



# StifPipe®

## Product Description

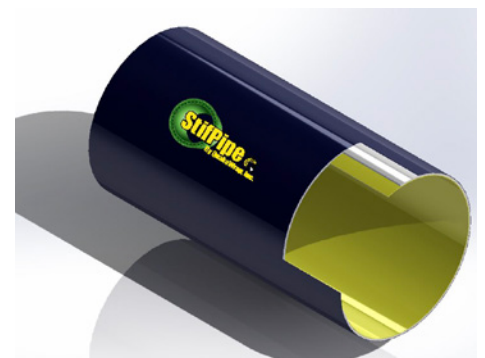
StifPipe® is comprised of a custom-design sandwich structure without the need of excessive layers of carbon fiber. It is a high-strength, lightweight, and corrosion resistant product ideal for water, wastewater, stormwater, oil, gas, and other fluid conveyance systems subject to internal and external loads. StifPipe®'s strength to unit weight ratio is unmatched by any material used in the pipeline industry. It can be used for structural pipeline rehabilitation with trenchless technology (by the wet layup or sliplining method) or new pipe installation. Sliplining with StifPipe® typically does not require any jacking equipment due to its light weight.

## Uses

- Structural lining of pipelines (no-dig)
- Structural point repair of pipelines (no-dig)
- New pipe installation (open-cut or trenchless)
- Applicable to all types of host pipe materials.

## Advantages

- Made of ultra-high strength FRP layers
- Corrosion resistant (inert to sulfuric acid and other chemicals listed in ASTM D543)
- High dimension ratio (50-100) due to high strength and thinner wall thickness
- Hydraulic capacity is improved for most applications due to smooth surface, thus low Manning's n value, and low thickness
- Easy installation with lightweight materials (e.g., a typical 36-inch StifPipe® weighs 30-35 lbs./ft.)
- Can be made to any shape to fit the host pipe.



## Manufacture

StifPipe® can be installed with the conventional FRP installation method (wet layup) or can be made on a mandrel and installed by sliplining. For most cases, the wet layup will require surface prep and environmental controls. The prefab StifPipe® can be manufactured on or in the vicinity of the project site. Each layer of glass, carbon fiber and 3D core layer is wrapped on a mandrel and let cure for 12 hours at room temperature. The curing process can be accelerated by using heat for both methods.

## Installation

(Basic steps of installation are indicated below. Refer to the technical specification for details.)

### Wet Layup

- Remove sharp protrusions and other irregularities
- Smoothen or abrade the surface as necessary to achieve a surface profile for required bond strength
- Clean the pipe surface of any debris, sediments, dust, tree roots, oil and grease by pressure washing and other means as necessary
- Apply a primer then a tack coat (epoxy) on the surface
- Apply resin saturated layers of StifPipe® per the design
- Apply a final, abrasion resistant top-coat and let cure
- Return the rehabilitated pipe to service after 12 hours or less with heated cure.

### Sliplining

- Inspect the interior of the pipe, smooth out any protrusions or joint offsets greater than 3% of the pipe internal diameter
- Install StifPipe® segments into the host pipe by manpower or with an excavator. Install grout ports (as necessary)
- Pump polymeric (epoxy or polyurethane) or cementitious grout into annular space.



# StifPipe®

## Shelf life and Storage

StifPipe® has unlimited shelf life when stored properly. Store in a dry place at 30°-120° F (0°-50° C).

## StifPipe® Laminate Properties

StifPipe® design is specific to each project depending on the internal and external loads. A typical design is comprised of dual layer (with chopped mat for improved impermeability) glass fiber, carbon fiber, and 3D polymeric fabric for improved stiffness. Properties of exemplary fabrics and resin (saturant) are provided below.

<b>Carbon Fabric Layer</b>		
<b>Property</b>	<b>Imperial</b>	<b>SI</b>
Weight	27-41 oz/yd <sup>2</sup>	639-970 g/m <sup>2</sup>
Tensile Strength	550 ksi	3,790 MPa
Tensile Modulus	33,500 ksi	230,980 MPa
<b>Carbon Fiber Laminate (saturated with QB 300SR)</b>		
Laminate thickness	0.049 in.	1.2 mm
Tensile Strength	135 ksi	930 MPa
Tensile Modulus	13,000 ksi	89,630 MPa
<b>Glass Laminate (biaxial, saturated with QB 300SR epoxy resin)</b>		
Weight (dry fabric)	26 oz/yd <sup>2</sup>	615 g/m <sup>2</sup>
Laminate thickness	0.080 in.	2.0 mm
Tensile Strength (0o/90o)	46.8/34.7 ksi	320/240 MPa
Tensile Modulus (0o/90o)	2,599 ksi/3,682 ksi	17,905 /25,370 MPa
<b>3D (Core) Fabric Layer (saturated with QB 300SR)</b>		
Thickness	0.23/0.39 in.	6/10 mm
Density (resin impregnated) (6/10 mm)	37.5 /42.5 lb/ft <sup>3</sup>	600/680 kg/m <sup>3</sup>
Compressive Strength (ISO 844)	1,450 psi	10 MPa
Shear Strength	508 psi	3.5 MPa
Flexural Strength	1,310 psi	8.5 MPa
Flexural Modulus	181,000 psi	1,250 MPa
<b>Epoxy Resin</b>		
Density	68 lb/ft <sup>3</sup>	1.1 g/cm <sup>3</sup>
Water Absorption	<1.0%	
Abrasion Wear Index (mg) (ASTM D4060)	457	
Hardness	85D	
Tensile Strength	10,000 psi	69 MPa
Tensile Modulus	244,200 psi	1,684 MPa
Compressive Strength	14,700 psi	101 MPa
Compressive Modulus	381,900 psi	2,633 MPa



# StifPipe®

## Ring Stiffness

With its composite system of carbon/glass fiber, and proprietary 3D fabric, StifPipe® is designed to take high external loads at minimal thickness and weight. StifPipe® mechanical properties are specific to each project and design. The Pipe Stiffness (PS value per ASTM D2412) is typically within the range of 50 to 100. The combined modulus of elasticity of a StifPipe® system, based on the parallel plate load test (ASTM D2412) is approximately 9,000,000 psi (62,000 MPa).

## Joints

StifPipe® pipe segments are connected in two ways:

1. Butt-joined pipe segments are connected with cured-in-place FRP strips, and
2. Pipe segments are made with bell and spigot ends, and the spigot with a custom-design gasket is pushed into the bell.

## Warranties and Disclaimers

Hychem warrants that this product shall conform to the technical specifications published in the product literature. The quality and fitness of the product is dependent upon the proper use and application of the product by the applicator. Hychem has no role in the application of the finished polymer other than to manufacture and supply its components. It is vital that the person applying this product understands the product and is fully trained and certified in the use of spray equipment and application of sol-gel materials. There are no warranties that extend beyond the description on the face of this instrument, except when provided in writing, directly by Hychem and executed under seal by a company officer.

## Field Support

Field support where provided, does not constitute supervisory responsibility. Suggestions made by HYCHEM either verbally or in writing may be followed, modified or rejected by the owner, engineer or contractor since they and not HYCHEM are responsible for carrying out procedures appropriate to a specific application.

## Customer Responsibility

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