Meldin®
HIGH-PERFORMANCE THERMOPLASTIC MATERIALS

Critical parts making THE difference
PRECISE FIT LIFETIME CONFIDENCE

SAINT-GOBAIN SEALS
Welcome to the Saint-Gobain Seals and Polymers World:
Experience You Can Rely On... Time After Time

Saint-Gobain has a rich tradition of excellence that dates back nearly 350 years. Today, it is one of the world’s top 100 industrial corporations and a leader in the development and production of engineered components and materials.

In 1665, Louis XIV signed the letters patent, leading to the creation of the Saint-Gobain Group on an industrial basis. One of the earlier and more notable projects was manufacturing the 357 mirrors for the Hall of Mirrors in the Palace of Versailles. From these glassmaking origins, Saint-Gobain continues its long history of developing new and innovative materials and products through arduous research.

With approximately 190,000 employees, operations in 64 countries and eight major cross-business research centers that serve all Activities, Saint-Gobain provides complete and thorough service to our customers, starting with our experienced design engineering team, moving to our high-tech labs, testing and research and development, and onto the manufacturing floor.

We believe that as a key ingredient in the wellbeing of each of us and the future of all, we have devoted much of our resources to creating strong research and development centers and establishing partnerships with prestigious universities and laboratories. Our commitment to innovation has resulted in the rapid progression of new Saint-Gobain products that did not exist five years ago.

Saint-Gobain is among the global leaders in each of its businesses: construction products, building distribution, packaging and innovative materials, including high-performance seals and polymers. Our seals and polymers are manufactured throughout the world with sites located in the Americas, Europe and Asia.

With a strong history of innovation, Saint-Gobain Seals is dedicated to providing the most technologically advanced products on the market today and finding solutions for the future.
A Tour of Our Capabilities

Saint-Gobain Seals’ global presence allows us to manufacture products in the Meldin® family throughout the world, with sites located in Bristol, Rhode Island, USA; Saltillo, Mexico; Logroño, Spain; Wertheim and Neuhaus, Germany; and Minhang, Shanghai, China.

Research, custom design and state-of-the-art testing are at the heart of Meldin® solutions. Deep collaboration with each customer, together with our expertise in engineering and customer service, help us deliver in the most demanding applications. Starting with custom blending, mold design, specialized processing and prototyping, all the way to maintaining extremely tight tolerances and meeting stringent quality requirements, we have your needs covered.

Our extensive experience of more than 50 years, together with the most modern manufacturing optimization techniques such as WCM, 5S, Kaizen and Six Sigma, allow us to deliver the highest quality Meldin® products. As a result of our dedication to excellence, our worldwide facilities are all ISO 9001 certified. Our sites in Logroño, Spain; Saltillo, Mexico; and Bristol, RI, USA, are also ISO 14001 and TS 16949 certified. Our sites in Wertheim and Neuhaus, Germany, are also TS 16949 certified.

Design Engineering
› 3-D modeling
› Finite Element Analysis (FEA)
› CAD drawings
› CAE simulation of process
› Mold flow

Research, Testing and Quality Assurance
› DMA (Dynamic Mechanical Analyzer), TMA (Thermomechanical Analyzer), TGA (Thermogravimetric Analyzer) and DSC (Differential Scanning Calorimetry)
› CMM (Coordinate Measuring Machines) and Smart Scope measuring systems
› SEM (Scanning Electron Microscopy)
› SPC stations
› Tribological material testing as well as mechanical, electrical and optical testing
› Application-specific testing, such as plain bearing testing, seal ring testing, etc.

Manufacturing
› Custom blending and compounding
› In-house tooling and mold design
› Overmolding
› Microinjection molding
› Bi-injection
› Specialized processing
› Assembly operation
› State-of-the-art machining

Bristol, Rhode Island, USA
Saltillo, Mexico
Logroño, Spain
Wertheim, Germany
Minhang, Shanghai, China
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High-performance polymers have proven to play a key role in our modern life, substantially contributing to the quality, comfort, safety and health of our global society. Linked to innovation and technology, these high-performance plastics are essential for advancing sustainable economic growth in the automotive, aerospace, energy and other industries.

Polymers in the Saint-Gobain Seals Meldin® thermoplastic material product line are positioned in the upper section of the polymer pyramid as shown below, representing High-Performance Polymers. The Meldin® family complements our other well-known offerings of thermoset polyimide material, Meldin® 7000, and Rulon® fluoropolymer compounds. Engineering polymers processing is available at our Saint-Gobain plants.

Advanced high-performance thermoplastics belonging to the Meldin® family are used in specialized applications where high thermal resistance and good mechanical properties at high temperatures are required. These polymers offer additional benefits such as low weight, corrosion resistance and chemical resistance, making them extremely attractive and versatile when replacing metals.
How Our Meldin® Family Started and Evolved

Historically, Saint-Gobain Seals (formerly Dixon Industries Corp.) focused on the production of fluoropolymer compounds. Beginning in 1957, our well-known Rulon® product line was used in a new plastic saddle design and was quickly adapted for wider use. In the 1970s, we developed the Meldin® 2000 product line (based on thermoset polyimide) primarily as a filler for Rulon®. We launched the Meldin® family of thermoplastic products in 1980, starting with the Meldin® 1000 and 5000 series.

The Meldin® 4000 series was added in 2014 after the acquisition of LS Kunststofftechnologie GmbH, a German manufacturer of high-performance thermoplastic components for the automotive, medical and industrial markets, with cutting-edge expertise in PAI compounding, design and manufacturing.

The Meldin® family complements Saint-Gobain Seals’ thermoset polyimide offerings (represented by the newly developed Meldin® 7000). The Meldin® product line provides a diverse array of high-performance engineered thermoplastic solutions for the most challenging needs, including:

› Good tribological properties at aggressive PV conditions
› Dry environment
› Low weight solutions
› High thermal resistance and dimensional stability
› Chemical and corrosion resistance
› Mechanical integrity
› Tight tolerance requirements

Meldin® components are designed to perform without external lubrication, offering various product options that allow customers to extend part life or reduce weight. We continue to develop innovative engineering materials that provide superior performance.

Proven in the Past ...

Meldin® thermoplastic materials have been proven over a range of industries and applications. Whether it is harsh chemical environments, tremendous pressure, extreme speeds, exceptionally high temperatures, issues of component weight, minimal opportunities for lubrication or concerns about corrosion, significant wear or dimensional stability, our custom-compounded unique grades are created and tailored to meet and exceed our customers’ current and emerging needs.

... Prepared for the Future
Introducing the Key Members of Our Meldin® Family

The Meldin® product line includes our popular 1000, 4000 and 5000 series, which have been developed to satisfy working conditions for applications where metals and other materials may not be adequate:

› Meldin® 1000 materials are proprietary polyphenylene sulfide (PPS) based thermoplastic compounds engineered to withstand harsh chemical, environment and temperature conditions.

› Meldin® 4000 materials are based on polyamide-imide (PAI) to provide superior mechanical properties at very high temperatures (up to 275°C).

› Meldin® 5000 materials are based on polyaryletherketone (PAEK) and its variant polyetheretherketone (PEEK) to provide superior thermal resistance combined with both strong mechanical properties and chemical resistance.

<table>
<thead>
<tr>
<th>Series</th>
<th>Base Polymer</th>
<th>Maximum Use Temp</th>
<th>Manufacturing Processes</th>
<th>Material Availability Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>PPS</td>
<td>204°C</td>
<td>Injection molding</td>
<td>Finished parts with limited shape possibility for prototypes</td>
</tr>
<tr>
<td>4000</td>
<td>PAI</td>
<td>275°C</td>
<td>Injection molding</td>
<td>Finished parts with limited shape possibility for prototypes</td>
</tr>
<tr>
<td>5000</td>
<td>PAEK/PEEK</td>
<td>260-300°C</td>
<td>Injection molding, hot compression molding or extrusion</td>
<td>Finished parts with limited shape possibility for prototypes</td>
</tr>
</tbody>
</table>

Along with our thermoset polyimide offering (Meldin® 7000), Saint-Gobain Seals is your one-stop shop for a wide range of high temperature polyimide and engineered thermoplastic solutions. Our state-of-the-art engineering and design capabilities will provide you with finished solutions based on compression molding, extrusion and injection molding. Meldin® material is not available for sale as raw material or in a basic stock shape. Industry knowledge and deep collaboration with our customers enable us to provide the seals, bearings, bushings, piston rings, thrust washers, vanes, gears and other parts to meet your application conditions.
Meldin® 1000 series is a Saint-Gobain Seals product line based on PPS compounds. Components made of Meldin® 1000 series materials exhibit excellent chemical and thermal resistance, have good dimensional stability and maintain structural integrity, providing design versatility.

All grades are processed by injection molding and available as finished parts. The different grade number references a different composition resulting in different properties. Few stock shapes are available, mainly to support prototyping activity.

Features/Benefits

› Superior resistance to chemicals ranging from acids and oils to solvents and fuels
› Excellent resistance to high temperature steam
› Low coefficients of thermal expansion help maintain good dimensional stability, especially in components functioning in close-clearance applications
› Low creep and low water absorption, allowing designers to specify close clearances in moving mating components
› High strength, good rigidity and a high strength-to-weight ratio for durability and wear resistance
› Can be designed into a range of structural, dynamic bearing and sealing components
› Piston rings or seals made with Meldin® 1000 have excellent self-energizing qualities

Successful Applications

› Bearings
› Seals
› Bushings
› Thrust washers
› Piston rings
**Meldin® 1000 – Technical Properties**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Test Method</th>
<th>Units</th>
<th>Meldin® 1003</th>
<th>Meldin® 1088</th>
<th>Meldin® 1277</th>
<th>Meldin® 1327</th>
<th>Meldin® 1357</th>
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</thead>
<tbody>
<tr>
<td><strong>Mechanical Properties</strong></td>
<td></td>
<td></td>
<td>psi (MPa)</td>
<td>psi (MPa)</td>
<td>psi (MPa)</td>
<td>psi (MPa)</td>
<td>psi (MPa)</td>
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<td>Tensile Strength</td>
<td>Break RT</td>
<td>ASTM D638</td>
<td>24,400 (168)</td>
<td>25,300 (175)</td>
<td>20,300 (140)</td>
<td>8,300 (57)</td>
<td>12,500 (86)</td>
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<td>Tensile Strength</td>
<td>Break 400°F (204°C)</td>
<td>ASTM D638</td>
<td>6,500 (45)</td>
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<td></td>
<td>1,900 (13)</td>
<td>3,400 (24)</td>
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<tr>
<td>Tensile Elongation</td>
<td>Break RT</td>
<td>ASTM D638</td>
<td>1.4</td>
<td>1</td>
<td>1.6</td>
<td>1.9</td>
<td>4.5</td>
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<tr>
<td>Tensile Elongation</td>
<td>Break 400°F (204°C)</td>
<td>ASTM D638</td>
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<td></td>
<td></td>
<td></td>
<td>6.3</td>
</tr>
<tr>
<td>Tensile Modulus</td>
<td>RT</td>
<td>ASTM D638</td>
<td>31 (21)</td>
<td>26.3 (18)</td>
<td>20 (14)</td>
<td>6.1 (4.3)</td>
<td>4.5 (3.1)</td>
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<tr>
<td>Flexural Strength</td>
<td>RT</td>
<td>ASTM D790</td>
<td>37,600 (259)</td>
<td>34,300 (237)</td>
<td>33,900 (234)</td>
<td>15,400 (106)</td>
<td>16,200 (112)</td>
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<td>Flexural Modulus</td>
<td>RT</td>
<td>ASTM D790</td>
<td>30 (21)</td>
<td>30.9 (21)</td>
<td>20 (14)</td>
<td>6.5 (4.5)</td>
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<td>Compressive Strength</td>
<td>RT</td>
<td>ASTM D695</td>
<td>22,500 (155)</td>
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<td></td>
<td></td>
<td>16,200 (112)*</td>
</tr>
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<td>Compressive Strength</td>
<td>400°F (204°C)</td>
<td>ASTM D695</td>
<td>3,400 (24)</td>
<td></td>
<td>3,300 (23)*</td>
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<td>3,300 (23)</td>
</tr>
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<td><strong>Thermal Properties</strong></td>
<td></td>
<td></td>
<td>°F (°C)</td>
<td>°F (°C)</td>
<td>°F (°C)</td>
<td>°F (°C)</td>
<td>°F (°C)</td>
</tr>
<tr>
<td>Melting Point</td>
<td>Onset</td>
<td>ASTM D3418</td>
<td>600 (316)</td>
<td>600 (316)</td>
<td>600 (316)</td>
<td>600 (316)</td>
<td>600 (316)</td>
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<tr>
<td>Coefficient of Thermal Expansion</td>
<td>along flow</td>
<td>ASTM E831</td>
<td>0.7 (1.25)</td>
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<td></td>
<td></td>
<td>1.9 (3.4)</td>
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<tr>
<td>Heat Deflection Temperature</td>
<td>ASTM D648</td>
<td>°F (°C)</td>
<td>500 (260)</td>
<td>500 (260)</td>
<td>500 (260)</td>
<td>450 (232)</td>
<td>450 (232)</td>
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<td>Thermal Conductivity</td>
<td>RT</td>
<td>ASTM F433</td>
<td>5.4 (0.75)</td>
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<tr>
<td><strong>General Properties</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>RT</td>
<td>ASTM D792</td>
<td>1.57</td>
<td>1.57</td>
<td>1.65</td>
<td>1.44</td>
<td>1.39</td>
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<tr>
<td>Water Absorption</td>
<td>RT, 24h</td>
<td>ASTM D570</td>
<td>0.03</td>
<td>0.02</td>
<td>0.01</td>
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<tr>
<td>Flammability</td>
<td>U/L</td>
<td></td>
<td>V-O</td>
<td></td>
<td></td>
<td>V-O</td>
<td></td>
</tr>
</tbody>
</table>

*2% offset yield stress reported if no peak stress observed

**Meldin® 1003**

This grade offers the highest level of strength and rigidity of the Meldin® 1000 series. It has a very low coefficient of friction and maintains high chemical resistance. It is typically used for thin parts such as piston rings or scroll tip seals.

**Meldin® 1088**

This is a bearing grade, internally lubricated according to our latest technology. It is also electrically conductive.

**Meldin® 1277**

This grade is used when structural integrity and low deformation are required. This material also exhibits good electrical insulative properties and dimensional stability.

**Meldin® 1327**

This grade is very suitable for tribological applications as it offers a low coefficient of friction and also good wear resistance for components that require very tight tolerances.

**Meldin® 1357**

This grade offers the lowest wear rate and coefficient of friction, making it the best candidate for tribological applications. In addition, its self-lubricating properties allow it to operate quietly even in dry environments.
Meldin® 4000 is Saint Gobain Seals’ product line of PAI (polyamide-imide) based compounds. The different numbers within the series refer to the unique composition and different properties of the various compounds.

Meldin® 4000 grades are manufactured by injection molding with a very limited number of shapes available for prototyping activity.

All 4000 series compounds have common properties that make them suitable replacements for metal components: they are stiff and retain high mechanical strength at elevated temperatures; they are very durable even in harsh applications in regards to wear; and they are chemically compatible with all automotive fluids (fuels and oils).

Features/Benefits

› Highest mechanical strength and stiffness of any thermoplastic up to 270°C
› Low creep
› Very good impact resistance
› Excellent fatigue resistance: when exposed to cyclical stress (loading or vibration), the material keeps very high tensile and flexural mechanical properties
› Outstanding wear resistance
› Excellent tribological properties
› Low coefficient of thermal expansion, especially for 4330 grade
› Very good thermal stability
› Low thermal conductivity (very good insulative properties)

Successful Applications

› Seal rings
› Thrust washers
› High precision bearings
› Bushings
› Vanes

![Graph of Meldin® 4000 Series Tensile Strength](image-url)
Meldin® 4210
This grade is used mainly for washers when needed to minimize the coefficient of friction.

Meldin® 4310
Wear grade used mostly for seal rings but also for washers and bearings.

Meldin® 4320
Wear grade mainly used for washers when wear reduction and extended lifetime of the component are key.

Meldin® 4330
This grade provides a very high mechanical and fatigue strength and is suitable for high precision bearings. It has the lowest coefficient of thermal expansion of the entire Meldin® 4000 series. It is electrically conductive due to filler composition.

### Meldin® 4000 – Technical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Condition</th>
<th>Test Method</th>
<th>Units</th>
<th>Meldin® 4210</th>
<th>Meldin® 4310</th>
<th>Meldin® 4320</th>
<th>Meldin® 4330</th>
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<tbody>
<tr>
<td><strong>Mechanical Properties</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>Break RT</td>
<td>ASTM D638</td>
<td>psi (MPa)</td>
<td>16,500 (114)</td>
<td>16,400 (113)</td>
<td>15,600 (108)</td>
<td>32,000 (221)</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>Break 455°F (235°C)</td>
<td>ASTM D638</td>
<td>psi (MPa)</td>
<td>7,700 (53)</td>
<td>10,900 (75)</td>
<td>7,200 (50)</td>
<td>16,000 (110)</td>
</tr>
<tr>
<td>Tensile Elongation</td>
<td>RT</td>
<td>ASTM D638</td>
<td>%</td>
<td>4.8</td>
<td>3.3</td>
<td>2.4</td>
<td>1.5</td>
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<tr>
<td>Tensile Modulus</td>
<td>RT</td>
<td>ASTM D638</td>
<td>psi (MPa)</td>
<td>5.5 (3.8)</td>
<td>9.9 (6.8)</td>
<td>10.4 (7.2)</td>
<td>23.9 (16.5)</td>
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<tr>
<td>Flexural Strength</td>
<td>RT</td>
<td>ASTM D790</td>
<td>psi (MPa)</td>
<td>21,300 (147)*</td>
<td>31,200 (215)</td>
<td>25,100 (173)</td>
<td>50,800 (350)</td>
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<tr>
<td>Flexural Modulus</td>
<td>455°F (235°C)</td>
<td>ASTM D790</td>
<td>psi (MPa)</td>
<td>10,300 (71)</td>
<td>16,400 (113)</td>
<td>11,200 (67)</td>
<td>25,700 (177)</td>
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<tr>
<td>Compressive Strength</td>
<td>RT</td>
<td>ASTM D695</td>
<td>psi (MPa)</td>
<td>19,300 (133)**</td>
<td>24,700 (170)</td>
<td>18,700 (129)**</td>
<td>36,300 (250)</td>
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<tr>
<td>Compressive Modulus</td>
<td>455°F (235°C)</td>
<td>ASTM D695</td>
<td>psi (MPa)</td>
<td>9,300 (64)**</td>
<td>10,300 (71)**</td>
<td>18,000 (124)****</td>
<td>18,000 (124)****</td>
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<td><strong>Thermal Properties</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Melting Point</td>
<td></td>
<td>ASTM D3418</td>
<td>°F (°C)</td>
<td>700 (371)</td>
<td>700 (371)</td>
<td>700 (371)</td>
<td>700 (371)</td>
</tr>
<tr>
<td>Glass Transition Tg</td>
<td>Onset</td>
<td>ASTM D3418</td>
<td>°F (°C)</td>
<td>536 (280)</td>
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<td>536 (280)</td>
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<td>Coefficient of Thermal Expansion</td>
<td>&lt; Tg</td>
<td>ASTM D696</td>
<td>in/in°F (m/m/°C) x 10⁻⁵</td>
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<td>0.5 (0.9)</td>
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<tr>
<td>Heat Deflection Temperature</td>
<td></td>
<td>ASTM D648</td>
<td>°F (°C)</td>
<td>534 (279)</td>
<td>540 (282)</td>
<td></td>
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<tr>
<td>Thermal Conductivity</td>
<td>RT</td>
<td>ASTM C177</td>
<td>BTU in/hr ft² (W/m°C)</td>
<td>3.9 (0.54)</td>
<td>3.8 (0.53)</td>
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<td><strong>Electrical Properties</strong></td>
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<td>Dielectric Strength</td>
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<td>ASTM D149</td>
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<td>Dielectric Constant</td>
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<td>6</td>
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<td>Volume Resistivity</td>
<td>RT</td>
<td>ASTM D257</td>
<td>Ohm*cm</td>
<td>8 x 10¹⁵</td>
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<td><strong>General Properties</strong></td>
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<tr>
<td>Specific Gravity</td>
<td>RT</td>
<td>ASTM D792</td>
<td>%</td>
<td>1.43</td>
<td>1.46</td>
<td>1.51</td>
<td>1.48</td>
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<tr>
<td>Water Absorption</td>
<td>RT, 24h</td>
<td>ASTM D570</td>
<td>%</td>
<td>0.24</td>
<td>0.28</td>
<td>0.17</td>
<td>0.26</td>
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</table>

*Value reported at 5% strain if strain exceeded 5% per ASTM D790
**2% offset yield stress reported if no peak stress observed
***Data obtained at 392°F (200°C)
A Snapshot of Meldin® 5000 Series

Components made with Meldin® 5000 series (PAEK and PEEK-based compounds) have several advantages over metals, machined ceramics and other costly machined materials, with the ease and convenience of thermoplastics. Having a high tensile, compressive and flexural strength, Meldin® 5000 materials are injection molded into tight-tolerance finished components in simple or complex designs that can exhibit metal-like finishes without expensive machining or secondary operations, and with the advantages of being lighter and corrosion resistant.

![Meldin® 5000 Series — Flexural Strength](image)

From a tiny bearing used in hand-held surgical tools to large diameter (>1.5 m) seal rings used in offshore oil and gas applications, Saint-Gobain offers a Meldin® 5000 grade that will meet your requirements. Meldin® 5301, Meldin® 5302, Meldin® 5320 and Meldin® 5330 grades provide excellent chemical resistance and thermomechanical properties in addition to superior dimensional stability and physical strength. Meldin® 5055 grade combines these excellent properties with inherent lubricity for higher load-bearing applications.

Most grades are processed by injection molding into finished components. There is also availability in hot compression molded or extruded parts, depending on the grade. All grades are available as finished parts, with some grades available as stock shapes to support prototyping.
Features/Benefits

- Corrosion resistance
- Impact resistance and electrical insulation unlike conventional materials
- Excellent chemical resistance
- Superior thermomechanical properties
- Metal-like finishes and complex designs without costly secondary operations
- Continuous temperature resistance up to 300°C (Meldin® 5302)
- Superior dimensional stability and physical strength
- Self-lubrication for high load-bearing applications (Meldin® 5055)

Successful Applications

- Bearings
- Bushings
- Connectors
- Insulators
- Piston rings
- Seal rings
- Valve seats
A More Complete Technical Picture of Our Meldin® 5000 Grades

**Meldin® 5055**
Typically used for bearings, this grade is resistant to very high loads with minimal deformation. It is self-lubricated and is resistant to aggressive fluids and high temperatures.

**Meldin® 5210**
This grade provides a very low coefficient of friction, especially against steel surfaces. It is used specifically for steering system yokes.

**Meldin® 5301**
This grade is used when mechanical properties are to be maximized. Meldin® 5301 grade can be used in contact with food as it complies both with 2002/72/EC and FDA 21 CFR 177.2415.

**Meldin® 5302**
This is a special grade with very high temperature resistance. It can be used in applications up to 300°C (continuous).

**Meldin® 5320**
This grade offers strength and rigidity as main advantages. It is typically used for structural parts and maintains good mechanical properties even at elevated temperatures.

**Meldin® 5330**
This grade exhibits good wear resistance and low friction. It is typically used for bearings and piston rings. It also offers a very low coefficient of thermal expansion.

**Meldin® 5350**
This grade offers superior wear resistance and lower friction compared to our 5330 grade.

**Meldin® 5390**
Wear resistant grade, good for various applications like washers and bearings.

**Meldin® 5530**
This grade has been specially created for parts submitted to tribological stresses. At high PV, wear and friction are very low and this is very important to increase the lifetime of the different components.

### Meldin® 5000 Series — Izod Impact Strength

<table>
<thead>
<tr>
<th>Grade</th>
<th>Meldin® 5000 Series — Izod Impact Strength</th>
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</thead>
<tbody>
<tr>
<td>Meldin® 5301</td>
<td><img src="image" alt="Impact Strength" /></td>
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<tr>
<td>Meldin® 5320</td>
<td><img src="image" alt="Impact Strength" /></td>
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<tr>
<td>Meldin® 5330</td>
<td><img src="image" alt="Impact Strength" /></td>
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<tr>
<td>Meldin® 5350</td>
<td><img src="image" alt="Impact Strength" /></td>
</tr>
<tr>
<td>Meldin® 5390</td>
<td><img src="image" alt="Impact Strength" /></td>
</tr>
<tr>
<td>Meldin® 5530</td>
<td><img src="image" alt="Impact Strength" /></td>
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</table>

Impact Strength (J/m)
## Meldin® 5000 – Technical Properties

<table>
<thead>
<tr>
<th>Condition</th>
<th>Test Method</th>
<th>Units</th>
<th>Meldin® 5000</th>
</tr>
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<tbody>
<tr>
<td><strong>Mechanical Properties</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>Yield RT</td>
<td>psi (MPa)</td>
<td>14,000 (97)</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>Break RT</td>
<td>psi (MPa)</td>
<td>17,000 (117)</td>
</tr>
<tr>
<td>Tensile Elongation</td>
<td>RT</td>
<td>%</td>
<td>1.2</td>
</tr>
<tr>
<td>Tensile Modulus</td>
<td>RT</td>
<td>psi*10^5 (GPa)</td>
<td>1.8 (3.3)</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>RT</td>
<td>psi (MPa)</td>
<td>26,400 (182)</td>
</tr>
<tr>
<td>Flexural Modulus</td>
<td>RT</td>
<td>psi*10^5 (GPa)</td>
<td>2.3 (4.1)</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>RT</td>
<td>psi (MPa)</td>
<td>3,600 (25)</td>
</tr>
<tr>
<td>Compressive Modulus</td>
<td>RT</td>
<td>psi*10^5 (GPa)</td>
<td>4.5 (3.1)</td>
</tr>
<tr>
<td><strong>Thermal Properties</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melting Point</td>
<td>Onset</td>
<td>°F (°C)</td>
<td>650 (343)</td>
</tr>
<tr>
<td>Coefficient of Thermal Expansion Along Flow &lt; Tg</td>
<td>ASTM E831</td>
<td>in/in°F (m/m°C) x 10^1</td>
<td>1.8 (3.3)</td>
</tr>
<tr>
<td>Coefficient of Thermal Expansion Along Flow &gt; Tg</td>
<td>ASTM E831</td>
<td>in/in°F (m/m°C) x 10^1</td>
<td>2.1 (3.8)</td>
</tr>
<tr>
<td>Coefficient of Thermal Expansion Average &lt; Tg</td>
<td>ASTM E831</td>
<td>in/in°F (m/m°C) x 10^1</td>
<td>2.3 (4.1)</td>
</tr>
<tr>
<td>Coefficient of Thermal Expansion Average &gt; Tg</td>
<td>ASTM E831</td>
<td>in/in°F (m/m°C) x 10^1</td>
<td>2.8 (5)</td>
</tr>
<tr>
<td>Heat Deflection Temperature</td>
<td>ASTM D648</td>
<td>°F (°C)</td>
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</tr>
<tr>
<td>Thermal Conductivity</td>
<td>RT</td>
<td>BTU in/hr ft² (W/m°C)</td>
<td>5.3 (0.76)</td>
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<tr>
<td><strong>Electrical Properties</strong></td>
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</tr>
<tr>
<td>Dielectric Strength</td>
<td>2.5 mm thickness</td>
<td>ASTM D149</td>
<td>V/mil/kV/mm</td>
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<td>Dielectric Constant</td>
<td>RT, 1 kHz</td>
<td>ASTM D150</td>
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<tr>
<td>Volume Resistivity</td>
<td>RT</td>
<td>Ohm·cm</td>
<td>10^4</td>
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<tr>
<td><strong>General Properties</strong></td>
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<tr>
<td>Specific Gravity</td>
<td>RT</td>
<td>ASTM D792</td>
<td>1.4</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>RT, 24h</td>
<td>ASTM D570</td>
<td>%</td>
</tr>
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</table>

Data reported are typical of grades processed by injection molding.

*Value reported at 5% strain if strain exceeded 5% per ASTM D790
**2% offset yield stress reported if no peak stress observed
***Data obtained at 235°C
****Data obtained at 249°C, 2% offset yield stress reported if no peak stress observed
# Compatible or Not?
## Meldin® Material’s Broad Relationship with Chemicals

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Meldin® 1000 Series</th>
<th>Meldin® 4000 Series</th>
<th>Meldin® 5000 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resistant to dilute acids and bases, aliphatic and aromatic hydrocarbons, aldehydes, ketones, alcohols, chlorohydrocarbons and oils.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resistant to most acids, aliphatic and aromatic hydrocarbons and chlorohydrocarbons. Strong bases, saturated steam are not recommended.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resistant to most chemicals. Not recommended for concentrated sulfuric and nitric acid.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Acids</strong></td>
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<tr>
<td>Acetic acid (10%)</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Glacial acetic acid</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Acetic anhydride</td>
<td>A</td>
<td>A</td>
<td>N/A</td>
</tr>
<tr>
<td>Benzene sulfonic acid</td>
<td>A</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Chromic acid (10%)</td>
<td>B</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Formic acid (88%)</td>
<td>A</td>
<td>C</td>
<td>B</td>
</tr>
<tr>
<td>Hydrochloric acid (10%)</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Hydrochloric acid (37%)</td>
<td>B</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Hydrofluoric acid (40%)</td>
<td>B</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Lactic acid</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Phosphoric acid (35%)</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Sulfuric acid (10%)</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Sulfuric acid (30%)</td>
<td>A</td>
<td>A</td>
<td>NR</td>
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<tr>
<td><strong>Bases</strong></td>
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<tr>
<td>Ammonium hydroxide (28%)</td>
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<td>C</td>
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<tr>
<td>Sodium hydroxide (15%)</td>
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<td>A</td>
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<tr>
<td>Sodium hydroxide (30%)</td>
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<td>A</td>
</tr>
<tr>
<td><strong>Aqueous salts</strong></td>
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</tr>
<tr>
<td>Aluminum sulfate</td>
<td>A</td>
<td>A</td>
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</tr>
<tr>
<td>Ammonium chloride</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Ammonium nitrate</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Barium chloride</td>
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<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Bromine</td>
<td>C</td>
<td>A</td>
<td>NR</td>
</tr>
<tr>
<td>Calcium chloride</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Calcium nitrate</td>
<td>A</td>
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</tr>
<tr>
<td>Ferric chloride</td>
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<tr>
<td>Magnesium chloride</td>
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<tr>
<td>Potassium permanganate</td>
<td>C</td>
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<td>A</td>
</tr>
<tr>
<td>Sodium bicarbonate</td>
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<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Sodium chloride</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Sodium hypochlorite</td>
<td>B</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Sodium sulfate</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Sodium sulfide</td>
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<td>A</td>
<td>A</td>
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<tr>
<td>Sodium sulfite</td>
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<tr>
<td><strong>Alcohols</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-Aminoethanol</td>
<td>B</td>
<td>NR</td>
<td>N/A</td>
</tr>
<tr>
<td>n-amyl alcohol</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>n-butyl alcohol</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Cyclohexanol</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Ethylene glycol</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>
Please note that this information is intended to be a general guide to illustrate chemical resistance one might expect of Meldin® compounds when exposed to various chemicals. Performance will vary depending on the chemicals used (or combinations thereof) and the conditions of service and compounds used. Temperature and duration of exposure are critical factors that must be considered when determining the degree of chemical resistance required for a particular application. If you require further information, our application engineers can provide their expertise regarding the Meldin® product and its compatibility with chemical environments, based on our knowledge of the chemistry of our compounds. However, testing under conditions as similar as possible to actual service conditions is always the optimal way to determine chemical compatibility for a particular application.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Meldin® 1000 Series</th>
<th>Meldin® 4000 Series</th>
<th>Meldin® 5000 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aldehyde &amp; Ketones</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetophenone</td>
<td>B</td>
<td>A</td>
<td>N/A</td>
</tr>
<tr>
<td>Benzaldehyde</td>
<td>B</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Cyclohexanone</td>
<td>A</td>
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<tr>
<td>Formaldehyde</td>
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<td>A</td>
</tr>
<tr>
<td>Furfural</td>
<td>A</td>
<td>C</td>
<td>A</td>
</tr>
<tr>
<td>Methyl ethyl ketone</td>
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<td><strong>Amines</strong></td>
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<td>B</td>
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<tr>
<td>n-Butyl amine</td>
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<td>Dimethylaniline</td>
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<td><strong>Esters</strong></td>
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<td>Butyl phthalate</td>
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<td><strong>Ethers</strong></td>
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<td>Tetrahydrofuran</td>
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<td><strong>Halogenated hydrocarbons</strong></td>
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<td>Carbon tetrachloride</td>
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<td>Mineral oil</td>
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<td>Motor oil</td>
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<td>Toluene</td>
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<td><strong>Nitrile/Nitro compounds</strong></td>
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<td>A</td>
</tr>
<tr>
<td>Nitromethane</td>
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</tbody>
</table>
Meldin® Material’s Tribological Performance

The Meldin® product line is designed for moving components in applications where friction and wear rate at contact points are significant parameters to consider. There are many factors that influence the behavior of the parts, including:

- Pressure
- Velocity
- Type of motion
- Mating hardware (material, roughness and hardness)
- Lubrication environment
- Temperature

When components are needed for parts in motion, tribology (the study of the interaction of friction, wear and lubrication) plays an important part. Saint-Gobain Seals’ state-of-the-art tribology lab has been designed with versatility and flexibility in mind. There are several test methods that can be used to evaluate the tribological properties of wear rate and coefficient of friction. We can perform tests to determine the most suitable Meldin® materials for various types of applications:

- Test various configurations in terms of load, velocity, material type, roughness, hardness, temperature and environment
- Test different mating surfaces in lubricated or dry conditions
- Test rotary motion in different conditions
- Use other standard and custom-designed test rigs to test rotary, linear, reciprocating, continuous and oscillating motions
A Closer Look at the Thrust Washer Testing Method (ASTM D3702)

For each Meldin® grade, we measure wear, the coefficient of friction, and surface temperatures in real time using sophisticated data acquisition systems. Specific values can vary depending on the specifics of the application.

The graphs to the left report typical test data for coefficient of friction and wear rate indicating PV limits in dry conditions. The ASTM D3702 test simulates the behavior of a washer. A sample is held against a rotating plate at a constant load (P, typically 5-250 PSI or 0.35-1.72 MPa) and a constant speed (V, typically 50-250 ft/min or 0.25-1.27 m/s) for a certain duration of time (typically 48-95 hours). Wear and coefficient of friction are then measured.
Increasing lifetime while reducing emissions and fuel consumption is becoming absolutely critical in the automotive industry. Replacing metal with high-performance Meldin® plastic components is an effective way to obtain these results and meet environmental and safety standards.

Thanks to its processability in tight tolerances, thermal expansion (CTE) close to metals and excellent resistance to chemicals or high temperatures, Meldin® components can provide low-friction, lighter weight solutions that are maintenance- and lubrication-free. Whether used for noise reduction or vibration control, our products have been developed to meet and exceed the industry’s increasing requirements for chemical and high-temperature resistance and processability in tight tolerances.
Features/Benefits

› Superior mechanical properties through a wide temperature range
  - High compressive strength and low creep
  - Continuous use at high temperature with minimal loss in performance
› Can function in dry conditions
› Low specific gravity – much lower than aluminum and steel
› Design flexibility and expertise to support customers’ needs
  - Mold parts with very tight tolerances (0.05 mm)
  - Replace combined metal parts in one injection-molded component
  - Overmold metal and injection-mold parts with tiny dimensions (micro-injection process)

Successful Automotive Applications

› Bearings  › Bushings  › Braking system components
› Gears  › Gerotor components  › Seal rings
› Thrust washers  › Steering system yokes

Meldin® Thermoplastic Typical Grades

<table>
<thead>
<tr>
<th>Meldin® 1003</th>
<th>Highest level of strength and rigidity.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meldin® 4310</td>
<td>Very good wear resistance; typically used for seal rings.</td>
</tr>
<tr>
<td>Meldin® 5210</td>
<td>Very low coefficient of friction against steel surfaces.</td>
</tr>
<tr>
<td>Meldin® 5330</td>
<td>Structural integrity and high resistance to thermal expansion.</td>
</tr>
</tbody>
</table>
Automotive Market: Case Studies

Application: Dual Clutch Transmission

Product: Meldin® 4310 and Meldin® 5330 (seal rings)

Typical Temperature: Ambient 300°F (150°C), surface temperature up to 464°F (240°C)

Typical Speed/Pressure: 8,000 RPM and 218 PSI (15 BAR)

Typical Counter Surface: Case hardened steel with rough surface

Media: Transmission fluid

Our Added Value:
- Torque loss 40% lower than competition
- Robust solution – seals run on rough surfaces
- Low and controlled leakage
- Chemical compatibility with transmission fluids
- Tight tolerances on finished parts

Application: Transmission & Gearbox

Product: Meldin® 4210, Meldin® 4320 and Meldin® 5330 (thrust washers)

Typical Temperature: 350°F (180°C)

Typical Speed/Pressure: PV around 430,000-570,000 PSI-ft/min (15-20 W/mmC)

Typical Counter Surface: Case hardened steel, unhardened steel, aluminum

Media: Transmission fluid

Our Added Value:
- Low wear and long lifetime for the components
- Low coefficient of friction that reduces torque losses
- Not abrasive versus counter surface (unhardened steel and aluminum are becoming more and more popular)
- Low chemical absorption and chemical compatibility with transmission fluids
- Thin walls, good tolerances, possibility to include functional features in the mold design
- Design expertise and in-house testing capabilities
Application: AC Compressor

**Product:** Meldin® 1003 (seals)
**Typical Temperature:** 300°F (150°C)
**Typical Speed/Pressure:** Low pressure (<1 BAR)
**Typical Counter Surface:** Anodized aluminum or hardened steel
**Media:** Oil lubricated

*Our Added Value*
- Low friction
- Good sealing capability
- Low wear and long lifetime for the components
- Chemical compatibility

Application: Braking System Components

**Product:** Meldin® material (brake booster or used as wire sensor holder for disc braking systems)
**Typical Temperature:** Peaks of 500°F (260°C)
**Typical Speed/Pressure:** High pressure

*Our Added Value*
- Low weight
- Low wear and long lifetime for the components
- High mechanical performance at high temperatures
Application: Steering System Yokes

**Product:** Meldin® 1327 and Meldin® 5210

**Typical Temperature:** 158-195°F (70-90°C)

**Typical Axial Force:** 56-80 lb (250-350 N)

**Typical Counter Surface:** Hardened steel

**Media:** Greased

- Very low coefficient of friction, especially against steel surfaces
- Over-molding capability to provide integrated wear resistant bearing pads (complete assembly solution), also providing integration of functional elements (e.g., damping elements)
- Tight tolerances on O.D. and friction contact
- Good wear behavior also against rough counter surfaces (steering rack)
- Metal/polymer and polymer/polymer combinations are possible
Application: Oil Pump

Product: Meldin® 1003, Meldin® 5330 and Meldin® 5530 (gerotor components)

Typical Temperature: 300°F (150°C), but in some applications this value can raise up to 480°F (250°C)

Typical Speed/Pressure: Low pressure (a few PSI/BAR); high speed (even 20,000 RPM in motorsport)

Typical Counter Surface: Aluminum

Media: Oil

- Low wear and long lifetime for the components
- Low noise
- Low weight
- Improves pump’s efficiency
- Material is forgiving when metal particles are present
- Minimal water and oil absorption
- Suitable replacement for sintered metals in oil pumps for racing or standard automotive gerotor components
When Our Thermoplastic Material Ensures Safety and Reliability in Critical Environments

Major oil and service companies are adopting new deep-water extraction techniques on and offshore, with operating pressure beyond 15 kpsi and temperatures of +200°C and beyond. Meldin® engineered plastics meet the new technical challenges for the energy market, ranging from typical seal rings, bushings and seat inserts for high-pressure ball valves to intricate components for Logging While Drilling (LWD), Measurement While Drilling (MWD) tools and high-temperature/high-pressure electrical connectors. Saint-Gobain Seals controls the process from powder to finished part with no limitations in diameter. Companies require more complex production for today’s severe oilfield applications, such as larger diameter (1.5 meters or larger) sealing systems using OmniSeal® spring-energized seals and Meldin® back-up rings. We quickly responded by developing a patented, bending-welding-sintering process to produce large diameter Meldin® rings for more demanding applications.

Features/Benefits

- High temperature and wear resistance
- Low coefficient of thermal expansion, in line with metal
- High elongation at break
- High compressive strength and low creep
- Enhanced tribological properties
- Long durability at extreme temperatures and sour gas concentrations
- Minimal water/fluid absorption
- Highly scalable ring manufacturing with no diameter limitation

Successful Energy Applications

- Back-up rings
- Piston seals
- Bearings
- Valve plates and rings
- Bushings
- Wear components

Meldin® Thermoplastic Typical Grades

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meldin® 5301</td>
<td>Used when tensile and compressive strength need to be maximized or when excellent chemical compatibility is needed.</td>
</tr>
<tr>
<td>Meldin® 5320</td>
<td>Offers strength and rigidity; used for structural parts, keeping good mechanical properties.</td>
</tr>
</tbody>
</table>
Energy Market: Case Studies

MELDIN® ENERGY

Application: FPSO (Floating Production, Storage and Offloading)
High-Pressure, High-Temperature Turret Swivel

<table>
<thead>
<tr>
<th>Product:</th>
<th>Meldin® 5301 (special high elongation type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Temperature:</td>
<td>300°F (150°C)</td>
</tr>
<tr>
<td>Typical Speed/Pressure:</td>
<td>Pressure up to 10,000 PSI (690 BAR)</td>
</tr>
<tr>
<td>Typical Counter Surface:</td>
<td>Inconel®</td>
</tr>
<tr>
<td>Media:</td>
<td>Hydrocarbons, oil, water</td>
</tr>
</tbody>
</table>

Our Added Value

- High compressive strength and low creep
- Extrusion gap up to 0.08 in. (2 mm)
- Low wear and long lifetime
- Low coefficient of friction
- Elongation at break
- Chemical compatibility

Application: Bushing for High Load Application

<table>
<thead>
<tr>
<th>Product:</th>
<th>Meldin® 5301 (bushings)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Temperature:</td>
<td>300°F (150°C)</td>
</tr>
<tr>
<td>Typical Speed/Pressure:</td>
<td>Pressure up to 6,235 PSI (430 BAR)</td>
</tr>
<tr>
<td>Typical Counter Surface:</td>
<td>Inconel®</td>
</tr>
<tr>
<td>Media:</td>
<td>Hydrocarbons, oil, water</td>
</tr>
</tbody>
</table>

Our Added Value

- Slow angular motion
- Low wear and long lifetime
- High compressive strength
- Low coefficient of friction
Why Our Thermoplastic Material Produces Environmental and Long-Term Solutions

Reducing energy consumption and increasing environmental and safety standards are among the key goals of companies in the industrial market. As industrial equipment is diversified across segments and applications, the requirements can be very different throughout the market.

With its high temperature resistance and excellent chemical resistance, Meldin® components can help companies reduce maintenance operations and downtime, and may even reduce equipment size, resulting in a compact system or one utilizing alternative energy solutions.

Features/Benefits

› Low coefficient of friction that reduces system energy consumption
› High tensile and compressive strength
› Low creep and very good dimensional stability
› Processability in tight tolerances
› Reduction of system components with injection molding process and bi-injection capability
› Can operate quietly in dry operating environments (Meldin® 1357)
› Design versatility

Successful Industrial Applications

› Bearings
› Valve seat inserts
› Bushings
› Vanes
› Piston rings
Meldin® Thermoplastic Typical Grades

**Meldin® 1003**
Highest level of strength and rigidity.

**Meldin® 1357**
Lowest wear rate and coefficient of friction.

**Meldin® 4330**
Excellent dimensional stability and the lowest coefficient of thermal expansion in the whole Meldin® product line. Ideal for high precision bushings.

**Meldin® 5301/5302**
FDA compliant grade for maximum tensile and compressive strength and special PEEK grade with very high temperature resistance.

**Meldin® 5330**
Structural integrity and high resistance to thermal expansion.

### Material Compressive Strength

<table>
<thead>
<tr>
<th>Material</th>
<th>Compressive Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meldin® 1003</td>
<td></td>
</tr>
<tr>
<td>Meldin® 1357</td>
<td></td>
</tr>
<tr>
<td>Meldin® 4330</td>
<td></td>
</tr>
<tr>
<td>Meldin® 5055</td>
<td></td>
</tr>
<tr>
<td>Meldin® 5330</td>
<td></td>
</tr>
<tr>
<td>Glass filled PA66</td>
<td></td>
</tr>
<tr>
<td>Glass filled PPA</td>
<td></td>
</tr>
</tbody>
</table>

### Material Tensile Strength

<table>
<thead>
<tr>
<th>Material</th>
<th>Tensile Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meldin® 1003</td>
<td></td>
</tr>
<tr>
<td>Meldin® 4210</td>
<td></td>
</tr>
<tr>
<td>Meldin® 4330</td>
<td></td>
</tr>
<tr>
<td>Meldin® 5055</td>
<td></td>
</tr>
<tr>
<td>Meldin® 5330</td>
<td></td>
</tr>
<tr>
<td>Glass filled PA66</td>
<td></td>
</tr>
<tr>
<td>Glass filled PPA</td>
<td></td>
</tr>
</tbody>
</table>
Industrial Market:
Case Studies

Application: Refrigeration Compressor

Product: Meldin® 1003, Meldin® 5330 and Meldin® 5350 (piston rings)

Typical Temperature: Around 285°F (140°C), some applications up to 350°F (180°C)

Typical Speed/Pressure: Pressure is typically around 435-508 PSI (30-35 BAR). Speed can vary between 1,800 and 5,000 RPM

Typical Counter Surface: Cast iron

Media: Refrigerants (R137, R407C, R404A, R22)

Our Added Value
• Low wear and long lifetime for the components
• Low friction
• Good sealing ability
• Improves compressor performance

Application: Food Blender Motor

Product: Meldin® 1357 and Meldin® 5055 (spherical bearing)

Typical Temperature: Typically low, below 120°F (50°C)

Typical Speed/Pressure: Speed up to 9,000 RPM

Typical Counter Surface: Carbon steel

Media: No lubrication (running dry)

Our Added Value
• Low friction
• Eliminates corrosion issues with metals
• Noise reduction
• Cost-effective solution (injection molding process)
Application: Vacuum Pump

- **Product:** Meldin® 5055 (vane)
- **Typical Temperature:** 195-212°F (90-100°C)
- **Typical Speed/Pressure:** High speed
- **Typical Counter Surface:** Steel
- **Media:** No lubrication (running dry)

**Our Added Value:**
- Self-lubricating properties
- High wear resistance
- High mechanical strength

Application: Diaphragm Pump

- **Product:** Meldin® 1357 (air poppet/seal)
- **Typical Temperature:** 320°F (160°C)
- **Typical Speed/Pressure:** Speed around 200 strokes per minute
- **Typical Counter Surface:** Stainless steel
- **Media:** Air (no lubrication)

**Our Added Value:**
- Low friction
- Long lifetime for the component
- Good impact resistance
- Good sealing properties
- Gentle with counter surface
Where Our Thermoplastic Material Maximizes Usage and Minimizes Costs

The life sciences market is driven by research and rapid development in science and technology, which has resulted in more effective medical systems and analytical instrumentation. The applications are increasingly demanding, with greater exposure to chemicals and more stringent operating conditions. This, coupled with the high cost of research and technology development, means longer life requirements and reduced maintenance cycles are expected. Our Meldin® product line solves these problems.

Features/Benefits

› Purity and cleanliness including compliance to FDA and USP guidelines
› Maintenance-free solutions with excellent friction control and low wear
› Lightweight and compact solutions
› Chemical resistance against a wide range of chemicals
› Steam compatibility for autoclaving and sterilization
› Flexible design capabilities and precision machining with tight tolerance control
› Dimensional stability across wide temperature range
› Critical sealing

Successful Life Sciences Applications

› Bearings
› Bushings
› Piston rings
› Seal rings
› Vanes

Meldin® Thermoplastic Typical Grades

| Meldin® 1003 | Highest level of strength and rigidity. |
| Meldin® 1357 | Lowest wear rate and coefficient of friction. |
| Meldin® 5301 | FDA compliant grade for maximum tensile and compressive strength. |
| Meldin® 5330 | Structural integrity and high resistance to thermal expansion. |
Life Sciences Market: Case Studies

Application: Medical Device Compressor

<table>
<thead>
<tr>
<th>Product:</th>
<th>Meldin® 1003 (piston rings)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Temperature:</td>
<td>131°F (55°C)</td>
</tr>
<tr>
<td>Typical Speed/Pressure:</td>
<td>High speed, around 20,000 RPM</td>
</tr>
<tr>
<td>Typical Counter Surface:</td>
<td>Cast iron</td>
</tr>
<tr>
<td>Media:</td>
<td>No lubrication permitted</td>
</tr>
</tbody>
</table>

- Low wear and long tool life
- Excellent sealing
- No need for lubrication

Application: Dental Drill

<table>
<thead>
<tr>
<th>Product:</th>
<th>Meldin® 5330 (shaft bearing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Temperature:</td>
<td>Up to 527°F (275°C) during autoclaving</td>
</tr>
<tr>
<td>Typical Speed/Pressure:</td>
<td>High speed, around 20,000 RPM</td>
</tr>
<tr>
<td>Typical Counter Surface:</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>Media:</td>
<td>Dry (no lubrication permitted)</td>
</tr>
</tbody>
</table>

- Excellent wear properties
- Long life under load
- Excellent dimensional stability under high speed and temperature
- Excellent steam compatibility to repeated sterilization autoclaving
Application Data Form

Company name ___________________________ Street address ___________________________
City ___________________________ State ___________________________
Zip code ___________________________ Purchasing contact ___________________________
Engineering contact ___________________________ Phone number ___________________________
Phone number ___________________________ Email address ___________________________

Action Required

❑ Material recommendation Date needed ____________
❑ Provide tech data on material Date needed ____________
❑ Part design recommendation Date needed ____________
❑ Produce prototypes Date needed ____________
Quote quantities production of ____________
Send quote to ____________ Date needed ____________

Product Information (attach drawing or sketch if available)

Design: ❑ New ❑ Existing Bearing size (units): ❑ Inches ❑ Millimeters

If existing:
Type/Brand __________________________________ I.D. __________________________ O.D. __________________________
Material ___________________________________ Length __________________________ Flange O.D. __________________________
Part/Drawing no. __________________________ Flange thickness __________________________
Describe end uses __________________________ Other dimensions __________________________

Desired characteristics ____________________________________________________________

__________________________________________________________

Other comments ____________________________________________________________

__________________________________________________________

Part Installation

Press fit on O.D. ____________________________________________________________

Shrink fit on O.D. ____________________________________________________________

Mechanical means ____________________________________________________________

Slip fit ____________________________________________________________

Bonding ____________________________________________________________

Other (list) ____________________________________________________________
Shaft Specifications
Press fit on O.D.__________________________
Shrink fit on O.D.__________________________
Mechanical means__________________________
Slip fit__________________________

Temperature
Typical ______ °F ______ °C
Maximum ______ °F ______ °C
Duration ______ Min. ______ Hrs.
Minimum ______ °F ______ °C
Duration ______ Min. ______ Hrs.

Velocity
Units: □ RPM □ Ft/Min □ M/Sec
Linear/stroke length__________________________
Number of strokes/min__________________________
Rotary__________________________
Degree of oscillation__________________________
Number of cycles/min__________________________
Other__________________________
Running surface □ ID □ OD □ Face

Service Life
Current ____________________________
Desired ____________________________

Product Testing
Test start date__________________________
Test duration__________________________

Housing Specifications
Diameter (and tolerance)__________________________
Material type__________________________
Length (and tolerance)__________________________

Load
□ Radial □ Thrust
Units: □ LB □ PSI □ N/mm² □ Other ______
□ Impact □ Cantilevered
□ Constant □ Misalignment
Typical__________________________
Maximum__________________________
Duration__________________________
Minimum__________________________
Duration__________________________

Environment
□ Dry □ Water □ Lubricated
□ Clean □ Dirt □ Vacuum
Chemicals (specify)__________________________
Gases (specify)__________________________
Oil (type)__________________________

Product Validation
□ Bench □ Field □ Both

Please email a copy of the completed Application Data Form to:
Saint-Gobain Seals
sealsmarketing@saint-gobain.com
WARNING: BEFORE USE OR INCORPORATION INTO A FINISHED GOOD, EACH PRODUCT MANUFACTURED OR SOLD BY SAINT-GOBAIN PERFORMANCE PLASTICS CORPORATION (EACH HEREINAFTER REFERRED TO AS A “PRODUCT”) MUST BE TESTED AND EVALUATED BY THE END-USER UNDER ACTUAL SERVICE CONDITIONS WITH SUFFICIENT SAFETY FACTORS TO DETERMINE IF SUCH PRODUCT IS SUITABLE FOR THE INTENDED USE. THE END-USER, THROUGH ITS OWN ANALYSIS AND TESTING, IS SOLELY RESPONSIBLE FOR THE SUITABILITY OF THE PRODUCT FOR ITS INTENDED USE AND FOR COMPLIANCE OF THE PRODUCT WITH ALL APPLICABLE PERFORMANCE, SAFETY AND WARNING REQUIREMENTS. THE END-USER ASSUMES ALL RISK AND LIABILITY WHATSOEVER IN CONNECTION WITH THE USE OF THE PRODUCTS IN ANY FINISHED GOOD MANUFACTURED BY END-USER.

FAILURE OF A PRODUCT CAN CAUSE EQUIPMENT FAILURE, PROPERTY DAMAGE, PERSONAL INJURY, AND/OR DEATH. FINISHED GOODS INCORPORATING OR USING A PRODUCT MUST BE DESIGNED WITH SAFETY FEATURES TO PREVENT PROPERTY DAMAGE, PERSONAL INJURY, AND/OR DEATH THAT CAN RESULT IN THE EVENT OF A PARTIAL OR TOTAL FAILURE OF THE PRODUCTS.

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1. Acceptance of Orders/Terms: All orders are subject to acceptance by Saint-Gobain Performance Plastics Corporation ("SGPPL") at its Wayne, New Jersey, headquarters. SGPPL reserves the right to reject any order. Possession of a price list does not constitute an offer to sell. Acceptance of any order by SGPPL is expressly conditioned on Customer’s assent to the terms and conditions set forth herein ("Terms") and the waiver by Customer of any terms and conditions contained in any order form, confirmation, or any other communication of Customer, whether previously or hereafter delivered to SGPPL, which either add to, differ from, modify, conflict with or are otherwise inconsistent with any term or condition herein. SGPPL hereby gives notice of its objection to any additional or different terms or conditions in any such order form, confirmation or communication. Customer’s failure to object in writing to these Terms prior to the earlier of Customer’s acceptance of the products ordered or fifteen (15) days after delivery thereof to Customer will constitute agreement by Customer to these Terms.

2. Product Changes: SGPPL reserves the right to discontinue the manufacture or sale of any product at any time or to alter, modify or redesign its products.

3. Price: All prices are subject to change without notice. Should any governmental action or request prevent SGPPL from implementing any price or continuing any price already in effect, SGPPL may at its option cancel Customer’s order or any part thereof.

4. Taxes/Duties: All federal, state or local sales, use or other taxes, and all duties, import fees or other assessments imposed on materials sold hereunder, or on the manufacture, sale or delivery thereof, shall be for Customer’s account.

5. Credit Approval: Customer credit approval is required prior to any shipment. If SGPPL determines at any time that Customer’s financial condition does not justify the extension of credit to Customer, then SGPPL may at its option require cash payments in advance or other satisfactory security prior to delivery.

6. Cancellation/Change Orders: Orders for standard products may only be revised or canceled by Customer prior to the date of loading at the place of shipment, and only with SGPPL’s prior consent. Orders for nonstandard or custom products may only be revised or canceled by Customer prior to the commencement of production, and only with SGPPL’s prior consent. Any product which SGPPL has the capability of producing but does not inventory, or does not have the capability of producing, is considered a nonstandard or custom product.

7. Packaging/Shipping/Risk of Loss: Unless otherwise agreed to by SGPPL in writing (i) SGPPL shall select the method of shipment, (ii) SGPPL shall ship materials FOB (SGPPL’s point of shipment), and (iii) costs for special packaging and/or handling requested by Customer shall be the responsibility of Customer. In the event of any general freight increase or any governmental ruling or regulation that results in increased freight costs, such additional costs shall be for Customer’s account. Title to, and the risk of loss, damage or shortage of, such materials shall pass to Customer upon delivery to the carrier regardless of notice to Customer. SGPPL assumes no responsibility for insuring shipments unless specifically agreed to in writing by SGPPL, in which case the cost of insurance shall be for Customer’s account.

8. Delivery: Quoted shipping and/or delivery dates are based on estimates at the time of quotation. SGPPL shall use reasonable commercial efforts to meet such shipping and/or delivery dates, but SGPPL shall not be liable for any direct or indirect costs or damages, including without limitation incidental or consequential damages, resulting from late deliveries. For orders with indefinite delivery dates, SGPPL shall have the right to manufacture or procure the materials covered thereby and hold such materials for Customer’s account pending receipt of definite shipping instructions. Except as expressly provided otherwise herein, Customer agrees to purchase and pay for all material ordered.

9. Claims for Loss, Damage or Shortage: Upon delivery, shipments must be inspected by Customer for damage, loss or shortage prior to acceptance from the carrier. If damage, loss or shortage exists with respect to any shipment and it is not concealed, Customer shall secure a notation of such damage, loss or shortage from the carrier on the freight bill or delivery receipt. If damage, loss or shortage is concealed, Customer must notify the carrier within 15 days, hold the merchandise for its inspection and secure a signed report from the carrier acknowledging the damage, loss or shortage. No claims for damage, loss or shortage will be allowed unless they are accompanied by an inspection report or signed delivery receipt noting such damage, loss or shortage signed by a representative of the carrier and forwarded to SGPPL within 30 days of the invoice date. Any claims for damage, loss or shortage should also be filed by Customer with the carrier in writing immediately upon receipt of the materials. In no event shall SGPPL be liable for damage or loss to a shipment caused by a carrier.
10. Payment: All invoices, whether partial or in full, shall be due and payable in full by Customer net 30 days from the date of shipment unless otherwise agreed to in writing by SGPPL. All past due, unpaid balances will bear a service charge of the lesser of one and one-half percent (1-1/2%) per month or the maximum interest rate permitted by applicable law. If Customer (i) becomes insolvent, files or has filed against it a petition in bankruptcy, makes any assignment for the benefit of creditors, or has a receiver or trustee appointed for it or its property, (ii) takes action to liquidate or otherwise cease doing business as a going concern, (iii) undergoes a change in ownership, (iv) fails to provide adequate assurance or security for credit extended, or (v) takes any other action that SGPPL determines in its sole discretion adversely impacts the conditions under which credit was extended, then all amounts outstanding from Customer hereunder shall at SGPPL’s option become immediately due and payable. ALL PAYMENTS, WHETHER UNDER THE STANDARD PAYMENT TERMS OR OTHERWISE, SHALL BE CONSIDERED RECEIVED BY SGPPL AS FOLLOWS: (A) FOR PAYMENTS BY CHECK, WHEN THE CHECK IS RECEIVED AT SGPPL’S DESIGNATED PAYMENT LOCATION, AND (B) FOR PAYMENTS BY ELECTRONIC FUNDS TRANSFER, THE BUSINESS DAY IMMEDIATELY PRECEDING THE DAY ON WHICH THE FUNDS ARE IMMEDIATELY AVAILABLE TO SGPPL. Customer shall pay all undisputed invoices regardless of any dispute that may exist as to other delivered or undelivered goods. With respect to any disputed invoice, Customer shall pay all amounts not in dispute. Customer expressly waives the right to assert any offset or counterclaim with respect to amounts due under any invoice issued by SGPPL hereunder.

11. Returned Materials: Material may only be returned with the prior approval of SGPPL. Material returned without such approval will not be accepted and such approval may be conditioned upon Customer paying a restocking charge of up to 25% and freight costs of returned material (and out-freight if applicable). All returned materials must arrive at the point of return designated by SGPPL in salable condition, as determined by SGPPL’s Quality Control Department, before any credit will be issued.

12. Warranty/Limitation of Liability: EXCEPT FOR PRODUCTS FOR WHICH SGPPL HAS ESTABLISHED A SPECIFIC WRITTEN WARRANTY, THE GOODS DELIVERED HEREUNDER ARE SOLD BY SGPPL WITHOUT ANY GUARANTY AND/OR WARRANTY, ORAL OR WRITTEN (WHETHER OR NOT SUCH GOODS REMAIN IN THE FORM IN WHICH THEY ARE ORIGINALLY DELIVERED TO CUSTOMER OR ARE FABRICATED BY CUSTOMER OR ANY OTHER PARTY TO PRODUCE A FINISHED PRODUCT). THE PRODUCT-SPECIFIC WRITTEN WARRANTIES REFERENCED ABOVE AND HEREBY INCORPORATED HEREIN ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, ORAL OR WRITTEN, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL SGPPL BE RESPONSIBLE FOR CONSEQUENTIAL, INCIDENTAL, INDIRECT OR SPECIAL DAMAGES OF ANY KIND, INCLUDING, WITHOUT LIMITATION, ANY EXPENSE FOR REMOVAL OR REINSTALLATION RESULTING FROM ANY DEFECT, INCLUDING ANY DIMENSIONAL DEFECT INVOLVING NONSTANDARD PRODUCTS. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, OR OF ANY EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION MAY NOT APPLY TO CUSTOMER. THE WARRANTY PROVIDED BY SGPPL GIVES CUSTOMER SPECIFIC LEGAL RIGHTS, AND CUSTOMER MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. NO FIELD REPRESENTATIVE, DISTRIBUTOR OR DEALER OF SGPPL IS AUTHORIZED TO MAKE ANY CHANGE OR MODIFICATION TO THESE WARRANTIES.

13. Remedies for Non-Warranty Claims: THE SOLE AND EXCLUSIVE REMEDY OF CUSTOMER AND THE SOLE AND EXCLUSIVE OBLIGATION OF SGPPL IN CONNECTION WITH CLAIMS RELATING TO MANUFACTURING DEFECTS ARE SET FORTH IN SECTION 12. THE SOLE AND EXCLUSIVE REMEDY OF CUSTOMER AND THE SOLE AND EXCLUSIVE OBLIGATION OF SGPPL FOR ANY BREACH OF CONTRACT CLAIM THAT MATERIALS DELIVERED DO NOT OTHERWISE CONFORM TO THE ACCEPTED ORDER SHALL BE EITHER THE RETURN OF CONSIDERATION PAID BY CUSTOMER TO SGPPL RELATED TO THE BREACH, OR UPON SGPPL’S ELECTION, THE DELIVERY OF CONFORMING PRODUCTS TO CUSTOMER. WITH RESPECT TO SGPPL’S NONCOMPLIANCE WITH ANY OTHER OBLIGATION OF SGPPL HEREUNDER, THE SOLE AND EXCLUSIVE REMEDY OF CUSTOMER AND THE SOLE AND EXCLUSIVE OBLIGATION OF SGPPL WILL BE AS SGPPL IN ITS DISCRETION WILL DETERMINE AS FOLLOWS: (1) SGPPL MAY ELECT TO CURE SUCH NONCOMPLIANCE WITHIN A REASONABLE PERIOD OF TIME, OR (2) IF SGPPL FAILS TO CURE SUCH NONCOMPLIANCE, CUSTOMER MAY RECOVER AN EQUITABLE AMOUNT NOT TO EXCEED SUCH CHARGES AS WERE PREVIOUSLY PAID TO SGPPL BY CUSTOMER HEREUNDER. CUSTOMER WAIVES ALL OTHER REMEDIES, STATUTORY OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, THE REMEDIES OF SPECIFIC PERFORMANCE AND REPLEVIN. ANY ACTION BROUGHT BY CUSTOMER IN CONNECTION WITH SGPPL’S PERFORMANCE HEREFUNDER MUST BE COMMENCED WITHIN SIX (6) MONTHS AFTER SUCH CAUSE OF ACTION ACCRUES OR IT WILL BE DEEMED WAIVED. SGPPL’S LIABILITY TO CUSTOMER, REGARDLESS OF WHETHER SUCH LIABILITY ARISES IN CONTRACT, TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE OR STRICT LIABILITY) OR OTHERWISE, SHALL IN NO EVENT EXCEED AMOUNTS PAID BY CUSTOMER TO SGPPL FOR THE PRODUCTS INVOLVED, AND CUSTOMER RELEASES SGPPL FROM ALL CLAIMS AND LIABILITIES IN EXCESS OF THIS LIMITATION. IN NO EVENT SHALL SGPPL BE RESPONSIBLE FOR CONSEQUENTIAL, INCIDENTAL, INDIRECT OR SPECIAL DAMAGES OF ANY KIND.

14. Excused Performance: SGPPL shall not be liable for nor be deemed to be in default of these Terms on account of any failure to perform its
obligations or attempt to cure any breach thereof if SGPPL has been delayed or prevented from doing so by any cause or condition beyond SGPPL’s reasonable control. If SGPPL determines that its ability to supply the total demand for the products, or obtain any or a sufficient quantity of any material used directly or indirectly in the manufacture of the products, is hindered, limited or made impracticable, SGPPL may allocate its available supply of the products or such material (without obligation to require other supplies of any such products or material) among itself and its customers as SGPPL determines in its sole discretion without liability for any failure of performance which may result therefrom. Delivery suspended or not made by reason of this action shall be canceled without liability, but these Terms shall otherwise remain unaffected.

15. Fair Labor Standards Act: SGPPL hereby certifies that the materials sold hereunder that were produced in the United States were produced in compliance with all applicable requirements of Sections 6, 7 and 12 of the Fair Labor Standards Act, as amended, and of regulations and orders of the United States Department of Labor issued under Section 14 thereof.

16. Change in Terms and Conditions of Sale: The terms and conditions contained herein constitute the entire agreement between SGPPL and Customer and supersede any and all prior representations, agreements or understandings, whether oral or written, relative to the materials delivered hereunder. No course of dealing or usage of trade shall be relevant to supplement or explain any of these terms or conditions. No modification of these terms and conditions shall be effective unless made in writing and executed by SGPPL.

17. General: This agreement shall not be assigned by Customer without the prior written consent of SGPPL, and any assignment made without such consent shall be null and void. This agreement shall inure to the benefit of and be binding upon the parties hereto and their respective successors and permitted assigns. This agreement shall be governed by and construed in accordance with the laws of the State of New Jersey, without giving effect to its conflicts of law provisions. The courts located in New Jersey shall have exclusive jurisdiction of all matters relating to or arising out of any sale of materials by SGPPL to Customer hereunder, and Customer hereby consents to the jurisdiction of such courts.
As a business unit under Saint-Gobain Performance Plastics’ Engineered Components division, Saint-Gobain Seals offers not only high-performance thermoplastic materials you see in this product handbook, but a wide range of critical sealing and polymer parts that make THE difference in our daily lives.

**Our main family of products includes:**

- OmniSeal® Spring-Energized Seals and Rotary Lip Seals
- Rulon® Fluoropolymer Materials
- Meldin® Thermoplastic and Thermoset Polyimide Materials

Other products in our portfolio include OmniFlex™ Fluoroelastomer Seals, Fluoroloy® high-performance custom-formulated materials, Marathon® valves and vacuum pump diaphragms, metal boss seals, v-packings, injection-molded plastic parts and stock shapes.
The majority of the seals and polymer components we manufacture are custom designed and matched with the best materials to optimize their performance in various applications and markets, and under the most extreme and critical conditions.

Saint-Gobain Seals products are extensively used in key markets such as Oil & Gas, Automotive, Life Sciences and Aerospace. We have also been instrumental in the Electronics and Industrial industries, providing energy-efficient and environmentally friendly designs. Our solutions reflect our business model, which focuses on co-development relationships and engineer-to-engineer direct collaboration. More than 93% of our products are custom engineered to the customer’s application. Please feel free to contact us at sealsmarketing@saint-gobain.com to request one of our catalogs, handbooks or brochures, or if you have any questions. Our global team is happy to assist you with your sealing and polymer needs.
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