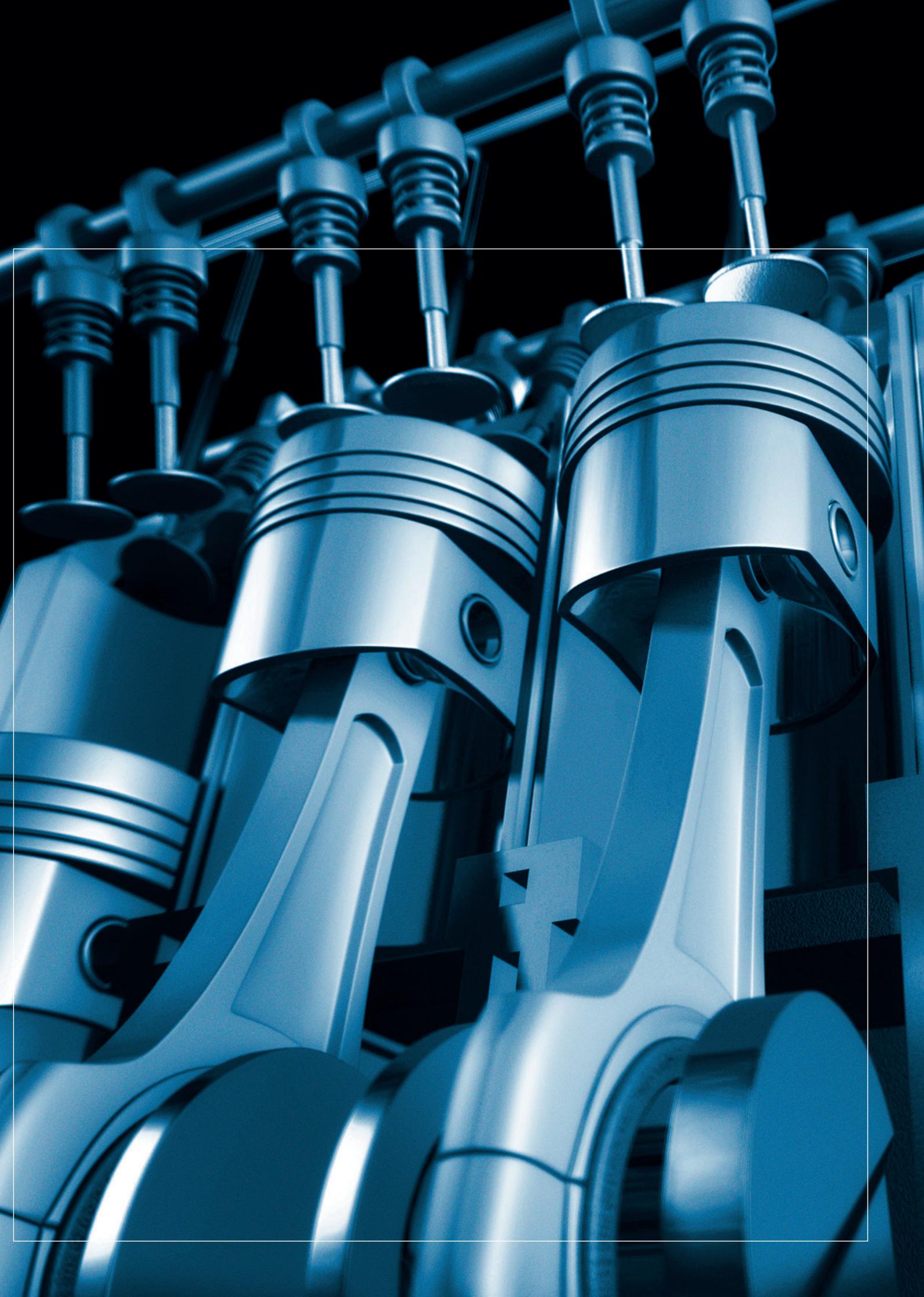
## Chemical Process Industry.

With a broad chemical and thermal resistance our fluoroelastomers help to increase the efficiency of chemical plant equipment by reducing downtime and production outages and consequently the cost of ownership. Constantly increasing requirements on safety and reliability under harshest conditions convince processors, equipment suppliers, and component suppliers to rely on 3M products.

## Oil & Gas.

With very specific applications and requirements the oil & gas industry deserves specific attention – and specific products. Due to the fact that the exploration of oilfields is becoming more and more challenging, 3M is constantly working on new products and expanded test methods to adapt to the needs of the market.





Our experienced technical service team is at hand to help you make the best decisions: from the choice of the right polymer, the composition of the perfect compound, right up to the adjustment of your process to make it as cost efficient as possible. Independent of the product you manufacture, whether it is an o-ring or a moulded good with complex shape, or metal bonding, our technical service will support you in reaching the best conditions for the finished part, fast cycle time, low scrap rate, excellent demoulding, low mould fouling – whatever your challenge might be.

## Injection Moulding.

An efficient and reliable process is key for a cost effective mass production. This translates into excellent scorch safety and fast cure to guarantee fast cycle times. Low mould fouling and good demouldability are additional parameters to be considered. Low and medium viscosity fluoroelastomers are the preferred materials.

## Transfer Moulding.

Requirements are comparable to injection moulding processes, but special attention must also be given to scorch safety in order to avoid curing in the transfer pot. Again low and medium viscosity grades should be considered first.

## Compression Moulding.

High precision parts require well prepared pre-forms (e.g. cord). Higher viscosity fluoroelastomers enable the processors to produce parts without air entrapments. Additional attention needs to be attributed to the cure profile of the selected fluoroelastomer compound. Best results can be obtained using medium to high viscosity grades.

## Extrusion.

Also here the stable process is the objective for an efficient production. Material selection and compound design are determinants of a smooth extrudate. Of equal importance is the right extrusion equipment including barrel size, screw geometry, and the surface quality of the die. Best results require the use of low viscosity materials with good scorch safety.

For all manufacturing processes our experienced technical support is ready to help you overcome the challenges in your process.





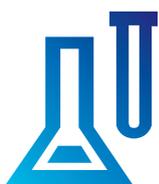


# Is it getting aggressive?

3M™ Dyneon™ Fluoroelastomers are the first choice when it comes to aggressive chemical environments. The chemical media in general industry, in transportation, and comparable applications in other industry segments are very demanding and requirements are subject to constant change.

The performance profile of Dyneon Fluoroelastomers can provide the most effective resistance profile for your application. Our portfolio, including grades with incorporated bisphenol cure system and peroxide curable products, both with different fluorine contents and viscosities, can help you to design and create the finished product that is perfect for the job.

► [Please fold out this page for more details.](#)



### Chemical and thermal resistance of 3M™ Dyneon™ Fluoroelastomers

	Dyneon Bisphenol cure Fluoroelastomers	Dyneon PO Fluoroelastomers	Dyneon Low Temperature Fluoroelastomer
Acids	-	+	+
Alcohol (Methanol)	+*	+*	+
Alcohol (others)	+	+	+
Aliphatic Hydrocarbons	+	+	+
Alkali (Concentrated)	-	+	+
Alkali (Dilute < 5%)	o	+	+
Aromatic Hydrocarbons	+	+	+
Biodiesel	o	+	+
<b>Fuels</b>	See separate chart		
Lubricants	+	+	+
Lubricants; highly amine additivated	o	+	+
Oxidation	+	+	+
Ozone	+	+	+
Radiation	+	+	+
Steam > 150 °C	-	+	+
Water < 100 °C	+	+	+
Water 100 – 150 °C	o	+	+
Water > 150 °C	-	o	o

Excellent resistance (little or no effect)	+
Good to excellent resistance (moderate effect)	o
Not recommended (substantial effect)	-

\* Depending on fluorine content

### Chemical and thermal resistance of 3M™ Dyneon™ Perfluoroelastomers

	PFE 90Z	PFE 40Z	PFE 131TZ	PFE 7104BZ	PFE 7502BZ	PFE 7301BZ	PFE 7403WZ
<b>Chemical Resistance</b>							
Acids	++	++	++	++	++	++	++
Hydrochloric acid	+	++	++	+	++	++	++
Nitric acid	+	++	++	+	++	++	++
Sulfuric acid	++	++	++	++	++	++	++
Carboxylic acid	+	++	++	+	++	++	++
Bases (Ammonia, NaOH)	++	++	++	++	++	++	++
Ethylene Diamine	++	++	+	++	+	+	+
Hot Water	+	++	o		++	o	o
Steam	++	++	+	++	++	+	+
Oxygenated Plasmas	n/a	n/a	n/a	n/a	n/a	n/a	Outstanding
Fluorinated Plasmas	n/a	n/a	n/a	n/a	n/a	n/a	Outstanding
<b>Temperature Resistance</b>							
Continuous (h)	220	220	316	220	275	316	316
<b>Compression Set</b>							
70 hrs @ 200 °C	29	15	14	29	15	14	18

Rating	++	+	o	-	--
% Swell	< 10	11-20	21-30	31-50	> 50

## Resistance of 3M™ Dyneon™ Fluoroelastomers to automotive fluids

Fuels	Test Conditions		Fluoroelastomer Bisphenol cure/PO cure	
	Temperature (°C)	Duration (h)	low %F	high %F
Fuel C	60	168	+	+
FAM A	60	168	o	++
CE 10	60	168	o	+
CE 22	60	168	o	+
CE 85	60	168	o	+
CM 30	60	168	-	+
FAM B	60	72	-	+
FAM B	60	168	-	+
Methanol	40	168	-	+
SME	125	1008	-	+*
RME	150	504	-	+*
Total AdBlue®	80	168	+	+
Total AdBlue®	125	168	-	-

\* Depending on compound formulation

	Temperature (°C)	Duration (h)	Di/Terpolymer Bisph	Terpolymer PO cure
<b>Blow by condensates (BMW GS 97018)</b>				
Blow by condensate 1	120	72	-	o
Blow by condensate 2	120	72	o	+
<b>Coolants</b>				
AC Delco Dex-Cool™ #10-101	150	504	-	o
AC Delco Dex-Cool™ extended life	107	168	o	+
Water/Ethylene glycol	150	168	o	+
<b>Engine Oils</b>				
Lubrizol OS 206304	150	94	+	+
<b>Gear Lubricants</b>				
Burmah SAF XO	150	500	-	o
Chrysler™ MS-9763	150	168	-	o
Chrysler™ MS-9763	125	1008	o	+
Chrysler™ MS-9020	150	168	-	o
Unocal™ 98-01-04 MPF Gear Oil SAE 90	150	168	+	+
<b>Transmission Fluids</b>				
ATF Esso LT 71141	150	168	-	+
Chrysler™ MS-9602	150	168	o	+
Chrysler™ MS-9602	125	1008	o	+
Dexron™ VI, ATF	150	168	-	-

Chrysler is a trademark of Chrysler Corporation  
 Delco Dex-Cool and Dexron are trademarks of General Motors Corporation  
 Lubrizol is a trademark of Lubrizol Corporation  
 Unocal is a trademark of Union Oil Company

Excellent resistance (little or no effect)	+
Good to excellent resistance (moderate effect)	o
Not recommended (substantial effect)	-



# Is it getting hot?

3M™ Dyneon™ Fluoroelastomers withstand the heat and control permeation.

Chemical resistance cannot be considered independently from thermal stability. A material which withstands a specific substance at room temperature might fail at elevated temperatures. Therefore thermal resistance in air and in the respective media is key and that is a major argument for using fluoroelastomers.

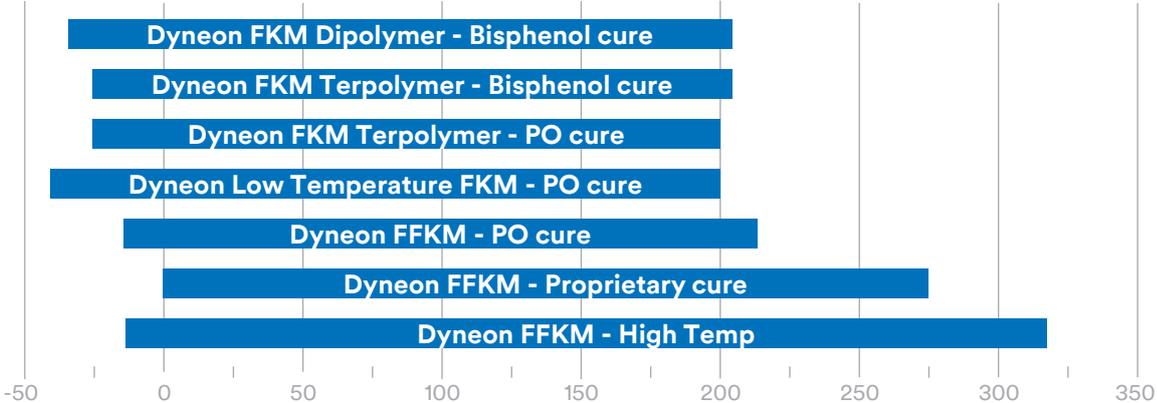
The applications become more and more demanding: with the demands for lower and lower emissions the engines in today's cars need to be more and more efficient, which results in higher temperatures under the hood.

Not only thermal resistance influences the excellent match of Dyneon Fluoroelastomers with the environmental requirements of today, but also the resistance to permeation. This is equally important for the automotive industry and the chemical process industry where sealing materials with increased service temperatures and reduced permeation help to extend the lifetime of the equipment, protect the environment, and reduce cost.

► [Fold back this page to find more details on the superior high temperature performance of Dyneon Fluoroelastomers and their excellent resistance to permeation.](#)



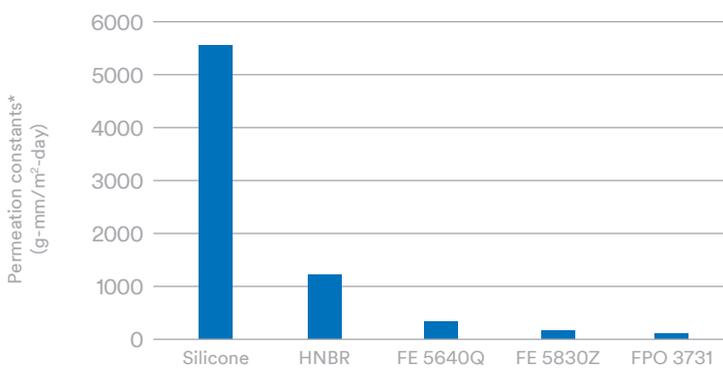
# Effective service temperature range of 3M™ Dyneon™ Fluoroelastomers.\*



\*Temperature range in °C; test results based on retention of physical properties

The most important determinant of thermal stability is the curative package used. As indicated in the chart above fluoroelastomer compounds based on bisphenolic cure systems show a thermal stability slightly more beneficial than compounds based on peroxide cure systems. The ultimate performance can be reached when perfluoroelastomer grades are used which are specially designed for high temperature applications. These grades take advantage of a nitrile curative package.

## Permeation data for elastomers commonly used in automotive applications.



\*CE10 Fuel @40 °C, 3 weeks

FE 5640Q: Bisphenol cure dipolymer, 65,9%F

FE 5830Z: Bisphenol cure terpolymer, 70,0%F

FPO 3731: Peroxide curable terpolymer, 69,8%F

## Permeation Testing.

With the implementation of new global regulations restricting the amount of evaporative emissions allowed by automobiles it is becoming increasingly important to understand and develop permeation measurement techniques that allow for accurate characterisation of a polymer or part. 3M is recognised in the automotive industry for its expertise and developments in permeation test methodologies that yield results that are accurate, reproducible, and scalable to commercial constructions.

# We pave the way to your success.

A product is only a good product when it fits to the process of the customer. Even the broadest product portfolio cannot cover each and every different processing requirement. Therefore we do not only offer our highly rated technical service, but also a range of elastomer additives to adjust the formulation precisely to the customer's needs.

## 3M™ Dynamar™ Rubber Additives.

A special curative package consisting of three products has been designed to enhance the bonding of ECO, NBR or NBR/PVC compounds to bisphenol cured FKM without the need for external bonding agents.

This package when added to ECO compounds, allows the processors to eliminate lead from their formulations, yet maintain excellent heat-age properties.

## 3M™ Dynamar™ Elastomer Additive FC 2171.

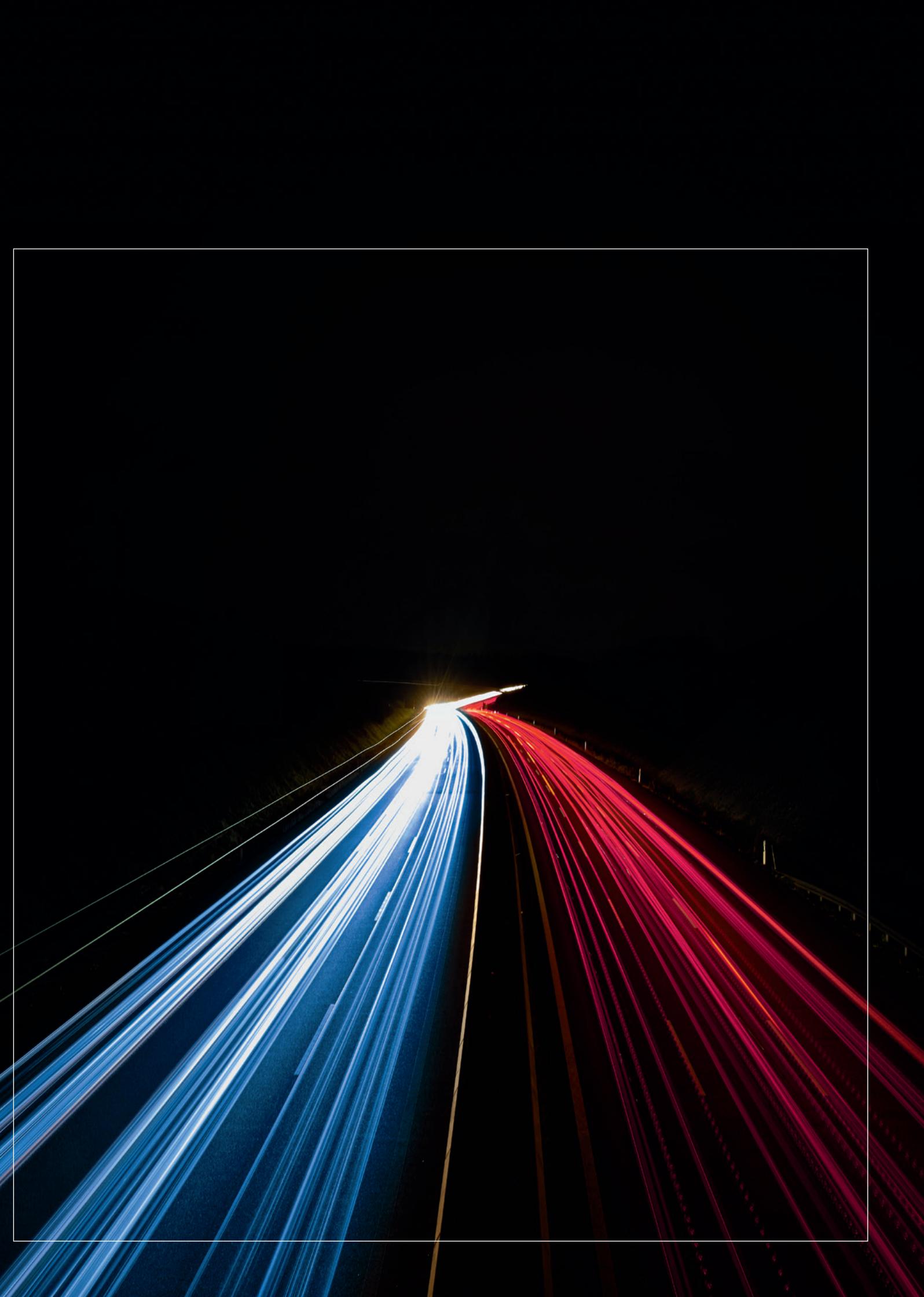
This product has been developed to enhance the processing of bisphenol-cured fluoroelastomers by offering reduced mill sticking, improved mould release (levels < 5 phr) and faster extrusion rates (at levels > 10 phr).

## Bonding Technology.

3M has a wide array of bonding technologies that allow processors to bond fluoroelastomers and fluoroplastics to a wide variety of metal and non-metal substrates (i.e. VMQ, ECO, NBR, NBR/PVC, HNBR, FP, etc.). This technology is well demonstrated in current commercial hose constructions but is also applicable to other composite structure requirements.

3M also offers primerless technology that can enable bonding to various steel substrates without the need for external priming or bonding agents. This can offer significant processing savings.





# Let's talk products.

The comprehensive portfolio of 3M™ Dyneon™ Fluoroelastomers includes a wide range of products: from bisphenolic and peroxide curable raw gums to di- and terpolymers with incorporated bisphenol curative package to special grades for low temperature applications and perfluorinated elastomers for ultimate thermal stability and chemical resistance.

► Please see details in the Product Comparison Guide in the pocket on the opposite page.

## Needless to say

Indicative of our commitment, most 3M design, development, production and service facilities have achieved global quality management certification. Production facilities have also received certification for their environmental management system. Please see the Dyneon website ([www.dyneon.eu](http://www.dyneon.eu)) for the most up-to-date certification details.

## Technical Information and Test Data

Technical information, test data, and advice provided by Dyneon personnel are based on information and tests we believe are reliable and are intended for persons with knowledge and technical skills sufficient to analyse test types and conditions, and to handle and use raw polymers and related compounding ingredients. No license under any Dyneon or third party intellectual rights is granted or implied by virtue of this information.

General recommendations on health and safety in processing, on work hygiene and on measures to be taken in the event of accident are detailed in our material safety data sheets.

You will find further notes on the safe handling of fluoropolymers in the brochure "Guide for the safe handling of Fluoropolymers Resins" by PlasticsEurope, Box 3, B-1160 Brussels, Tel. +32 (2) 676 17 32.

The present edition replaces all previous versions. Please make sure and inquire if in doubt whether you have the latest edition.

## Important Notice

All information set forth herein is based on our present state of knowledge and is intended to provide general notes regarding products and their uses. It should not therefore be construed as a guarantee of specific properties of the products described or their suitability for a particular application. Because conditions of product use are outside Dyneon's control and vary widely, user must evaluate and determine whether a Dyneon product will be suitable for user's intended application before using it. The quality of our products is warranted under our General Terms and Conditions of Sale as now are or hereafter may be in force.

## Where to go for more information?

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