SECTION 1

THE BASICS

Look for this blue line in the left margin of the Design Manual documents. This line shows you where the latest update has been made.

THE BASICS

WHAT IS FIBERGLASS REINFORCED POLYMER?

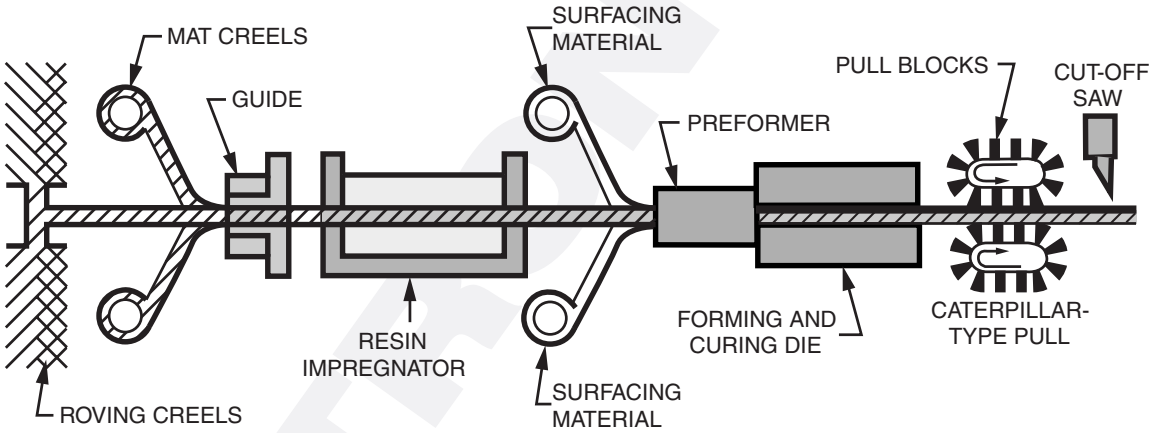
Fiberglass reinforced polymer (FRP) is most often referred to simply as “fiberglass” in practice (as in fiberglass tanks, fiberglass grating, fiberglass structural shapes, fiberglass boats, etc.). Used in this context, “fiberglass” is a composite consisting of a polymer resin matrix reinforced by embedded glass fibers. The strength of a fiberglass part is determined primarily by the type, orientation, quantity, and location of the glass fibers within the part.

The resin binds the reinforcing glass together and this resin/glass bond aids in developing stiffness in the part. The type of resin used determines corrosion resistance, flame retardance, and maximum operating temperature, as well as contributing significantly to certain strength characteristics including resistance to impact and fatigue.

WHAT IS PULTRUSION?

Pultrusion is a manufacturing process for producing continuous lengths of FRP structural shapes. Raw materials include a liquid resin mixture (containing resin, fillers and specialized additives) and reinforcing fibers. The process involves pulling these raw materials (rather than pushing as is the case in extrusion) through a heated steel forming die using a continuous pulling device. The reinforcement materials are in continuous forms such as rolls of fiberglass mat or doffs of fiberglass roving. As the reinforcements are saturated with the resin mixture (“wet-out”) in the resin impregnator and pulled through the die, the gelation (or hardening) of the resin is initiated by the heat from the die and a rigid, cured profile is formed that corresponds to the shape of the die.

While pultrusion machine design varies with part geometry, the basic pultrusion process concept is described in the following schematic.



CONTINUOUS PULTRUSION

The creels position the reinforcements for subsequent feeding into the guides. The reinforcement must be located properly within the composite and controlled by the reinforcement guides.

The resin impregnator saturates (wets out) the reinforcement with a solution containing the resin, fillers, pigment, and catalyst, plus any other additives required. The interior of the resin impregnator is carefully designed to optimize the “wet-out” (complete saturation) of the reinforcements.

Upon exiting the resin impregnator, the reinforcements are organized and positioned for the eventual placement within the cross section form by the preformer. The preformer is an array of tooling which squeezes away excess resin as the product is moving forward and gently shapes the materials prior to entering the die. In the die the thermosetting reaction is heat activated (energy is primarily supplied electrically) and the composite is cured (hardened).

- Upon exiting the die, the cured profile is pulled to the saw for cutting to length. It is necessary to cool the hot part before it is gripped by the pull block (made of durable urethane foam) to prevent cracking and/or deformation by the pull blocks. Strongwell uses two distinct pulling systems, one that is a caterpillar counter-rotating type and the other a hand-over-hand reciprocating type.
- In certain applications an radio frequency wave generator (RF) unit is used to preheat the composite before entering the die. When in use, the RF heater is positioned between the resin impregnator and the preformer.