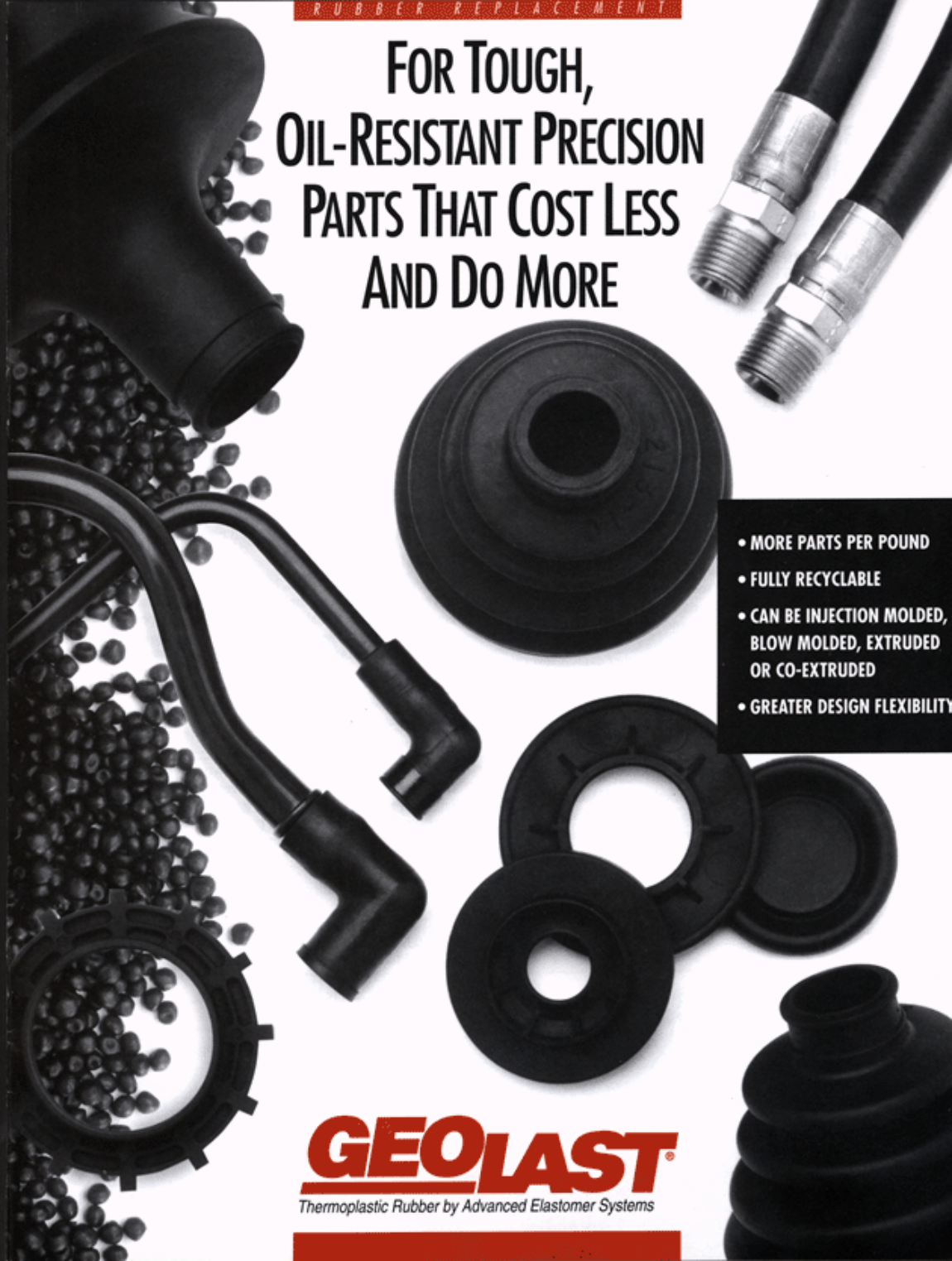




FOR TOUGH, OIL-RESISTANT PRECISION PARTS THAT COST LESS AND DO MORE

- MORE PARTS PER POUND
- FULLY RECYCLABLE
- CAN BE INJECTION MOLDED,
BLOW MOLDED, EXTRUDED
OR CO-EXTRUDED
- GREATER DESIGN FLEXIBILITY

GEOLAST®

Thermoplastic Rubber by Advanced Elastomer Systems

Performs Like Rubber, Processes Like Plastic

Geolast[®] Thermoplastic rubber is an oil-resistant thermoplastic elastomer (TPE) from Advanced Elastomer Systems that performs with the versatility of rubber and processes with the efficiency of thermoplastic.

For years, nitrile rubber (NBR) and epichlorohydrin (ECO) have been known for their resistance to gasoline and oils. But designers have had to include loose dimensional tolerances in their NBR and ECO rubber products. Batch mixing, slow vulcanization, and piles of unusable scrap are problems processors face. Now you can design for close, tight, injection molded tolerances and say good-bye to those processing dilemmas. With Geolast rubber you gain through cost savings and better performance over thermoset rubbers, such as NBR, polychloroprene, ECO and even some urethanes.

Performance Competitive With NBR And ECO

Geolast rubber features good retention of properties in hot air and hot oil aging (see Figure 4). Geolast rubber provides a good combination of the low-temperature (-40°C [-40°F]) performance and the degree of oil resistance commonly associated with NBR and ECO rubber compounds. Parts made of Geolast rubber exhibit low oil swell. In addition, the low compression set of Geolast rubber makes it suitable for use in sealing applications.

Part Design With Freedom

Injection molded parts made from Geolast rubber feature two to three times tighter tolerances than thermoset NBR or ECO. Geolast rubber simplifies your design of parts with either massive or delicate wall thicknesses. And you can simplify multi-part designs while you eliminate metal inserts. With grades ranging in hardness from 70 Shore A to 45 Shore D, Geolast rubber can be used to create high-performing, dual-durometer parts. Geolast rubber frees you to design for performance requirements instead of confining you within the processing limits of thermoset technology.

Cost Saving And Efficiency

Standard thermoplastic processing of Geolast rubber saves time and production steps compared to thermoset rubber. Geolast rubber can be blow molded into various ID/OD shapes with good tolerance control. Geolast rubber also can be insert molded or co-injection molded – processes not practical for thermosets. For extrusions, Geolast rubber has low die swell, which minimizes the trial-and-error process of tuning your extrusion dies.

You can control costs by heat-welding components to make larger assemblies, without the high cost of injection molded joints. You can regrind and reuse clean Geolast rubber scrap, retaining key physical properties even after multiple regrinds. The specific gravity of Geolast rubber is 15% to 30% lower than NBR or ECO. This means you can create more parts per kilogram or pound and produce lighter-weight parts. Geolast rubber lets you design a better part and make it faster, with savings of 15% or more.

Where Geolast Rubber Can Go To Work

Geolast rubber is effective in jobs demanding oil resistance, wide service temperatures and cost efficiency.

AUTOMOTIVE

Air ducts, vibration bellows, blow molded boots, brake fluid reservoir seals carburetor components, covers, diaphragms, gas cap seals, gaskets, hose covers, pressure control vent connectors, oil cap seals, spacers, shock absorber seals, vacuum connectors.

APPLIANCES

Bumpers, casters, impellers, oil seals, reservoirs, sumps, wheels.

INDUSTRIAL

Bellows, boots and breather tubes in two-cycle engines, bumpers, casters, control cables, covers, couplings, diaphragms, engine components, gaskets, hose covers, hydraulic lines, motor mounts, packing seals, rollers, seals, shock mounts, tank liners, tubing, valve seats.

PETROLEUM PRODUCTION

Dampeners, down-hole components, gaskets, injection lines, seals, covers.

Although Geolast rubber has been extensively tested in accredited laboratories worldwide, thorough end-use testing of each part is recommended prior to market introduction to assure performance.



Advantages Over Competitors

Geolast rubber's advanced combination of properties stack up well to competitive compounds such as nitrile, polychloroprene, chlorosulfonated polyethylene, epichlorohydrin and polyurethane in many applications. A comparison of properties of Geolast rubber vs. other materials is shown in Figure 1.

FIGURE 1

COMPARISON OF PROPERTIES GEOLAST® THERMOPLASTIC RUBBER VS. OTHER MATERIALS*								
	Geolast Rubber	Thermoset Rubber Compounds				Thermoplastic Elastomers		
		Nitrile	Polychloroprene	Chlorosulfonated Polyethylene	Epichlorohydrin	Santoprene® Thermoplastic Rubber	Copolyester	Polyurethane
Specific Gravity	1.0	1.2	1.4	1.4	1.4	.97	1.2	1.15
Durometer, Shore	70A - 45D	40A - 90D	50A - 90A	40A - 90A	40A - 90A	45A - 50D	40D - 70D	60A - 60D
Compression Set	G/E	G/E	G/E	G	G	G/E	F	F
Service Temperature Range, °C	-40 to 125**	-40 to 116	-46 to 121	-46 to 125	-40 to 135	-51 to 135	-68 to 135	-40 to 121
Service Temperature Range, °F	-40 to 257**	-40 to 240	-50 to 250	-50 to 257	-40 to 275	-60 to 275	-90 to 275	-40 to 250
Recyclability	yes	no	no	no	no	yes	yes	yes
Ozone Resistance	G	F	F	E	E	E	E	G/E

E = Excellent G = Good F = Fair P = Poor ** See Figure 4

The key to excellent performance and success over competitive material lies in the outstanding physical properties of Geolast rubber, detailed below in Figure 2.

FIGURE 2

TYPICAL PHYSICAL PROPERTIES OF GEOLAST® THERMOPLASTIC RUBBER*								
Property	Method	ASTM Test Data			Grade of Geolast Rubber			
		°C	°F	Units	701-70	701-70 W183	701-87 W183	703-45
Hardness	D 2240	23	73	Shore, 5 sec.	70A	80A	87A	45D
Specific Gravity	D 297	23	73	—	1.0	1.0	.99	.97
Tensile Strength	D 412	23	73	MPa (psi)	5.9 (850)	8.1 (1,175)	11 (1,600)	14.8 (2,150)
Ultimate Elongation	D 412	23	73	percent	260	290	330	350
100% Modulus	D 412	23	73	MPa (psi)	3.3 (475)	4.5 (650)	6.4 (930)	10.8 (1,570)
Tear Strength	D 624	23	73	kN/m (pli)	26 (140)	32.5 (175)	52 (290)	79 (440)
Compression Set, 22 Hours	D 395-B	100	212	percent	28	31	41	52
		125	257	percent	37	42	50	78
Tension Set	D 412	23	73	percent	9	15	25	40
Brittle Point	D 746	—	—	°C	-40	-40	-38	-35

- Hardness range from 70 Shore A to 45 Shore D enables design of oil-resistant rubber parts for rugged, durable performance.
- Low specific gravity – 15% to 30% lower than NBR – means a lower weight of Geolast rubber for a specific part. Therefore, you can manufacture 15% to 30% more parts per kilogram or pound using Geolast rubber.
- Excellent oil resistance is demonstrated without sacrifice of brittle point.

- Rugged tear strength comparable to NBR shows tough resistance to physical abuse. Good hot-tear strength means faster demolding and shorter production cycles.
- Low tension set indicates durability and resistance to loss of shape.
- Low compression set helps parts made of Geolast rubber retain their structural integrity and original shape in sealing applications – even at high temperatures.

*See Disclaimer of Warranty and Liability on back cover.

Figure 3 below details the low weight change of Geolast rubber in a broad range of fluids.

FIGURE 3

TYPICAL FLUID RESISTANCE OF GEOLAST[®] THERMOPLASTIC RUBBER*

Fluid	ASTM D 471 Test Data			Percent Weight Change, Grade of Geolast Rubber			
	Hours	°C	°F	701-70	701-70 W183	701-87 W183	703-45
ASTM #3 Oil	70	125	257	3.0	3.0	6.0	13.0
ASTM Reference Fuel C	168	23	73	20.8	24.8	23.0	22.7
Diesel Fuel #2	168	23	73	3.7	6.0	7.3	7.8
95% Ethanol	168	23	73	-2.7	-0.2	-0.3	2.2
Break Fluid (DOT 3)	168	23	73	7.7	6.3	3.5	1.0
50% Antifreeze/50% Water	168	100	212	6.0	7.3	5.3	3.0
Water	168	100	212	5.6	6.3	6.1	6.2
10% Hydrochloric Acid	168	23	73	1.4	1.2	0.7	0.5
50% Sodium Hydroxide	168	23	73	-0.9	-0.3	0.5	-0.2

In conditions of hot oil and dry heat, as shown in figure 4 below, Geolast rubber has demonstrated relatively small changes in important properties such as hardness, tensile strength, elongation and modulus.

FIGURE 4

CHANGE IN GEOLAST[®] THERMOPLASTIC RUBBER PROPERTIES*

Property	ASTM D 471 Test Data		Grade of Geolast Rubber			
			701-70	701-70 W183	701-87 W183	703-45
Hot Air Aging	For 168 Hours @ 125°C (257°F)					
Hardness, Points Change			0	0	-2	-2
Ultimate Tensile Strength, % Change			-7	+4	+8	+12
Ultimate Elongation, % Change			-30	-24	-22	-21
100% Modulus, % Change			+8	+11	+10	+13
Weight Change, %			-1.4	-1.2	-1.2	-1.2
Hot Oil Aging (ASTM #3 Oil)	For 70 Hours @ 125°C (257°F)					
Ultimate Tensile Strength, % Change			-39	-37	-20	-7
Ultimate Elongation, % Change			-35	-33	-33	-30
100% Modulus, % Change			-12	-24	+1	+8
Weight Change, %			+3	+3	+6	+13
Hot Oil Aging (IRM 903 Oil)	For 168 Hours @ 125°C (257°F)					
Ultimate Tensile Strength, % Change			-39	-26	-13	-13
Ultimate Elongation, % Change			-42	-30	-23	-37
100% Modulus, % Change			-6	-11	-7	-7
Weight Change, %			-4.3	-3.1	-0.7	+11.6

*See Disclaimer of Warranty and Liability on back cover.

With these superior physical properties, it is not difficult to see why Geolast rubber performs better than competitive materials under a variety of conditions. The next series of figures demonstrates the performance of Geolast rubber vs. NBR and ECO in a variety of tests.

GEOLAST® THERMOPLASTIC RUBBER vs. THERMOSETS

Figure 5 compares specific gravity of all grades of Geolast rubber to NBR and ECO. With Geolast rubber's lower specific gravity in all grades, you can save 15% to 30% on the weight of every part you produce. Therefore, you can manufacture more parts per kilogram or pound of raw material.

FIGURE 5

SPECIFIC GRAVITY*

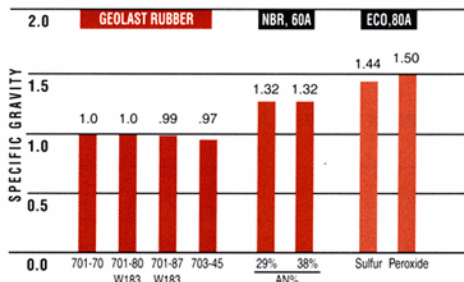


FIGURE 6

GEOLAST® THERMOPLASTIC RUBBER vs. THERMOSETS

In terms of ultimate elongation, all grades of Geolast rubber can out-perform NBR and ECO – depending on their type of cure. Consider the overall advantages gained by not having to cure Geolast rubber as you study Figure 6. Geolast rubber requires no vulcanization step in processing.

% ULTIMATE ELONGATION*

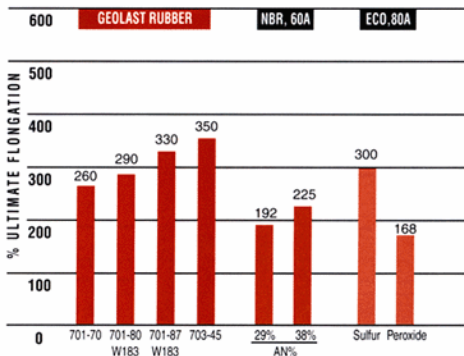
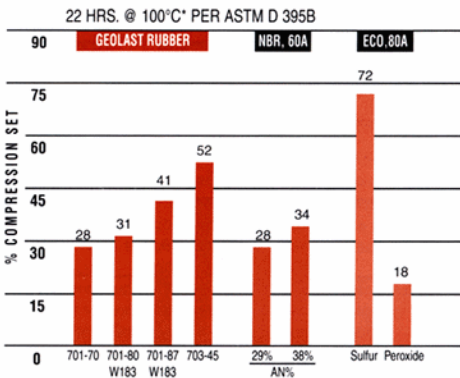


FIGURE 7

GEOLAST® THERMOPLASTIC RUBBER vs. THERMOSETS

Geolast rubber grades offer a favorable range of low compression sets for good long-term sealing. Figure 7 shows the comparison in compression set between Geolast rubber, NBR and ECO at 100°C (212°F) for 22 hours. As the figure shows, softer grades are well within the range of thermoset NBR, and all grades typically outperform sulfur-cured ECO.

% COMPRESSION SET*

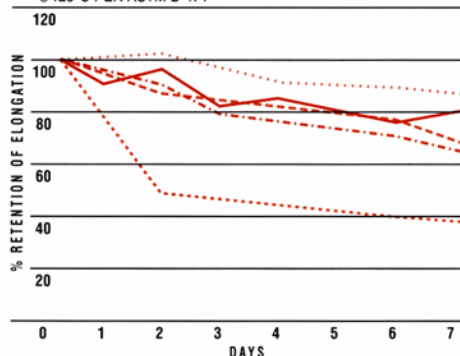


*See Disclaimer of Warranty and Liability on back cover.

FIGURE 8

HOT AIR AGING*

@ 125°C PER ASTM D 471



GEOLAST® THERMOPLASTIC RUBBER vs. THERMOSETS

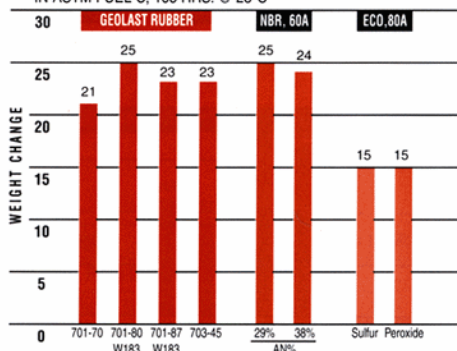
Figure 8 shows what happened when Geolast rubber was tested against NBR and ECO for hot air aging. After a week, Geolast rubber retained about 80% of its original elongation, far superior to NBR and sulfur-cured ECO. Only peroxide-cured ECO matched Geolast rubber.

- = ECO, 80A (Peroxide)
- = Geolast Rubber 701-70
- = NBR, 60A (38% AN)
- = NBR, 60A (29% AN)
- = ECO, 80A (Sulfur)

FIGURE 9

REFERENCE FUEL AGING*

IN ASTM FUEL C, 168 HRS. @ 23°C



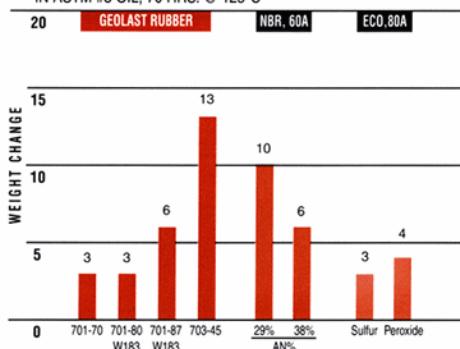
GEOLAST® THERMOPLASTIC RUBBER vs. THERMOSETS

Figure 9 shows how different grades of Geolast rubber compare to NBR and ECO after immersion in ASTM Fuel C at room temperature. All grades of Geolast rubber show weight change comparable to NBR and slightly above ECO.

FIGURE 10

HOT OIL AGING*

IN ASTM #3 OIL, 70 HRS. @ 125°C



GEOLAST® THERMOPLASTIC RUBBER vs. THERMOSETS

How well Geolast rubber stacks up to competition in ASTM #3 oil at high temperatures is demonstrated in Figure 10. Softer grades show weight change that is less than, or comparable to, NBR and equal to ECO. In general, softer grades of Geolast rubber offer excellent low weight change characteristics at an economical finished part cost.

*See Disclaimer of Warranty and Liability on back cover.

Performance Summary

The competitive performance attributes of Geolast rubber offer many advantages over thermoset rubber when specified for flexible applications. When compared to NBR and ECO, Geolast rubber can provide the following advantages:

- Lower specific gravity
- Better long-term compression set than NBR or sulfur-cured ECO
- Better retention of elongation when aged in hot air
- Less weight gain than NBR in ASTM Fuel C
- Low weight gain in ASTM #3 oil and IRM 903 oil
- Outstanding performance in a broad range of fluids

Geolast rubber is processed in standard thermoplastic production systems – extrusion, injection molding, blow molding and sheet extrusion. This feature pays off with several cost-saving benefits for products requiring the oil-resistant performance of vulcanized NBR:

- Direct recycling of clean in-process scrap
- Two to three times closer control of key dimensional part tolerances
- No vulcanization required
- Shorter molding cycle time
- Lower extrusion die swell
- Ability to co-extrude with rigid thermoplastics

Outstanding Technical and Customer Service

When you work with Advanced Elastomer Systems, you have the backing of a technical services team that ensures the processing and manufacturing integrity of Geolast rubber anywhere around the world.

Comprehensive knowledge of our materials and your marketplace helps keep your production high and your costs low. Calling upon Advanced Elastomer Systems' worldwide resources, our technical professionals can assist you with your processing and manufacturing challenges. Comprehensive processing information for the injection molding, extruding and blow molding of Geolast rubber is available on request.

Our customer service offers ordering ease that fits your schedule. With timely, reliable delivery always the goal, specially-trained professionals lend expertise to shipping and storage challenges around the world and around the clock. They will answer your handling, scheduling and billing questions and will go the extra step to keep customer satisfaction high.

If you have a special design problem or have processing questions about Geolast rubber, contact Advanced Elastomer Systems for immediate technical support.



Worldwide Offices



Argentina

Simko SA
Av. de los Constituyentes 1636
1650 San Martín
Pcia. de Buenos Aires
Argentina
Phone: 54-11-4753-1111
Fax: 54-11-4753-4866



Australia

Qenos Australia Pty., Ltd.
251-305 Maitland St.
Altona, VIC. 3018
Australia
Phone: 61-3-9258-7333
Fax: 61-3-9358-4518



Belgium

Advanced Elastomer Systems NV/SA
avenue de Bâle 1
1140 Brussels, Belgium
Phone: 32-2-706-33-11
Fax: 32-2-706-33-10



Brazil

Advanced Elastomer Systems
Brasileira, Ltda.
Avenida Atlântica, 831
09060-001 Santo André - SP
Brazil
Phone: 55-11-4425-6111
Fax: 55-11-4425-9050



Canada

Advanced Elastomer Systems,
Canada, Inc.
40 King Street West
Scotiabank Plaza
Toronto, Ontario M5H 3Y4
Canada
Central/Western Canada
Phone: 905-841-8739
Fax: 905-841-8968
Quebec/Eastern Canada
Phone: 450-585-9026
Fax: 450-581-8440



Chile

Redev, Ltda.
San Camilo, 957
Santiago, Chile
Phone: 56-2-665-2019
Fax: 56-2-222-5233



Colombia

M & V Asociados Ltda.
Carrera 42 No. 166 - 27
Bogotá, Colombia
Phone: 57-1-528.1303
57-1-670.3643
Fax: 57-1-671.2906



Egypt

Entrag
7 El Boustani El Saidy Square
Talaat Harb Square
Cairo, Egypt
Phone: 20-2-392-11-18
Fax: 20-2-391-68-42



France

Advanced Elastomer Systems NV/SA
19, Le Parvis
92073 La Défense Cedex
France
Phone: 33-1-41-45-77-20
Fax: 33-1-41-45-77-59



Germany

Advanced Elastomer Systems NV/SA
Zweigniederlassung Köln
Neusser Landstrasse 16
50735 Köln, Germany
Phone: 49-221-74907-0
Fax: 49-221-74907-11



Hong Kong/China

Advanced Elastomer Systems
Hong Kong Ltd.
Unit 1706, 17/F., Central Plaza
18 Harbour Road
Wanchai
Hong Kong
Phone: 852-2-828-3228
Fax: 852-2-802-4630



India

Ulat Enterprises Pvt., Ltd.
G-24, First Floor
Vikas puri
New Delhi-110018
India
Phone: 91-11-555-7615
Fax: 91-11-555-7230



Indonesia

PT Halim Sakti
Jl. Tomang Raya No. 4
Jakarta 11430
Indonesia
Phone: 62-21-560-0400
Fax: 62-21-560-0390



Israel

Israel Barter Trading Co., Ltd.
P.O. Box 38
Ramat-Gan 52100
Israel
Phone: 972-3-6735102
Fax: 972-3-6721880



Italy

Advanced Elastomer Systems NV/SA
Filiale Italiana
Via Caduti Bollate, 38
20021 Bollate (MI)
Phone: 39-02-38300142
Fax: 39-02-38301160



Japan

Advanced Elastomer Systems
Japan, Ltd.
7F Shiba-Tsukuba Bldg.
2-4-2 Nagata-cho, Chiyoda-ku
Tokyo 100-0014 Japan
Phone: 81-3-3506-6400
Fax: 81-3-3519-7691

Advanced Elastomer Systems
Japan, Ltd.
Nagoya Sales Office
6F South House Bldg.
3-6-29 Nishiku, Naka-ku
Nagoya 460-0003 Japan
Phone: 81-52-971-8821
Fax: 81-52-950-2530



Korea

Advanced Elastomer Systems Korea, Ltd.
3rd Floor Anglican Church Building
3-7, Jeong-Dong Joong-Gu
Seoul, Korea
Phone: 82-2-736-7113
Fax: 82-2-736-7116



Mexico

Químicos Argosial, S.A. de C.V.
Lázaro Cárdenas No. 30
Col. San Jerónimo Tepetalcalt
Tlalnequil, Edo. de México 54090
México
Phone: 525-729-5700
Fax: 525-729-5714



New Zealand

ExxonMobil Chemical New Zealand, Ltd.
P.O. Box 8789
Symonds Street
Auckland, New Zealand
Phone: 64-9-3029172
Fax: 64-9-3024766



Singapore

Advanced Elastomer Systems
Singapore Pte. Ltd.
83 Science Park Dr.
P.O. Box 38
801-0304 The Curie
Singapore Science Park
Singapore 118 258
Phone: 65-773-1611
Fax: 65-773-1600



South Africa

Carst and Walker (Pty) Ltd.
P.O. Box 87-710
Houghton 2041
Republic of South Africa
Phone: 27-11-482-2929
Fax: 27-11-482-3606



Spain

Advanced Elastomer Systems NV/SA
Avda. Diagonal, 615, 4° B
08028 Barcelona, Spain
Phone: 34-93-444-96-00
Fax: 34-93-430-42-18



Sweden

Advanced Elastomer Systems NV/SA
Box 1057
Spannålsgratan 19
40522 Gothenburg, Sweden
Phone: 46-31-63-82-90
Fax: 46-31-80-29-81



Taiwan

Advanced Elastomer Systems Taiwan
Suite C, 5/F., No. 261
Sec. 3 Nanking East Road
Taipei, Taiwan
Phone: 886-2-2546-5098
Fax: 886-2-2546-5099



Thailand

Solutia Thailand, Ltd.
193/80 Lake Rajada Office Complex, 19F
Ratchadapisek Road, Klongtoey
Bangkok 10110, Thailand
Phone: 662-264-0603/5
Fax: 662-264-0944



Turkey

Polymerland Turkey
Alian Erbulak Sok Eken Han No. 6
Gayrettepe
Istanbul, Turkey
Phone: 90-212-274-34-86
Fax: 90-212-272-37-30

Solvent Uretim
Cendere Yalıv 64/B
Kagithane 80350
Turkey
Phone: 00-90-212-294-22-30
Fax: 00-90-212-294-22-45



United Kingdom

Advanced Elastomer Systems NV/SA
Unit 1 Harcourt Way
Meridian Business Park
Braunstone
Leicester LE3 2WP
United Kingdom
Phone: 44-116-289-6122
Fax: 44-116-263-1055



United States

Advanced Elastomer Systems, L.P.
388 S. Main Street
Akron, OH 44311
Phone: 1-330-849-5000
Phone: 1-800-305-8070
Fax: 1-330-849-5599

Advanced Elastomer Systems, L.P.
2401 Walton Blvd.
Auburn Hills, MI 48326
Phone: 1-248-373-5544
Fax: 1-248-373-6011

www.aestpe.com

DISCLAIMER OF WARRANTY AND LIABILITY: Although the information and recommendations set forth herein ("Information") are believed to be correct, ADVANCED ELASTOMER SYSTEMS, L.P., AND ITS AFFILIATES, MAKE NO REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, AS TO THE ACCURACY OR COMPLETENESS THEREOF, OR OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OF ANY OTHER NATURE REGARDING INFORMATION, OR ANY PRODUCT, PROCESS OR EQUIPMENT OF ADVANCED ELASTOMER SYSTEMS OR ITS AFFILIATES OR OF ANY OTHER MANUFACTURER OR SUPPLIER MENTIONED HEREIN. Nothing contained herein is to be construed as a recommendation to use any product, process, equipment or formulation in conflict with any patent. Advanced Elastomer Systems, and its affiliates, make no representation or warranty, express or implied, that the use thereof will not infringe any patent. Persons receiving information must make their own determination as to its suitability to their purposes prior to use. In no event will Advanced Elastomer Systems or its affiliates be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information or the products, processes or equipment to which Information refers. "VISTAFLEX" is a registered trademark of ExxonMobil Corporation licensed exclusively to Advanced Elastomer Systems, L.P. © Copyright 2001 Advanced Elastomer Systems, L.P. Printed in U.S.A.



**Advanced
Elastomer
Systems**

The worldwide leader in engineered TPES