



## CarbonStrong CS-850 Composite

### PRODUCT DESCRIPTION

CarbonStrong CS-850 Composite is a system comprised of thermoset Saturating Epoxy (TCI 300-S) and Carbon Fiber Fabric (TCI-C) to form a Carbon Fiber Reinforced Polymer (CFRP) laminate used to strengthen and/or upgrade structural elements.

### APPLICATIONS

<b>Structural Capacity Changes</b>	<ul style="list-style-type: none"> <li>• Increased live and/or dead loads in structures.</li> <li>• Increased traffic volumes on bridges and viaducts.</li> <li>• Increased capacity and structural strength of pipes.</li> <li>• Ability to accommodate changes of building utilization or industrial machinery layout.</li> <li>• Allows for the removal of walls, columns, or sections of floor slabs.</li> </ul>
<b>Seismic Retrofitting</b>	<ul style="list-style-type: none"> <li>• Upgrade of reinforced concrete columns.</li> <li>• Retrofit of unreinforced masonry walls</li> <li>• Increases lateral shear resistance in reinforced masonry walls.</li> </ul>
<b>Blast Resistant Upgrade</b>	<ul style="list-style-type: none"> <li>• Column protection.</li> <li>• Masonry wall protection.</li> </ul>
<b>Structural Damage &amp; Repair</b>	<ul style="list-style-type: none"> <li>• Repairs aging or corroded members.</li> <li>• Repairs or upgrades inferior materials.</li> <li>• Repairs inadequate construction techniques.</li> <li>• Repairs large diameter pipes to achieve strengthening and waterproofing</li> <li>• Repair members damaged by fire or natural disaster.</li> </ul>

### ADVANTAGES:

- NSF/ANSI Standard 61 & NSF 372 Approved
- Meets design criteria of **AWWA C305**, **ACI 440**, **CSA S806**, and **CSA S16**
- Long pot lifetime
- High strength-to-weight ratio
- **0% VOC** and **100% solvent-free**
- Non-corrosive, non-magnetic and non conductive
- Acid / alkali resistance
- Light weight, adds negligible dead load to structure
- May be utilized to enhance shear, confinement, and flexural strength

### EPOXY:

TCI 300-S is a two-component, 100% solid, room temperature cure thermoset epoxy system with low viscosity and long pot life characteristics.

- Pot life at 23°C temperature, 200 g mass: 1.5 – 2.0 hours
- Gel time at 23°C temperature, 200 g mass: 2.0 – 3.0 hours
- Cure cycle: 3 days at room temperature or 6 hours at 45°C + 24 hours at room temperature
- Shelf life: two (2) years in original unopened, properly stored containers

### CARBON FIBRE FABRIC

TCI-C is a unidirectional carbon fibre fabric; stitched from Toho UTS 50 24k fiber. 70% of the fibres run in the 0° direction (600g/m<sup>2</sup>), and 30% of the fibres run in 90° direction (250 g/m<sup>2</sup>).

- Shelf life: ten (10) years in proper storage conditions



Mechanical and Physical Properties		Epoxy Material		
Typical Dry Carbon Fibre Properties		Cured 6 Hrs @ 45°C + 24 Hrs @ Room Temperature		
Physical Properties	Typical Test Value	Properties	ASTM Method	Typical Test Value
Tensile Strength	660 Ksi (4,550 MPa)	Tensile Strength	D638	10,050 psi (69.3 MPa)
Tensile Modulus	34 Msi ( 234.0 GPa)	Tensile Modulus	D638	406 Ksi (2,800 MPa)
Ultimate Elongation	1.90%	Elongation Percent	D638	7.5%
Density	0.068 lbs./in.3 (1.82 g/cm3)	Flexural Strength	D790	16,900 psi (116.5 MPa)
Min. weight per sq. yd.	35.9 oz./yd2 (850 g/m2)	Flexural Modulus	D790	478 Ksi (3,296 MPa)
		Glass Transition Temperature	D4065 Tg	94°C (201°F)

COMPOSITE GROSS LAMINATE PROPERTIES IN THE MAJOR FIBRE DIRECTION			
PROPERTIES	ASTM METHOD	TYPICAL TEST VALUE	CHARACTERISTIC DESIGN VALUE
Ultimate Tensile Strength in Primary Fiber Direction	D3039	131.4 Ksi (906.0 Mpa)	116.1 ksi (800.5 Mpa)
Tensile Modulus in Primary Fiber Direction	D3039	11,016 Ksi (75.95 Gpa)	8,870 ksi (61.16 Gpa)
Elongation at Break	D3039	1.20%	1.04%
Flexural Strength	D790	70.33 Ksi (484.9 Mpa)	56.35 ksi (388.5 Mpa)
Flexural Modulus	D790	5,894 Ksi (40.64 Gpa)	5,119 ksi (35.29 Gpa)
Longitudinal Compressive Strength	D3410	46.27 Ksi (319.0 Mpa)	36.36 ksi (250.7 Mpa)
Longitudinal Compressive Modulus	D3410	6286 Ksi (43.34 Gpa)	4327 Ksi (29.83 Gpa)
In-Plane Shear Strength	D5379	8.30 Ksi (57.23 Mpa)	7.16 ksi (49.37 Mpa)
In-Plane Shear Modulus	D5379	617.3 Ksi (4.26 Gpa)	522.9 Ksi (3.61 Gpa)
Interlaminar Shear Strength	D2344	5.76 Ksi (39.71 Mpa)	5.21 Ksi (35.92 Mpa)
Overlap Shear Strength	D7616	1,960 psi (13.51 Mpa)	1,380 psi (9.52 Mpa)
Shear Bond Strength to Steel Substrates	D7616	1,010 psi (6.96 Mpa)	670 psi (4.62 Mpa)
Longitudinal Coefficient of Thermal Expansion [ppm/F°]	D696	5.1 ppm./F°	
Transverse Coefficient of Thermal Expansion[ppm/F°]	D696	12.0 ppm./F°	
Poisson's Ratio		0.13	0.13
Nominal Laminate Thickness	D1777	0.049 in (1.25 mm)	0.049 in (1.25 mm)



Environmental Durability Performance – Percent Retention									
Environmental Durability Test	ASTM	Exposure Time		Exposure Time		Exposure Time		Exposure Time	
		1,000 h		3,000 h		10,000 h		40,000 h	
		Strength	Modulus	Strength	Modulus	Strength	Modulus	Strength	Modulus
Water Resistance	D2247	92.7	98.2	-	-	-	-	91.1	97.8
Saltwater Resistance	D1141	95.0	98.5	91.8	100.6	98.1	98.1	-	-
Alkali Resistance	C581	90.5	97.0	97.8	98.8	97.3	94.3	-	-
Dry Heat Resistance	D3045	99.1	95.4	101.9	101.1	103.9	104.7	-	-

## INSTALLATION

### Environmental conditions

- Maintain a dry dehumidified environment and maintain the ambient temperature at a minimum of 10° F above the dew point
- Substrate surfaces shall be at least at SSD (Saturated Surface Dry) condition prior to installation • Maintain the required environmental conditions of substrate surfaces until at least 48 hours after the installation has been completed.
- The surface temperature of the substrate shall not fall below 5° C. Don't apply the protective coating if the substrate surface temperature is above 40° C

### Surface preparation:

- Concrete substrate must be sound and clean. Remove all spalled or fractured areas and inject any cracks that exceed 0.3 mm in width.
- All surfaces must be free of dust, laitance, grease, waxes, coating materials, and any other foreign particles
- For bond-critical applications such as flexural or shear strengthening:
  - o Concrete surfaces must be prepped to a profile of ICRI CSP # 3, subject to design, and any surface irregularities (offsets, fins, etc.) greater than one mm shall be ground smooth
  - o Sharp corners or edges where the FRP system will turn shall be rounded to at least a 13 mm radius
  - o Concrete surfaces shall be dry to at least 5%.
  - o Ensure the minimum pull-off strength of the concrete substrate is not less than 300 psi (2.0 Mpa), subject to design and code requirements.
  - o Steel surfaces shall be prepped to near white metal per SSPC.
  - o Steel surfaces should be separated from the CFRP laminates by a GFRP veil to preclude galvanic reaction.
- For contact critical applications such as confinement of columns:
  - o Surface preparation should promote continuous intimate contact between the CFRP system and the substrate surface
  - o Ensure to patch and fill voids
  - o Substrate surfaces should be flat or convex and even
  - o Substrate surfaces shall be thoroughly cleaned using mechanical and/or high-pressure sand /water blasting
- All substrate surfaces have to be primed using TCI 800-D. Refer to the current 800-D datasheet for primer mixing and application procedures

### Fabric Saturation:

- Mix TCI-300-S components using the recommended mixing ratio and stir for at least 5 minutes. Wait five minutes for the mixture to relieve any entrapped air bubbles. Refer to the current 300-S data sheet for mixing and application procedures
- Impregnate TCI-C fabric with TCI 300-S manually or by using a mechanical saturating machine
- The epoxy/carbon fibre weight ratio shall be 1:1



**CARBON FIBRE  
TECHNOLOGIES**



#### **Installation of Saturated Fabric:**

- Where required, apply an epoxy paste on the substrate surface using TCI 200-B. Refer to the current TCI 200-B datasheet for mixing and application procedures.
- Apply the saturated fabric to the substrate surface.
- Entrapped air between layers must be released or rolled out before the resin sets
- Allow for the curing time of the CFRP system for at least 8 hours before the application of successive layers
- The number of CFRP layers is per design documents and shop drawings
- Apply a layer of TCI 200-B on top of the final CFRP laminate to fill any voids or seams and to even the top of the surface (if required)
- Finally, apply a topcoat of TCI ShieldStrong (955-PL), refer to the current ShieldStrong (955-PL) datasheet for mixing and application procedures.

#### **Final cure and return to service**

Allow 72 hours for a final cure before returning to service.

#### **LIMITED WARRANTY**

Ten (10) year material replacement warranty is available. For complete details contact [info@tcicarbonfibre.com](mailto:info@tcicarbonfibre.com). Copy is furnished upon request.

#### **Legal Disclaimer**

Keep product containers tightly closed, keep products out of reach of children, products are not for internal consumption, products are for industrial use only, products are for professional use only. IN CASE OF EMERGENCY: Call CANUTEC +1 (613) 996-6666. Prior to each use of any product of Technical Construction Infrastructure Inc. ("TCI"), users must read and follow the warnings and instructions on the products most current product label, specification, products datasheet, products safety data sheet, and products material safety data sheet. Current safety data sheet, datasheet, and other TCI product literature can be obtained by emailing [info@tcicarbonfibre.com](mailto:info@tcicarbonfibre.com), or by calling +1 (905) 997-5800. The information included herein is for illustrative purposes only, and to the best of our knowledge, is accurate and reliable. TCI cannot, however, under any circumstances make any guarantee of results or assume any obligation or liability in connection with the use of this information.

