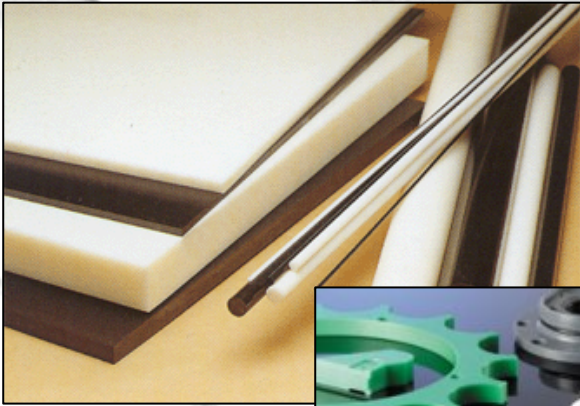


# **PROFESSIONAL PLASTICS, INC.**

*The Nation's Largest Supplier of High-Performance Engineering Materials*

**Premium Thermoplastic & Thermoset Sheets, Rods, Tubes & Film**





Since our establishment in 1984, Professional Plastics has been a family owned and operated company focused on providing our customers the best selection, prices and service in North America.

While we've grown our engineering plastics operation into over a dozen full-scale stocking locations throughout the US, our commitment hasn't changed. Today, Professional Plastics supplies the widest range of engineering plastics in the industry.

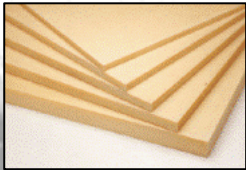
Our expansive inventory, competitive prices and exceptional customer service has helped us become the largest supplier of high-performance plastic shapes in North America.

Professional Plastics is a Master Distributor for Meldin® & Rulon® by Saint Gobain, Plavis® by Daelim and Turcite® by Trelleborg. We are also a prime distributor of Quadrant EPP materials such as Torlon®, Techtron®, Ertalylte®, Nylatron®, Semitron®, Celazole® and others.

## **General Purpose Engineering Plastics**

### **ABS - Engineering Grade**

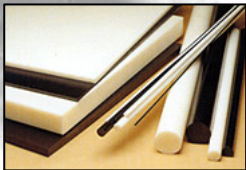
ABS has perhaps the best balance of properties when cost is a factor. It has good chemical and stress-resistance as well as a combination of toughness with rigidity and creep resistance. Easily machined, tough, low cost rigid thermoplastic material. ABS exhibits high impact strength & is ideal for turning, drilling, and milling. Good chemical and stress cracking resistance to inorganic salt solutions, alkalis, acids, and some oils. Excellent abrasion resistance; electrical properties, moisture and creep resistance.



### **Acetal Copolymer & Delrin® Acetal Homopolymer**

Acetal provides high strength and stiffness coupled with enhanced dimensional stability and ease of machining. As a semi-crystalline material, acetal is also characterized by a low coefficient of friction and good wear properties — especially in wet environments. Because of its high strength, modulus, and resistance to impact and fatigue, Acetal is used as a weight-saving metal replacement.

- Copolymer acetal is preferred to Delrin where centerline porosity is concerned.
- Premium Brand: Acetron GP



### **Nylon® - Extruded & Cast**

The exceptional bearing and wear properties of Nylon® make it one of the most widely used plastics in the world. Nylon® is frequently used as a replacement for bronze, brass, aluminum, steel and other metals, as well as other plastics, wood, and rubber. • High tensile strength and modulus of elasticity Nylon exhibits high impact resistance, a high heat distortion temperature. It resists wear, abrasion, and vibration. Nylon can withstand contact with chemicals, alkalis, dilute acids or oxidizing agents.

- Available Types: 6/6 (extruded), 6 (cast) - Premium Brands: Nylatron & MC 901
- Available in Natural, Black, MD, Glass-Filled, Oil-Filled & various other compounds.



### **Nylatron® GS Nylon - Extruded**

Nylatron® GS is a molybdenum disulphide (MoS<sub>2</sub>) filled nylon offering improved strength and rigidity. With a lower coefficient of linear thermal expansion than Nylon 101, Nylatron GS is the extruded grade, whereas Nylatron GSM is the Cast Grade. Nylatron GS parts maintain better fit and clearances, and have less tendency to seize as bearings.



### **Polycarbonate - Machine Grade Plate & Rod**

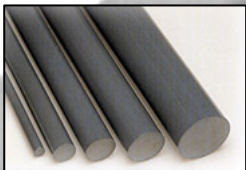
Machine-grade polycarbonate is an amorphous thermoplastic material with high-impact strength, high modulus of elasticity, and good dimensional stability. These properties, in addition to good electrical characteristics, make machine grade polycarbonate stock shapes an excellent choice for electrical/electronic applications. Its strength, impact resistance and transparency also make it an ideal material for certain transparent structural applications such as sight glasses and windows.

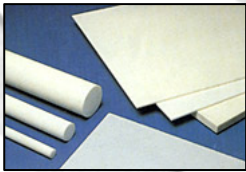


### **PVC - Type 1 Grey - Sheets & Rods**

PVC Sheets & Rods are available from stock in dozens of sizes.

PVC is the most widely used member of the vinyl family. Common applications include chemical processing tanks, valves, fittings & piping systems. PVC Sheets, Rods & Tubes offer excellent corrosion and weather resistance. It has a high strength-to-weight ratio and is a good electrical and thermal insulator. PVC is also self-extinguishing per UL flammability tests. PVC may be used to temperatures of 140°F (60°C).





### **Ertalyte® PET-P**

Ertalyte® PET-P is an unreinforced, semi-crystalline thermoplastic polyester characterized as having the best dimensional stability coupled with excellent wear resistance, a low coefficient of friction, high strength, and resistance to moderately acidic solutions. Ertalyte® is capable of sustaining high loads and enduring wear conditions. Ertalyte® PET-P offers good chemical and abrasion resistance. Its low moisture absorption enables mechanical and electrical properties to remain virtually unaffected by moisture.



### **Ertalyte® TX**

Ertalyte® TX rod for machining high-wear-resistant parts is an unreinforced semi-crystalline thermoplastic polyester (PET-P) that has a solid lubricant filler. The material has excellent performance in both high-pressure and high-velocity conditions, and is ideally suited for applications involving soft metal and plastic mating surfaces. High strength and stiffness, high wear-resistance, very good dimensional stability, high creep resistance and very good chemical resistance. This combination of properties make Ertalyte TX an ideal material for machining bushings and bearings that require no startup or running lubrication. Ertalyte TX has FDA and USDA compliance and is ideal for applications in food packaging and processing equipment.



### **Delrin® AF Blend**

Delrin® AF Blend is a unique thermoplastic material for use in moving parts in which low friction and long wear life are important. It is a combination of PTFE fibers uniformly dispersed in Delrin® acetal resin.

- Delrin® 100AF Blend includes 13% PTFE Fiber.
- Also available in full-strength 20% PTFE on a custom order basis.
- **For extended life, consider Ertalyte TX as an excellent, long-wear replacement for Delrin AF**



### **Turcite® A (Blue)**

Turcite® is a high-quality, internally lubricated material that is ideal for applications with demanding wear and friction requirements. Its low water absorption enables components made with Turcite® to retain their integrity over long periods. Turcite® A is a resilient formulation that performs well under vibratory and dynamic loading



### **Turcite® X (Red)**

Turcite® is a high-quality, internally lubricated material that is ideal for applications with demanding wear and friction requirements. Its low water absorption enables components made with Turcite® to retain their integrity over long periods. Turcite® X has minimal hygroscopic characteristics and low thermal expansion properties, resulting in a structurally stable material.



### **Olefin-Based Industrial Plastics** **Polypropylene Sheets & Rods**

Noted for its excellent chemical resistance in corrosive environments, this polymer is easily welded and machined. Homopolymer and copolymer grades, as well as, a popular heat-stabilized formulation, are used in various applications throughout the chemical and semiconductor industries.

- Available in Sheets (standard and custom sizes), rods, welding rods, cut-to-size blocks, and tubing.



### **UHMW-PE**

UHMW-PE offers a combination of excellent properties – outstanding abrasion resistance, superior impact resistance, non-sticking and self-lubricating properties and excellent mechanical properties, even in cryogenic conditions. UHMW-PE exhibits virtually no water absorption. It is corrosion resistant, as well as, abrasion and impact resistant



### **HDPE Sheets & Rods**

HDPE (high-density polyethylene) offers excellent impact resistance, light weight, low moisture absorption, and high tensile strength. HDPE is also non-toxic and non-staining and meets FDA and USDA certification for food processing. Available As Extruded or Stress Relieved (S/R)



### **LDPE - Low Density Polyethylene**

Low Density Polyethylene is economical plastic material with good chemical resistance. LDPE provides high impact strength at low temperatures. It also exhibits excellent electrical properties.

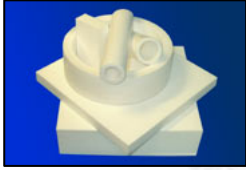
Advantages: cheap, good chemical resistance, high impact strength at low temperatures, excellent electrical properties. Disadvantages: low strength, low stiffness, low maximum operating temperature, flammable, poor UV resistance, high gas permeability (particularly CO2), susceptible to environmental stress cracking

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Visit [www.professionalplastics.com](http://www.professionalplastics.com) for information and data sheets on more than 500 different plastic materials



## **Fluoropolymer Plastic Materials**



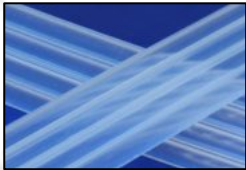
### **Teflon® - PTFE- Virgin Grade**

Teflon® - PTFE Virgin Grade Rods & Sheets - exhibit astonishing chemical resistance and ultra high-purity. Self-lubricating and with a low friction coefficient, Teflon PTFE (polytetrafluoroethylene) is ideally suited for the manufacture of high-temperature seals, insulators and bearings used in semiconductor, aerospace & chemical processing industries.



### **Kel-F® - PCTFE**

Kel-F® - PCTFE (PolyChloroTriFluoroEthylene) is a fluorocarbon-based polymer and is commonly abbreviated PCTFE. PCTFE offers the unique combination of physical and mechanical properties, nonflammability, chemical resistance, near zero moisture absorption, and excellent electrical properties. These characteristics cannot be found in any other thermoplastic fluoropolymer with a useful temperature range of -400°F to +400°F. PCTFE also has extremely low outgassing, making it well suited for use in aerospace and flight applications.



### **FEP**

FEP is a relatively soft thermoplastic with lower tensile strength, wear resistance, and creep resistance than many other engineering plastics. However, it is chemically inert and has a low dielectric constant over a wide frequency range. FEP possesses a very high degree of stress crack resistance, a low coefficient of friction, exceptional dielectric properties, heat resistance, retention of properties after service at 400°F (204°C) with useful properties at -454°F (-270°C), and meets FDA 21CFR.177.1550. FEP has high transparency (with good transmittance of UltraViolet and visible wavelengths.) FEP offers the lowest refractive index of all thermoplastics with low light reflection (the same as water.)



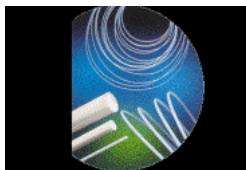
### **PFA**

PerFluoroAlkoxy (PFA) offers similar properties to FEP, but is considered more of a premium resin. PFA is preferred when extended service is required in hostile environments involving chemical, thermal, and mechanical stress. PFA offers high melt strength, stability at high processing temperatures, excellent crack and stress resistance, a low coefficient of friction, and more than 10 times the Flex life of FEP. It has high resistance to creep and retention of properties after service at 500°F (260°C), with useful properties at -320°F (95°C). PFA also meets FDA 21CFR.177.1550.



### **Halar® - ECTFE**

Halar ECTFE is a partially fluorinated semi-crystalline polymer offering a unique combination of mechanical properties, thermal and chemical resistance with an outstanding ease of processability. Halar ECTFE, a copolymer of ethylene and chlorotrifluoroethylene, can bring advantages to the end user when compared to other fluoropolymers. It is a very versatile polymer, available in all forms to meet processing needs. Halar offers excellent resistance to abrasion, harsh chemicals, and permeation.



### **Tefzel® - ETFE**

Tefzel® ETFE provides both corrosion resistance and mechanical strength over a wide temperature range. The fluoroplastic family offers plastics with high chemical resistance, low and high temperature capability, resistance to weathering, low friction, electrical and thermal insulation. High purity, Excellent chemical resistance, good permeability resistance & excellent abrasion resistance over a temperature range of -300°F to +300°F (-185°C to +150°C).



### **Rulon® LR (Maroon)**

Rulon® LR is a maroon colored bearing material best known for its versatile design properties. It is compatible with most hardened steel substrates. Mild steel is acceptable; harder running surfaces are better. Rulon® has a practically universal chemical inertness. Of the chemicals encountered in commercial practice, only molten sodium and fluorine, at elevated temperatures and pressures, show any signs of attack.



### **Rulon® J (Gold)**

Rulon® J is an all-polymeric reinforced, dull gold colored PTFE compound that operates exceptionally well against soft mating surfaces such as 316 stainless steel, aluminum, mild steel, brass and other plastics. The unique "shaft friendly" material is also low in friction and wear and is self lubricating. Rulon® J has one of the lowest coefficients of friction of most reinforced PTFE materials. This makes it ideally suited for start/stop applications where stick-slip must be eliminated. The tribological properties of this material also make it suitable for both bearing and wear component applications.



### **Symalit® PVDF 1000 - FM4910**

Symalit® PVDF and PVDF Flex materials allow the use of FM4910 listed materials in the construction of semiconductor equipment, where protections against property damage and production interruption is critical. FM4910 listed materials from Symalit offer significant reduction in fire risks and virtually eliminate costly suppression systems.



### **Fluorosint® 207**

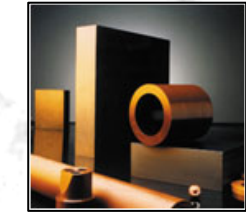
Fluorosint® 207's unmatched dimensional stability, excellent creep resistance and white color uniquely position this material to serve FDA regulated applications. It is non-permeable in steam and complies with the FDA's regulation 21 CFR 175.300. Its relative wear rate is 1/20 the rate of PTFE below 300°F (150°C) making it an excellent choice for aggressive service bearings and bushings.



### **Fluorosint® 500**

Fluorosint® 500 has nine times greater resistance to deformation under load than unfilled PTFE. Its coefficient of linear thermal expansion approaches the expansion rate of aluminum, and is 1/5 that of PTFE — often eliminating fit and clearance problems. It is 1/3 harder than PTFE, has better wear characteristics and maintains low frictional properties. Fluorosint® 500 is also non-abrasive to most mating materials.

## **High-Performance Advanced Engineering Materials**



### **Vespel® Polyimide - SP-1, SP-21, SP-22, SP-211 & SP-3**

Vespel® SP-1 polyimide provides a combination of temperature resistance, chemical resistance, mechanical toughness, natural lubricity, wear-resistance and insulation properties. Vespel SP-1 grade provides operating temperatures from cryogenic to 300°C (570°F), great plasma resistance, plus a UL rating for minimal electrical and thermal conductivity. Vespel® SP-1 is the unfilled base resin grade. SP-1 provides maximum physical strength, elongation, and toughness as well as the best electrical and thermal insulation values.



### **Meldin® Polyimide - 7001 & 7021**

A thermosetting polyimide, Meldin® 7001 is made from the unfilled base resin. This grade offers the maximum mechanical properties and high chemical resistance. The Meldin® 7001 grade is ideal for electrical and thermal insulating applications. More ductile than ceramics, and lighter weight than metals, MELDIN® 7001 is a popular choice for structural parts in aerospace and other applications where metal replacement is desirable. Available in plates up to 12" x 12" for best yield.



### **Plavis® Polyimide Shapes**

Plavis® polyimide shapes provide superior high-temperature resistance, excellent wear and friction properties, good electrical and physical properties, and chemical inertness. Plavis polyimide delivers outstanding resistance to creep and lubricated or unlubricated performance, ultra-low outgassing, excellent mechanical strength and impact resistance. Plavis polyimide is applied in the industries of aircraft and aerospace, automotive, electrical and electronics, chemical and mechanical engineering, semiconductors, and etc.



### **Torlon® 4301**

Torlon 4301® exhibits excellent wear resistance in bearing grades and is able to endure harsh thermal, chemical and stress conditions. Due to its versatile performance capabilities and proven use in a broad range of applications, Torlon 4301® is a reliable choice. The addition of PTFE and graphite provides higher wear resistance and lower coefficient of friction compared to the unfilled grade. TORLON 4301 PAI also offers excellent dimensional stability over a wide temperature range. This grade excels in severe wear applications such as non-lubricated bearings, seals, bearings cages and reciprocating compressor parts.



### **Torlon® 4203**

Torlon® 4203 polyamide-imide offers excellent compressive strength and the highest elongation of the Torlon® grades. It also provides electrical insulation and exceptional impact strength. This grade is commonly used for electrical connectors and insulators due to its high dielectric strength. Its ability to carry high loads over a broad temperature range makes it good for structural components such as linkages and seal rings. Torlon® 4203 is also an excellent choice for wear applications involving impact loading and abrasive wear.



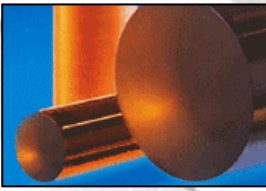
### **Torlon® 5530**

In addition to strength and dimensional stability, Torlon® 5030 is electrically insulative. It has exceptional dielectric strength- over 800-volt/ mil. It offers best- in- class radiation resistance, withstanding exposure to 10 x 9th rads\*. Close tolerance components are produced from 5030 including welding tip insulators, CVT clutch rollers, fasteners, igniter cups & cases, gears, splines, hydraulic poppets and many other structural and dynamic components.



### **Celazole® PBI**

Celazole® PBI is the highest performance engineering thermoplastic available today. It offers the highest heat resistance and mechanical property retention over 400°F of any unfilled plastic. It has better wear resistance and load carrying capabilities at extreme temperatures than any other reinforced or unreinforced engineering plastic. Celazole PBI is also an excellent thermal insulator. Other plastics in melt do not stick to PBI. These characteristics make it ideal for contact seals and insulator bushings in plastic production and molding equipment.



#### **Ultem® 1000 Polyetherimide**

Ultem® 1000 (standard, unfilled polyetherimide) offers excellent chemical resistance, high dielectric strength, natural flame resistance, and extremely low smoke generation. Ultem's® exceptionally high mechanical properties and ease of fabrication including bonding make it an easy choice when exceptional performance is required.



#### **PEEK - Virgin Sheets & Rods**

PEEK is an abbreviation for PolyEtherEther-Ketone, a high performance engineering thermoplastic. PEEK grades offer chemical and water resistance similar to PPS (PolyPhenylene Sulfide), but can operate at higher temperatures. PEEK can be used continuously to 480°F (250°C) and in hot water or steam without permanent loss in physical properties. For hostile environments, PEEK is a high strength alternative to fluoropolymers. PEEK carries a V-0 flammability rating and exhibits very low smoke and toxic gas emission when exposed to flame.



#### **Techtron® PPS**

Techtron® PPS offers the broadest resistance to chemicals of any advanced engineering plastic. They have no known solvents below 392°F (200°C) and are inert to steam, strong bases, fuels and acids. Minimal moisture absorption and a very low coefficient of linear thermal expansion, combined with stress-relieving manufacturing, make PPS ideally suited for precise tolerance machined components. Techtron® PPS is ideal for structural applications in corrosive environments or as a PEEK replacement at lower temperatures.



#### **Macor® Machinable Glass Ceramic**

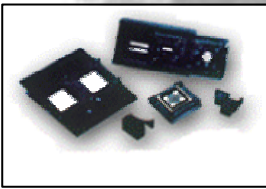
Macor® is a machinable glass ceramic material that possesses outstanding engineering properties. Unlike other ceramics, Macor® can be machined with ordinary metalworking tools. Macor® is also a problem solving material combining the performance of a technical ceramic with the versatility of a high performance plastic. Macor® has no porosity and when properly baked out, will not outgas. It is strong and rigid and, unlike high temperature plastics, will not creep or deform. Macor® is also radiation resistant.

### **Static Controlled Materials (ESd & Conductive)**



#### **Semitron® ESD225 - Acetal**

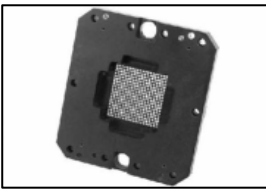
Semitron® ESD products are inherently dissipative and electrically stable unlike many other "dissipative" plastic shapes. They do not rely on atmospheric phenomena to activate, nor are surface treatments used to achieve dissipation. Static electricity is dissipated through these products as readily as it is dissipated along the surface. All of these products dissipate 5 KV in less than 2 seconds per Mil-B-81705C.



#### **Semitron® ESD 410C - Conductive Ultem®**

Semitron ESD 410C (black) – static dissipative/conductive PEI. Having an excellent mechanical performance up to 210°C, Semitron ESD 410 provides ESD- solutions at higher temperatures.

- Additionally, Semitron ESD 410 exhibits excellent dimensional stability (low coefficient of linear thermal expansion and small water absorption), ideal for handling equipment in the electrical/electronic or semiconductor industries.



#### **Semitron® ESD 420 - ESD PEI (Ultem)**

Semitron® ESD 420 - Static Dissipative PEI is the only, truly dissipative plastic product for use in high temperature applications. ESD 420 has a unique combination of properties: static dissipation, low coefficient of expansion, high strength and heat resistance and is non-sloughing. ESD 420 has a tensile modulus of 550,000 psi, a heat deflection temperature (at 264 psi) of 420°F, and a surface resistivity in the intermediate range of 10<sup>6</sup> to 10<sup>9</sup> ohms/square (W/sq.). Semitron® ESD 420, which is available in stock shapes for machining, is ideal for making fixtures for handling silicon wafers and devices in equipment for manufacturing semiconductor devices. Semitron® ESD 420 is also ideal for use in equipment for handling components in the hard-drive manufacturing and assembly processes.



#### **Semitron® ESD 500HR - ESD PTFE**

Semitron ESD 500HR (white) – static dissipative PTFE Reinforced with a proprietary synthetic mica, Semitron ESD 500HR offers an excellent combination of low frictional properties, good dimensional stability and electrostatic dissipation. Whenever virgin PTFE causes electrical discharge problems, Semitron ESD 500HR will provide a controlled bleed-off of static charges while maintaining typical PTFE-properties such as broad chemical resistance and low coefficient of friction.



#### **Semitron® ESD 520HR - ESD PAI**

Semitron® ESD 520HR has an industry first combination of electrostatic dissipation (ESd), high strength and heat resistance. This new ESD material is ideal for making nests, sockets and contactors for test equipment and other device handling components. The key features of 520HR are its unique ability to resist dielectric breakdown at high voltages (>100V). Typical carbon fiber enhanced products become irreversibly more conductive when exposed to even moderate voltage.



### **Pomalloy® ESd - ESd Acetal**

Pomalloy® ESd is a static-dissipative acetal copolymer. This non-carbon-filled, permanently static dissipative material is non-migratory and non-humidity dependent. With enhanced lubricity, Pomalloy ESd provides superior wear resistance and ease of machining. Its extremely low outgassing values and non-sloughing characteristics make it ideal for applications where particulate generation cannot be tolerated. Enhanced lubricity, chemically resistant, and dimensionally stable.

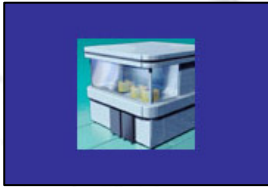
- Pomalloy® ESd is an exclusive trade name of Professional Plastics, Inc.



### **Tivar® Anti Static UHMW**

Tivar® AntiStat UHMW is an ideal material to use when potentially volatile conditions exist, such as those in grain elevators and munitions plants, effectively safeguarding against static discharges. In addition, it resists heat and protects robotics and other products that are sensitive to dust accumulation and electrical charge buildup. With a surface resistivity range of  $10^5$  to  $10^9$  (ohms/cm<sup>2</sup>) TIVAR® AntiStatic handles tough conditions where dust and static electricity can cause problems. Black TIVAR® AntiStatic is available in two standard sheet sizes: 48" x 120" sheets with gauge sizes ranging from 1/16" to 6"; 60" x 120" sheets with gauge sizes ranging from 3/8" to 1". It is also available in rod, board, tube, tape and profiles.

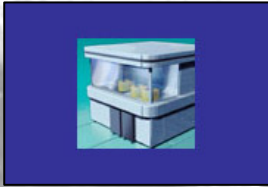
Now Available in two types: Tivar® EC & Tivar ECSD. (see website for details)



### **PC-300 ESd Polycarbonate Sheet**

PC-300™ ESd Polycarbonate is a plastic sheet product that controls static electricity for many applications, including windows, doors, mini-environment glazing panels, and machine guards, covers and enclosures. It is a premium quality polycarbonate sheet coated with SciCron Technologies proprietary, clear, C-300™ static dissipative coating which prevents charge generation on the sheet surfaces. This controls particulate attraction and prevents electrostatic discharge (ESD) events completely independent of humidity. PC-300 Polycarbonate fabricates simply, is light in weight and is available in large sheet sizes. It has superior impact resistance and flame-spread properties, plus excellent clarity, chemical resistance, and mar resistance.

**Also available in PC-350 (Bending Grade)**



### **AC-300 ESd Acrylic Sheet**

AC-300™ Acrylic is a plastic sheet product that controls static electricity in many applications, including windows, doors, machine covers and enclosures, and fabricated desiccators and cabinets. It is a premium quality acrylic sheet coated with SciCron Technologies clear, C-300™ static dissipative coating which prevents charge generation on the sheet surfaces. This controls particulate attraction and prevents electrostatic discharge (ESD) events completely independent of humidity. AC-300 Acrylic fabricates simply, is light in weight and is available in large sheet sizes. It has excellent optical properties, chemical resistance, surface hardness and mar resistance.

**Also available in AC-350 (Bending Grade)**



### **Kydex® 100AS - Anti-Static**

KYDEX 100AS, a proprietary alloy sheet, brings new dimensions to anti-static protective materials in: formability, rigidity, breakage resistance, and chemical resistance. This sheet is available in standard and custom gauges from .028" (.71mm) and up, in many distinctive textures and hundreds of colors. Unlike other anti-static thermoplastic sheets, KYDEX 100AS retains its anti-static properties even after thermoforming. It has a surface resistivity of  $10^9$  to  $10^{12}$  Ohms/square.



### **Royalstat® R63 Conductive ABS/PVC**

Royalite® R63 is a unique ABS/PVC sheet product that is both electrically conductive and fire rated. R63 meets the minimum static decay requirements outlined in MIL-B-81705C and NFPA Code 99 Specifications.

- R63 is also recognized under the component program of Underwriters Laboratories, with a rating of UL94 V-1 at .066.
- R63 provides permanent static protection against electrostatic damage to sensitive devices being assembled or transported.

## **Thermoset & Composite Materials**

### **Phenolic - Grade CE**

CE Canvas Phenolic exhibits good mechanical and impact strength with continuous operating temperature of 250°F. CE Phenolic is a durable & stable material at an economical price. CE Phenolic provides good Insulation Properties.

- Meets Mil-I-24768/14
- CE stands for Canvas Electrical Grade.



### **Phenolic - Grade LE**

Phenolic Grade LE Line provides good mechanical & electrical strength. Recommended for intricate high strength parts. Continuous operating temperature 250°F. Excellent Insulation Properties. Moisture resistant grade for electrical applications.

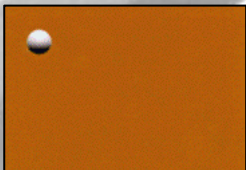
- Meets Mil-I-24768/13
- LE stands for Linen Electrical Grade Phenolic



### **Phenolic - Grade X Paper**

X-Grade Paper Phenolic is manufactured from high strength paper bonded with a phenolic resin. The resulting material is a tough laminate with a high impact resistance, excellent tensile, compressive and flexural strengths. High impact strength, as well as, excellent tensile, compressive and flexural strengths. Continuous operating temperature of 250F. Perfect for stable, high-strength Tooling Plates used in the production of printed circuit boards or tablespots on routers & fabricating equipment.

- Meets Mil-I-24768/12 & Meets LP-509 Type PBM

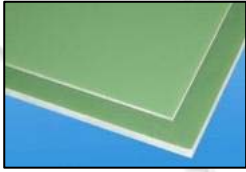




### G-10/FR-4 Sheets

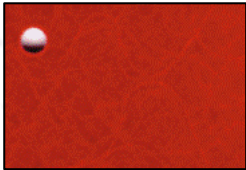
G-10/FR-4 is a thermosetting industrial laminate consisting of a continuous filament glass cloth material with an epoxy resin binder. It has characteristics of high strength, excellent electrical properties and chemical resistance not only at room temperature but also under humid or moist conditions. G-10/FR-4 meets the specifications of Mil-I-24768/27. G-10/FR4 exhibits excellent dimensional stability, and outstanding insulating properties. This product is moisture resistant and provides superior electrical properties.

- Meets Mil-I-24768/27 (GEE-F)



### G-11 Glass Epoxy Laminate

G-11 combines a woven glass fabric and a high temperature epoxy resin system (Tg over 180°C) that is non-brominated. The product provides consistent quality and good electrical properties under dry and humid conditions, as well as high flexural, impact, and bond strength at room and elevated temperatures. This product is suitable for a variety of structural, high humidity, and electrical insulation applications, which include cryogenic applications (NIST process system) and many other applications for which very high or very low temperatures are part of the environmental requirement of the application. G-11 meets or exceeds the requirements of MIL-I-24768/3, Type GEB.



### GPO-3 Glass Polyester Laminate

GPO-3 laminate performs well in electrical applications that require high arc and carbon track resistance as well as flame resistance, physical strength, and moderate heat resistance. Grade GPO-3 laminate is used extensively in the making of phase and end barriers, insulating supports, bus bar supports and mounting panels in switchgear and other types of electrical apparatus. Grade GPO-3 is a UL recognized product with a temperature index of 120 degrees celsius electrical and 140 degrees celsius mechanical. Grade GPO-3 is produced in three standard colors: red, black, and white and is molded in thicknesses of 1/32" to 2".



### Durapol®

Durapol® IGL L200 wave solder pallet materials are recognized worldwide and appreciated for their high temperature resistance, good machinability, chemical resistance, static dissipative properties and are sensor detectable. Durapol® materials have helped the PCB manufacturers to reduce solder defects, protect components against heat and electrostatic discharge, increase the productivity and improve stability of the manufacturing process, while reducing the size of carriers in conjunction with the miniaturizing trends for the PCB's. Solder wave, SMT, selective soldering process: whatever the process, Durapol® products can be machined according to customer expectations.

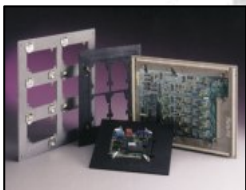


### Durostone®

Durostone® wave solder pallet materials have excellent mechanical properties at elevated temperatures.

Durostone is easier to handle than other products used for PCB tooling due to two factors:

- The density, which helps to reduce the weight of the finished tooling.
- The glass and resin content, which ensures that the line operators and the machinists are not subjected to skin irritation alleviating any health & safety concerns.



### Glastic CBC, CBC-C & NBC

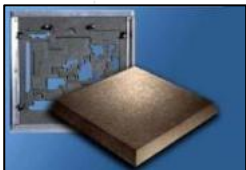
Glastic solder pallet materials are lightweight, with dimensional stability, flatness, thermal shock resistance and chemical resistance making them ideal products for the very hostile, lead-free environments presented in wave solder applications. Each sheet is closely checked for warp, twist, surface resistivity and other key properties prior to being micro-sanded to the tightest tolerance control available (+/- 0.002").

Available in three popular versions to meet your assembly needs:

(CBC) Non-Conductive

(CBC-C) Electrical static safe semi-conductive

(NBC) Optically sense-able without compromising electric static discharge safety.



### WaveMax 5000 – SP525M

Wavemax 5000 is non-woven substrate combined with high temperature and static dissipative epoxy resin.

Wavemax has superior machining properties, and is capable of producing thin walls with high strength for finely machined parts. It has excellent mechanical strength at elevated temperatures. The continuous operating temperature is over 200°C. Short excursions to temperatures approaching 360°C, such as in wave soldering or IR re-flow, will not adversely affect the life of this material

- Surface resistivity: Ohms/sq 10<sup>5</sup> to 10<sup>9</sup>
- Volume resistivity: Ohm-cm 10<sup>4</sup> to 10<sup>11</sup>



### StatNot™ – MC511SN(ESd G-11)

MC511SN - StatNot is a composite material consisting of woven glass and a static-dissipative epoxy resin system. It offers electrostatic dissipative properties (10<sup>6</sup> to 10<sup>10</sup> ohm squares). This material is used when static dissipation is required from surface to surface of the composite in the X, Y, and Z directions. The product can serve as slot filler material in structural applications. Other applications include PCB test fixtures and tabletops used for testing and repair of military electronics.



## Forming Grade Materials



### **ABS - Forming Grade (General Purpose)**

ABS Sheet is offered by Professional Plastics in a wide range of colors & grades. Sheets are produced in monolayer and co-extruded multilayer ABS (Acrylonitrile-Butadiene-Styrene) sheet products. Combinations of 100% customer color virgin, virgin cap/utility base, low gloss (matte) cap/utility base, and custom color cap/utility base are available.



### **ABS - FR Forming Grade Sheet (Flame Retardant)**

FR ABS Sheet (Flame retardant - Fire Rated ABS Sheet) is offered by Professional Plastics in a wide range of colors & grades. Certain grades are formulated to meet the smoke and fire specifications recommended by the Federal Transit Administration (formerly UMTA) to consistently meet FTA guidelines for flammability\* and smoke emission\* as measured by ASTM E-162 and ASTM E-662. All materials meet UL Ratings of UL94V-0 or greater.



### **Royalite® R59**

Royalite® R59 is an ABS/PVC alloy that is listed UL94 V-0, UL94 5VA, and UL94 V-1. R59 is also manufactured in compliance with Motor Vehicle Specification MVSS-302.

Combining high impact and tensile strength with excellent ductility and thermoformability has made R59 the material of choice for a wide array of applications requiring a fire rated material. R59 is produced utilizing a proprietary cap sheet technology, which insures superior color and gloss control, in addition to excellent grain retention after thermoforming. R59 pressure forms extremely well and is engineered for applications such as medical, telecommunication, and electronic equipment housings.



### **Kydex 100 Sheet**

Kydex® 100 High-Impact Fire Rated Sheet: - Aircraft Approved

Super tough, durable KYDEX 100, a proprietary alloy sheet, brings new dimensions to thermoformers in: formability, rigidity, breakage resistance, chemical resistance and fire retardancy. Kydex Sheet is a high performance thermoplastic sheet is available in a wide range of standard and customer colors, textures, and sheet sizes. Kydex sheet is Underwriters Laboratories, Inc.® recognized for UL Std 94 V-0/5V and UL 746C and has 18 ft-lbs./in (953 J/m) Notched Izod impact resistance.



### **High-Impact Polystyrene - HIPS**

High Impact Polystyrene (HIPS) has great dimensional strength, balanced properties of impact strength and heat resistance, is easily machined, and is relatively low in cost. Styrene is available in standard 48" x 96" sheets, or customer Sheets & Rolls. HIPS is economical, easy to form, durable to temperatures as low as -20F, and can be sterilized by ETO, gamma, or electron beam. It gives off no corrosive or noxious fumes, is 100% recyclable and is available in Prime & Reprocessed Grades. HIPS is also available in Conductive Grades upon request.

## Transparent Materials



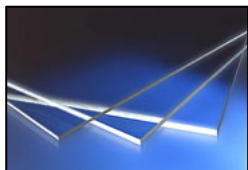
### **Acrylic - PMMA**

Acrylic is an amorphous thermoplastic which is optically transparent, unaffected by moisture, and offers a high strength-to-weight ratio. Acrylic offers high light transmittance and can be easily heat-formed without loss of optical clarity. Prolonged exposure to moisture, or even total immersion in water, does not significantly effect the mechanical or optical properties of this outstanding economical and multi-purpose material. Cast acrylic is 17 times stronger than glass & is easily machined & thermoformed.



### **Polycarbonate GP Sheet - Glazing Grade**

Polycarbonate sheet (aka Lexan, Makrolon) glazing offers superior durability, unmatched design flexibility and structural integrity that easily surpasses laminated glass and acrylic alternatives. Polycarbonate offers Excellent Impact Resistance, Clarity & Electrical properties. It is UV resistant and is available in Clear (GP), Abrasion-Resistant (AR1,AR2), Fire-Retardent (F/R), Sign Grade (SG), Solar (SL), Bullet-Resistant (BR) & Static Control Grades (PC300 & PC350).



### **PETG Sheet**

PETG / Spectar® Co-polyester sheet is a thermoplastic sheet used in engineering applications. PETG offers the capability to produce complex shapes, precise details, deep draws and compound curves without worrying about durability. It's easily formed, die-cut and punched. It brings increased design freedom and lower fabrication costs. In sheet form, PETG has the impact strength and fabrication ease that acrylic can't touch, with the durability to significantly reduce packaging and shipping costs.

## **Fluid Handling & Tubing Products**



### **Teflon® PTFE Tubing**

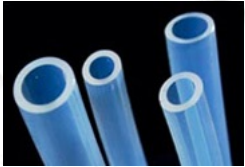
Teflon® PTFE Tubing exhibits astonishing chemical resistance and ultra high-purity.

- Working temperature range 500° F (260° C) to -454° F (-270° C)
- Chemically Resistant (all common solvents, acids and bases)
- Chemically Inert, Low Extractables & Excellent Dielectric Insulation Properties



### **FEP Tubing**

FEP tubing (Fluorinated Ethylene Propylene tubing) is made from a melt processable thermoplastic that has end uses similar to PTFE. However, it has several properties PTFE does not have. FEP is one of the clearest plastics available on the market and can be supplied in long, continuous coils. Also, it can be welded and tubes can be sealed by melting. FEP tubing has a continuous working temperature of 400° F (204°C). Good transmission of ultraviolet rays • FDA compliant & USP Class VI approved.



### **PFA Tubing**

PFA (PerFluoroAlkoxy) offers similar properties to FEP, but is considered more of a premium resin. PFA is preferred when extended service is required in hostile environments involving chemical, thermal, and mechanical stress. PFA offers high melt strength, stability at high processing temperatures, excellent crack and stress resistance, a low coefficient of friction, and more than 10 times the Flex life of FEP. It has high resistance to creep and retention of properties after service at 500°F (260°C), with useful properties at -320°F (95°C). PFA also meets FDA 21CFR.177.1550.



### **Tygon® R-3603 Laboratory Tubing**

Tygon® R-3603 Laboratory Tubing is crystal-clear and flexible, and handles virtually all inorganic chemicals found in the lab. It is non-oxidizing and non-contaminating. Long-lasting and crack-resistant, Tygon® R-3603 Laboratory Tubing is less permeable than rubber tubing. The glassy-smooth inner bore helps prevent buildup so that cleaning is facilitated. Coils are marked at 1-foot intervals for easy measuring. Autoclavable. Remains flexible at -45°F (43°C). Durometer Hardness: Shore A, 55. Outstanding chemical resistance and lot-to-lot consistency for reproducible results. Increases productivity in peristaltic pumps - outlasts other clear tubing 2 to 1. Ideal for condensers, incubators, desiccators, gas lines and drain lines



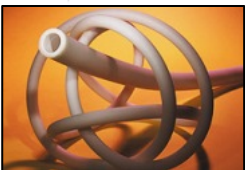
### **Tygon® B-44-3 Beverage Tubing**

Tygon® B-44-3 Beverage Tubing is specially formulated for transferring a wide variety of beverages including soft drinks, fruit juices, flavored teas and bottled water. In virtually all cases, Tygon® Beverage Tubing will not affect the taste or odor of product transferred through it, while its' excellent non-wetting properties facilitate complete drainage and permit simple flush-cleaning. Many of the unique properties inherent to Tygon® Beverage Tubing also apply to a wide variety of complex applications ranging from fine cosmetic production to the dispensing of water-based printing inks found in the publishing industry. The versatility and proven performance of Tygon® B44-3 Beverage Tubing have made it today's most widely specified clear, flexible plastic tubing.



### **Versilic® SPX-50 High-Strength Silicone Tubing**

Peroxide-cured Versilic® High-Strength Silicone Tubing is designed for use in applications where flexibility, resiliency and durability are required. Its smooth inner surface reduces the risk of particulate entrapment and microscopic buildup during fluid transfer. In addition, its high and low working temperatures help the tubing retain its flexibility under extreme conditions. Because of its consistently reliable performance, Versilic® High-Strength Silicone Tubing is ideal for applications such as food & beverage dispensing & processing, appliance manufacturing, cosmetic production and electronic equipment.



### **PharmaPure® Tubing**

PharmaPure® is a premium, low spallation, biologically compatible peristaltic pump tubing developed especially for pharmaceutical, biotechnology, and laboratory applications. This tubing meets the demanding challenges of providing unsurpassed pump life, with ultra-low particulate spallation and very low permeability. PharmaPure®'s superior flex life characteristics simplifies the manufacturing process by reducing production downtime due to pump tubing failures. PharmaPure® has low permeability and is ideal for protecting sensitive cell cultures, fermentation, separation, purification, process monitoring, and sterile filling.



### **PVDF/ Kynar Pipe & Tubing**

Chemfluor® PVDF is manufactured from Kynar® 740, an engineering thermoplastic that offers the stable characteristics of a fluoropolymer, as well as mechanical strength, abrasion resistance and high purity. Chemfluor® PVDF also offers excellent chemical resistance, UV radiation resistance and low permeability. These shapes are stocked in rigid material, but are available in other resins on a custom basis. Chemfluor® PVDF can be used in the semiconductor, pulp and paper, and pharmaceutical industries, as well as for nuclear waste, and chemical and food processing. Chemfluor® PVDF meets ASTM standard D3222.

## **FM-4910 Approved Flame Safe Materials**



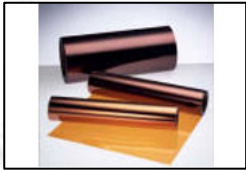
### **FM 4910 Fire-Safe Plastics**

Cleanroom Materials Flammability Test Protocol (Class 4910) As computer chips get smaller and faster, the manufacturing process required to create them gets more and more complex—even the slightest delay in production can mean millions of dollars in lost revenue. One of the major causes of delay in the chip manufacturing process is contamination. Contamination from a fire, no matter how small, could potentially put a chip maker out of business for weeks, if not permanently. In the past, cleanrooms and wet benches needed to be protected by sprinklers or more expensive special fire-protection systems. But, by the time a cleanroom fire propagated and triggered a sprinkler or special fire protection system, damage could already have occurred in the rest of the cleanroom. Driven by rising insurance costs and potential lost earnings, chip makers are requiring suppliers to use materials in wet-bench fabrication that are less flammable and therefore don't need additional—and costly—fire protection systems installed, so they will be inherently safe when they arrive in the cleanroom. The Cleanroom Materials Flammability Test Protocol (Class 4910) contains the method for conducting tests. Now, wet-bench manufacturers and users can apply the cleanroom protocol to develop plastic materials and equipment capable of resisting fire, emitting little, if any smoke, and producing little, if any, corrosive by-products. Materials passing the cleanroom protocol, subsequently, can be listed in the Approval Guide, a publication of FM Approvals.

### **High Performance Films**

#### **Kapton® Polyimide Film**

Kapton film from DuPont has more than 35 years of proven performance as the flexible material of choice in applications involving very high, 400°C (752°F), or very low, -269°C (-452°F) temperature extremes. Kapton is used in a wide variety of applications such as substrates for flexible printed circuits, transformer and capacitor insulation and bar code labels. Kapton® polyimide film possesses a unique combination of properties that make it ideal for a variety of applications in many different industries. The ability of Kapton® to maintain its excellent physical, electrical, and mechanical properties over a wide temperature range has opened new design and application areas to plastic films.



#### **Kaptrex® Polyimide Film**

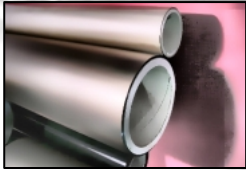
This high-performance polyimide film provides similar high performance solutions as offered by Kapton®, but at a more economical price. Kaptrex PI film provides an excellent balance of electrical, mechanical, thermal, and chemical properties over a wide range of temperatures.

This high-performance polyimide film provides excellent electrical properties and resistance to high temperature and radiation. It is suitable for insulation of "H" class (180°C or 356°F) electrical machines and appliances under working temperature of 200°C(392°F).



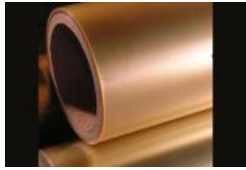
#### **PEEK Film - Crystalline**

Crystalline PEEK film offers an outstanding range of physical, thermal, chemical & radiological properties. PEEK is a high performance semi-crystalline thermoplastic. PEEK's characteristics include high temperature performance, excellent wear properties, superior chemical resistance, hydrolytic stability and outstanding toughness and strength. PEEK meets many aerospace, automotive, fire, smoke and toxicity, food/water, medical/pharmaceutical, and military approvals and standards.



#### **Ultem® PEI Film**

Polyetherimides are amorphous thermoplastics whose chemical structure is based on repeating aromatic imide units. Thermoplastic polyimides are linear in structure without crosslinks. Film/Thin Sheet Products: Ultem® 1000-1000, CRS, XHT 6050 – Polyetherimide. Benefits: High rigidity, High strength, Inert to flame, High temperature resistance, Excellent chemical resistance Applications: Flexible circuits, Solder mask tape, Electrical insulation, Speaker cones and voice coils, High temperature vacuum bagging films.



#### **PVDF Film**

PVDF Film (Kynar® Film) is both strong and tough as reflected by its tensile properties and impact strength. Compared to many thermoplastics, PVDF Film (Kynar® Film) has excellent resistance to creep and fatigue, yet in thin sections such as films, PVDF (Kynar®) components are flexible and transparent. Applications for PVDF (Kynar®) Film: • Filters • Diaphragms • Release Films • Piezoelectric films • Chemical Resistant Tank Linings • Fuel Cell Seals • Medical bags



#### **Makrofol® Polycarbonate Film Overview & Links**

Makrofol® DE and Bayfol® PC polycarbonate films are available in a wide variety of surface textures, including glass-clear with both sides gloss. These films offer high light transmittance, excellent surface uniformity, and ease of processing. All films use pure Bayer Makrolon polycarbonate resin. Most meet FDA approval and have the necessary UL ratings.



**Nationwide Toll-Free (800) 966-7767**

Visit [www.professionalplastics.com](http://www.professionalplastics.com) for information  
and data sheets on more than 500 different plastic materials

Note: The information contained herein is based on typical properties and values for reference and comparison purposes only. This information should not be used as the sole basis for design and specification. Furthermore, it should not be used as a basis for quality control or considered as minimum performance characteristics. Actual performance data may vary. All values at 73 F (23 C) unless otherwise noted.

Property	Units	Test Method ASTM	Acetal Homopolymer Delrin ®	Nylon ® 6/6 Extruded	Nylatron ® GS	Ultem ® 1000	PEEK - Virgin
Specific Gravity	-	D-792	1.42	1.14-1.15	1.16	1.27	1.32
Tensile Strength, 73 F	psi	D-638	10,000	12,400	12,500	15.2	14,500
Tensile Modulus of Elasticity, 73 F	psi	D-638	4.5 x 10 <sup>5</sup>	4.7 X 10 <sup>5</sup>	480,000	430,000	490,000
Tensile Elongation, 73 F	%	D-638	30	50	25	60	50
Flexural Strength 73 F	psi	D-790	11,500	14,000	17,000	21,000	24,600
Flexural Modulus of Elasticity, 73 F	psi	D-790	410,000	450,000	460,000	480,000	590,000
Shear Strength, 73 F	psi	D-732	9,000	9,600	10,500	15,000	7,690
Compressive Strength	psi	D-695	16,000	12,500	16,000	20,300	20,000
Compressive Modulus of Elasticity, 73 F	psi	D-695	450,000	420,000	420,000	420,000	450,000
Coefficient of Friction (dry vs. Steel) Dynamic	-	-	0.25	0.25	0.20	-	0.40 – 0.45
Limiting PV with 4:1 safety factor applied	Ft.lbs/in <sup>2</sup> min	QTM 55007	2,700	2,700	3,000	1,875	8,500
Hardness, Rockwell, 73 F	-	D-785	M89 (R122)	M85 (R115)	M85 (R115)	M109	R126
Durometer, 73 F	-	D-676	D86	D80	D85	-	D85
Tensile Impact (notched), 73 F	Ft lb/in	D-256	170	90 – 180	-	-	40 - 60
Coefficient of Linear Thermal Expansion	In/in/ F	D-696	6.8 x 10 <sup>-5</sup>	4 X 10 <sup>-5</sup>	4 x 10 <sup>-5</sup>	3.45 X 10 <sup>-5</sup>	2.6 X 10 <sup>-5</sup>
Deformation Under Load (122 F, 2000 psi)	%	D-621	0.5	1.0 - 3.0	-	-	-
Deflection Temperature 264 psi 66 psi	F	D-648 D-648	264 334	194 455	200	392 410	320 -
Melting Point	F	D-789	347	491	500	-	640
Continuous Service Temp. in Air (Maximum)	F	-	180	210	220	340	480
Dielectric Strength, Short Term	V/mil	D-149	450	400	350	830	480
Dielectric Constant, 60 Hz	-	D-150	3.7	4.0	-	3.15	3.2
10 Hz	-	D-150	3.7	4.0	-	3.15	-
10x6 Hz	-	-	3.7	3.6	-	-	3.3
Water Absorbtion – 24 hrs	%	D-570	0.25	1.2	0.3	0.25	0.15
- Saturation	%	D-570	0.90	8.5	7.0	1.25	0.50

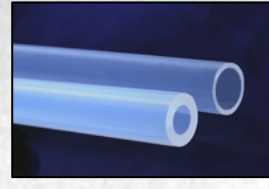
Property	Units	Test Method ASTM	Polycarbonate Machine Grade	PVC – Type 1 Gray	Ertalyte ® PET-P	Ertalyte® TX	Delrin AF® Blend
Specific Gravity	-	D-792	1.20	1.47	1.41	1.44	1.5
Tensile Strength, 73 F	psi	D-638	9,500	7,000	12,400	10,500	8,000
Tensile Modulus of Elasticity, 73 F	psi	D-638	320,000	350,000	460,000	500,000	435,000
Tensile Elongation, 73 F	%	D-638	100	50-150	20	5	15
Flexural Strength 73 F	psi	D-790	13,000	12,500	18,000	14,000	12,000
Flexural Modulus of Elasticity, 73 F	psi	D-790	350,000	300,000 – 800,000	490,000	360,000	445,000
Shear Strength, 73 F	psi	D-732	9,200	9,240	8,000	8,500	7,600
Compressive Strength	psi	D-695	11,500	10,380	15,000	15,250	16,000
Compressive Modulus of Elasticity, 73 F	psi	D-695	300,00	-	420,000	400,00	350,000
Coefficient of Friction (dry vs. Steel) Dynamic	-	-	0.38	-	.02	0.19	0.19
Limiting PV with 4:1 safety factor applied	Ft.lbs/in <sup>2</sup> min	QTM 55007	-	-	2,800	6,000	8,300
Hardness, Rockwell, 73 F	-	D-785	M75 (R126)	R115	M94 (R125)	M94	M85 (R115)
Durometer, 73 F	-	D-676	D80	D82	D87	-	D83
Tensile Impact (notched), 73 F	Ft lb/in	D-256	-	-	0.5	0.4	0.7
Coefficient of Linear Thermal Expansion	In/in/ F	D-696	3.7 x 10 <sup>-5</sup>	5.6 x 10 <sup>-5</sup>	3.3 x 10 <sup>-5</sup>	4.5 x 10 <sup>-9</sup>	5 X 10 <sup>-5</sup>
Deformation Under Load (122 F, 2000 psi)	%	D-621	0.3	-	-	-	-
Deflection Temperature 264 psi 66 psi	F	D-648 D-648	270 285	165 135-180	240 -	180 -	244 -
Melting Point	F	D-789	310	360	491	491	347
Continuous Service Temp. in Air (Maximum)	F	-	250	160	210	210	180
Dielectric Strength, Short Term	V/mil	D-149	380	350-500	385	-	400
Dielectric Constant, 60 Hz	-	D-150	3.2	3.0 – 4.0	-	-	-
10 Hz	-	D-150	3.1	-	-	-	-
10x6 Hz	-	-	2.96	-	-	3.6	3.1
Water Absorbtion – 24 hrs	%	D-570	0.15	0.05	0.07	0.06	0.2
- Saturation	%	D-570	0.35	-	0.9	0.47	1.0

Property	Units	Test Method ASTM	UHMW-PE	Teflon® PTFE Virgin	Kel-F® PCTFE	FEP	PFA
Specific Gravity	-	D-792	0.94	2.16	2.12	2.15	2.15
Tensile Strength, 73 F	psi	D-638	15.2	3,350	5,300	3,400	3,600
Tensile Modulus of Elasticity, 73 F	psi	D-638	430,000	-	207,000	-	-
Tensile Elongation, 73 F	%	D-638	60	300	150	325	300
Flexural Strength 73 F	psi	D-790	21,000	No break	8,500	No break	No break
Flexural Modulus of Elasticity, 73 F	psi	D-790	480,00	72,000	180,000	85,000	85,000
Shear Strength, 73 F	psi	D-732	15,000	-	-	-	-
Compressive Strength	psi	D-695	20,300	-	5,500	-	-
Compressive Modulus of Elasticity, 73 F	psi	D-695	42,000	95,000	180,000	-	-
Coefficient of Friction (dry vs. Steel) Dynamic	-	-	-	.04 - .10	-	-	0.2
Limiting PV with 4:1 safety factor applied	Ft.lbs/in <sup>2</sup> min	QTM 55007	-	-	-	-	-
Hardness, Rockwell, 73 F	-	D-785	M109	R10 – R20	-	-	-
Durometer, 73 F	-	D-676	-	D50	D80	D56	D60
Tensile Impact (notched), 73 F	Ft lb/in	D-256	-	30 - 200	5	-	-
Coefficient of Linear Thermal Expansion	In/in/ F	D-696	3.45 X 10 <sup>-5</sup>	6.5 x 10 <sup>-5</sup>	7.0 x 10 <sup>-5</sup>	-	-
Deformation Under Load (122 F, 2000 psi)	%	D-621	-	3 – 7	-	-	-
Deflection Temperature 264 psi	F	D-648	392	100 – 140	-	-	-
66 psi		D-648	410	250	-	-	-
Melting Point	F	D-789	-	644	425	500	590
Continuous Service Temp. in Air (Maximum)	F	-	340	500	400	400	500
Dielectric Strength, Short Term	V/mil	D-149	830	500 – 650	500	-	-
Dielectric Constant, 60 Hz	-	D-150	3.15	-	-	-	-
10 Hz	-	D-150	3.15	-	-	-	-
10x6 Hz	-	-	-	2.1	2.3 – 2.7	2.1	2.1
Water Absorption – 24 hrs	%	D-570	0.25	0 – 0.5	0	<0.01	<0.03
- Saturation	%	D-570	1.25	-	0	-	-

Property	Units	Test Method ASTM	Phenolic Grade CE Canvas	Phenolic Grade LE Linen	Phenolic Grade X Paper	G-10/FR-4 Glass Epoxy Sheet	ABS Engineering Grade
Specific Gravity	-	D-792	1.35	1.34	1.40	1.85	1.04
Tensile Strength, 73 F	psi	D-638	9,500	12,500	20,000	40,000	5,000- 7,500
Tensile Modulus of Elasticity, 73 F	psi	D-638	-	-	-	-	3.1 x 10 <sup>5</sup>
Tensile Elongation, 73 F	%	D-638	-	-	-	-	5-70
Flexural Strength 73 F	psi	D-790	22,200	22,000	25,000	65,000	6,000 – 11,500
Flexural Modulus of Elasticity, 73 F	psi	D-790	3,520	3,520	3,080 – 4,180	6,380	3.4 x 10 <sup>5</sup>
Shear Strength, 73 F	psi	D-732	13,500	11,750	12,000	21,500	-
Compressive Strength	psi	D-695	37,000	37,000	36,000	60,000	2.5 – 11
Compressive Modulus of Elasticity, 73 F	psi	D-695	-	-	-	-	-
Coefficient of Friction (dry vs. Steel) Dynamic	-	-	-	-	-	-	0.35
Limiting PV with 4:1 safety factor applied	Ft.lbs/in <sup>2</sup> min	QTM 55007	-	-	-	-	-
Hardness, Rockwell, 73 F	-	D-785	M100	M100	M105	M110	R105
Durometer, 73 F	-	D-676	-	-	-	-	-
Tensile Impact (notched), 73 F	Ft lb/in	D-256	1.4 – 1.9	1.10 – 1.35	0.76 – 0.82	5.5 – 7.0	-
Coefficient of Linear Thermal Expansion	In/in/ F	D-696	-	-	-	-	5.3
Deformation Under Load (122 F, 2000 psi)	%	D-621	-	-	-	-	-
Deflection Temperature 264 psi	F	D-648	-	-	-	-	215
66 psi		D-648	-	-	-	-	220
Melting Point	F	D-789	-	-	-	-	220
Continuous Service Temp. in Air (Maximum)	F	-	266	257	266	284	140
Dielectric Strength, Short Term	V/mil	D-149	150 - 500	150 – 500	500-700	400-500	450
Dielectric Constant, 60 Hz	-	D-150	-	-	-	-	2.87
10 Hz	-	D-150	-	-	-	-	-
10x6 Hz	-	-	-	-	-	-	-
Water Absorption – 24 hrs	%	D-570	0.75 – 4.4	0.90 – 2.50	1.80 - 6.0	0.10 – 0.25	0.30
- Saturation	%	D-570	-	-	-	-	0.70

Property	Units	Test Method ASTM	Vespel® SP-1	Meldin® 7001	Torlon® 4203	Torlon® 4301	Torlon® 5530
Specific Gravity	-	D-792	1.43	1.43	1.41	1.45	1.61
Tensile Strength, 73 F	psi	D-638	12,500	12,500	18,000	12,000	15,000
Tensile Modulus of Elasticity, 73 F	psi	D-638	-	-	600,000	900,000	900,000
Tensile Elongation, 73 F	%	D-638	7.5	7.5	10	3	3
Flexural Strength 73 F	psi	D-790	-	-	24,000	23,000	20,000
Flexural Modulus of Elasticity, 73 F	psi	D-790	450,000	450,000	600,000	800,000	850,000
Shear Strength, 73 F	psi	D-732	13.0	13.0	16,000	16,400	-
Compressive Strength	psi	D-695	19,300	19,300	24,000	22,000	27,000
Compressive Modulus of Elasticity, 73 F	psi	D-695	350,000	350,000	478,000	950,000	600,000
Coefficient of Friction (dry vs. Steel) Dynamic	-	-	0.29	0.29	0.35	0.20	0.20
Limiting PV with 4:1 safety factor applied	Ft.lbs/in <sup>2</sup> min	QTM 55007	-	-	12,500	22,500	20,000
Hardness, Rockwell, 73 F	-	D-785	E45-60	E45-60	E80 (M120)	E70 (M106)	E85 (M125)
Durometer, 73 F	-	D-676	-	-	-	-	D90
Tensile Impact (notched), 73 F	Ft lb/in	D-256	0.8	0.8	2.0	0.8	0.7
Coefficient of Linear Thermal Expansion	In/in/ F	D-696	30	30	1.7 x 10 <sup>-5</sup>	1.4 x 10 <sup>-5</sup>	2.6 x 10 <sup>-5</sup>
Deformation Under Load (122 F, 2000 psi)	%	D-621	0.14	0.14	-	-	-
Deflection Temperature 264 psi 66 psi	F	D-648 D-648	680 -	680 -	532 -	534 -	520 -
Melting Point	F	D-789	No melt	No melt	n/a	n/a	n/a
Continuous Service Temp. in Air (Maximum)	F	-	500	500	500	500	500
Dielectric Strength, Short Term	V/mil	D-149	560	560	580	-	700
Dielectric Constant, 60 Hz 10 Hz 10x6 Hz	- - -	D-150 D-150 -	- - 3.55	- - 3.55	- - 4.2	- - 6.0	- - 6.3
Water Absorbion – 24 hrs - Saturation	% %	D-570 D-570	0.24 0.72	0.24 0.72	0.4 1.7	0.4 1.5	0.3 1.5

Property	Units	Test Method ASTM	Techtron® PPS	Rulon® LR	Turcite® A	Turcite® X	Macor®
Specific Gravity	-	D-792	1.35	2.27	1.49	1.46	2.52
Tensile Strength, 73 F	psi	D-638	13,500	2,000	7,600	5,900	-
Tensile Modulus of Elasticity, 73 F	psi	D-638	500,00	-	-	-	-
Tensile Elongation, 73 F	%	D-638	15	135	15.0	19.0	-
Flexural Strength 73 F	psi	D-790	21,000	-	11,000	8,000	13,600
Flexural Modulus of Elasticity, 73 F	psi	D-790	575,000	-	350,000	335,000	9,700,000
Shear Strength, 73 F	psi	D-732	9,000	-	-	-	3,700,000
Compressive Strength	psi	D-695	21,500	-	13,000	12,000	50,000
Compressive Modulus of Elasticity, 73 F	psi	D-695	430,000	-	-	-	-
Coefficient of Friction (dry vs. Steel) Dynamic	-	-	0.4	0.25	0.30	0.22	-
Limiting PV with 4:1 safety factor applied	Ft.lbs/in <sup>2</sup> min	QTM 55007	3,000	10,000	7,500	42,000	-
Hardness, Rockwell, 73 F	-	D-785	M95 (R125)	-	M81	M63	A48
Durometer, 73 F	-	D-676	D85	D60-75	-	-	-
Tensile Impact (notched), 73 F	Ft lb/in	D-256	0.6	6.0	0.57	0.54	-
Coefficient of Linear Thermal Expansion	In/in/ F	D-696	2.8 X 10 <sup>-5</sup>	-	5.2 X 10 <sup>-5</sup>	5.2 X 10 <sup>-5</sup>	5.2 x 10 <sup>-6</sup>
Deformation Under Load (122 F, 2000 psi)	%	D-621	-	-	-	-	-
Deflection Temperature 264 psi 66 psi	F	D-648 D-648	250 -	- -	205 -	203 -	240 -
Melting Point	F	D-789	540	-	-	-	None
Continuous Service Temp. in Air (Maximum)	F	-	425	500	180	180	1,832
Dielectric Strength, Short Term	V/mil	D-149	540	400-500	-	-	1000
Dielectric Constant, 60 Hz 10 Hz 10x6 Hz	- - -	D-150 D-150 -	- - 3.0	- - 2.5	- - -	- - -	- - 6.03
Water Absorbion – 24 hrs - Saturation	% %	D-570 D-570	0.01 0.03	0 0	0.2 -	0.2 -	0.01 -



### Materials List from A to Z

ABS M/G	Delrin ®	Hygard ®	Polyurethane	VespeI ® PI
ABS Forming Grade	Delrin ® AF	Macor ®	PVC	Meldin ® PI
Acetal	Dibond ®	Makrofol ®	PVDF – Kynar ®	Techtron ® PPS
Acrylic	Duraplex ®	MC 901 ®	Radel ®	Semitron ® ESD
Adhesives	Durapol ®	Mylar ®	Royalite ®	Techtron® HPV
AC-300 ® ESD	Durostone ®	Noryl ®	Rulon ®	Torlon ®
AC-350 ® ESD	Extren ®	Nylon ®	Ryno Board ®	Nylatron ®
Aircraft Grade Acrylic	FEP	Nylatron ®	Ryton ®	Ertalyte ®
Arboron ®	Fluorosint ®	PC-300 ®	Semitron ®	Makrofol ®
Bags	FM 4910 Materials	PC-350 ®	StarBoard ®	Acrylite ®
Bev-A-Line ® Tubing	Foam-X ®	PEEK	Symalit ® PVDF	Kydex ®
Boltaron ®	G-10/FR-4	PETG	Techtron ®	Tygon ®
Braided Tubing	Gatorform ®	PET-P	Teflon ®	Komatex ®
Celazole ® PBI	Glastic ®	PFA	Tivar ®	Macor ®
Cogetherm ®	Halar ®	Phenolics	Torlon ®	Makrofol ® Films
Coroplast ®	HDPE	Polycarbonate	Turcite ® A & X	Symalit ® PVDF
Corzan ®	HIPS	Polypropylene	Tygon ®	Tivar ®
CEM-1	HTP 800 ®	Polysulfone	UHMW - PE	Turcite ®
Cirlex ®	Hydex ®	Polyimide Tubing	Ultem ® PEI	Plavis ®
CPVC	Hydlar ®	PolyCarve ®	Vivak ®	& many more .....

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