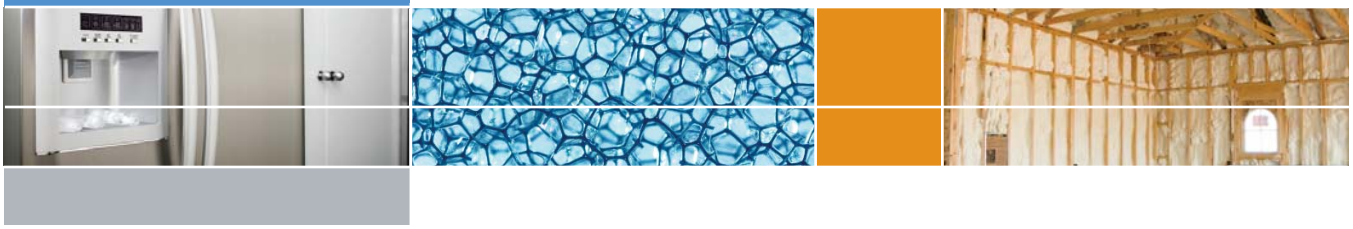
NIAX* Silicone L-6164

URETHANE ADDITIVES - RIGID FOAM



Niax silicone surfactant L-6164 is a non-hydrolyzable silicone copolymer designed for use in opening rigid foam cells. Because of the unique requirements to open the highly stabilized rigid polyurethane foam, a special surfactant is required.

Key Features and Typical Benefits

- open Cell content controlled by use level
- cell opening even in overpacked conditions
- hydrolytically stable
- homogeneous liquid

Potential Applications

Niax silicone surfactant L-6164 uniquely offers a cell opening capability which can be used to resolve dimensional stability issues caused by the unbalanced cell-gas diffusion observed in water-blown formulations. Open-celled rigid foams can be used for low- or non-thermal conductivity requirements such as void filling or structural applications that include such items as picnic coolers or entry doors.

Typical Physical Properties	
Physical Appearance	Clear liquid
Viscosity at 25°C, cSt	5000
Specific Gravity of 25°C	0.937
Flash Point, Pensky-Martens Closed Cup, °C (°F)	91 (195)

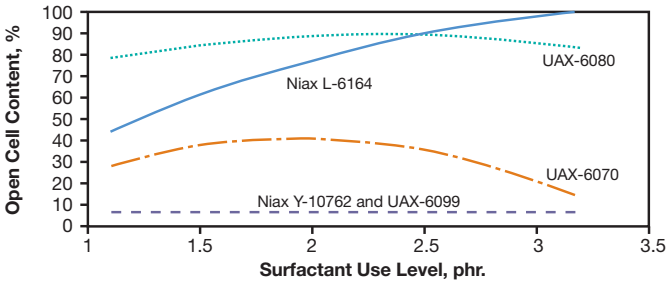
Performance

The performance of Niax silicone L-6164 has been evaluated in standard and non-standard water blown formulations. The data that follows employs a traditional commercial all-water-blown formulation and compares the performance of Niax silicone L-6164 against the other Niax cell opening silicones. These foam samples were molded at a 15 percent overpack with an in-place density of 2.20 pounds per cubic feet.

Cell Opening

Cell opening is very dependent on the system formulation. Therefore, a spectrum of products like Niax silicone Y-10762, UAX-6099, UAX-6070 and UAX-6080 had been introduced to meet the specific required cell opening performance. Silicones UAX-6080 and UAX-6070 have demonstrated cell opening performance in some of the most stable formulations, but have been limited by the non-hydrolytic stability character of their molecules. Niax silicone L-6164 was developed to offer improved cell-opening capability and to be hydrolytically stable. Figure 1 compares the cell-opening capability of the currently available Niax cell opening silicones in this particular formulation. It also shows the open-cell content of the rigid foam as a function of the surfactant use level as it is varied between 1.1 and 3.2 parts per hundred resin. As shown in the figure, Niax silicone L-6164 uniquely offers control of open-cell content with adjustment of the use level.

Figure 1: Open Cell Content Versus Surfactant



Flowability

Flowability is a good indication of open-celled surfactant performance. The silicone must offer the necessary initial cell stabilization with the appropriate timing of the cell opening of the rigid foam. If the timing is improperly balanced, the flow will suffer or, at the other extreme, the cells will not open. Figure 2 presents the flow index of a foam rising free in an isothermal 180 cm x 6 cm. vertical tube. The cell opening silicones represented in this graph were run at a 3.2 parts per hundred resin (phr.) use level. As can be observed, Niax silicone L-6164 does not show any significant loss in flow over the very closed foams obtained with Niax silicone Y-10762 and UAX-6099 while producing an open celled foam.

Another attribute of flowability is the distribution of the polyurethane foam along the length of the flow. This is evaluated from the same flow index foam by weighing 15 cm. samples along the rise. As shown in Figure 3, Niax silicone L-6164 demonstrates a density distribution very similar to the very closed cell foams of Niax silicone Y-10762 and UAX-6099. This is another indication of properly balanced stabilization/cell opening performance.

Figure 2: Flow Index

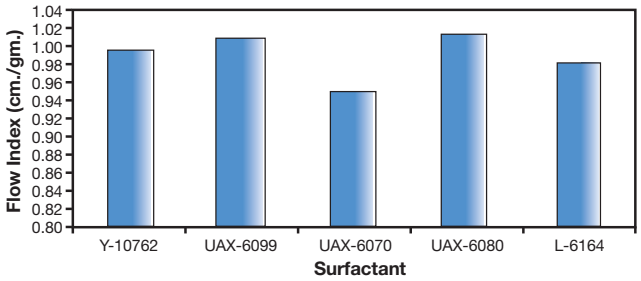
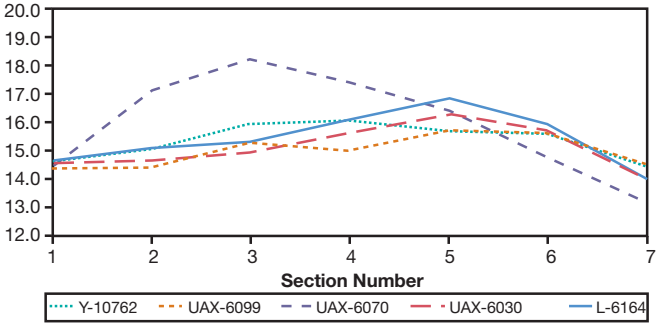


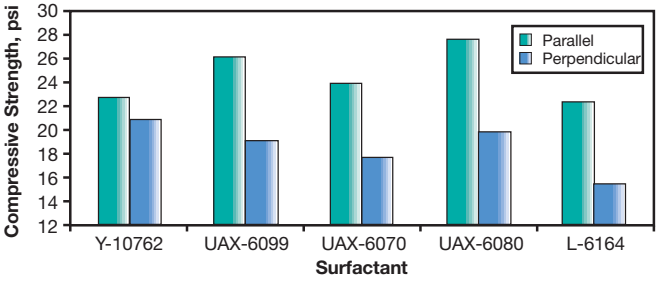
Figure 3: Flow Tube Density



Compressive Strength

Compressive strength data for the surfactants is presented in Figure 4 for the 3.2 phr. use level. Some minor loss of compressive strength is observed with the Niax silicone L-6164. But this is not beyond what would be anticipated with the phenomenon of removing the contribution to the compressive strength from “balloon” of gas in a closed-cell foam.

Figure 4: Compressive Strength

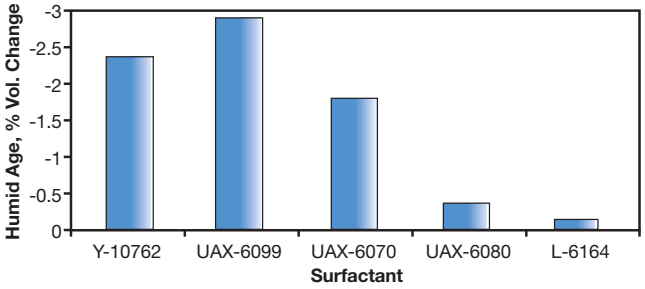


*Niax is a trademark of Momentive Performance Materials Inc.

Dimensional Stability

The ultimate objective of opening the rigid foam cells is to improve the dimensional stability. Figure 5 shows the results of seven days dimensional stability testing are presented in for humid age (70°C/95% relative humidity). As expected with the water blown foams, the foams demonstrating high closed-cell content, like Niax silicone Y-10762, UAX-6099 and even UAX-6070 demonstrate shrinkage. This is because the diffusion of carbon dioxide out of the cells is more rapid than the diffusion of air into the cells, creating a negative pressure differential. By opening the cells of the foam through the use of silicone UAX-6080 and Niax silicone L-6164, there is no pressure differential. Therefore, the foams demonstrate a significant improvement in dimensional stability.

Figure 5: Humid Age Dimensional Stability



Conclusion

Niax silicone L-6164 uniquely offers a homogeneous, hydrolytically stable liquid surfactant which controls the balance between initial cell stabilization and final cell opening. It demonstrates a broad response curve between open cell content and use level. In addition, it maintains excellent foam flowability and density distribution performance without any significant loss in physical properties. This allows the user to employ the technique of cell opening in a rigid foam to control the dimensional stability issues associated with water blown foam.

Patent Status

Nothing contained herein shall be construed to imply the nonexistence of any relevant patents or to constitute the permission, inducement or recommendation to practice any invention covered by any patent, without authority from the owner of the patent.

Product Safety, Handling and Storage

Customers considering the use of this product should review the latest Material Safety Data Sheet and label for product safety information, handling instructions, personal protective equipment if necessary, and any special storage conditions required. Material Safety Data Sheets are available at www.momentive.com or, upon request, from any Momentive Performance Materials representative. Use of other materials in conjunction with Momentive Performance Materials products may require additional precautions. Please review and follow the safety information provided by the manufacturer of such other materials.

Limitations

Customers must evaluate Momentive Performance Materials products and make their own determination as to fitness of use in their particular applications.

Emergency Service

Momentive Performance Materials maintains an around-the-clock emergency service for its products.

Location	Emergency Service Provider	Emergency Contact Number
Mainland U.S., Puerto Rico	CHEMTREC	1-800-424-9300
Alaska, Hawaii	CHEMTREC	1-800-424-9300
Canada	CHEMTREC	1-800-424-9300
Europe, Israel	NCEC	+44 (0) 1235239670
Middle East	NCEC	+44 (0) 1235239671
Asia Pacific (except China)	NCEC	+44 (0) 1235239670
China	NCEC	+86-10-5100-3039
Latin America (except Brazil)	NCEC	+44 (0) 1235239670
Brazil	SOS Cotec	08000111767 or 08007071767
All other locations world wide	NCEC	+44 (0) 1235239670
At sea	Radio U.S. Coast Guard in U.S. waters NCEC in International waters	 +44 (0) 1235239670

For Health related calls, contact Momentive Performance Materials at +1-518-233-2500 (English only).

DO NOT WAIT. Phone if in doubt. You will be referred to a specialist for advice.

Customer Service Centers

Worldwide Hotline

T +1 800 295 2392 / +1 607 786 8131
F +1 607 786 8309

North America

cs-na.silicones@momentive.com

Silicones – Fluids, Urethane Additives, Silanes, Specialty Coatings, RTVs and Elastomers

T +1 800 523 5862 / +1 800 334 4674
F +1 304 746 1654 / +1 304 746 1623

Consumer Sealants/ Construction Sealants and Adhesives

T +1 877 943 7325
F +1 304 746 1654

Latin America

cs-la.silicones@momentive.com

South America

T +55 11 4534 9650
F +55 11 4534 9660

Mexico and Central America

T +52 55 2169 7670
F +52 55 2169 7699

Europe, Middle East, Africa and India

cs-eur.silicones@momentive.com

T +00 800 4321 1000 / +40 21 3111848

Pacific

cs-ap.silicones@momentive.com

China

T +800 820 0202 / +86 21 3860 4892

Japan

T +0120 975 400 / +81 276 20 6182
F +81 276 31 6259

Korea

T +82 2 6201 4600
F +82 2 6201 4601

Malaysia

T +60 3 9206 1555
F +60 3 9206 1533

Thailand

T +66 2207 3456
F +66 2207 3488

MOMENTIVE™

22 Corporate Woods Boulevard
Albany, NY 12211 USA
+1 800 295 2392
+1 607 786 8131
momentive.com

MPM 124-010-20E-GL 08/11 Printed in U.S.A.