

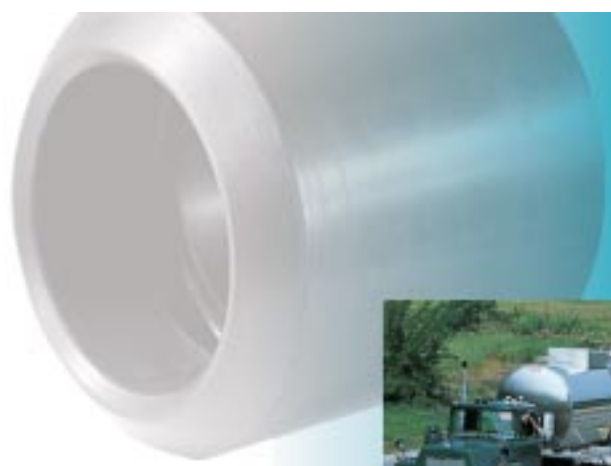


Viton[®] fluoroelastomer

A Product of DuPont Dow Elastomers

FOR MORE RELIABLE RUBBER
COMPONENTS AND SEALS... SPECIFY
VITON FLUOROELASTOMERS

- ▶ **Reduce Lifetime Costs**
- ▶ **Cut Unscheduled Downtime**
- ▶ **Increase Temperature Capability**
- ▶ **Stand Up to Aggressive Fluids**
- ▶ **Comply with Tougher Regulations**





Seals, rubber parts last longer with Viton® fluoroelastomers

Viton can help you reduce costs by preventing sealing failures, extending maintenance intervals, handling more aggressive fluids and higher temperatures, increasing safety, and meeting stringent environmental regulations.

With Viton, you can meet these needs with performance proven by decades of service in harsh environments.

REDUCE LIFETIME COSTS

Viton far outlasts nitriles and other general-purpose elastomers. It allows you to extend service intervals and stretch maintenance dollars.

CUT UNSCHEDULED DOWNTIME

Viton protects against unscheduled downtime because it provides increased reliability. You can extend warranty periods with greater confidence.

INCREASE TEMPERATURE CAPABILITY

In many applications, rubber parts are stressed by accidental temperature excursions as well as by increases in operating temperatures designed to increase production. In some situations, Viton can serve continuously at 204°C (399°F) with excursions to 315°C (599°F).

STAND UP TO AGGRESSIVE FLUIDS

Viton performs well in a wide range of aggressive fluid environments. Systems can tolerate changes in fluids and have more versatility for broader application.

COMPLY WITH TOUGHER REGULATIONS

Environmental regulations have raised the stakes for leaks, spills and emissions. Viton helps guard against these problems and increases safety for workers and plant neighborhoods.

PROVEN PERFORMANCE

Since its introduction in 1957, Viton has solved sealing and other problems in major industries:

- Aircraft and Aerospace*
- Automotive*
- Chemical Processing and Transportation*
- Off-Highway and Heavy-Duty Equipment*
- Petroleum Refining and Transportation*

Major uses include bonded seals, radial lip seals, caulks, coatings, vibration dampeners, expansion joints, gaskets, O-rings, piston seals, custom shapes, and stock rod and sheet.

LEARN MORE ABOUT WHAT VITON CAN DO FOR YOU

This brochure contains extensive technical data and information to show what Viton can do for you. It's all here: data confirming superior thermal, chemical and mechanical performance, and comparisons with other elastomers. Basic information is included to help you select the best type of Viton for your application, along with examples of economic analyses.



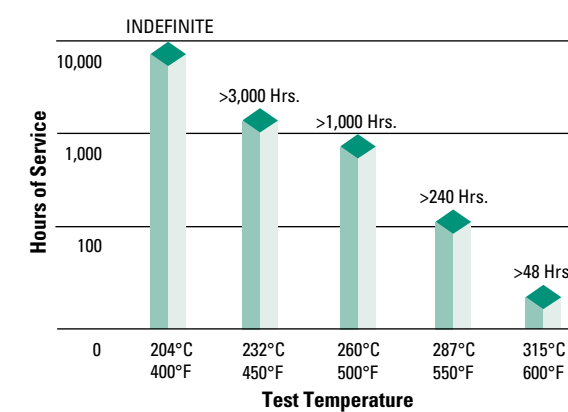
Viton in O-rings and other parts extends maintenance intervals for heavy-duty equipment.

SUPERIOR THERMAL STABILITY

Resisting damage from thermal upsets is important insurance against failure for seals and other components. Viton® fluoroelastomers resist hardening and embrittlement indefinitely in air at up to 204°C (399°F), and they endure thermal excursions to 315°C (599°F) (Figure 1). And with the high-temperature capability of Viton, some users can increase operating temperatures to improve productivity or gain other advantages.

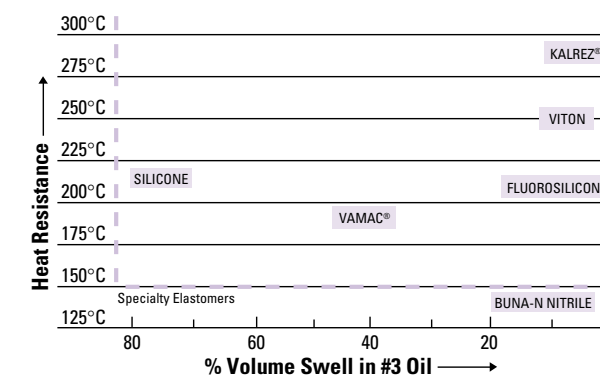
Viton delivers at low temperatures, too. Dynamic seal applications for Viton have been successful at -40°C, and in some cases, appropriately designed parts of Viton can still offer static sealing capabilities down to -160°C.

FIGURE 1: HEAT RESISTANCE OF VITON



What's more important, Viton retains good performance in fluids at elevated temperatures. Figure 2 compares the performance of Viton and other elastomers in a standard SAE/ASTM test that measures volume swell in hot oil. A swell of more than 30% is usually unacceptable.

FIGURE 2: HEAT AND OIL RESISTANCE OF SPECIALTY ELASTOMERS (ASTM D2000/SAE J200)



BROAD CHEMICAL COMPATIBILITY

Because Viton is compatible with a very wide range of chemicals, fuels and solvents, it can reduce costs through extended service life and reduced unscheduled downtime for seals and components. Broad compatibility also increases product versatility to extend applications. Much more information is available about the performance of Viton with chemicals and fluids. The DuPont Dow publication, "Fluid Resistance of Viton®," can be obtained from any DuPont Dow Elastomers office listed on the back cover.

PERMEATION RESISTANCE TO FIGHT EMISSIONS

Even if high temperatures or aggressive fluids aren't involved, Viton may be specified because it has good resistance to permeation. In automotive, chemical processing and other industries, Viton helps control fugitive emissions to meet Clean Air Act requirements.

TABLE 1: PERMEATION RATES FOR SELECTED ELASTOMERS, NYLON 12 AND FLUOROPOLYMERS.*

Material	Average Permeation Rate for ASTM Standard Fuels, (g x mm) (m ² x days)			
	Fuel C	90% Fuel C, 10% Ethanol	85% Fuel C, 15% Methanol	15% Fuel C, 85% Methanol
NBR (33% ACN)	669	1028	1188	264
HNBR (44% ACN)	230	553	828	211
Fluorosilicone	455	584	635	261
Nylon 12	5.5	24	83	90
Viton GLT	2.6	14	60	149
Viton B70	0.8	6.7	32	95
Viton A200	0.8	7.5	36	55
Viton GFLT	1.8	6.5	14	11
Viton B200	0.7	4.1	12	7.4
Viton GF	0.7	1.1	3.0	0.9
Tefzel® ETFE 1000LZ	0.03	0.05	0.20	0.20
Teflon® PFA 1000LP	0.05	0.03	0.13	0.05
Teflon® FEP 1000L	0.03	0.03	0.03	0.03

* Mathematically normalized to 1 mm thicknesses using data from tests described in ASTM E96-53T.

Table 1 shows permeability to standard ASTM fuels for general purpose and specialty types of Viton and several other materials. Other information about types of Viton is given on page 5 in "Selecting the Type of Viton® That's Best for You."

Sealing components of Viton resist chemical attack and permeation to help cut emissions and increase safety.



TABLE 2: COMPARISON OF ELASTOMER PROPERTIES*

Common Name	Neoprene	Ethylene Propylene	Buna-N Nitrile	VAMAC®	Silicone	Fluoro-silicone	VITON®	KALREZ®
ASTM D1418 Designation	CR	EPM, EPDM	NBR	AEM	MQ, VMQ	FVMQ	FKM	FFKM
ASTM D2000 Designation	BC, BE	CA, DA	BG, BK	EE, EP	FE, GE	FK	HK	HK+
Service Temperature								
Max. Continuous Service Temperature	105°C	150°C	121°C	150°C	230°C	175°C	204°C	316°C
Low Temperature Properties (Tg)	-50°C	-54°C	-30, -25°C	-16°C	-125, -85°C	-65°C	-30, -17°C	-8°C
Chemical Compatibility**								
Lubricating Oils	2	4	1	1	4	1	1	1
Fuel Oils	2	4	1	1	4	1	1	1
Hydraulic Oils	2	4	1	1	2,3	1	1	1
Fireproof Hydraulic Fluids	2	1	3	4	3	4	4	1
Vegetable Oils, Animal Fats	2,3	2,3	1	1	1,3	1	1	1
Gasoline (high octane)	3,4	4	1,2	3	4	1	1	1
Kerosene	2	4	1	2	4	1	1	1
Aromatic Hydrocarbons	4	4	2,4	4	4	2,3	1	1
Aliphatic Hydrocarbons	2	4	1	1	4	2	1	1
Alcohols	1	2	1	1	2	1,2	1	1
Ketones	3,4	1	4	4	4	4	4	1
Halogenated Solvents	4	4	4	3	4	1,2	2	2
Water (<80°C)	1,2	1	1	1	1	1	1	1
Water (>80°C)	3	1	1	1	1	1	1	1
Concentrated Acids	4	4	4	4	4	3	2	1
Diluted Acids	2,3	2	3,4	1	4	3	1	1
Alkalis	1,2	1	2	4	1,2	2	4	1
Mechanical Properties								
Tensile Strength, MPa	25	17	27	15	10	10	20	15
Hardness, Durometer, Shore A (D)	30-95	40-90	40-95	40-90	30-90	40-80	55-95	65-95

*Data has been drawn from tests at DuPont Dow facilities and industry sources. Data is presented for use only as a general guide and should not be the basis for design decisions. See the back of this brochure for additional information about the data.

**Key: Chemical Compatibility: 1 = Satisfactory; 2 = Fair; 3 = Doubtful; 4 = Unsatisfactory.



Parts of Viton maintain their sealing force despite constant use and harsh chemical environments.

A TOUGH CONTENDER

The compatibility of Viton fluoroelastomers with some important materials is shown in Table 2. The capabilities of other elastomers shown for comparison can be helpful when you're considering changing materials to increase reliability or accommodate more severe operating conditions.

Viton also offers mechanical ruggedness so seals and components resist damage during installation and use. Basic mechanical property data listed show that Viton compares favorably with other elastomers in tensile strength, range of hardness and leak-preventing resistance to compression set.

Viton retains sealing force to prevent leaks even after compression for long periods in severe environments. After 100 hours in air at 150°C (302°F), Viton retains more than 90% of its original sealing force, while seals of fluorosilicone, polyacrylate and nitrile retain only 70%, 58% and 40%, respectively.

Viton has excellent resistance to atmospheric oxidation, sunlight and ozone. After 20 years of exposure to direct sunlight, seals of Viton showed no traces of cracking. In addition, Viton did not crack after one year in an atmosphere containing 100 ppm ozone.

Viton is more resistant to burning than hydrocarbon rubbers.

SELECTING THE TYPE OF VITON® THAT'S BEST FOR YOU

We've developed many types of Viton to meet specific end-use and processing needs. Table 3 shows how different types of Viton compare in chemical resistance and mechanical properties.

Selecting the type that best meets your needs is important, but it isn't complicated, and help is available from DuPont Dow Elastomers. The general purpose types differ primarily from the specialty types in chemical resistance. In the specialty family, the choice is among four types that are tailored for superior fluid resistance, low-temperature performance or combinations of these properties.

Each type of Viton is available in a number of grades. The grade to be used for a specific application is selected for manufacturability as well as performance.

PART COSTS OR LIFE CYCLE COSTS?

When Viton is specified, it's not because "nothing else will work." Although they usually cost more than parts made with ordinary elastomers, parts of Viton are selected because they deliver higher value through increased reliability and service life.

The additional cost of a seal of Viton is insignificant, for example, compared with the cost of the pump it protects, or of lost business, pollution or safety risks due to the pump's failure.



Because Viton resists hydraulic fluids and fuels over a wide temperature range, it is widely used for high-reliability seals and other applications in aircraft.

TABLE 3: RELATIVE CHEMICAL COMPATIBILITY AND MECHANICAL PROPERTIES OF VITON FLUOROELASTOMERS

Chemical Environment	Viton—General Use Family Types			Viton—Specialty Family Types				
	A	B	F	GB, GBL	GF	GLT	GFLT	
Automotive and aviation fuels	1	1	1	1	1	1	1	
Automotive fuels oxygenated with MEOH, ETOH, MTBE, etc.	NR	2	1	2	1	NR	1	
Engine lubricating oil, SE and SF	2	1	1	1	1	1	1	
Engine lubricating oil, SG and SH	3	2	1	1	1	2	1	
Aliphatic hydrocarbon process fluids, chemicals	1	1	1	1	1	1	1	
Aromatic hydrocarbon process fluids, chemicals	2	2	1	1	1	2	1	
Aqueous fluids, steam, mineral acids	3	2	2	1	1	1	1	
Compression and low-temperature performance								
Resistance to compression set	1	2	2	2	3	2	2	
Low-temperature flexibility	2	2	3	2	3	1	1	

Key: 1 = Excellent 2 = Very Good 3 = Good NR = Not Recommended

Consider these situations for seals:

- **Seals must be replaced due to failure.** Since seals of Viton can last much longer than other seals, they may never need to be replaced during the life of the equipment. Thus, unscheduled downtime costs are eliminated.
- **Seals are replaced on a schedule.** If longer-lasting seals of Viton are used, their cost can be offset by extending maintenance intervals.
- **Seals are replaced in a few of many identical units.**

Seals of Viton can lower costs when seal replacement is covered by a warranty. If as little as 1% of a production process requires warranty service for seal replacements, reliable seals of Viton will save more than their incremental cost.



Thanks to its broad chemical compatibility, Viton in gaskets and valve components allows transportation equipment to be used for a wide range of materials.



**ASSURE PERFORMANCE
BENEFITS BY SPECIFYING
VITON® FLUROELASTOMERS**

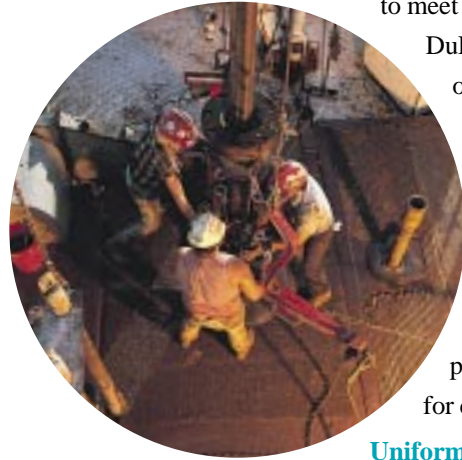
Viton gives you advantages over other fluoroelastomers because its performance is supported by innovation, quality and long experience.

The right product for you. No other manufacturer offers as broad a selection of fluoroelastomer types to meet your specific application needs.

DuPont Dow scientists are inventors on more breakthrough patents in the fluoroelastomer field and have developed more technology firsts in this area than any other manufacturer. This technical innovation has been focused on meeting user needs for improved performance and product grades for cost-effective processing.

Uniformity. DuPont Dow Elastomers is the only fluoroelastomer producer with multi-site, worldwide ISO 9002 registration. This quality assurance for fluoroelastomers is available only from DuPont Dow.

Solutions, not problems. All the benefits of DuPont knowledge are available to you when you use Viton. Since 1957, longer than any other manufacturer, DuPont, and now DuPont Dow have continuously supported the development of new fluoroelastomer technology and products.



The variety of harsh chemicals used in petroleum exploration make Viton an excellent choice for reliable service.

**MAKE SURE YOU GET
WHAT YOU SPECIFY**

You can make sure that you're receiving the quality and performance benefits of Viton by insisting that your parts carry the Viton certification mark. Or you can ask your supplier to document in writing that your parts are made with Viton.

Fluoroelastomers move through compounders to parts manufacturers, and finished parts often are sold to distributors or component manufacturers or OEMs before they reach end users. Because this supply chain is so long, communications can break down. Users may not be sure they've received parts made with the material they've selected. If you select Viton, insist on the DuPont Dow certification mark or other documentation to be sure you are getting Viton.

PUT VITON TO WORK FOR YOU

Contact any of the DuPont Dow offices on the back cover for more information. We're ready to work with you and your parts supplier to recommend the correct type of Viton and the best formulation to meet your needs.



Automotive OEMs use low-permeability components of Viton in fuel systems to help meet Clean Air Act requirements.

THE "MADE WITH GENUINE DUPONT DOW ELASTOMERS VITON®" CERTIFICATION MARK IS YOUR ASSURANCE OF QUALITY THAT ONLY VITON FLUROELASTOMERS CAN PROVIDE.



**For more information on
Viton® fluoroelastomers:**

**302-792-4000
www.dupont-dow.com**

Global Headquarters

DuPont Dow Elastomers L.L.C.
300 Bellevue Parkway, Suite 300
Wilmington, DE 19809
Tel. (302) 792-4000
Fax. (302) 892-7390

**South and Central America
Regional Headquarters**

DuPont Dow Elastomers Ltda.
Rua Henrique Monteiro, 90
5:andar—Pinheiros
Sao Paulo—SP 05423-912
Brazil
Tel. +55-11-816-0256
Fax. +55-11-814-6845

European Regional Headquarters

DuPont Dow Elastomers S.A.
2, chemin du Pavillon
CH-1218 Le Grand-Saconnex
Geneva, Switzerland
Tel. +41-22-717-4000
Fax. +41-22-717-4001

Viton Business Center

DuPont Dow Elastomers L.L.C.
505 Blueball Road
Triumph Industrial Park
P.O. Box 306
Elkton, MD 21922-0306
Tel. (410) 392-2500
Fax. (410) 392-2540

Asia Pacific Regional Headquarters

DuPont Dow Elastomers PTE Ltd.
1 Maritime Square #10-54
World Trade Center
Singapore 099253
Tel. +65-275-9383
Fax. +65-275-9395

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