

SANTOPRENE™

Brand TPVs

SpringSeal® improves pipe gasket performance



WELCOME TO MORE.
santoprene.com



Case Study:*SpringSeal® pipe gasket***Objective:***To produce a pipe gasket with a higher level of performance while using less material***Designer:***SpringSeal® Inc.***PROBLEM**

For many years, gaskets and seals for the polyethylene and PVC pipe industries were traditionally manufactured using thermoset rubber. In the mid-1990s, Mark Knapp, founder and president of SpringSeal® Inc., had the idea to develop dual hardness gaskets in order to improve sealing performance.

While dual durometer technology was available in the rubber industry, it was deemed very specialized and expensive. If a dual durometer gasket were to be successful, the design and material selection would be crucial.

**SOLUTION**

Having developed a design for a dual durometer gasket, SpringSeal of Streetsboro, Ohio initially selected an SEBS-based thermoplastic elastomer (TPE) for product trials. However, due to problems with the heat and UV resistance of the material, the gasket failed in field applications. As an alternative, a local manufacturer recommended using a thermoplastic vulcanizate (TPV), a higher performance TPE based on EPDM rubber and polypropylene. This material had not been widely considered for pipe gaskets primarily because it was not regarded as being price competitive compared to thermoset rubber.

Using a TPV was to prove critical as it allowed a gasket design that simply was not possible with thermoset rubber. Importantly, the design of the new dual durometer gasket used significantly less material, overcoming the differential in cost between the TPV and thermoset rubber. After pressure testing the pipe to compare a thermoset rubber gasket with a TPV gasket, SpringSeal discovered that dual durometer TPV gaskets improved the sealing performance by

increasing the hoop strength of the pipe. SpringSeal was so encouraged by the success of the early tests that it proceeded to further develop these initial design concepts. A new approach in gasket design and manufacturing had begun.

“We needed to find a company that could provide the right level of support – a company we could rely on to help us successfully develop these new gaskets and enable us to break into the large diameter pipe seal market. Obviously, the company would also need to provide TPV materials that would meet specific performance criteria,” said Knapp. “We selected ExxonMobil Chemical’s team for Santoprene™ TPVs because of its unparalleled expertise and experience in the elastomer industry.”

ExxonMobil was very involved in advising SpringSeal during the successful development and launch of its new products, from material recommendations to sales support involving meetings with major pipe OEMs. The minimum performance of SpringSeal’s products is dictated by standards set by ASTM, CSA and other similar organizations. The company needed a material that could not only meet these standards but surpass the performance of products manufactured using thermoset rubber. Santoprene TPV met the requirements and ExxonMobil provided data from test studies taken over a 14-year period that demonstrated the specialty elastomer would last longer and outperform the current thermoset rubber materials.

Material recommendations were in fact critical to the application with three different grades of Santoprene TPV being used to perform specific functions. One grade was for the sealing portion, another for the low-coefficient-of-friction (COF) film layer and the final grade for the high modulus reinforcement portion. To assist in SpringSeal’s product design, ExxonMobil utilized sophisticated 3-D finite element analysis (FEA) modeling to simulate stretching the gasket on the pipe, assembling the pipe joint (thus compressing the gasket), and finally fully pressurizing and stress testing the joint. In each case, a high density polyethylene (HDPE) pipe was modeled as a flexible material to accurately predict the sealing characteristics of the system. FEA determined the pipe insertion forces, seal contact pressure and appropriate material locations for a variety of seal designs. Using this data, the seals were then manufactured to specification using tri-extrusion processing.

Material Used:
Santoprene™ brand TPVs

Manufacturing Process:
Multi-layer extrusion

Color:
Black

ExxonMobil undertook in-house prototyping of tools for the complex tri-extrusion designs. Standard and proprietary tests, such as assembly force and joint tightness were also performed in-house, as well as at third party test laboratories. This “proof of concept” testing validated what the FEA model predicted – that the pipe joint could be assembled completely dry with no added external lubricant. Furthermore, the seal remained in its designed location on the pipe, eliminating the possibility of gasket roll-off, a common problem with thermoset rubber gaskets.

Application support was provided to help SpringSeal understand the various regional specifications and standards required for product selection and compliance. ExxonMobil provided processing support to optimize the critical extrusion variables associated with gasket performance and assisted with the recommendations for extruding and downstream equipment.

Finally, a cooperative development agreement was put in place at the beginning of the project. This has led to several patents between the two companies in various world areas.

Manufacturing today takes place at the company’s main plant in Garrettsville, Ohio and at a processor based in St. Louis, Missouri, using methods unavailable with traditional thermoset rubber. The thermoplastic gaskets are manufactured using high speed co- and tri-extrusion technologies and are fused together using a proprietary welding system. The gaskets are processed as a plastic at a lower temperature than the thermoset gaskets they replace. This more energy efficient process, along with the ability to recycle Santoprene TPV, is becoming an increasingly important benefit as it reduces costs and waste.

“It has been a great experience. ExxonMobil has assisted SpringSeal in all aspects of developing these new gaskets. It has taken many years to fine tune the products and bring them to market. Having ExxonMobil’s support in so many different areas has been vital to our success,” said Knapp.

SpringSeal quickly established a reputation for manufacturing highly engineered, price competitive products which offer many performance advantages compared with conventional pipe gaskets. The company is producing systems using multi-durometer Santoprene TPVs to provide a higher level of performance than conventional gaskets. It claims to be the only company

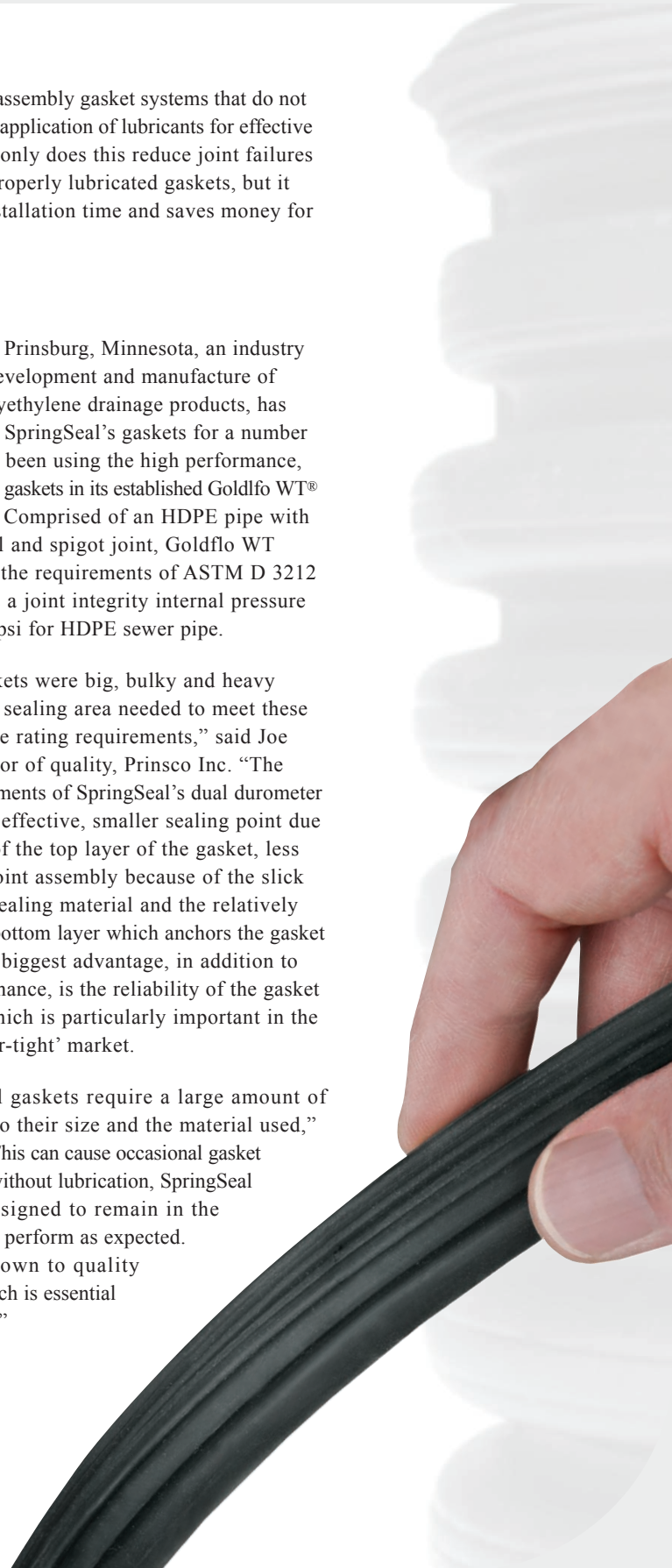
that offers dry assembly gasket systems that do not require manual application of lubricants for effective assembly. Not only does this reduce joint failures caused by improperly lubricated gaskets, but it also speeds installation time and saves money for pipe installers.

RESULTS

Prinsco Inc. of Prinsburg, Minnesota, an industry leader in the development and manufacture of corrugated polyethylene drainage products, has benefited from SpringSeal’s gaskets for a number of years. It has been using the high performance, multi-durometer gaskets in its established Goldflo WT® product range. Comprised of an HDPE pipe with an integral bell and spigot joint, Goldflo WT products meet the requirements of ASTM D 3212 which requires a joint integrity internal pressure rating of 10.8 psi for HDPE sewer pipe.

“Previous gaskets were big, bulky and heavy because of the sealing area needed to meet these ASTM pressure rating requirements,” said Joe Larkins, director of quality, Prinsco Inc. “The major improvements of SpringSeal’s dual durometer gaskets are an effective, smaller sealing point due to the design of the top layer of the gasket, less resistance in joint assembly because of the slick nature of the sealing material and the relatively stiffer hollow bottom layer which anchors the gasket in place.” The biggest advantage, in addition to sealing performance, is the reliability of the gasket in the field, which is particularly important in the growing ‘water-tight’ market.

“Conventional gaskets require a large amount of lubricant due to their size and the material used,” said Larkins. “This can cause occasional gasket roll-off. Even without lubrication, SpringSeal gaskets are designed to remain in the gasket seat and perform as expected. It all comes down to quality installation which is essential to our success.”



Worldwide Sales Offices

Americas

13501 Katy Frwy.
Houston, Texas, U.S.A. 77079
+1-281-584-7614

388 S. Main Street
Akron, Ohio, U.S.A. 44311
+1-800-305-8070
+1-330-849-5000

Europe

Avenue de Bâle 1
B-1140 Brussels, Belgium
+32-2-706-3511

Asia

1 HarbourFront Place
#06-00 HarbourFront Tower One
Singapore 098633
+65-6885-8539

©2008 Exxon Mobil Corporation. To the extent the user is entitled to disclose and distribute this document, the user may forward, distribute, and/or photocopy this copyrighted document only if unaltered and complete, including all of its headers, footers, disclaimers, and other information. You may not copy this document to a Web site. ExxonMobil does not guarantee the typical (or other) values. Analysis may be performed on representative samples and not the actual product shipped. The information in this document relates only to the named product or materials when not in combination with any other product or materials. We based the information on data believed to be reliable on the date compiled, but we do not represent, warrant, or otherwise guarantee, expressly or impliedly, the merchantability, fitness for a particular purpose, suitability, accuracy, reliability, or completeness of this information or the products, materials, or processes described. The user is solely responsible for all determinations regarding any use of material or product and any process in its territories of interest. We expressly disclaim liability for any loss, damage, or injury directly or indirectly suffered or incurred as a result of or related to anyone using or relying on any of the information in this document. There is no endorsement of any product or process, and we expressly disclaim any contrary implication. The terms, "we", "our", "ExxonMobil Chemical", or "ExxonMobil" are used for convenience, and may include any one or more of ExxonMobil Chemical Company, Exxon Mobil Corporation, or any affiliates they directly or indirectly steward. ExxonMobil, the ExxonMobil Emblem, the "Interlocking X" Device, Santoprene, Vistamaxx, Exact, Exxelor, and Vistalon are trademarks of Exxon Mobil Corporation.

ExxonMobil
Chemical

exxonmobilchemical.com
santoprene.com

Innovative elastomeric solutions

Santoprene™ brand TPVs

The benefits of vulcanized rubber with the processing ease of thermoplastics

Vistamaxx™ specialty elastomers

New options for elasticity in nonwovens, films and polymer modification

Exact™ plastomers

Polyolefins used to enhance polymer toughness, sealing and clarity

Exxelor™ modifiers

Functionalized polymers to enhance performance of engineered thermoplastics

Vistalon™ EPDM rubber

High performance polymers for a wide variety of applications