



TuffCarbon Plate™

Pre-impregnated & Cured Pultruded Carbon Fiber Plates

1.01 DESCRIPTION

TuffCarbon Plate™ is a range of pultruded carbon-fiber-reinforced polymer (CFRP) plates designed for the external structural strengthening of existing concrete, wood, masonry and steel members. TuffCarbon Plate™ is externally bonded onto the surface of the substrate to strengthen and stiffen existing structures, using an epoxy resin specifically designed for the application. Please use the correct product grade that complies with VOC regulations as per federal, state, county and city regulations/codes at the place of installation of product.

1.02 USES

- Aging of Construction Materials
- Construction or Design Defects
- Horizontal, Vertical, and Overhead
- Increase Load Capacity of Beams and Slabs
- Increased Live Loads in Structures
- Increased Traffic Volumes on Bridges
- Installation of Heavy Machinery in Buildings
- Insufficient Reinforcement and Structural Depth
- Steel Reinforcement Corrosion
- Stress Reduction in Steel Reinforcement
- Structural Change Support
- Vehicle Impact
- Vibrating Structures

1.03 FEATURES

- Ease of Installation with Limited or No Downtimes
- Easy to Integrate into Surroundings
- Excellent Fatigue Resistance
- High Static, Flexural and Shear Capacity
- High Tensile Strength and Modulus of Elasticity
- Lightweight with a High Strength-To-Weight Ratio
- Low Aesthetic Impact
- No Wiping with Solvent Required
- Non-Corrosive and Alkali-Resistant
- Non-Intrusive; No Significant Change to Existing Dimensions Of The Structural Member
- Plates can be Ordered in Most Lengths or Cut On-Site
- Removable "Peel-Ply" Protective Plastic Film

1.04 TECHNICAL DATA

ACI 440.2R-08, Guide for the Design and construction of Externally Bonded FRP Systems for strengthening concrete structures, July 2008, (USA)

1.05 PACKAGING

Available in any length up to 820 ft or 250 m

TuffCarbon Plate™ 4 width 4" or 100 mm

TuffCarbon Plate™ 5 width 5" or 120 mm

TuffCarbon Plate™ 6 width 6" or 150 mm

1.06 COLOR

Black

1.07 COVERAGE GUIDE

Coverage of TuffPaste™ or TuffPoxy™ 3FS resins with CFRP Plates:

TuffCarbon Plate™ 4 - approx. 50 LF/gallon

TuffCarbon Plate™ 5 - approx. 32 LF/gallon

TuffCarbon Plate™ 6 - approx. 22 LF/gallon

1.08 PREPARATION

1. All materials being used and surfaces in contact with the **TuffCarbon Plate™ System** should be conditioned between 40-95°F (4.44-35°C) for proper performance. Provide heating or cooling, as necessary, to compensate for temperature extremes and changes in cure time.
2. For concrete and masonry substrates, mechanically prepare the substrate to remove coatings, laitance, and any other surface contaminants and to provide a proper surface profile. The surface profile should be a minimum of CSP-3, per ICRI 310.2R.
3. For steel substrates, abrasive blast to "white metal" in accordance with Society for Protective Coatings (SSPC) Specification SP-5-89 or NACE No. 1, using clean, dry abrasive to obtain a minimum 3 mil profile (76 microns).
4. The surface flatness should not vary by more than 1/8" (0.3175 cm) over a 3' length (3 mm per meter). The length is measured along the direction that the laminate is to run.
5. Existing surface irregularities must be filled with an appropriate repair mortar such as **TuffMend™ VOH**, **TuffPoxy™ 3FS**, or **TuffPaste™**. Allow the leveling material to cure no longer than 24 hours before installing the laminate over it.
6. The adhesive strength of the concrete must be verified after surface preparation by random pull-off testing (ACI 503R) at the discretion of the engineer. Minimum tensile strength, 200 psi (1.4 MPa) with concrete substrate failure.
7. **TuffCarbon Plate™** should be cut with tools using a "shearing" force (e.g.) guillotine or heavy-duty shears. Care must be taken to support both sides of the TuffCarbon Plate to avoid splintering. A Skill saw may be used with a diamond blade. Hacksaw or other abrasive cutting methods may also be used. Care must be taken to

support the Plate on both sides to avoid splintering. (See caution).

1.09 MIXING

Consult **TuffPoxy™ 3** or **TuffPaste™** technical data sheets for mixing and application information on epoxy resins

1.10 APPLICATION

All temperature conditions are acceptable when clean and dry. Apply the neat mixed PSI's Epoxy onto the concrete with a trowel or spatula to a nominal thickness of 1/16" (1.5 mm). Apply the mixed PSI's Epoxy onto the **TuffCarbon Plate™** laminate with a "roof-shaped" spatula to a nominal thickness of 1/16" (1.5 mm). Within the open time of the epoxy, depending on the temperature, place the **TuffCarbon Plate™** laminate onto the concrete surface. Using light finger pressure, position the laminate in the desired location with the adhesive-coated side against the substrate. Using a hard rubber roller and moderate pressure, press the laminate against the substrate until adhesive begins to exude from under both edges of the laminate. Remove excess adhesive with a steel trowel. Glue line should not exceed 1/8" (3 mm).

1.11 CURING

The structure and the external reinforcement must not be disturbed for a minimum of 24 hours and protected from rain and dust. The epoxy will reach its design strength after 7 days.

1.12 CLEANUP

Tools and Equipment: Clean tools with PSI's **100 Solvent** (ethyl alcohol, toluene, etc.) before the product dries.

1.13 STORAGE AND SHELF LIFE

TuffPoxy™ The material should be stored between 40–95°F (4–35°C) in a cool, dry area away from direct sunlight. The shelf life of properly stored, unopened bags is 12 months from the date of manufacture. An excessive temperature differential and/or high humidity can shorten the shelf life expectancy.

1.14 LIMITATIONS

DO NOT place at temperatures below 40°F (5°C) unless special provisions are followed. Avoid hazards by following all precautions found in the Safety Data Sheets (SDS), product labels, and technical literature. Do not dilute. Wear protective gloves and goggles. Avoid prolonged skin contact. Additional precautions, safety information,

and first aid are contained in the Safety Data Sheet (SDS).

READ SDS PRIOR TO USING PRODUCT. KEEP OUT OF THE REACH OF CHILDREN.

1.15 CAUTION

Wear protective gloves and goggles. Avoid prolonged skin contact. Extra care must be taken to avoid exposure to carbon dust. Caution **TuffCarbon Plate™** laminate strips are non-reactive and fully cured. They do not require a material safety data sheet. However, caution must be used when handling the **TuffCarbon Plate™** laminates since a fine "carbon dust" may be present on the strips. Gloves must, therefore, be worn to protect against skin irritation.

Caution must also be used when cutting **TuffCarbon Plate™** laminates to protect against airborne carbon dust generated by the cutting procedure. Use of an appropriate, properly fitted NIOSH approved respirator is recommended.

1.16 PHYSICALS	
Tensile Strength	290075 psi (> 2000 MPa avg)
Tensile Modulus	2 x 10 ⁷ psi (> 138 GPa)
Traverse Tensile Strength	4061 psi (> 28 MPa)
Compression Strength	194350 psi (1340 MPa)
Compression Modulus	2 x 10 ⁷ psi (> 130 GPa)
ILSS	7.97 x 10 ⁶ psi (55 GPa)
Flexural Strength	2.17 x 10 ⁸ psi (1500 GPa)
Flexural Modulus	1.96 x 10 ⁷ psi (135 GPa)

Please read all information in the General & Safety Guidelines, Technical Data Sheets, Guide Specifications and Safety Data Sheets (SDS) before applying material. PSI Products are for "Professional Use Only" and preferably applied by professionals who have prior experience with PSI Products or have undergone training in application of PSI Products. Published technical data and instructions are subject to change without notice. Contact your local PSI representative or visit our website for current technical data, instructions, and project specific recommendations.

LIMITED WARRANTY

PSI warrants its products to be free of manufacturing defects and that they will meet PSI current published physical and chemical properties. Seller's sole responsibility shall be to replace that portion of the product which proves to be defective. There are no other warranties by PSI of any nature whatsoever expressed or implied, including any warranty of merchantability or fitness for a particular purpose in connection with this product. PSI shall not be liable for damages of any sort, including remote or consequential damages resulting from any claimed breach of any warranty whether expressed or implied. PSI shall not be responsible for use of this product in a manner to infringe on any patent held by others. In addition, no warranty or guarantee is being issued with respect to appearance, color, fading, chalking, staining, shrinkage, peeling, normal wear and tear or improper application by the applicator. Damage caused by abuse, neglect and lack of proper maintenance, acts of nature and/or physical movement of the substrate or structural defects are also excluded from the limited warranty. PSI reserves the right to conduct performance tests on any material claimed to be defective prior to any repairs by owner, general contractor, or applicator.

DISCLAIMER

All guidelines, recommendations, statements, and technical data contained herein are based on information and tests we believe to be reliable and correct, but accuracy and completeness of said tests are not guaranteed and are not to be construed as a warranty, either expressed or implied. It is the user's responsibility to satisfy himself, by his own information and test, to determine suitability of the product for his own intended use, application and job situation and user assumes all risk and liability resulting from his use of the product. We do not suggest or guarantee that any hazard listed herein are the only ones which may exist. Neither seller nor manufacturer shall be liable to the buyer or any third person for any injury, loss or damage directly or indirectly resulting from use of, or inability to use, the product. Recommendations or statements, whether in writing or oral, other than those contained herein shall not be binding upon the manufacturer, unless in writing and signed by a corporate officer of the manufacturer. Technical and application information is provided for the purpose of establishing a general profile of the material and proper application procedures. Test performance results were obtained in a controlled environment and PSI makes no claim that these tests or any other tests, accurately represent all environments.