

CNC Materials //

Metals

| MATERIAL | OPTIMAL QUANTITY | TOLERANCES (+/-) | ADVANTAGES & CONSIDERATIONS | FINISH & APPEARANCE |
|------------------|------------------|------------------|---|---|
| Stainless Steel | 1 – 1,000 | +/- 0.005" | <ul style="list-style-type: none"> • High Strength • High Corrosion Resistance • High Weldability | <ul style="list-style-type: none"> • Standard Machined Finish • Tumbled • Bead Blasted (Sand or Glass) • Painted • Powder coat • Post Processing Finishes |
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| Low Carbon Steel | 1 – 1,000 | +/- 0.005" | <ul style="list-style-type: none"> • Common Steel • High Machinability and Easy to Weld • Can Be Hardened • Not Corrosion Resistant | <ul style="list-style-type: none"> • Standard Machined Finish • Tumbled • Bead Blasted (Sand or Glass) • Painted • Powder coat • Post Processing Finishes |
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| Aluminum | 1 – 1,000 | +/- 0.005" | <ul style="list-style-type: none"> • High Strength, Low Weight • High Machinability • Low Cost | <ul style="list-style-type: none"> • Standard Machined Finish • Tumbled • Bead Blasted (Sand or Glass) • Painted • Powder coat • Post Processing Finishes |
| <p>Aluminum is easy to machine and can be cut, chipped, and shaped much faster than other metals. Aluminum has an oxidized outer layer that offers corrosion resistance and is suitable for use in a variety of industries including aerospace, automotive, healthcare, and electronics. Aluminum has a high strength-to-weight ratio, making it perfect for aircraft and automotive pieces. Aluminum is receptive to finishing processes like anodizing and painting. Fathom offers many different types of aluminum for CNC machining, including:</p> <ul style="list-style-type: none"> • Aluminum 6061-T6: Excellent machinability, can be heat-treated, and has a great strength-to-weight ratio. Good for computer parts, automotive parts, bicycle frames. • Aluminum 7075-T6: Good for projects that require high-stress and high-performance parts. Great strength-to-weight ratio and hardness but less corrosion-resistant than other aluminum. Good for military parts, missile parts, sporting goods. • Aluminum 6060: Has medium strength, good corrosion resistance, easy to weld and form. Common applications include architectural parts, ladders, rails, fences, electronic modules, machinery, automotive, irrigation, pipes, and furniture. • Aluminum 6082: Excellent strength and corrosion resistance. Commonly used in the construction industry. • Aluminum 5083: Good for parts exposed to extreme environments. Excellent strength, chemical, corrosion, and heat resistance. Used on ships, rail cars, pressure vessels, and vehicles. • Aluminum 6063: Used for architectural applications. Offers a good surface finish and excellent corrosion resistance. Easy to weld and anodize. Common applications include window frames, doors, irrigation, and extrusions. • Aluminum 5052: Strength can be enhanced with cold working. Easy to weld, corrosion resistant, and medium-to-high strength. Used for fuel tanks, utensils, and fan blades. • Aluminum 2024: Excellent choice for aerospace applications. Offers fatigue resistance, fracture toughness, and moderate-to-high strength. Used for aircraft and automotive parts. • Aluminum 7050: Should not be welded. Offers toughness, good mechanical strength, and good corrosion resistance. Used for aircraft parts. • Aluminum MIC6: Made using alloys and a casting method, resulting in a cast plate with desirable properties. Smooth, light weight, has excellent tolerance and machinability. Free from contaminants. Commonly used in electronics, machining parts, and laser technology. • Aluminum 2017: Provides ductility, machinability, corrosion resistance, and great strength. Rivets, fasteners, pulleys, knitting needles, and aerospace parts are all made using aluminum 2017. • Aluminum 2014: High-strength applications. Can be heat-treated and offers good machinability. Used for aerospace and defense parts. | | | | |
| Brass | 1 – 1,000 | +/- 0.005" | <ul style="list-style-type: none"> • Corrosion and Chemical Resistant • High Density and Strength • Non-Conductive | <ul style="list-style-type: none"> • Standard Machined Finish • Tumbled • Bead Blasted (Sand or Glass) • Painted • Powder coat • Post Processing Finishes |
| <p>Brass, an alloy of copper and zinc, is strong, corrosion-resistant, wear-resistant, and has lower friction. Brass offers good machinability and is thermally and electrically conductive. Brass parts are used in a wide variety of industries. Fathom offers many different types of brass for CNC machining, including:</p> <ul style="list-style-type: none"> • Admiralty Brass – C443: Also known as arsenical brass. Alloyed with zinc and tin. Excellent corrosion resistance and heat transfer characteristics. Common applications of include distiller tubes, condenser plates, architectural applications, or any parts that may encounter salt or fresh water. • Architectural Bronze – C385: Often referred to as C385 brass. Alloyed with copper, lead, iron, and trace amounts of zinc. Offers long-term durability and excellent corrosion resistance. Applications include shower doors, elevator trim, funeral urns, drawer pulls, valves, and gun sights. <p><i>(continued on next page)</i></p> | | | | |

- **Brass Plate / Leaded Muntz Metal – C365:** Made from copper, zinc, tin, and lead. Easy to machine, strong, and corrosion-resistant. Applications include parts for the shipbuilding industry, condenser plates, and architectural components.
- **Commercial Bronze – C220:** Made from copper, zinc, and tin. Easy to form, corrosion resistant, high strength, and excellent color. Commonly used in lighting fixtures, kick plates, jewelry, medals, hardware, and marine hardware.
- **Free Machining Brass – C360:** Alloy of copper and lead. Used to make bar and brass rod items, including machine parts, couplings, circuit boards, industrial hardware, and plumbing products.
- **German Silver / Nickel Silver – C770:** Not made of silver. Alloy of copper, zinc, and alloyed nickel. Has a silver-like appearance with excellent strength, corrosion resistance, and electrical conductivity. Often used for decorative applications.
- **High Leaded Brass – Engravers' Brass – C353:** Made from copper, zinc, lead, and trace iron. Stiff, easy to machine and polish. Good for soldering. Applications include hardware, drawer handles, nuts, gears, signs, and placards.
- **Low Leaded Brass – C330:** Alloy of copper, lead, iron, and zinc. Offers strength, corrosion resistance, and formability but is not recommended for welding. Used to make tubing.
- **Naval Brass – C464:** Commonly used in marine applications. Offers excellent hardness, strength, and corrosion resistance. Can be soldered and brazed. Applications include fasteners, condenser tubes, cannons, and marine hardware.
- **Red Brass – C230:** Made from copper and zinc. Strong and corrosion-resistant. Can be cold worked, brazed, soldered, and hot-formed. Used for decorative components, light fixtures, jewelry, sprinklers, and weather stripping.

Plastics

| MATERIAL | OPTIMAL QUANTITY | TOLERANCES (+/-) | ADVANTAGES & CONSIDERATIONS | FINISH & APPEARANCE |
|---|------------------|------------------|--|---|
| HDPE | 1 – 100 | +/- 0.008" | <ul style="list-style-type: none"> • Medium Impact Strength • Flexible (Shore D70) • FDA Compliant • No Water Absorption | <ul style="list-style-type: none"> • Standard Machined Finish • Tumbled • Flame or Vapor Polished (Acrylic Only) |
| <p>High-density polyethylene (HDPE) or polyethylene high-density (PEHD) // Thermoplastic polymer is strong and cost-effective. HDPE has a high strength-to-density ratio allowing it to be used as a replacement for heavier materials. Chemical, mold, corrosion, and impact resistant. Applications include piping, chemical containers, cable insulators, fuel tanks, and toys. HDPE is recyclable.</p> <ul style="list-style-type: none"> • HDPE Matte Sheet // Durable and long-lasting material. Lightweight and can withstand exposure to moisture and the sun. HDPE matte sheet is used to make cutting boards and other products. • HDPE Smooth Sheet // Excellent impact strength. Durable material that is chemical, corrosion, and weather resistant. Applications of HDPE smooth sheet include piping systems, fuel tanks, mechanical parts, folding chairs, frozen food molds. • HDPE Pipe Grade // Offers chemical and UV resistance. Excellent performance qualities with stress crack resistance. HDPE pipe grade is suitable for outdoor and industrial applications. • HDPE Antiskid // Durable material that does not become slippery when wet. Lightweight, resistant to rotting and mold with excellent weathering and impact resistance. HDPE antiskid is suitable for outdoor and marine applications. • HDPE ColorCore® // Excellent chemical and impact resistance. Resistant to warp, rot, and abrasion. Suitable for outdoor applications. HDPE ColorCore® is used for marine, recreation, and sign applications. | | | | |
| PC | 1 – 100 | +/- 0.008" | <ul style="list-style-type: none"> • Medium Tensile and High Impact Strength • Maintains Properties Over Range of Temperatures • High Optical Clarity (Clear) | <ul style="list-style-type: none"> • Standard Machined Finish • Tumbled • Flame or Vapor Polished (Acrylic Only) |

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| | Polycarbonate (PC) // Transparent thermoplastic polymer. Strong, recyclable, heat and weather resistant. Can be used to make parts that touch food. High impact resistance makes it an excellent glass replacement. Good heat resistance and can be easily shaped without cracking. Applications include safety helmets, face shields, insulators, lenses, packaging, aerospace parts, and automotive parts. | | | |
| ABS | 1 – 100 | +/- 0.008" | <ul style="list-style-type: none"> • Medium Tensile and High Impact Strength • Electrical Insulator • High Machinability • Low Cost | <ul style="list-style-type: none"> • Standard Machined Finish • Tumbled • Flame or Vapor Polished (Acrylic Only) |
| | Acrylonitrile Butadiene Styrene (ABS) // Strong and tough. Offers good chemical and thermal stability along with high heat deflection and dimensional stability. ABS has excellent electrical insulation and is suitable for many different environments. Used for pipes, keyboards, and refrigeration parts. | | | |
| Acrylic | 1 – 100 | +/- 0.008" | <ul style="list-style-type: none"> • High Tensile Strength • Can Be Polished for High Optical Clarity | <ul style="list-style-type: none"> • Standard Machined Finish • Tumbled • Flame or Vapor Polished (Acrylic Only) |
| | Acrylic // Also known as polymethyl methacrylate (PMMA). Clear polymer often used as an alternative to glass. Durable and able to withstand extreme weathering. Chemical, shatter, scratch, and UV resistant. Lightweight and tough material that can be used in applications where it must be scratch resistant and stand up to harsh elements. Acrylic has a higher light transmittance than glass. Parts made using acrylic do not lose their brilliance and transparency. Acrylic has a refractive index of 1.49. Applications include contact lenses and glasses, light fixtures, greenhouse panels, screens, syringes, and surgical trays. | | | |
| Nylon 6/6 | 1 – 100 | | <ul style="list-style-type: none"> • High Tensile and Medium Impact Strength • Maintains Properties Over Range of Temperatures | <ul style="list-style-type: none"> • Standard Machined Finish • Tumbled • Flame or Vapor Polished (Acrylic Only) |
| | Nylon 6/6 // Also known as nylon 6-6, nylon 6,6, polyamide 66 or PA 66. Milky white, grey, or black in appearance. Excellent strength and stiffness, lower moisture absorption. Offers chemical, heat, corrosion, and abrasion resistance. Used for medical components, electronics, aerospace, gears, electronic casings, wheels, and other structural components. | | | |
| Acetal (Delrin®) | 1 – 100 | +/- 0.008" | <ul style="list-style-type: none"> • Medium Tensile and Medium Impact Strength • Holds Machining Tolerances Well • Good Wear and Fatigue Resistance | <ul style="list-style-type: none"> • Standard Machined Finish • Tumbled • Flame or Vapor Polished (Acrylic Only) |
| | Acetal // Also known as Delrin® or polyoxymethylene (POM). Wear and impact resistant. Stiff with excellent dimensional stability and high-tensile strength. Both Acetal and Delrin® are thermoplastics. Acetal is a non-amorphous semi-crystalline. Delrin® is a homopolymer. Acetal has a centerline porosity. Delrin includes PTFE fluorocarbon fibers that confer the same properties as acetal but with the added characteristics of being solid and slippery, eliminating the need for lubrication. Applications include medical device components, conveyor systems, safety restraints, and gears. | | | |
| ULTEM® | 1 – 100 | +/- 0.008" | <ul style="list-style-type: none"> • High Tensile Strength • High Working Temperature Range (335°F) • Electrical Insulator • High Optical Clarity (Clear) | <ul style="list-style-type: none"> • Standard Machined Finish • Tumbled • Flame or Vapor Polished (Acrylic Only) |
| | Ultem® is a thermoplastic used to make seals, valves, medical instruments, missile components, electrical hardware, aircraft components and more. Ultem® CNC is perfect for applications that require thermal... (continued on next page) | | | |

properties and excellent strength. During CNC machining of Ultem®, a computer directs the machines to subtract material, shaping the part. CNC technology can control lathes, mills, routers, grinders and other machines. Using a single set of prompts, CNC machinery can perform three-dimensional cutting tasks.

- **Ultem® Polyetherimide (PEI)** // High strength, long-term heat resistance, and excellent rigidity. Ultem® PEI has great dimensional stability, chemical resistance and flame resistance. Used for parts that require sterilization.
- **Ultem® 1000** // Good electrical properties and dimensional stability, even in high heat environments. Chemical resistance and flame retardance. Used to make components for the aerospace, automotive and HVAC industries.
- **Ultem® 2300** // PEI that is 30% glass. Added glass results in higher dimensional stability. Glass also adds increased rigidity and tensile strength. Used for aircraft, electrical, automotive, and medical applications.
- **Ultem® 2100/2200** // Glass-filled grades of Ultem®. Addition of glass gives tensile strength, stiffness, and dimensional stability. Ultem® 2100 is perfect for applications that require strength and rigidity at high temperatures. Ultem® 2300 is ideal for applications that call for dimensional stability and chemical resistance.
- **Ultem® 2400** // PEI that is 40% glass. High-performance plastic. Particularly useful in medical applications where the component must be repeatedly sterilized.

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| Tooling Board / Precision Foam | 1 – 100 | +/- 0.008" | <ul style="list-style-type: none"> • High wear • High temperature • High quality machined surface • Tooling applications | <ul style="list-style-type: none"> • Standard Machined Finish • Tumbled • Flame or Vapor Polished (Acrylic Only) |
| | Renshape // Foam tooling and high temp boards. Renshape is a high wear high temperature application board that represents great tooling aspects at light weight with strong durability. | | | |