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MELDIN® POLYMERS

HIGH-PERFORMANCE THERMOPLASTIC MATERIALS



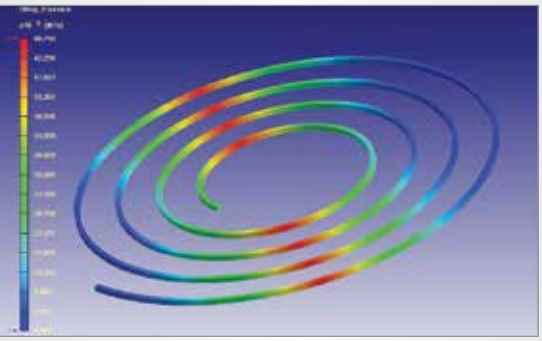
BEYOND
the boundaries of possible

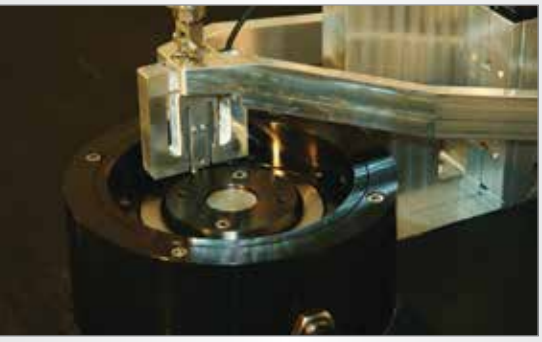
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Welcome to the Omniseal Solutions' World: Experience You Can Rely On ... Time After Time

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, Omniseal Solutions™ is dedicated to providing the most technologically advanced products on the market today and finding solutions for the future.



Saint-Gobain Group Headquarters, France

A Tour of Our Capabilities

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Omniseal Solutions' 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; 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.

Design Engineering

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

R&D, Lab and Testing

- DMA (Dynamic Mechanical Analyzer), TMA (Thermo-mechanical 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

AS 9100 Rev.D

ISO 13485:2016

ISO 9001:2015

ISO 14001:2015

ISO 45001:2018



Bristol, Rhode Island, USA



Saltillo, Mexico



Logroño, Spain



Minhang, Shanghai, China

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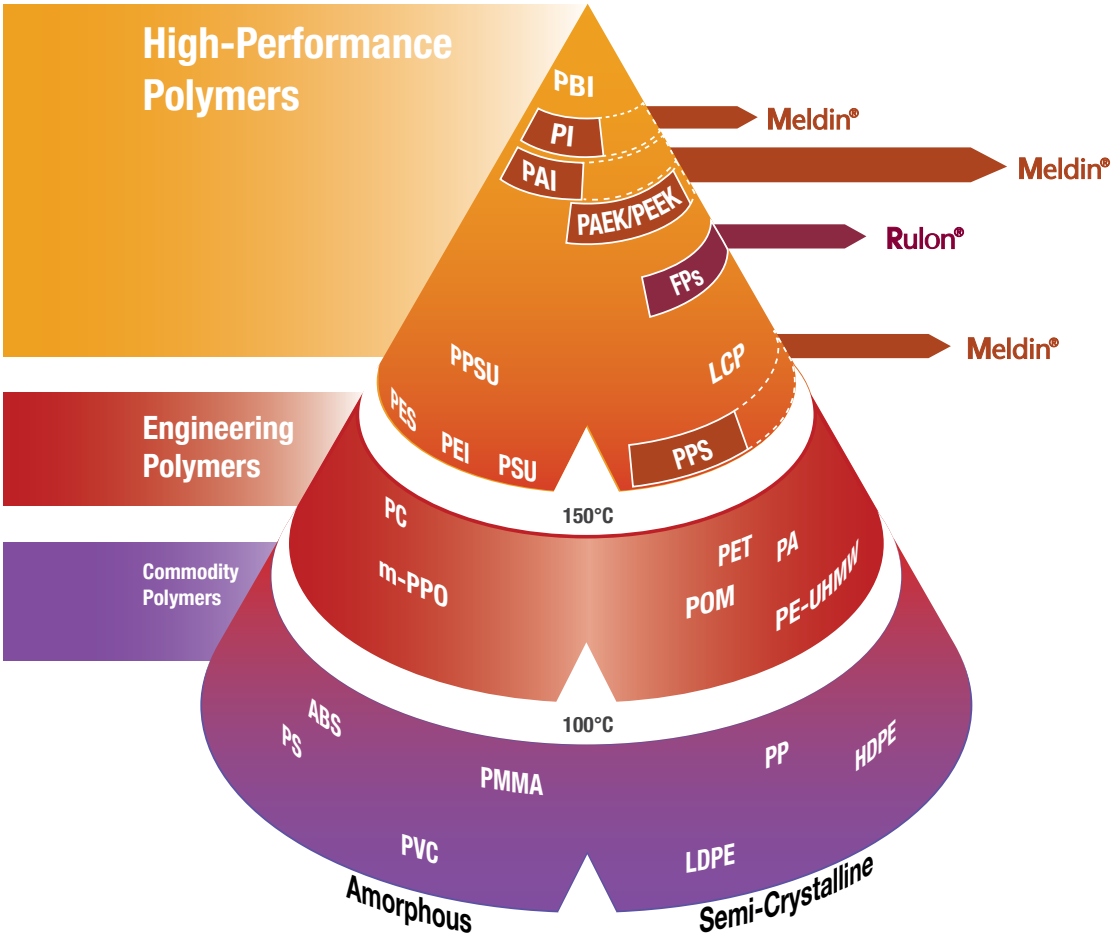
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The Importance of Meldin® Thermoplastic Material in Today's World

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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 aviation, life science, space, energy and other industries.

Polymers in the Omniseal Solutions' Meldin® thermoplastic material 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® compounds. Engineering polymers processing is available at our 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.

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How Our Meldin® Family Started and Evolved







Historically, Omniseal Solutions™ (formerly Dixon Industries Corp.) focused on the production of polymer compounds. Beginning in 1957, our well-known Rulon® solution 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 Omniseal Solutions' thermoset polyimide offerings (represented by the newly developed Meldin® 7000). The Meldin® 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

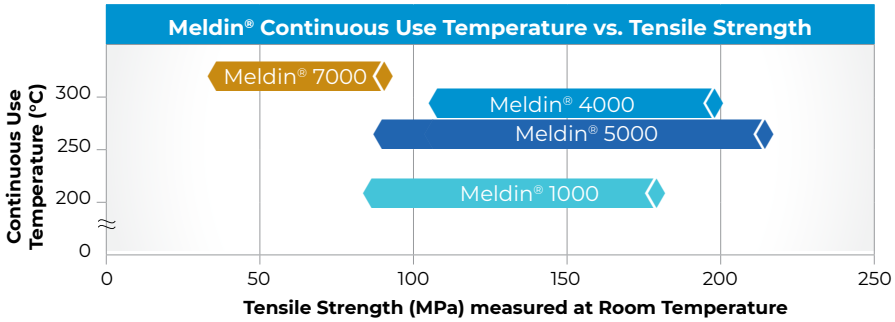
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The Meldin® line includes our popular 1000, 4000 and 5000 series, which have been developed to satisfy working conditions for applications where metals and other materials may not be adequate:

- 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.

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

Along with our thermoset polyimide offering (Meldin® 7000), Omniseal Solutions™ 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.







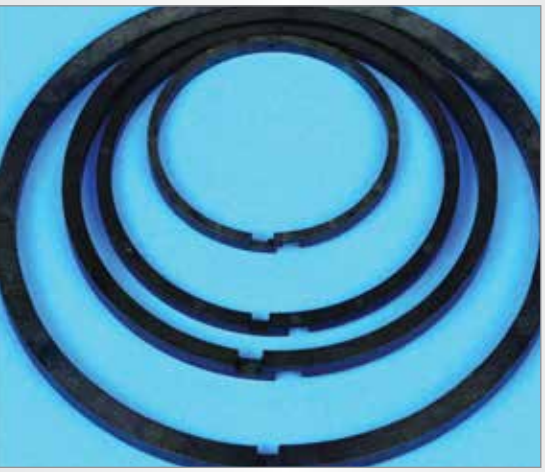


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A Snapshot of Meldin® 1000 Series





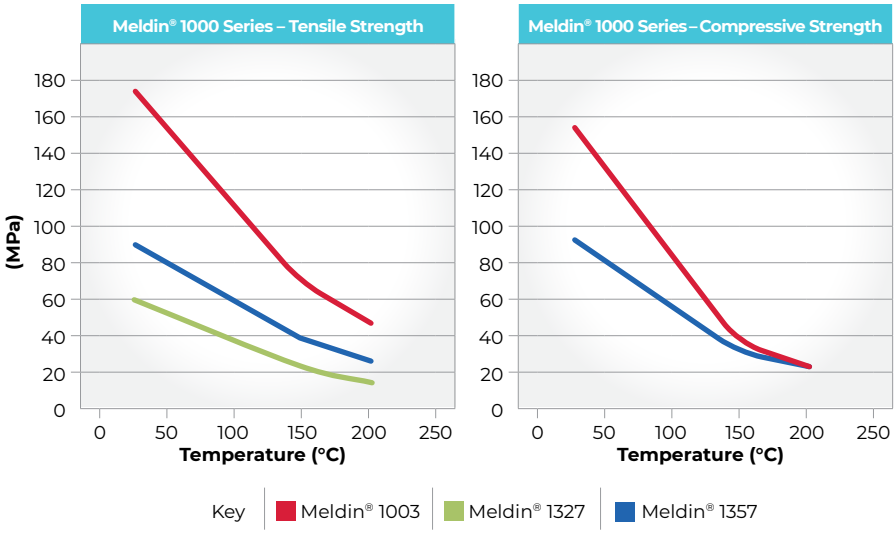


Meldin® 1000 series is a Omniseal Solutions™ product line based on PPS compounds. Components made of Meldin® 1000 series materials exhibit excellent chemical and thermal resistance, have good dimensional stability and maintain structural integrity, providing design versatility.

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
- Bushings
- Piston rings
- Seals
- Thrust washers

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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

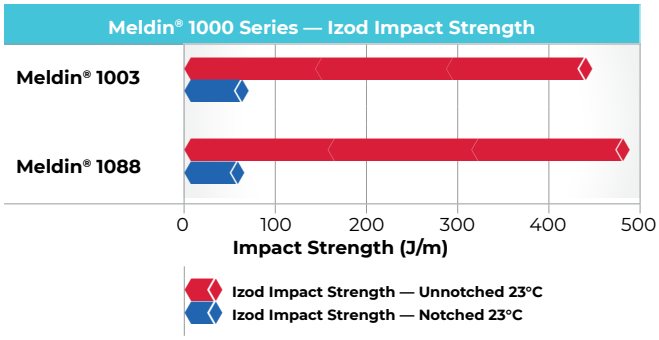
This grade is used when structural integrity and low deformation are required. This material also exhibits good electrical insulative properties and dimensional stability.

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® 1000 – Technical Properties

	Condition	Test Method	Units	Meldin® 1003	Meldin® 1088	Meldin® 1277	Meldin® 1327	Meldin® 1357
Mechanical Properties								
Tensile Strength	Break RT	ASTM D638	psi (MPa)	24,400 (168)	25,300 (175)	20,300 (140)	8,300 (57)	12,500 (86)
Tensile Strength	Break 400°F (204°C)	ASTM D638	psi (MPa)	6,500 (45)			1,900 (13)	3,400 (24)
Tensile Elongation	Break RT	ASTM D638	%	1.4	1	1.6	1.9	4.5
Tensile Elongation	Break 400°F (204°C)	ASTM D638	%	2			6.3	
Tensile Modulus	RT	ASTM D638	psi*10^5 (GPa)	31 (21)	26.3 (18)	20 (14)	6.1 (4.3)	4.5 (3.1)
Flexural Strength	RT	ASTM D790	psi (MPa)	37,600 (259)	34,300 (237)	33,900 (234)	15,400 (106)	16,200 (112)
Flexural Modulus	RT	ASTM D790	psi*10^5 (GPa)	30 (21)	30.9 (21)	20 (14)	6.5 (4.5)	
Compressive Strength	RT	ASTM D695	psi (MPa)	22,500 (155)			16,200 (112)*	13,500 (93)
Compressive Strength	400°F (204°C)	ASTM D695	psi (MPa)	3,400 (24)			3,300 (23)*	3,300 (23)
Thermal Properties								
Melting Point		ASTM D3418	°F (°C)	600 (316)	600 (316)	600 (316)	600 (316)	600 (316)
Glass Transition Tg	Onset	ASTM D3418	°F (°C)	190 (90)	190 (90)	190 (90)	190 (90)	190 (90)
Coefficient of Thermal Expansion	along flow	ASTM E831	in/in/°F (m/m/°C) x 10^{-5}	0.7 (1.25)		1.4 (2.5)		1.9 (3.4)
Coefficient of Thermal Expansion	average	ASTM E831	in/in/°F (m/m/°C) x 10^{-5}	2 (3.6)				2.2 (3.9)
Heat Deflection Temperature		ASTM D648	°F (°C)	500 (260)	500 (260)	500 (260)	450 (232)	450 (232)
Thermal Conductivity	RT	ASTM F433	BTU in/hr ft^2 (W/m°C)	5.4 (0.75)				
General Properties								
Specific Gravity	RT	ASTM D792		1.57	1.57	1.65	1.44	1.39
Water Absorption	RT, 24h	ASTM D570	%	0.03	0.02	0.01		0.21
Flammability		U/L		V-O		V-O		

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

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A Snapshot of Meldin® 4000 Series







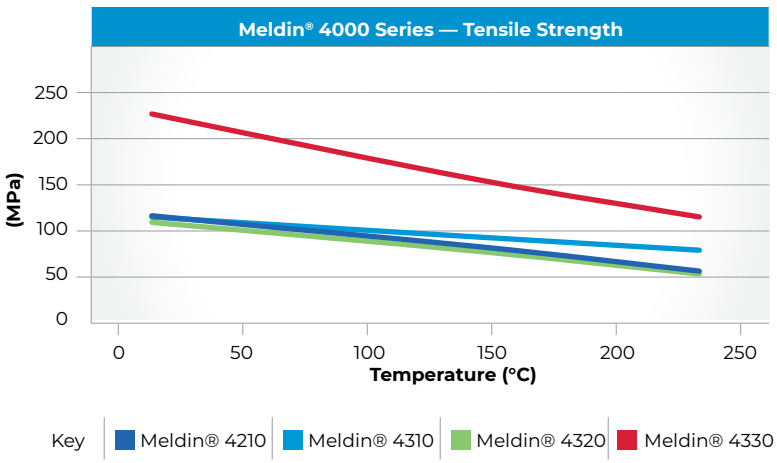
Meldin® 4000 is Omniseal Solutions™ product line of PAI (polyamide-imide) based compounds. The different numbers within the series refer to the unique composition and different properties of the various compounds.

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 many fluids (e.g., 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
- Bushings
- Thrust washers
- Vanes
- High precision bearings

Meldin® 4210

This grade is used mainly for washers when needed to minimize the coefficient of friction.

Meldin® 4310

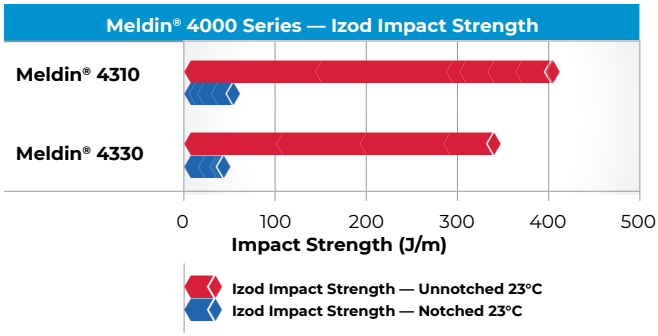
Wear grade used mostly for seal rings but also for washers and bearings.

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

	Condition	Test Method	Units	Meldin® 4210	Meldin® 4310	Meldin® 4320	Meldin® 4330
Mechanical Properties							
Tensile Strength	Break RT	ASTM D638	psi (MPa)	16,500 (114)	16,400 (113)	15,600 (108)	32,000 (221)
Tensile Strength	Break 455°F (235°C)	ASTM D638	psi (MPa)	7,700 (53)	10,900 (75)	7,200 (50)	16,000 (110)
Tensile Elongation	RT	ASTM D638	%	4.8	3.3	2.4	1.5
Tensile Modulus	RT	ASTM D638	psi*10^5 (GPa)	5.5 (3.8)	9.9 (6.8)	10.4 (7.2)	23.9 (16.5)
Flexural Strength	RT	ASTM D790	psi (MPa)	21,300 (147)*	31,200 (215)	25,100 (173)	50,800 (350)
Flexural Strength	455°F (235°C)	ASTM D790	psi (MPa)	10,300 (71)	16,400 (113)	11,200 (67)	25,700 (177)
Flexural Modulus	RT	ASTM D790	psi*10^5 (GPa)	6.1 (4.2)	10 (6.9)	12 (8.3)	27.6 (19.9)
Compressive Strength	RT	ASTM D695	psi (MPa)	19,300 (133)**	24,700 (170)	18,700 (129)**	36,300 (250)
Compressive Strength	455°F (235°C)	ASTM D695	psi (MPa)	9,300 (64)**		10,300 (71)**	18,000 (124)***
Compressive Modulus	RT	ASTM D695	psi*10^5 (GPa)	5.1 (3.5)	7.7 (5.3)	8.1 (5.6)	14.4 (9.9)
Thermal Properties							
Melting Point		ASTM D3418	°F (°C)	700 (371)	700 (371)	700 (371)	700 (371)
Glass Transition Tg	Onset	ASTM D3418	°F (°C)	536 (280)	536 (280)	536 (280)	536 (280)
Coefficient of Thermal Expansion	< Tg	ASTM D696	in/in/°F (m/m/°C) x 10^{-5}		1.4 (2.5)		0.5 (0.9)
Heat Deflection Temperature		ASTM D648	°F (°C)		534 (279)		540 (282)
Thermal Conductivity	RT	ASTM C177	BTU in/hr ft^2 (W/m°C)		3.9 (0.54)		3.8 (0.53)
Electrical Properties							
Dielectric Strength	2.5 mm thickness	ASTMD149	V/mil (kV/mm)				
Dielectric Constant	RT, 1 kHz	ASTM D150	-		6		
Volume Resistivity	RT	ASTM D257	Ohm*cm		8*10^{15}		
General Properties							
Specific Gravity	RT	ASTM D792		1.43	1.46	1.51	1.48
Water Absorption	RT, 24h	ASTM D570	%	0.24	0.28	0.17	0.26

*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)

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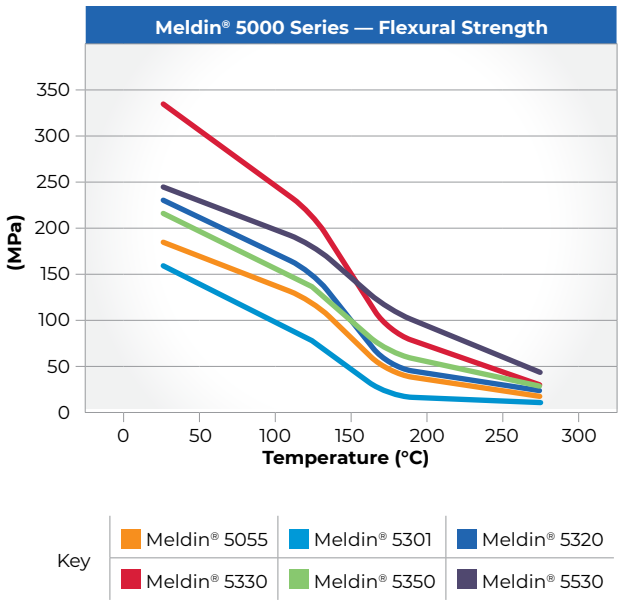
A Snapshot of Meldin® 5000 Series







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.

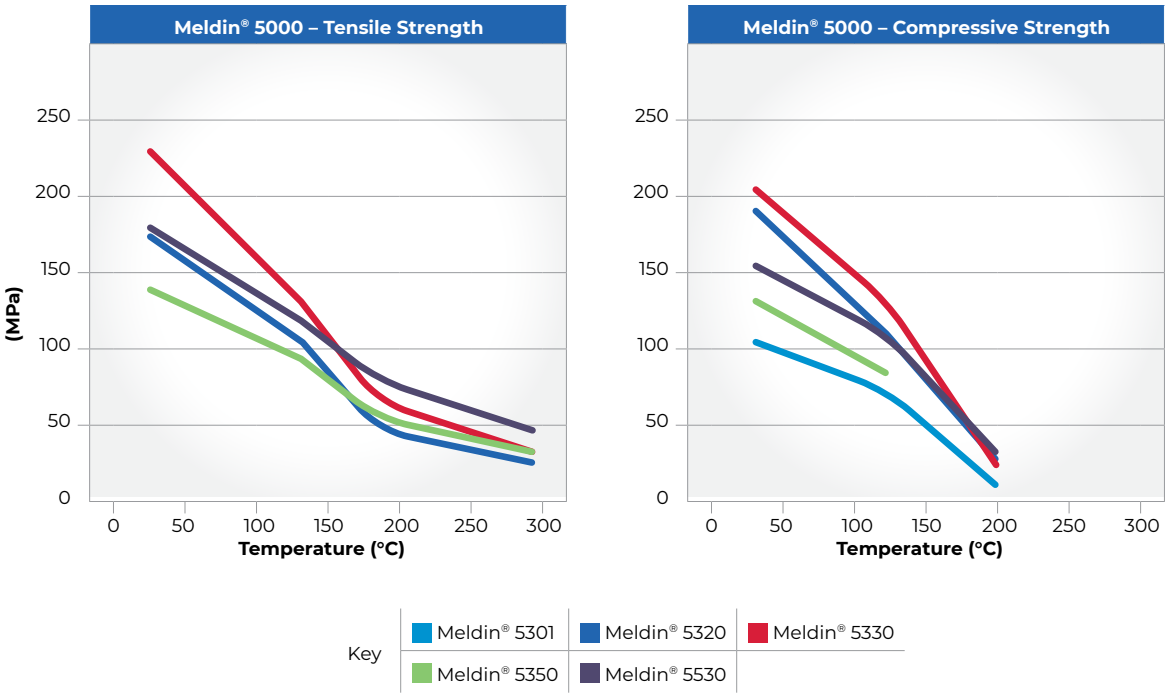


From a tiny bearing used in hand-held surgical tools to large diameter (> 1.5 m) seal rings used in offshore oil and gas applications, Omniseal Solutions™ offers a Meldin® 5000 grade that will meet your requirements. Meldin® 5301, Meldin® 5302, Meldin® 5320 and Meldin® 5330 grades provide excellent chemical 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

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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

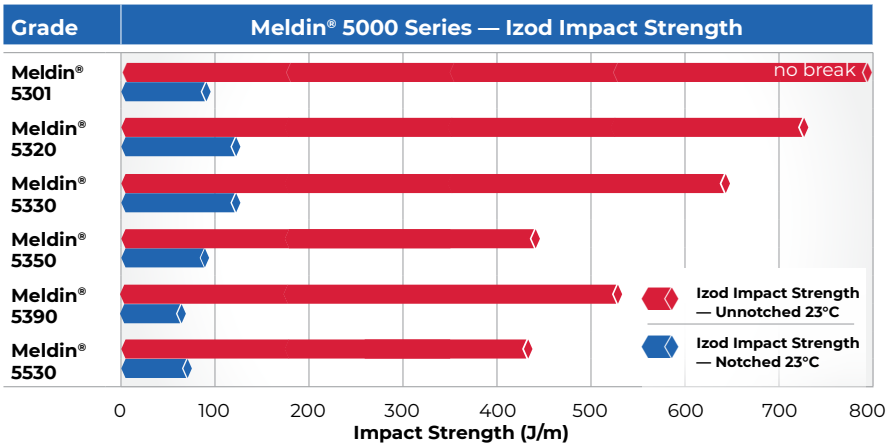
This grade offers superior wear resistance and lower friction compared to our 5330 grade.

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.



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Meldin® 5000 – Technical Properties

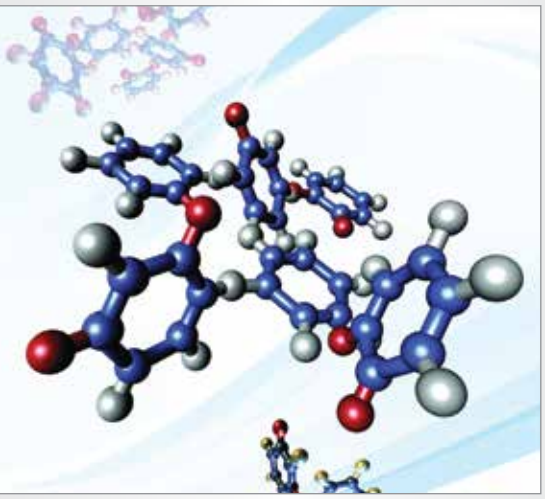
	Condition	Test Method	Units	Meldin® 5055	Meldin® 5210	Meldin® 5301	Meldin® 5302	Meldin® 5320	Meldin® 5330	Meldin® 5350	Meldin® 5390	Meldin® 5530
Mechanical Properties												
Tensile Strength	Yield RT	ASTM D638	psi (MPa)			14,000 (97)	17,000 (117)					
Tensile Strength	Break RT	ASTM D638	psi (MPa)	16,300 (112)	10,200 (70)		17,000 (117)	24,000 (166)	33,000 (228)	20,000 (138)	20,500 (141)	24,700 (170)
Tensile Strength	Break 480°F (249°C)	ASTM D638	psi (MPa)		1,400 (10)			3,600 (25)	5,100 (35)	4,800 (33)	5,700 (39)***	7,100 (49)
Tensile Elongation	RT	ASTM D638	%	1.2	6.6	65	20	2.1	2	2.2	1.9	1.9
Tensile Modulus	RT	ASTM D638	psi*10^5 (GPa)	23 (15.9)	4.6 (3.2)	5.1 (3.5)	6.4 (4.4)	14 (9.7)	32 (22.3)	14.7 (10.1)	20.3 (14)	26 (18)
Flexural Strength	RT	ASTM D790	psi (MPa)	26,400 (182)	16,800 (123)*	22,600 (156)	26,400 (182)	33,500 (231)	48,000 (331)	30,600 (211)	31,000 (214)	34,800 (240)
Flexural Strength	480°F (249°C)	ASTM D790	psi (MPa)	2,600 (18)	1,200 (8)*	1,000 (7)		4,100 (28)	5,100 (35)	4,800 (33)	5,800 (40)*	6,500 (45)
Flexural Modulus	RT	ASTM D790	psi*10^5 (GPa)	21.2 (14.5)	4.6 (3.2)	6 (4.1)	6.7 (4.6)	14.5 (10)	27.6 (19)	13.8 (9.5)	17.7 (12.2)	24.7 (17)
Compressive Strength	RT	ASTM D695	psi (MPa)	18,000 (124)	15,700 (108)**	17,200 (119)		31,200 (215)	34,800 (240)	21,700 (150)	22,900 (158)**	25,500 (176)
Compressive Strength	392°F (200°C)	ASTM D695	psi (MPa)		2,300 (16)****	9,700 (67)		4,300 (30)	3,600 (25)		3,800 (26)****	5,100 (35)
Compressive Modulus	RT	ASTM D695	psi*10^5 (GPa)	4.5 (3.1)	4.2 (2.9)		5.1 (3.5)				10.4 (7.1)	
Thermal Properties												
Melting Point		ASTM D3418	°F (°C)	650 (343)	650 (343)	650 (343)	707 (375)	650 (343)	650 (343)	650 (343)	651 (343)	650 (343)
Glass Transition Tg	Onset	ASTM D3418	°F (°C)	290 (143)	290 (143)	290 (143)	320 (160)	290 (143)	290 (143)	290 (143)	290 (143)	290 (143)
Coefficient of Thermal Expansion	Along Flow < Tg	ASTM E831	in/in/°F (m/m/°C) x 10^{-5}	1.8 (3.3)		2.5 (4.5)	2.8 (5)	1 (1.8)	0.8 (1.4)	0.84 (1.5)		0.7 (1.2)
Coefficient of Thermal Expansion	Along Flow > Tg	ASTM E831	in/in/°F (m/m/°C) x 10^{-5}	2.1 (3.8)		6.7 (12)		1 (1.8)	0.8 (1.4)	0.84 (1.5)		0.7 (1.2)
Coefficient of Thermal Expansion	Average < Tg	ASTM E831	in/in/°F (m/m/°C) x 10^{-5}	2.3 (4.1)		3.1 (5.5)	3.4 (6)	2.5 (4.5)	2.2 (4)	2.5 (4.5)		2 (3.5)
Coefficient of Thermal Expansion	Average > Tg	ASTM E831	in/in/°F (m/m/°C) x 10^{-5}	2.8 (5)		7.8 (14)		6.2 (11)	5.6 (10)	6.2 (11)		5 (9)
Heat Deflection Temperature		ASTM D648	°F (°C)	600 (316)		305 (152)		617 (325)	626 (330)	600 (316)		626 (330)
Thermal Conductivity	RT	ASTM F433	BTU in/hr ft^2 (W/m°C)	5.3 (0.76)		2 (0.29)		2.1 (0.3)	6.6 (0.95)	6.1 (0.87)		9.1 (1.3)
Electrical Properties												
Dielectric Strength	2.5 mm thickness	ASTM D149	V/mil (kV/mm)			407 (16)		510 (20)				
Dielectric Constant	RT, 1 kHz	ASTM D150				3.1		3.2				
Volume Resistivity	RT	ASTM D257	Ohm*cm			10^{16}		10^{16}	10^5	10^{10}		10^6
General Properties												
Specific Gravity	RT	ASTM D792		1.4	1.36	1.3	1.31	1.51	1.4	1.45	1.45	1.44
Water Absorprion	RT, 24h	ASTM D570	%	0.2	0.17	0.5		0.11	0.06	0.06	0.06	

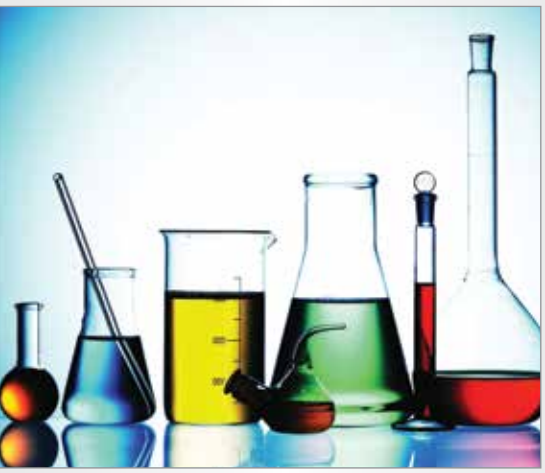
Data reported are typical of grades processed by injection molding

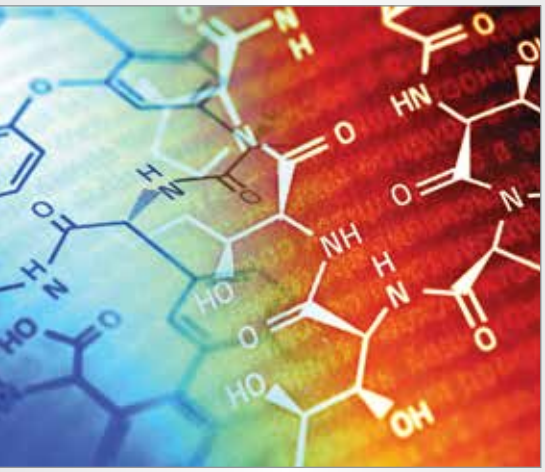
*Value reported at 5% strain if strain exceeded 5% per ASTM D790
**2% offset yield stress reported if no peak stress observed
***Data obtained at 235°C
****Data obtained at 249°C, 2% offset yield stress reported if no peak stress observed

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Compatible or Not? Meldin® Material's Broad Relationship with Chemicals







A= Suitable, B= Limited Suitability, C= Very Limited Suitability, NR= Not Recommended, N/A= No Info			
Chemical	**Meldin® 1000 Series**	**Meldin® 4000 Series**	**Meldin® 5000 Series**
	Resistant to dilute acids and bases, aliphatic and aromatic hydrocarbons, aldehydes, ketones, alcohols, chlorohydrocarbons and oils.	Resistant to most acids, aliphatic and aromatic hydrocarbons and chlorohydrocarbons. Strong bases, saturated steam are not recommended.	Resistant to most chemicals. Not recommended for concentrated sulfuric and nitric acid.
Acids			
Acetic acid (10%)	A	A	A
Glacial acetic acid	A	A	A
Acetic anhydride	A	A	N/A
Benzene sulfonic acid	A	NR	NR
Chromic acid (10%)	B	A	A
Formic acid (88%)	A	C	B
Hydrochloric acid (10%)	A	A	A
Hydrochloric acid (37%)	B	A	A
Hydrofluoric acid (40%)	B	NR	NR
Lactic acid	A	A	A
Phosphoric acid (35%)	A	A	A
Sulfuric acid (10%)	A	A	A
Sulfuric acid (30%)	A	A	NR
Bases			
Ammonium hydroxide (28%)	A	C	A
Sodium hydroxide (15%)	A	NR	A
Sodium hydroxide (30%)	A	NR	A
Aqueous salts			
Aluminum sulfate	A	A	A
Ammonium chloride	A	A	A
Ammonium nitrate	A	A	A
Barium chloride	A	A	A
Bromine	C	A	NR
Calcium chloride	A	A	A
Calcium nitrate	A	A	A
Ferric chloride	A	A	A
Magnesium chloride	A	A	A
Potassium permanagate	C	A	A
Sodium bicarbonate	A	A	A
Sodium chloride	A	A	A
Sodium hypochlorite	B	A	A
Sodium sulfate	A	A	A
Sodium sulfide	A	A	A
Sodium sulfite	A	A	A
Alcohols			
2-Aminoethanol	B	NR	N/A
n-amyl alcohol	A	A	A
n-butyl alcohol	A	A	A
Cyclohexanol	A	A	A
Ethylene glycol	A	A	A

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Chemical	Meldin® 1000 Series	Meldin® 4000 Series	Meldin® 5000 Series
Aldehyde & Ketones			
Acetophenone	B	A	N/A
Benzaldehyde	B	A	A
Cyclohexanone	A	A	A
Formaldehyde	A	A	A
Furfural	A	C	A
Methyl ethyl ketone	A	A	A
Amines			
Aniline	B	A	A
n-butyl amine	B	A	A
Dimethylaniline	B	A	N/A
Ethylene diamine	B	NR	A
Morpholine	B	A	A
Pyridine	B	NR	A
Esters			
Amyl acetate	A	A	A
Butyl acetate	A	A	A
Butyl phthalate	NR at HT	A	N/A
Ethyl acetate	A	A	A
Ethers			
Butyl ether	A	A	N/A
Cellosolve	A	A	N/A
P-Dioxane	A	A	A
Tetrahydrofuran	A	A	A
Halogenated hydrocarbons			
Acetyl chloride	A	A	A
Benzyl chloride	B	A	A
Carbon tetrachloride	B	A	A
Chlorobenzene	B	A	A
2-chloroethanol	B	A	A
Chloroform	NR	A	A
Ethylene chloride	B	A	A
Hydrocarbons			
Cyclohexane	A	A	A
Diesel fuel	A	A	A
Gasoline	A	A	A
Heptane	A	A	A
Mineral oil	A	A	A
Motor oil	A	A	A
Stoddard solvent	A	A	N/A
Toluene	B	A	A
Nitrile/Nitro compounds			
Acetonitrile	A	A	A
Benzonitrile	B	A	N/A
Nitrobenzene	B	A	A
Nitromethane	B	A	A



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.

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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. Omniseal Solutions™ 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

Meldin® 5301

Used when tensile and compressive strength need to be maximized or when excellent chemical compatibility is needed.

Meldin® 5320

Offers strength and rigidity; used for structural parts, keeping good mechanical properties.



Piston seals



Bushings



Back-up rings

Energy Market: Case Studies

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

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



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



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

Our Added Value

- Slow angular motion
- Low wear and long lifetime
- High compressive strength
- Low coefficient of friction



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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



Piston rings



Bearings and bushings



Vanes

Meldin® Thermoplastic Typical Grades

Meldin® 1003

Highest level of strength and rigidity.

Meldin® 1357

Lowest wear rate and coefficient of friction.

Meldin® 4330

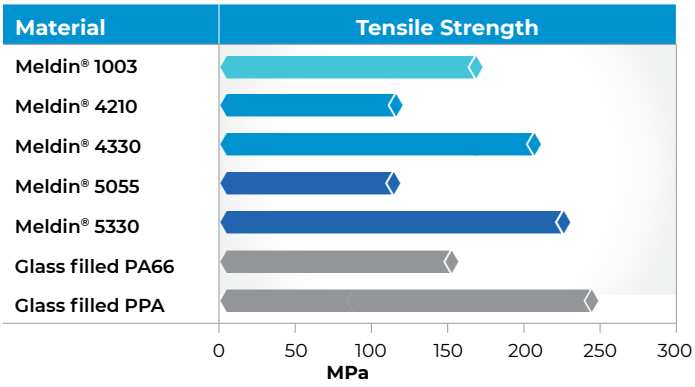
Excellent dimensional stability and the lowest coefficient of thermal expansion in the whole Meldin® product line. Ideal for high precision bushings.

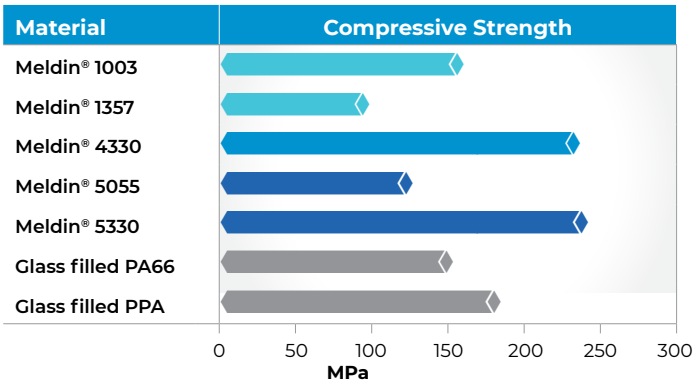
Meldin® 5301/5302

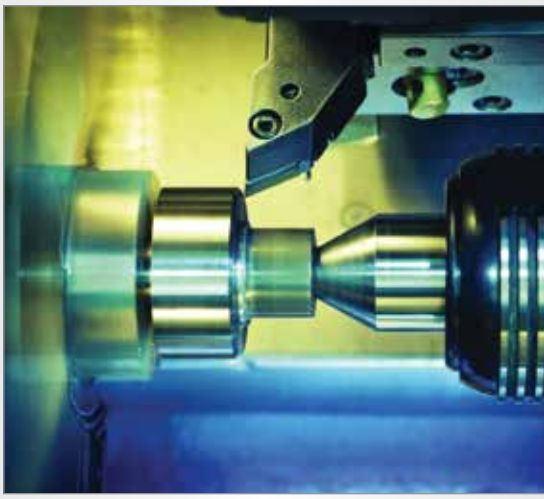
FDA compliant grade for maximum tensile and compressive strength and special PEEK grade with very high temperature resistance.

Meldin® 5330

Structural integrity and high resistance to thermal expansion.











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)

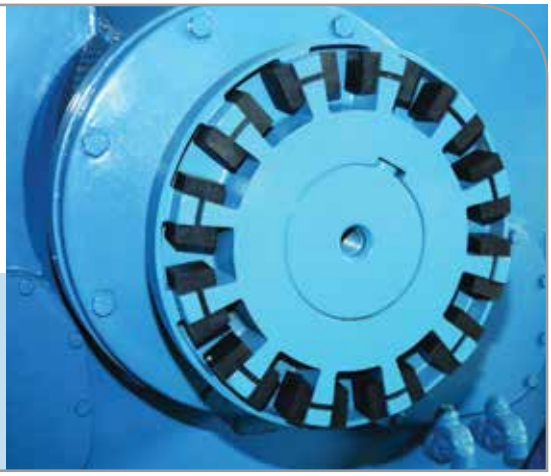
Our Added Value

- 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



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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.



Piston rings



Bearings and bushings



Seal rings

Life Sciences Market: Case Studies

MELDIN® LIFE SCIENCES

Application: Medical Device Compressor

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



Our Added Value

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



Application: Dental Drill



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

Our Added Value

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



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Application Data Form

Company name_____ Street address_____
City_____ State_____
Zip code _____
Engineering contact _____ Purchasing contact _____
Phone number_____ Phone number_____
Email address _____ 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)_____

Application Data Form

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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_____

Please email a copy of the completed Application Data Form to:

Omniseal Solutions™
Email: help@omniseal-solutions.com

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

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Warranty

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.

Any statements, technical information, and recommendations in this publication are believed to be reliable, but the accuracy or completeness thereof is not guaranteed. The statements, technical information, and recommendations in this publication shall not be the basis of buyer's decision to purchase the Product and should not be relied upon to establish specification limits or as the basis of design. Saint-Gobain Performance Plastics Corporation makes no warranties, express or implied, and assumes no liability in connection with the use of the statements, technical information, and recommendations in this publication. Saint-Gobain Performance Plastics Corporation reserves the right to make any changes without notice to the Products and to the information and contents of this or any other publication, including, without limitation, materials, dimensional attributes, performance characteristics and other properties.

Nothing contained herein or in any of our literature shall be considered a license or recommendation to use any process or to manufacture or to use any product in a manner which otherwise infringes any patent or other intellectual product right of Saint-Gobain Performance Plastics Corporation or of any third party.

Saint-Gobain Performance Plastics Corporation warrants that its products do not infringe on any patent, copyright, trade secret or other proprietary right of a third party except to the extent Customer provides the specific design of the products or any part thereof.

IF ANY PRODUCT IS RESOLD BY BUYER, A COPY OF THIS NOTICE MUST BE PROVIDED TO THE SUBSEQUENT PURCHASER/END-USER.

Warranty

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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

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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.

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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 HEREUNDER 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.

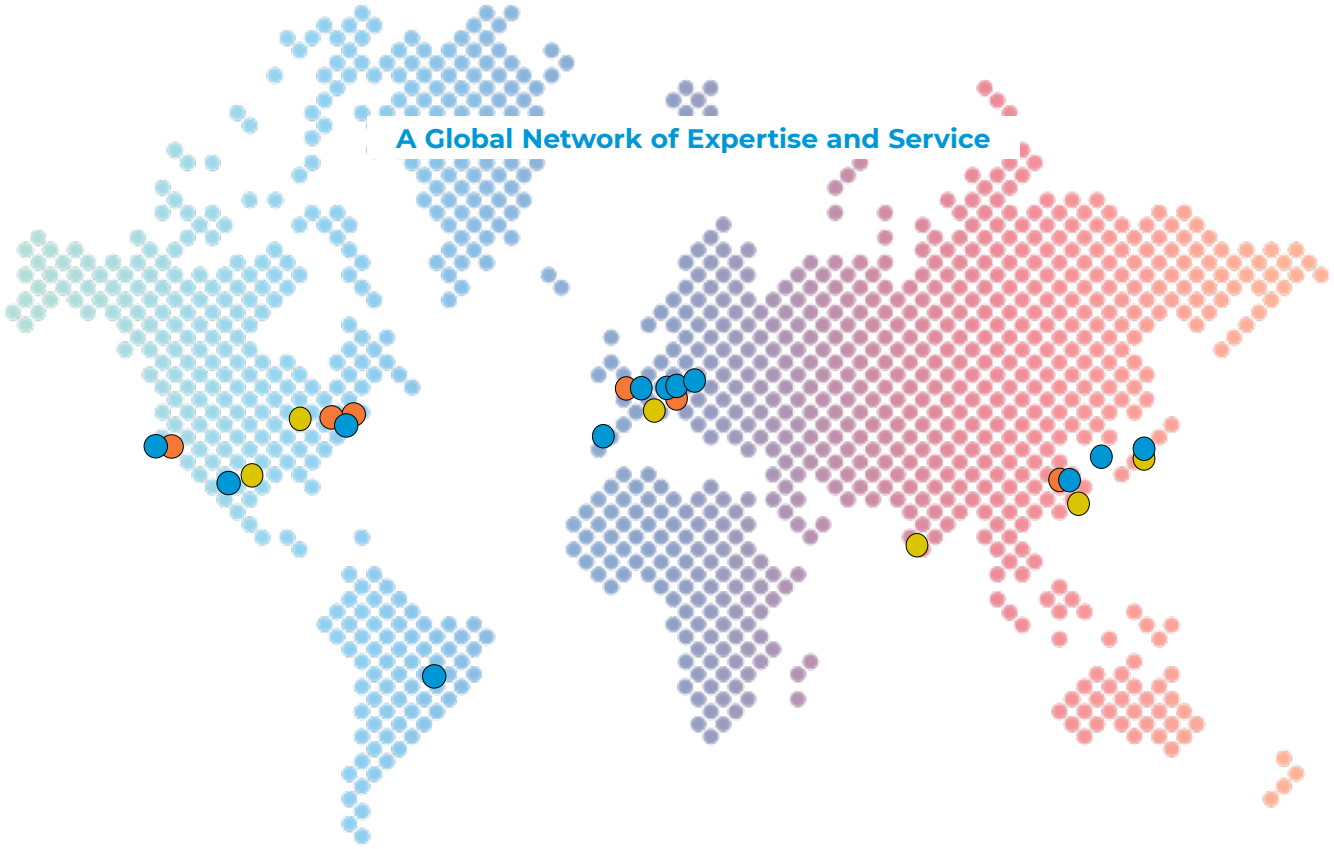
17. General: This agreement shall not be assigned by Customer without the prior written consent of SGPPL, and any assignment made without such consent shall be null and void. This agreement shall inure to the benefit of and be binding upon the parties hereto and their respective successors and permitted 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.

Omniseal Solutions
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Notes

Notes

A Global Network of Expertise and Service



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