FLUOROSINT® PTFE FAMILY OF ADVANCED FLUOROPOLYMER MATERIALS

QUADRANT

You inspire … we materialize®

FLUOROSINT® ENHANCED PTFE MATERIALS

SEE HOW THESE MATERIALS STACK UP IN YOUR APPLICATION

Quadrant developed the FLUOROSINT® range of enhanced PTFE materials to fill the performance gaps where unfilled and low-tech, filled PTFE based polymers underperform. Each FLUOROSINT material was specifically developed to excel in demanding bearing and seal applications. While each of these materials possess the chemical resistance and compliance of PTFE, each material offers some special benefits that give the designer clear performance advantages.

Higher pressure seals and wear parts where precision is critical.

FLUOROSINT 500
- Outstanding dimensional stability, approximating aluminum
- Low deformation under load

Lower pressure seats and seals where virgin PTFE fails and food contact compliance may be required.

FLUOROSINT 207
- Food contact compliant composition (FDA* and 2002/72/EC**)
- Very good wear resistance
- Very low coefficient of friction

High performance bearings, bushings and seals where higher loads and minimal wear are required.

FLUOROSINT HPV
- Food contact compliant composition (FDA*)
- Excellent wear resistance
- Unmatched bearing performance

Extreme service seals and wear parts at elevated temperature where strength and stability are critical.

FLUOROSINT MT-01
- Very low deformation under load
- Good wear resistance
- Excellent dimensional stability

* U.S. Food and Drug Administration
** Directive of the European Union

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FLUOROSINT® 500

EXCEPTIONAL DIMENSIONAL STABILITY FOR PRECISE TOLERANCE CONTROL

Ivory

Key benefits

FLUOROSINT® 500 Enhanced PTFE offers an ideal combination of stability and wear resistance for sealing applications where tight dimensional control is required. FLUOROSINT 500 also greatly reduces the risk of a catastrophic system failure by becoming a sacrificial wear surface. With a deformation under load 9 times lower than virgin PTFE, FLUOROSINT 500 allows designers to greatly improve the efficiency of systems without sacrificing the wear resistance and forgiving benefits of PTFE. The synthetic mica developed and manufactured by Quadrant delivers tolerance performance approximating that of aluminum.

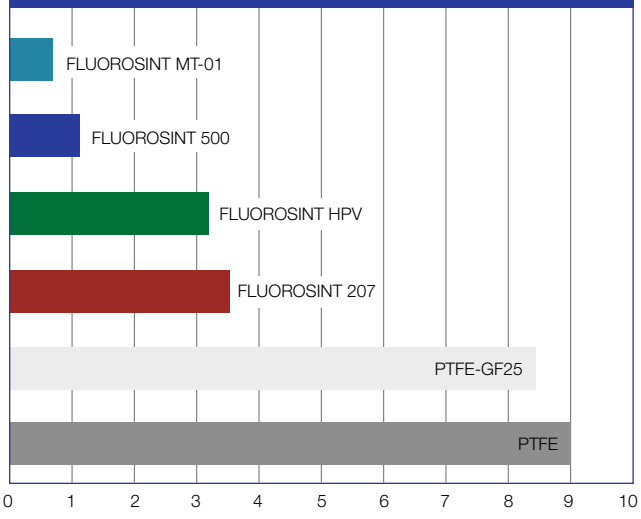
Common applications

· Split and one-piece seals
· Valve seats
· Shrouds
· Slide bearings
· Wear strips
· Sacrificial, abradable seals
· Thrust washers

Application example

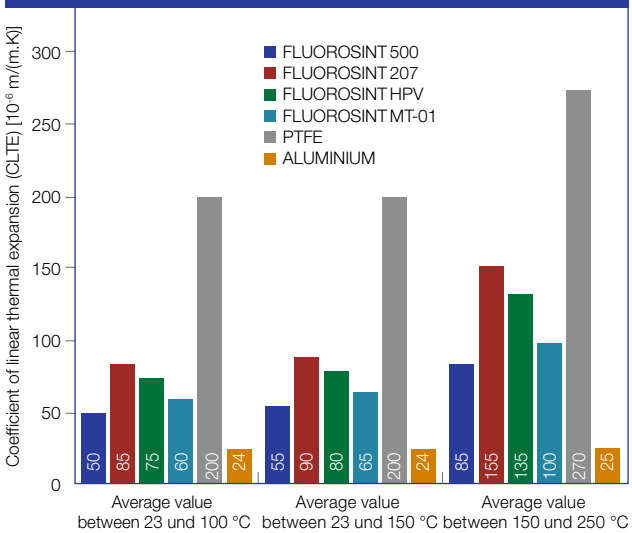
FLUOROSINT 500 has been used very successfully as a replacement for metal/aluminum seals and shrouds in compressors. In addition to the security a sacrificial part provides the system, FLUOROSINT 500 allows the introduction of abradable sealing technology where mating parts are allowed to «cut» their own running clearance and thus permitting significant gains in efficiency.

DEFORMATION UNDER COMPRESSIVE LOAD



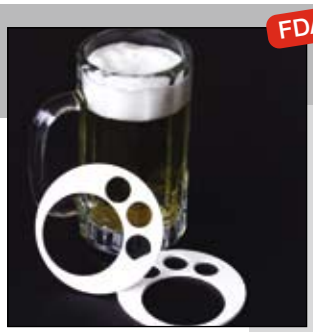
Creep after 24 hours under a compressive stress of 13.8 MPa (2000 psi) at 50 °C - (%)

COEFFICIENT OF LINEAR THERMAL EXPANSION



FLUOROSINT® 207

LOWEST COEFFICIENT OF FRICTION OF FLUOROSINT GRADES



FDA Compliant

White

Key benefits

FLUOROSINT® 207 Enhanced PTFE is a significant performance upgrade for any designer using PTFE for applications where temperature resistance, chemical resistance and food contact compliance (FDA and 2002/72/EC) are all important. FLUOROSINT 207 lasts far longer than unfilled PTFE in wear applications and has a very low coefficient of friction. FLUOROSINT 207 works well against most mating surfaces.

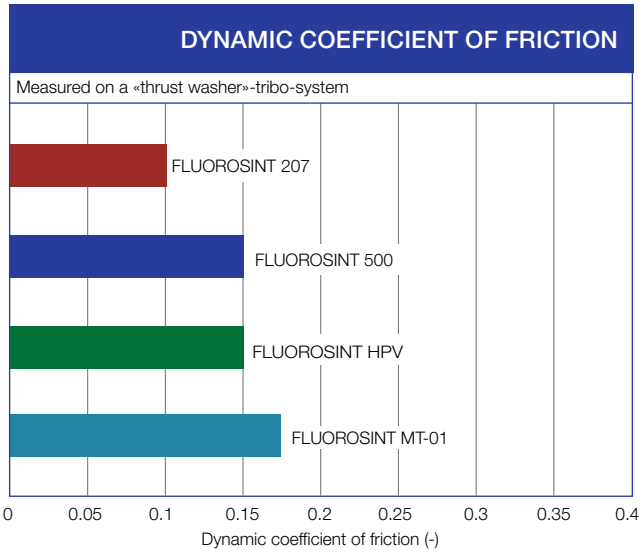
Common applications

· Seals
· Mixers
· Pumps
· Appliances
· Bearings
· Valve seats

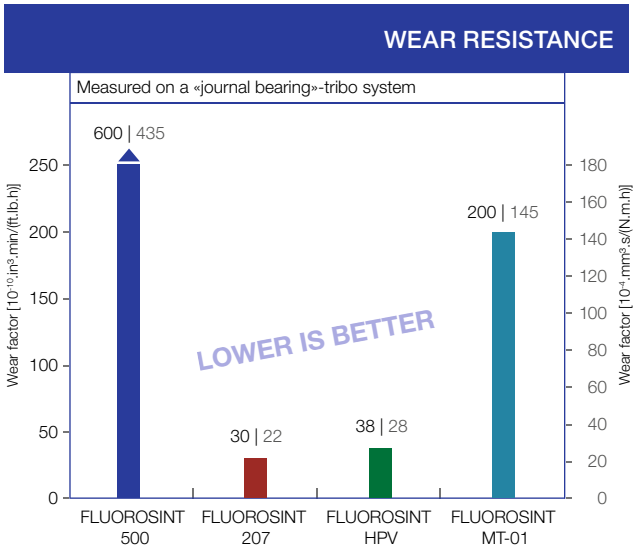
Application example

FLUOROSINT 207 replaces unfilled PTFE and low-tech, filled PTFE's in wear and seal applications where either stability or wear resistance are causing failures. A commercial beverage filling system replaced virgin PTFE seals with FLUOROSINT 207 and improved fill accuracy associated with leaks caused by failed seals.

Test conditions:
– Rotating plastics test specimen Ø 28.58 mm (1.125") x Ø 25.4 mm (1") - see ASTM D 3702
– Stationary steel washer Ø 31.62 mm (1.245") x Ø 15.88 mm (0.625") - see ASTM D 3702
– Pressure: 1.72 MPa (250 psi)
– Sliding velocity: 0.102 m/s (20 ft/min)
– PV-value: 0.175 MPa.m/s (5000 psi.ft/min)
– Surface roughness of the AISI C-1018 steel (Rc = 20) mating surface: Ra = 0.40 µm (16 µ")
– Normal environment (air, 23 °C / 50 % RH)
– Unlubricated operation

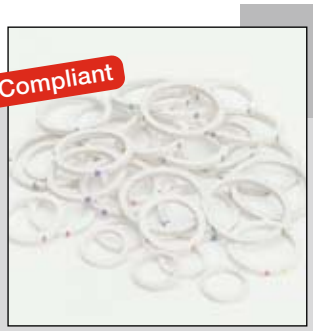


Test conditions:
– Bushing Ø 17.65 x Ø 13.1 x 12.7 mm (Ø 0.695" x Ø 0.516" x 0.5")
– Pressure: 0.29 MPa (42.4 psi)
– Sliding velocity: 0.60 m/s (118 ft/min)
– PV-value: 0.175 MPa.m/s (5000 psi.ft/min)
– Surface roughness of the rotating AISI W-1 steel (HB 180-200) mating surface: Ra = 0.40 µm (16 µ")
– Total distance run: 431 km (after 200 h)
– Normal environment (air, 23 °C / 50 % RH)
– Unlubricated operation



FLUOROSINT® HPV

MOST WEAR RESISTANT FLUOROSINT GRADE – OUTLASTS LOW-TECH PTFE BASED MATERIALS



Tan

Key benefits

FDA compliant FLUOROSINT® HPV is a high performance bearing grade of FLUOROSINT – optimized for high PV and very low wear factor. FLUOROSINT HPV was developed for bearing applications where other, low-tech PTFE formulations exhibit premature wear or simply cannot perform. FDA compliance gives food and pharmaceutical equipment manufacturers new design options and all benefit from its excellent load bearing and wear characteristics.

Common applications

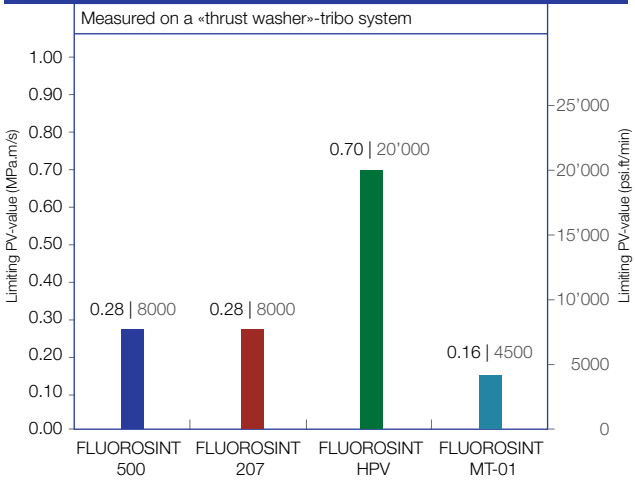
· Bearings
· Commercial food equipment
· Wear guides
· High performance seals
· Thrust washers

Application example

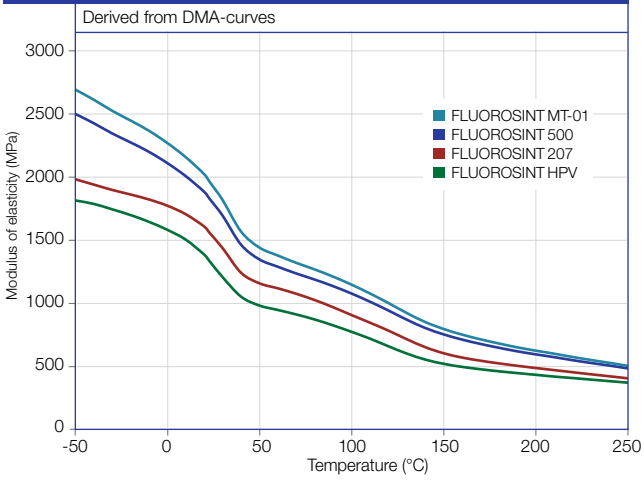
FLUOROSINT HPV was specified by a manufacturer of commercial sausage production equipment as a replacement for a low-tech filled PTFE material. The old material would wear quickly and not properly stretch the product during filling. The premature wear caused tears in the product and required frequent replacement. An additional benefit of FLUOROSINT HPV – improved dimensional stability – allowed designers to remove a press fit metal part that was required to compensate for the low-tech material's lack of dimensional control.

Test conditions:
– Rotating plastics test specimen Ø 28.58 mm (1.125") x Ø 25.4 mm (1") - see ASTM D 3702
– Stationary steel washer Ø 31.62 mm (1.245") x Ø 15.88 mm (0.625") - see ASTM D 3702
– Sliding velocity: 0.51 m/s (100 ft/min)
– Stepwise increase of pressure: + 0.17 MPa (25 psi) every 10 minutes
– Surface roughness of the AISI C-1018 steel (Rc = 20) mating surface: Ra = 0.40 µm (16 µ")
– Normal environment (air, 23 °C / 50 % RH)
– Unlubricated operation

LOAD BEARING CAPABILITY (LIMITING PV)

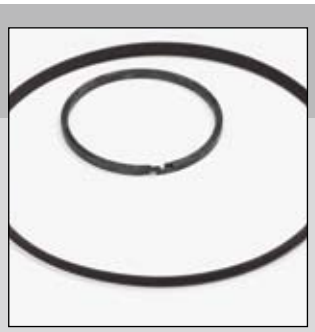


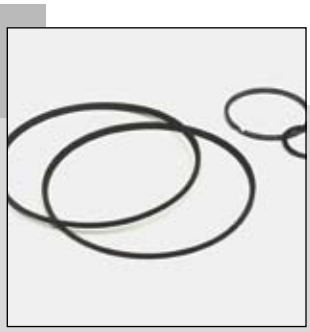
STIFFNESS VERSUS TEMPERATURE



FLUOROSINT® MT-01

ULTRA-HIGH PERFORMANCE GRADE FOR STABILITY AT ELEVATED TEMPERATURE





Dark grey

Key benefits

FLUOROSINT® MT-01 is an extreme service grade developed specifically for applications where the benefits of PTFE-based materials also require strength, stiffness and stability. FLUOROSINT MT-01 delivers high mechanical performance at elevated temperature and as a result is often specified in seat, seal and wear applications where extreme conditions are present.

Common applications

· High temperature seals
· Linear guides
· Wear bands
· Ovens and dryers

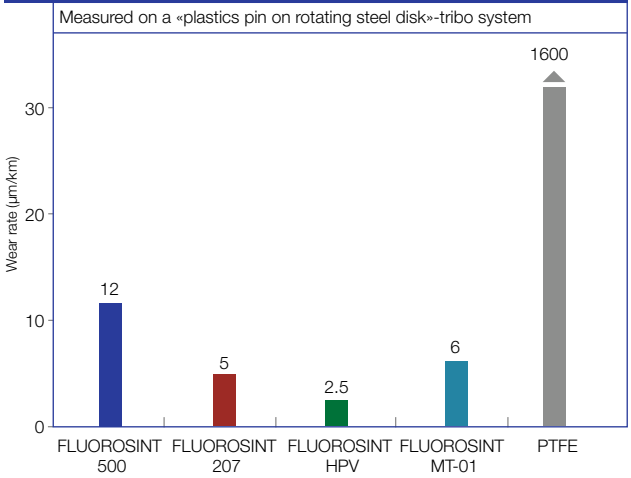
Application example

FLUOROSINT MT-01 is widely specified in chemical processing equipment like the aggressive environment present during sour gas processing. FLUOROSINT MT-01 extends the temperature envelope of PTFE and provides remarkable stability for applications that see extremes. Seals, replaced monthly in oil recovery equipment have been replaced with FLUOROSINT MT-01 and now outlast other components.

Test conditions:
– Pressure: 3 MPa
– Sliding velocity: 0.33 m/s
– Surface roughness of the C35 steel mating surface: Ra = 0.70 - 0.90 µm
– Total distance run: 28 km
– Normal environment (air, 23 °C / 50 % RH)
– Unlubricated operation

WEAR RESISTANCE

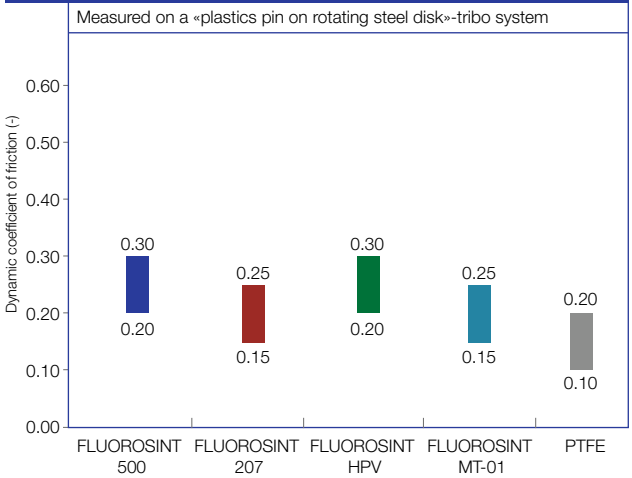
Measured on a «plastics pin on rotating steel disk»-tribo system



Test conditions:
– Pressure: 3 MPa
– Sliding velocity: 0.33 m/s
– Surface roughness of the C35 steel mating surface: Ra = 0.70 - 0.90 µm
– Total distance run: 28 km
– Normal environment (air, 23 °C / 50 % RH)
– Unlubricated operation

DYNAMIC COEFFICIENT OF FRICTION

Measured on a «plastics pin on rotating steel disk»-tribo system



PHYSICAL PROPERTIES OF THE FLUOROSINT® GRADES (INDICATIVE VALUES•)

Properties	Test methods	Units	FLUOROSINT® 500	FLUOROSINT® 207	FLUOROSINT® HPV	FLUOROSINT® MT-01
Colour	–	–	ivory	white	tan	dark grey
Density	ISO 1183-1	g/cm³	2.32	2.30	2.06	2.27
Water absorption:						
– after 24/96 h immersion in water of 23 °C (1)	ISO 62	mg	–	–	10 / 20	–
	ISO 62	%	–	–	0.07 / 0.15	–
– at saturation in air of 23 °C / 50 % RH	–	%	< 0.1	< 0.1	0.1 - 0.2	–
– at saturation in water of 23 °C	–	%	1.5 - 2.5	1 - 2	0.5 - 1	1.5 - 2.5
Thermal Properties						
Melting temperature (DSC, 10 °C/min)	ISO 11357-1/-3	°C	327	327	327	327
Thermal conductivity at 23 °C	–	W/(K.m)	0.77	–	–	–
Coefficient of linear thermal expansion:						
– average value between 23 and 100 °C	–	m/(m.K)	50 x 10^{-6}	85 x 10^{-6}	75 x 10^{-6}	60 x 10^{-6}
– average value between 23 and 150 °C	–	m/(m.K)	55 x 10^{-6}	90 x 10^{-6}	80 x 10^{-6}	65 x 10^{-6}
– average value between 150 and 250 °C		m/(m.K)	85 x 10^{-6}	155 x 10^{-6}	135 x 10^{-6}	100 x 10^{-6}
Temperature of deflection under load:						
– method A: 1.8 MPa	ISO 75-1/-2	°C	130	100	80	95
Max. allowable service temperature in air :						
– for short periods (2)	–	°C	280	280	280	300
– continuously : for min. 20,000 h (3)	–	°C	260	260	260	260
Min. service temperature (4)	–	°C	-20	-50	-50	-20
Flammability (5):						
– «Oxygen Index»	ISO 4589-1/-2	%	≥ 95	≥ 95	≥ 95	≥ 95
– according to UL 94 (1.5 / 3 mm thickness)	–	–	V-0 / V-0	V-0 / V-0	V-0 / V-0	V-0 / V-0
Mechanical Properties at 23 °C						
Tension test (6):						
– tensile stress at yield (7)	ISO 527-1/-2	MPa	7	10	10	14
– tensile strength (7)	ISO 527-1/-2	MPa	7	10	10	14
– tensile strain at break (7)	ISO 527-1/-2	%	15	> 50	> 50	20
– tensile modulus of elasticity (8)	ISO 527-1/-2	MPa	1750	1450	1200	1900
Compression test (9):						
– compressive stress at 1/2 % nominal strain (8)	ISO 604	MPa	12 / 19	10.5 / 15	10 / 14.5	11 / 17
Charpy impact strength – unnotched (10)	ISO 179-1/1eU	kJ/m²	8	30	55	-
Charpy impact strength – notched	ISO 179-1/1eA	kJ/m²	4.5	7.5	12	4
Rockwell hardness (11)	ISO 2039-2	–	R 55	R 50	R 45	R 74
Electrical Properties at 23 °C						
Electric strength (12)	IEC 60243-1	kV/mm	11	8	–	–
Volume resistivity	IEC 60093	Ohm.cm	> 10^{13}	> 10^{13}	–	–
Surface resistivity	ANSI/ESD STM 11.11	Ohm/sq.	> 10^{13}	> 10^{13}	> 10^{13}	< 10^{5}
Relative permittivity ε_r: at 100 Hz	IEC 60250	–	–	–	–	–
Relative permittivity ε_r: at 1 MHz	IEC 60250	–	2.85	2.65	–	–
Dielectric dissipation factor tan δ: at 100 Hz	IEC 60250	–	–	–	–	–
Dielectric dissipation factor tan δ: at 1 MHz	IEC 60250	–	0.008	0.008	–	–

Note: 1 g/cm³ = 1,000 kg/m³ ; 1 MPa = 1 N/mm² ; 1 kV/mm = 1 MV/m. – : currently no data available

Legend:

(1) According to method 1 of ISO 62 and done on discs Ø 50 x 3 mm.
(2) Only for short time exposure (a few hours) in applications where no or only a very low load is applied to the material.
(3) Temperature resistance over a period of min. 20,000 hours. After this period of time, there is a decrease in tensile strength – measured at 23 °C – of about 50 % as compared with the original value. The temperature values given here are thus based on the thermal-oxidative degradation which takes place and causes a reduction in properties. Note, however, that the maximum allowable service temperature depends in many cases essentially on the duration and the magnitude of the mechanical stresses to which the material is subjected.
(4) Impact strength decreasing with decreasing temperature, the minimum allowable service temperature is practically mainly determined by the extent to which the material is subjected to impact. The values given here are based on unfavourable impact conditions and may consequently not be considered as being the absolute practical limits.
(5) These estimated ratings, derived from raw material supplier data and other publications, are not intended to reflect hazards presented by the materials under actual fire conditions. There are no «UL File Numbers» available for the FLUOROSINT stock shapes.
(6) Test specimens: Type 1 B
(7) Test speed: 50 mm/min [chosen acc. to ISO 10350-1 as a function of the ductile behaviour of the material (tough or brittle)]
(8) Test speed: 1 mm/min
(9) Test specimens: cylinders Ø 8 x 16 mm
(10) Pendulum used: 4 J
(11) 10 mm thick test specimens
(12) Electrode configuration: Ø 25/Ø 75 mm coaxial cylinders ; in transformer oil according to IEC 60296 ; 1 mm thick test specimens.

- This table, mainly to be used for comparison purposes, is a valuable help in the choice of a material. The data listed here fall within the normal range of product properties of dry material. **However, they are not guaranteed and they should not be used to establish material specification limits nor used alone as the basis of design.**

  It has to be noted that the products listed in this table are reinforced and/or filled, and hence show an anisotropic behaviour (properties differ when measured parallel and perpendicular to the extrusion or compression direction).

As a result of our internal continuous improvement programmes, of availability and gathering of new and/or additional technical data, of increasing knowledge and experience, as well as of changing market requirements and revised internationally recognised material/test standards, Quadrant Engineering Plastic Products is extending and updating its literature and technical information on a continuous basis. We therefore invite and recommend our customers to consult our website for the latest and up to date information on our materials.

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Quadrant has extensive product and machining information available online. Our website is a portal to a wealth of technical data and the easiest was to engage our application specialists. Our team stands ready to help offer solutions to your toughest problems.

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