



GEF Incorporated

CUSTOM PULTRUSIONS

TECHNOLOGY • CAPABILITIES • SOLUTIONS



GEF Incorporated

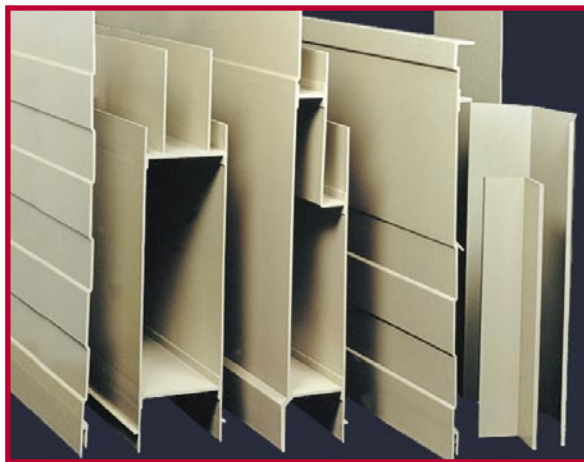


Why Consider Custom Pultrusion?

A custom pultruded part manufactured by Strongwell can be an excellent solution to a wide range of problems in practically any application where standard materials or other fiberglass shapes do not meet the needs of the customer. A custom pultrusion should be considered when a unique shape is needed and/or when the properties of other materials are not suitable for the application. Strongwell can work with the customer to develop custom pultrusions designed specifically for the application, resulting in better performance, increased reliability and lower life cycle costs associated with the custom pultrusion. Parts consolidation and the competitive advantage that a proprietary design can bring are also attractive reasons to consider a custom pultrusion.

Benefits of Fiberglass

- Strong
- Corrosion Resistant
- Lightweight
- Dimensionally Stable
- Low Maintenance
- EMI/RFI Transparent
- Low Conductivity (Thermally and Electrically)



Benefits of Custom Pultrusion

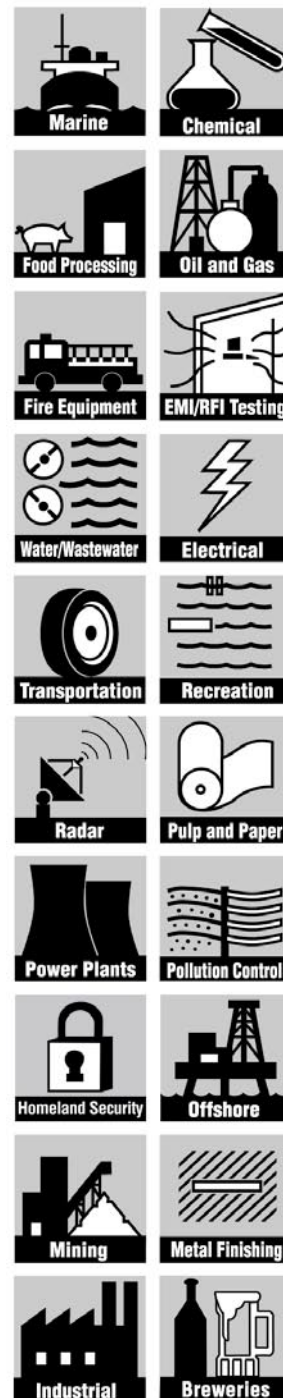


- Designed specifically for the application
- Provides better performance
- Provides increased reliability
- Results in lower life cycle costs
- Allows for parts consolidation
- Creates a competitive advantage

With more than 60 pultrusion machines running up to 40 lines per machine, Strongwell has the unmatched production capacity to manufacture custom pultruded parts. Combined with the broadest range of pultrusion design and engineering expertise, Strongwell offers more custom capabilities than anyone in the industry.

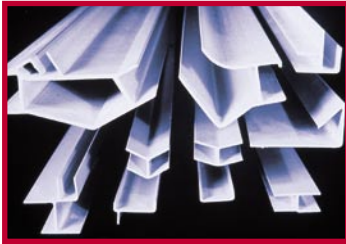
A significant amount of information is needed for Strongwell to properly design and quote a custom pultrusion. The Custom Pultrusion Checklist, found on Strongwell's website at www.strongwell.com, provides an excellent starting point for both the customer and Strongwell's custom pultrusion design team. We strongly encourage customers to submit the checklist early in the consideration process.

Markets





Technology



Shapes

Virtually any shape with a constant cross-section can be pultruded. This allows for the integration of various parts.



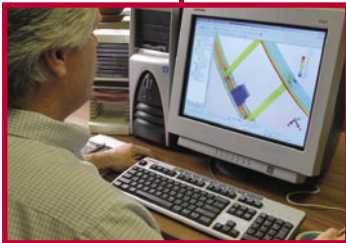
Resins

Standard resins can be modified or special resins can be used to optimize the performance of the pultrusion in challenging environments, such as those found in high temperature or extremely caustic areas. Typical resins include polyesters, vinyl esters, PVC, epoxies, phenolics, urethanes and blends.



Reinforcements

The type, form, placement and quantity of reinforcements can be customized to maximize economy, develop oriented strength and create or enhance other physical characteristics of a pultruded part. Typical reinforcements used include glass or carbon fibers in multi-filament strands, mat (long fibers held together with a resinous binder) or stitched fabrics.



Composite Design

A standard shape can be made into a custom pultrusion by customizing the resin or reinforcement to achieve a particular customer need.



Core Materials

Strongwell has extensive experience in pultruding over various core materials including foam, balsa, polyethylene and aluminum. In other applications, foam can be added after the part is pultruded.



Surface Veil Printing

By pre-printing graphics or text on the surfacing veil, Strongwell can easily customize a pultruded part for market identification or specific product needs.



Capabilities

Strongwell's expertise in pultrusion design, engineering and manufacturing makes it possible to offer unique solutions to meet the customer's exact requirements. Strongwell uses award-winning pultrusion processes in its ISO 9000:2001 certified manufacturing facilities. In-house composite engineers, mechanical engineers, and certified structural engineers assist in product conception and ensure custom products meet specifications. In-house drafting, AutoCAD and 3-D modeling capabilities also provide customers with expert solutions to specific needs.

Key Capabilities

- Strong composite and process engineering
- In-house structural design engineering (registered Professional Engineers)
- In-house laboratory for ASTM structural and electrical testing
- Extensive research and development capabilities
- AutoCAD mechanical and structural detailing
- Equipment and machine shop for design and build of advanced pultrusion machinery, tooling and dies
- Complete fabrication facilities to cut or machine parts for custom applications
- Unmatched production capacity



The pultrusion machine shown above (one of the largest in the world), was specially designed by Strongwell to pultrude very large parts, such as Strongwell's 36" x 18" EXTREN DWB® double web beam.

Strongwell has numerous multi-cavity pultrusion machines that allow for efficient multi-line production on a single machine.

Multi-cavity machines, such as the one shown below, allow Strongwell to increase capacity and shorten lead times for special orders.



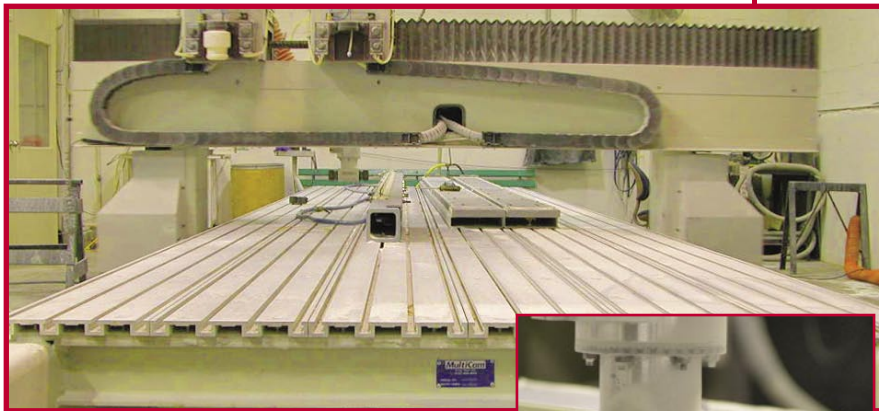


Capabilities

Fabrication

Strongwell can furnish custom fabricated assemblies based upon customer drawings. Individual parts can also be fabricated in a number of ways to produce specialized parts for custom applications. Strongwell's fabrication services include:

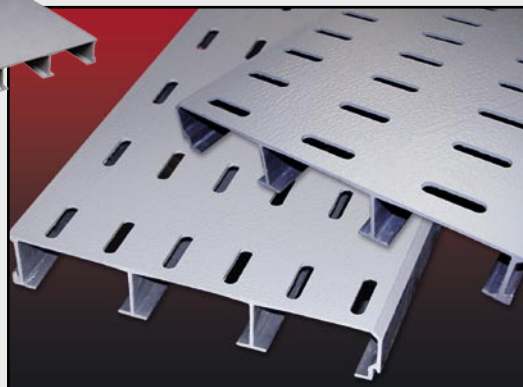
- Cutting
- Grinding
- Drilling
- Coating
- Routing
- Painting



Strongwell can perform many secondary operations on pultruded parts using CNC equipment. These operations include vertical and horizontal drilling, machining, cutting and routing. The customer benefits from this additional service because it adds value to the part and provides a product that will more closely meet the specifications and end use.

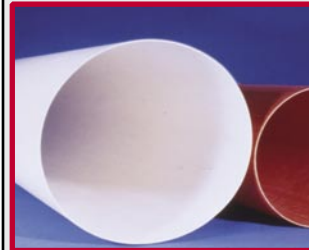
Before

Using specially designed CNC machines, Strongwell can perform certain fabrication services quickly and efficiently, resulting in significant cost savings for the customer.



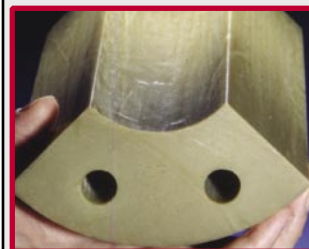
Shapes and Sizes

Strongwell has the expertise and capability to produce custom pultrusions in a wide range of sizes in almost any shape from a 36" x 18" double web beam for infrastructure applications to small 1/4" square bars used as circuit board stiffeners.



Large

Small



Thick

Thin



Complex

Simple





Solutions

Strongwell works every day to provide solutions to tough engineering and design challenges like the examples shown here. The unique properties possible with pultruded composite materials offer cost-effective solutions. As engineers become aware of the features and benefits of pultrusion, the range of applications for composite materials continues to grow.



Wastewater

Designed to interlock by alternating the top and bottom of the part, these large pultruded profiles (20" wide x 5" high) form structural covers for wastewater treatment cells.



Infrastructure

A 36" x 18" double web beam provides the superstructure of a 38' vehicular bridge. The bridge is rated at AASHTO HS-20, which is capable of carrying full tractor trailer traffic. The combination of size and laminate composition provide the strength and stiffness required for bridge designs.



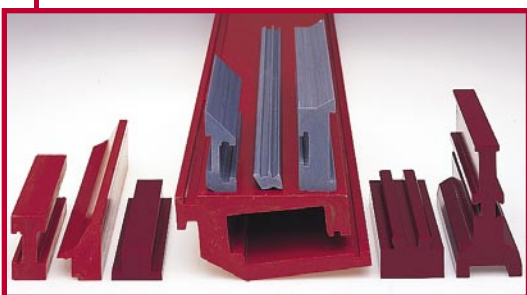
Automotive

A lightweight one-piece driveshaft replaces conventional two-piece steel driveshafts on GM and Chrysler pick-up trucks and vans for fuel economy and better mileage. The composite is formed using fiberglass, graphite and a special resin pultruded over an aluminum tube. The composite reinforces the aluminum tube, eliminating the need for center bearings. The one-piece driveshaft reduces assembly time, inventory costs, maintenance, powertrain noise, and vibration.



Marine

A specially designed part (above-right) replaces wood battens under fuel tanks and engines and along interior gunnels of high speed boats. The part provides high strength in areas that receive the wave force impact from high speed boating and is impervious to moisture and water. The part also eliminates the corrosion and maintenance problems experienced with wood components. Strongwell also pultrudes shafts for trolling motors (above-left). The corrosion-resistant composite shafts absorb the vibration and shock of wave action and objects in the water.



Pulp and Paper

Fiberglass profiles topped with ceramic plates replace polyethylene or stainless steel for felt blades or foils in paper manufacturing. The fiberglass/ceramic foil holds dimensional stability and is resistant to corrosion from the chemicals used for manufacturing and cleanup.



Solutions



Landscaping

This custom fabricated perimeter fencing for Drury Inns was made to mimic the look of wrought iron.



Hotel/Motel

A fiberglass E-channel reduces maintenance for Red Roof Inns by encasing the exposed edge of concrete walkways on the second floor balconies. Corrosion resistant fiberglass handrail systems, which replaced badly corroded steel structures, attach to the channel.



Cooling Tower

Specially designed fiberglass shapes are used in the new construction of cooling towers and in the repair of deteriorating wood cooling towers.



Transit

Non-conductive fiberglass third rail protection boards and tie extender brackets were installed to cover the top of a commuter railway's electric third rail.



Armor

Strongwell ballistics-resistant fiberglass panels demonstrate the versatility of the pultrusion process. The specially-designed 1/2" panel pictured above stopped three .44 Magnum bullets fired from a distance of 15 feet - the standard for UL Level 3 ballistic resistance.



For pricing call: GEF Incorporated, Winfield WV (304) 755-1600

Tubes

Strongwell has extensive experience in producing custom tubes of all shapes, sizes and colors to meet customer specifications. Typical shapes include round, square, rectangular, triangular and oval tubes with various wall thickness, but other tube shapes can also be accommodated. A spectrum of color options are available, and Strongwell can work with the customer to develop custom surface appearances, such as wood grain, to achieve an attractive, customized look.



Appearance

Fiberglass tool handles feature a very smooth, glossy appearance and can be made in a wide range of colors. In fact, Strongwell's tool handles have received industry awards for their attractive appearance. The color is integral to the part because the pigment is throughout the thickness – not just on the surface of the handle. These combined features eliminate the need for paint or coatings.



Reinforcement

Strongwell operates specially designed plugging machines to reinforce stress points for shovels and other tool handles.

Structural Capabilities

Thick-walled tubes can be produced for use in structural applications. Components can be carbon fiber, fiberglass or a mixture of the two, depending on the specifications.



Features

Lightweight, corrosion resistant custom tubes form the legs of this surveying tripod. The composite tubes give the manufacturer a competitive edge over tripods made using metal tubes.

Architectural Applications

Strongwell's engineering and manufacturing expertise allow the company to produce large tubes with thin walls, as shown at right. In this application, Strongwell worked with the customer to produce tubes that would be used to manufacture architectural columns.



Innovative Solutions in Fiberglass

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