

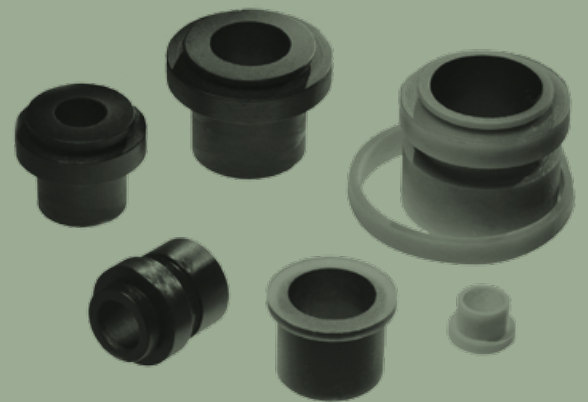


Polygon grinds, shapes, turns, mills,
routes, drills, chamfers, cuts,
engineers, designs and develops

YOUR COMPLETE COMPOSITE SOLUTION

high-precision components

ENGINEERING, FABRICATION, MACHINING & ASSEMBLY DESIGN GUIDE



Innovation Beyond Metals™

polygoncomposites.com



IDEA CENTER & FABRICATION CAPABILITIES

Engineered composite products

HISTORY

Founded in 1949 by a chemist working on advanced composite materials during World War II at the U.S. Wright-Patterson Air Force base, Polygon Company has grown into an engineered materials company with global distribution and sales offices around the world. We have been transforming composites into finely machined components for over 60 years. We have two facilities in North America and one in Xiamen, China ready to take your composite application from design through machining including painting, labeling, packaging and assembly.

IDEA CENTER

We had to literally discover our own analytical data to provide a base line from which to work. This creative energy has led to the development of what we call our Idea Center. Today our Idea Center not only does in house development, but also contract development work for outside entities interested in carrying forward their own composite projects or products. The depth of knowledge that exists within Polygon when it comes to precision OEM composite applications is unparalleled anywhere in the world.

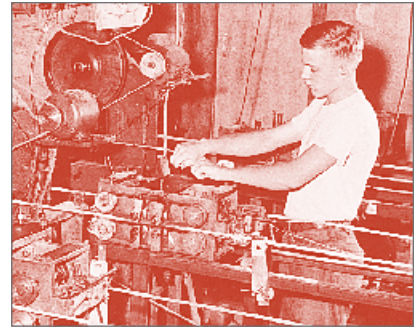
- Serving Fortune 500 companies: GM, Xerox, Tyco-US Surgical, Terex, Guidant Medical, Delphi, Westinghouse Electric, General Electric and many more.
- Past project sampling:
 - Automotive applications: Composite wiper arms, drive shafts, car antennas, suspension systems and race car engine connecting links.
 - Aerospace and military: Propulsion cans, projectiles, stealth fuel systems.
 - Medical components: Multi-lumen cannula, brain tumor probe, fracture management fixators.
 - Recreational: Braided baseball bats.
 - Office equipment: Composite electrical conductors and path ways.

ENGINEERING, FABRICATION, MACHINING AND ASSEMBLY

Polygon grinds, shapes, turns, mills, routes, drills, chamfers, cuts and does a whole host of other machining operations for quantities that range in the millions to just a few. We have our own tool and die shop which allows us the versatility to make prototypes or produce products in limited quantities. We can then transfer any large opportunity to the advanced production floor where we can machine things in the hundreds, thousands or millions. Our roots were in taper grinding composite pultruded rods used in the recreational market. This led to advanced centerless grinding machines that today typically hold tolerances tenths of a thousandth in a high production environment. Today Polygon has several Japanese Koyo advanced centerless grinding machines with vibration dampening devices to maintain precise control over our ground products, similar type equipment exists within the steel needle bearing industry.

We were one of the first composite fabrication companies to incorporate CNC machining into this very hostile and harsh machining environment, (composites are unique and require specialized tooling as well as an ability to handle the dust using unique filtration systems that are also environmentally friendly). We understand that when an application requires a fabricated composite, the application requires machining a very abrasive and hard material.

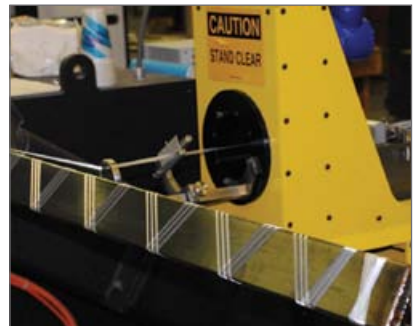
Today the Polygon facilities incorporate numerous types of CNC fabrication machinery in various venues. This includes robotic lathes, machining centers, palletized machining, automatic cut off and advanced production assembly, cleaning and painting. We even have a 13' x 12' automatic roll grinder, one of the few in existence today. All the advanced CNC machine programming is done within Polygon by our technicians and production engineers to maintain our high quality standards.



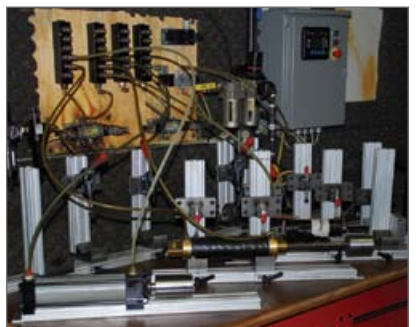
Since 1949, Polygon has been a leading innovator in the design and manufacturing of advanced composites.



Polygon has invested in types of CNC machinery.



Filament winding on a square mandrel.



Cylinder test station.

ENGINEERING, FABRICATION, MACHINING AND ASSEMBLY (CONTINUED)

Assembly projects are also second nature to us. Because “connecting” things to composites is a very unique challenge, Polygon has unique intellectual property surrounding the science of creating pressure vessels such as fluid power cylinders. We are also experts in bonding, insert molding or mechanically incorporating dissimilar materials to composites. We can also machine metallic constituents that need to be incorporated into a design and provide the value added assembly required to make a finished product or sub-assembly.

Polygon has built and maintains a unique testing lab which incorporates a wet chemistry lab, physical property analysis capabilities, analytical equipment (FTIR, TMA, DSC and etc.), as well as some high voltage testing apparatus. Our bushing lab is unsurpassed in wear analysis that can also incorporate dirt and dust lineally or rotationally. The medical section has an ability to do autoclaving and electrical cauterization insulating property testing. We also maintain relationships with several nationally recognized testing facilities when independent medical certifications are needed such as implantation, biotoxicity or FDA/ISO protocols are required.

Not only do we make the composite materials, but we finish them to very exacting tolerances. Whether it's over 40 million armature shaft insulators a year at +/- .0005" tolerances or 100-200 feet of 24" diameter cylinder tubing at +/- .003" tolerances, Polygon has the internal infrastructure to handle the task. Our three manufacturing facilities of over 250,000 square feet can handle just about any secondary machining requirement your application might have. Added to machining capabilities are our extensive painting, coating and assembly abilities. We can clear coat, paint, test and assemble almost any product for our customers. We can even assist with the design and prototype portion offering taxed engineering departments relief in delivering a project on-time and within budget.

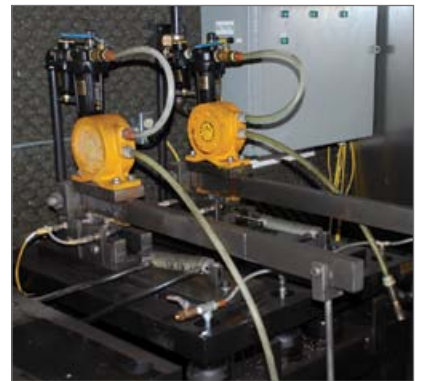
Over the last several years Polygon has developed an ability to source components for our customers, whether domestic or foreign, as part of an assembly product offering. In addition to sourcing and securing those components, we can assemble them and in some instances even drop ship them to our customer's customers. Added to the above mentioned capabilities is our extensive expertise working with certification and procedural agencies such as NSF, UL or NAIMA (biocompatibility or toxicity testing). Polygon is also ISO 9001:2000 and ISO 14001 registered (manufacturing and design).

Below is a partial listing of Polygon's processing capabilities:

- **Filament Winding:**
 - 3 and 4 axis CNC winders
 - Single and multi-spindle machines
- **Filament Braiding:**
 - 6 to 96 Carrier machines
 - CNC controlled
- **Hybrid Processing:**
 - In situ winding, braiding and pultrusion capabilities
- **Centerless Grinding:**
 - Through feed grinding
 - Plunge and form grinding
 - Roll Grinding
- **Thermoset Pultrusion:**
 - Multiple lines
- **Thermoplastic Pultrusion:**
 - In line co-extrusion
 - Numerous lines
- **Testing Labs:**
 - Instron, FTIR, Infrared spectroscopy, wet lab, DSC, autoclaves, etc.
 - Extensive bearing and bushing wear testing capabilities
 - Internally developed cylinder cycling and pressure testing benches for both hydraulic and pneumatic cylinders
- **Assembly:**
 - Semi-clean room for assembly projects
- **CNC Lather Turning:**
 - Robotic
 - Swiss machines
 - Cellular systems
- **CNC Machining Centers:**
 - Pallet changing capability
 - Fully integrated
- **Painting/Coating:**
 - Separate fire-proof painting and coating side building.
 - 1 automated painting line
- **Internal Tool and Die:**
 - Polygon maintains its own internal tool department employing tool & die makers
- **Manual Machining Capabilities:**
 - Cylindrical OD grinding and turning
 - Numerous lathes, saws, drilling, router and punch press capabilities



Small bearing tester.



Clutch bearing tester.



MEDICAL



BEARINGS



CYLINDERS



ELECTRICAL

Innovation Beyond Metals™

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