

OIL, GAS & PETROCHEMICAL

OFFSHORE EQUIPMENT



**QUADRANT PLASTICS FOR:
CHEMICAL/OIL & GAS PROCESSING**



QUADRANT
ENGINEERING PLASTIC PRODUCTS

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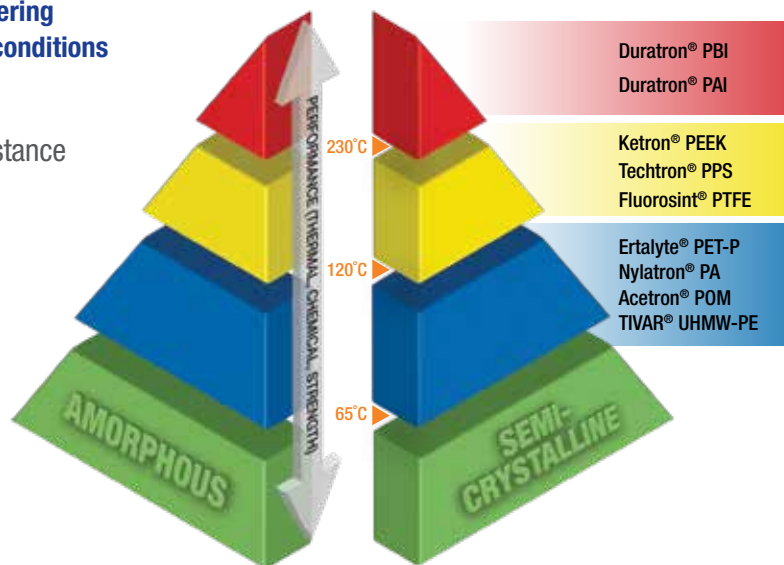
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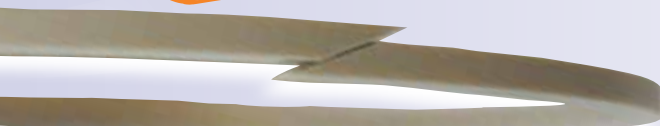
WHY QUADRANT MATERIALS?

Quadrant has a proven and growing portfolio of engineering materials for components that handle the challenging conditions of the oil, gas, & petrochemical industry.

- Extreme hot and cold temperature and pressure resistance in aggressive environments and deeper depths
- Superior corrosion resistance to chemicals in the harshest of environments
- Self-lubricating thermoplastics remove the need for external lubrication
- Lightweight plastic products with longer wear life



OURS: LOW STRESS



THEIRS: HIGH STRESS

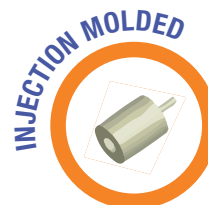
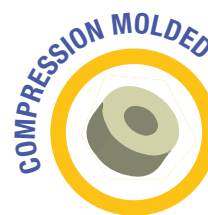


WE TAKE THE STRESS OUT

Any shape converter can take a good resin and make high stress materials with poor properties. Specify the shape manufacturer and then you are specifying a process which includes consistent resin and consistent shape properties... including consistent low stress materials. Let Quadrant eliminate the guess work and provide a consistent low stress shape regardless of the resin.

Quadrant provides flexibility in material portfolio and manufacturing capabilities providing you with a competitive edge.

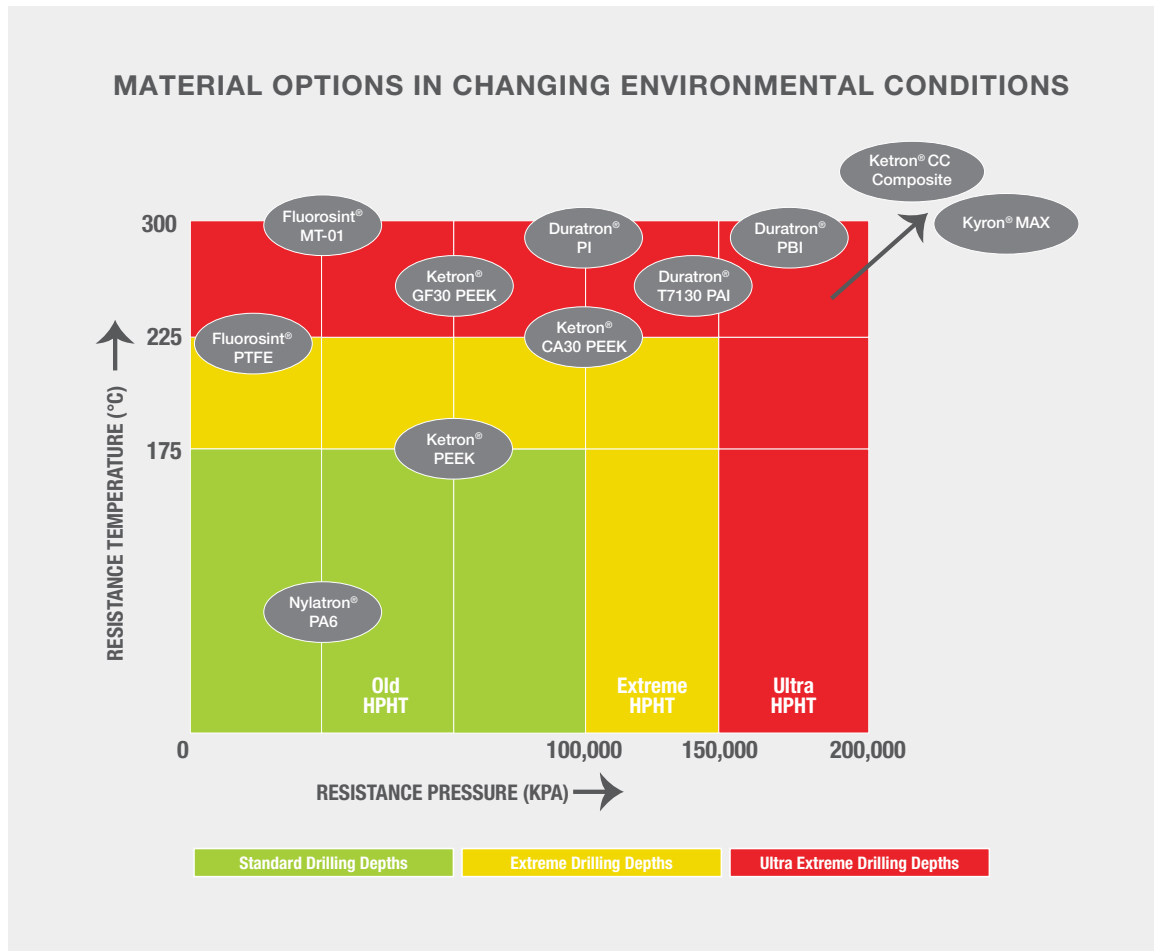
- Low stress shapes with extreme size availability from compression molded, extruded, injection molded and cast
- Offering custom and broad size availability on segmented welded rings with an OD range of 700mm – 3m
- The industry's first NORSOK M-710 certified stock shapes for oil, gas and petrochemical applications
- Compliance with many common industry specifications, such as ISO, ASME, API and NACE



MATERIAL COMPARISON

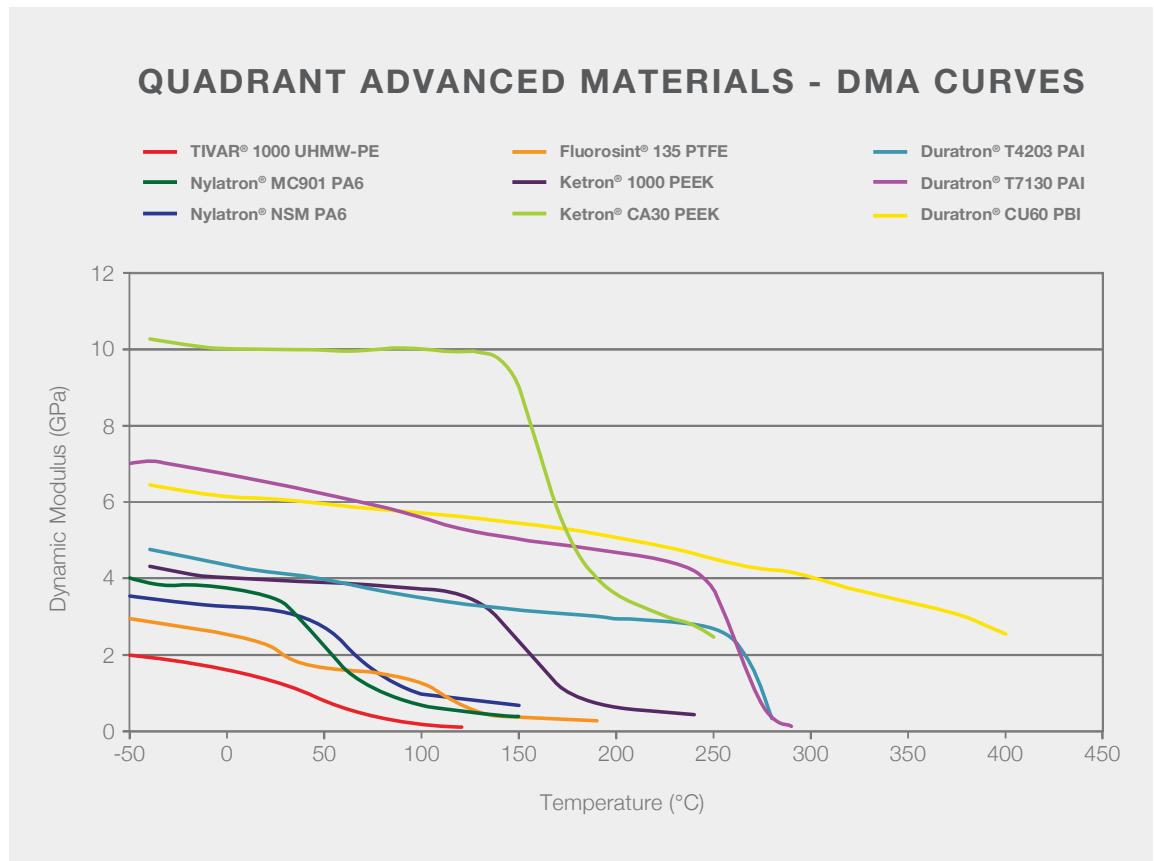
HPHT (HIGH PRESSURE HIGH TEMPERATURE)

Quadrant develops the materials of choice for design engineers where performance and reliability are required in extreme and hostile environments. Advanced properties of chemical and abrasion resistance combined with HPLT/HPHT ratings and superior strength make the Quadrant family of materials the ideal choice for structural parts, bushings, bearings, seals and back up rings.

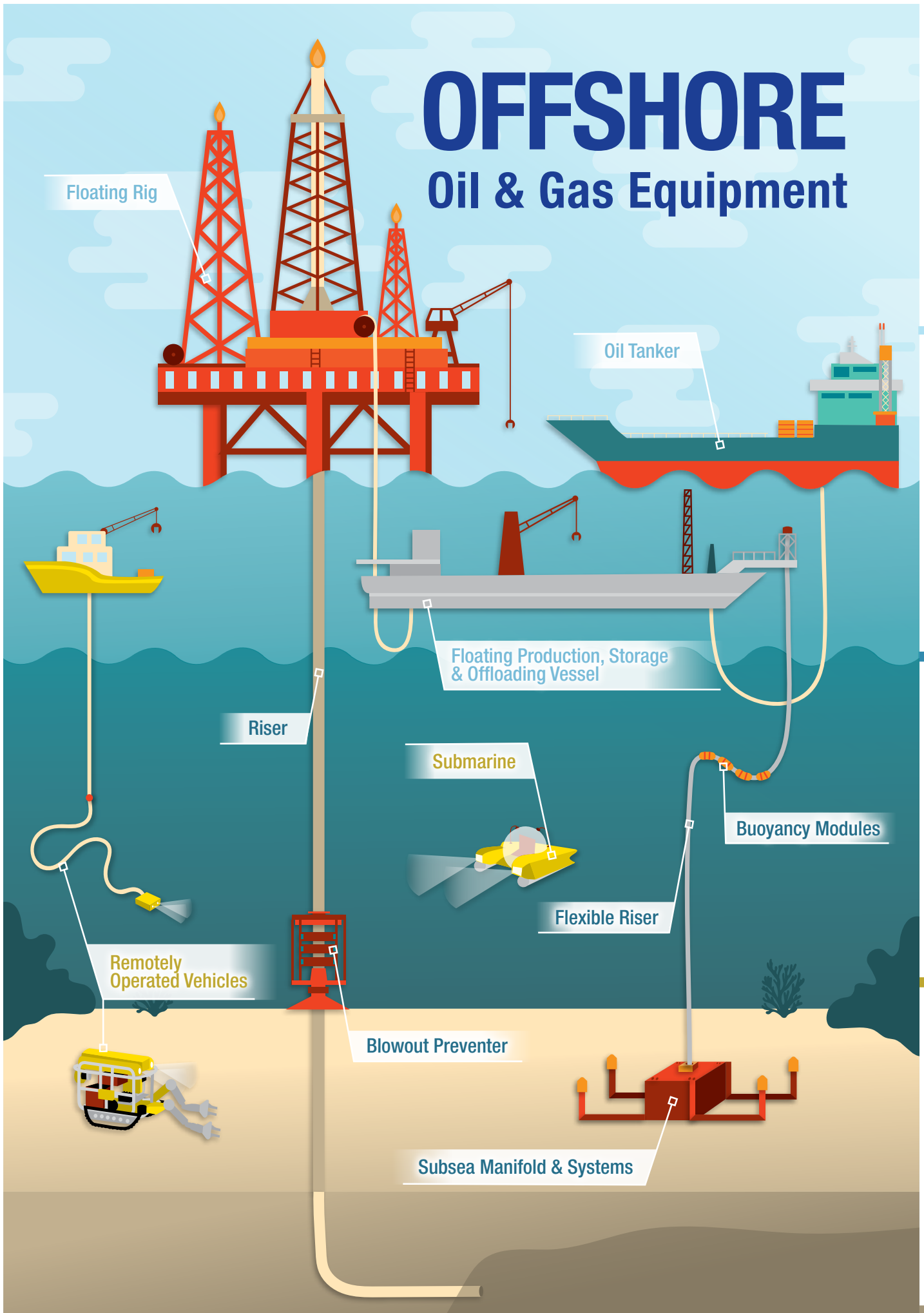


DMA (DYNAMIC MECHANICAL ANALYSIS)

DMA indicates polymer stiffness at varying temperatures. These data are useful in determining component suitability at operating temperature.



OFFSHORE Oil & Gas Equipment



ABOVE WATER/ON-PLATFORM

Above the water structures, components, systems, and accompanying vessels are used for well drilling, exploration, or extraction of petroleum and natural gas. Necessary materials for these environments offer light weight, strength and stiffness, along with wear resistance and great corrosion resistance.

MATERIALS:

- TIVAR® UHMW-PE
- Nylatron® PA
- Techtron® PPS
- Fluorosint® PTFE
- Ketron® PEEK

APPLICATIONS:

- Work platforms
- Cable sheaves
- Slide pads
- Pipe handling
- Swivel joints
- Bend restrictions
- Winches
- Pipe-in-pipe spacers
- Seals
- Bearings



SUBSEA

Deep ocean equipment and systems far off-shore and below the water line often include equipment located on the sea floor. Suitable materials in this extreme environment call for excellent strength and stiffness across a broad temperature spectrum as well as great toughness, impact, and corrosion resistance.

MATERIALS:

- TIVAR® UHMW-PE
- Nylatron® PA
- Ketron® PEEK
- Duratron® PAI

APPLICATIONS:

- Buoyancy modules
- Isolation valves
- Blowout preventer
- Insulators
- Connectors
- Flexible joints
- Wear pads



EXPLORATORY/SURVEY

Highly engineered sonar and exploratory sensing equipment is used to locate, identify, define, and even map the ocean floor. Materials may require electrical insulation, impact resistance for toughness at cold temperatures, and the ability to handle extreme pressures at great depths.

MATERIALS:

- TIVAR® UHMW-PE
- Acetron® GP POM-C
- Nylatron® PA
- Ketron® PEEK

APPLICATIONS:

- Scanning
- Acoustic
- Sonar devices
- ROVs
- Cameras
- Bumpers
- Connectors
- Crawlers



DOWN-HOLE

Down-hole equipment is anything that may go into the well for drilling, completion, or production enhancement of the flow from the underground reservoir. Components demand extreme strength and stiffness at various temperatures, along with the ability to resist degradation from aggressive drilling fluids and down-hole chemicals.

MATERIALS:

- Ketron® PEEK
- Techtron® PPS
- Duratron® PAI
- Ertalyte® PET-P

APPLICATIONS:

- Back up rings
- Frac balls
- Frac plugs
- Insulators
- Connectors
- Couplers
- Flow meters





		TIVAR® 1000 UHMW-PE Virgin UHMW-PE	Ertalon® GSM PA6 MoS2-filled PA6	Ertalon® NSM PA6 Premium Solid Lubricant filled PA6	Acetron® GP POM-C Premium Porosity-free POM-C	Fluorosint® 135 PTFE Proprietary filled PTFE	Ketron® 1000 PEEK Unfilled PEEK	Ketron® 1000 IM PEEK Unfilled Injection Molded PEEK	Ketron® GF30 PEEK 30% Glass filled PEEK	Ketron® CA30 PEEK 30% Carbon filled PEEK	Ketron® CM 1030HT PEK 30% Carbon filled PEK HT	Duratron® T4203 PAI Electrical grade PAI	Duratron® T4301 PAI Bearing Grade PAI	Duratron® CU60 PBI Unfilled PBI	
Physical Properties	Specific Gravity	g/cc	0.93	1.15	1.15	1.41	1.91	1.31	1.31	1.51	1.41	1.43	1.41	1.45	1.30
	Water Absorption	%	<0.01	0.60	0.30	0.20	0.10	0.10	0.10	0.10	0.06	0.15	0.40	0.40	0.40
	Moisture Absorption at Saturation	%	<0.01	7.00	7.00	0.90	0.30	0.50	0.50	0.30	0.30	0.50	1.70	1.50	5.00
Mechanical Properties	Hardness, Rockwell M	-	-	85	80	88	-	100	107	103	102	110	120	106	125
	Hardness, Shore D	-	66	85	85	85	74	85	88	89	93	91	-	-	94
	Tensile Strength, Ultimate	MPa	40.0	82.7	75.8	65.5	8.96	110.0	110.0	96.5	131.0	110.0	138.0	103.0	110.0
	Elongation at Break	%	300	20	20	30	3	40	40	2	5	3	10	3	2
	Tensile Modulus OR Modulus of Elasticity	GPa	0.552	2.760	2.830	2.760	2.550	4.340	4.140	6.890	7.580	9.310	4.140	6.210	5.860
	Flexural Yield Strength	MPa	24.1	110.0	110.0	82.7	17.2	172.0	159.0	159.0	177.5	152.0	165.0	159.0	221.0
	Flexural Modulus	GPa	0.60	3.45	3.28	2.76	2.07	4.14	4.14	6.89	8.62	7.93	4.14	5.52	6.55
	Compressive Yield Strength	MPa	20.7	103.0	96.5	93.1	48.3	138.0	138.0	152.0	200.0	200.0	165.0	152.0	345.0
	Compressive Modulus	GPa	0.552	2.760	2.760	1.790	1.380	3.450	2.930	3.790	-	3.760	3.300	6.550	6.210
	Izod Impact, Notched	J/cm	NB	0.214	0.267	0.534	0.267	0.320	0.210	0.427	0.550	0.534	1.070	0.427	0.267
	Coefficient of Friction, Dynamic	-	0.12	0.20	0.18	0.25	<=0.15	0.32	0.32	-	0.20	0.24	0.35	0.20	0.24
	K (wear) Factor	x10 ⁻⁸ mm ³ /N-m	-	201.0	24.2	403.0	64.5	755.0	755.0	-	302.0	171.0	70.5	20.1	121
	Limiting Pressure Velocity	MPa-m/sec	0.1050	0.1050	0.5250	0.0946	0.5010	0.2980	0.2980	-	0.8760	0.5250	0.4200	1.4000	1.3100
Thermal Properties	CTE, linear	µm/m-°C	198.0	90.0	99.0	97.2	45.0	46.8	46.8	21.6	18.0	37.8	37.8	25.2	23.4
	Thermal Conductivity	W/m-K	0.409	0.342	-	0.231	-	0.252	0.252	0.429	0.922	0.908	0.259	0.533	0.403
	Melting Point	°C	135	216	216	168	327	340	340	340	340	343	-	-	-
	Maximum Service Temperature, Air	°C	82.2	127.0	93.3	82.2	260	249	249	249	250	249	260	260	316
	Deflection Temperature at 1.8 MPa (264 psi)	°C	46.7	93.3	93.3	104.0	104.0	160.0	160.0	232.0	270.0	249.0	278.0	279.0	427.0
	Flammability, UL94	-	HB	HB	HB	HB	V-0	V-0	V-0	V-0	V-0	V-0	V-0	V-0	V-0

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