

# Fortec Carbon Bars

Carbon fiber reinforced polymer (CFRP) rods (rebar) for structural reinforcement



**Product Description** Fortec Carbon Bars are pultruded carbon fiber reinforced polymer (CFRP) rods or bars for structural reinforcement. They are designed for strengthening concrete, timber and masonry structures and usually used with the Near Surface Mounted (NSM) installation technique. Bars are inserted into grooves cut into the substrate and bonded with an epoxy resin. The bars can also be used as original reinforcement for these structures and used for mechanical connection of Fortec CFRP fabrics on substrates where additional anchorage is desired.



### Key Features

- ❖ Fast installation time
- ❖ No substrate surface preparation required
- ❖ Simple groove installation
- ❖ Easy gun-applied epoxy resins
- ❖ Protected via recessed installation
- ❖ Better fire resistance

### PRODUCT USE

#### Target Applications

- ❖ Positive moment reinforcing in beams and slabs
- ❖ Negative moment reinforcing in decks
- ❖ Load transfer dowels
- ❖ Masonry wall reinforcement
- ❖ Pre- and post-tensioned structures
- ❖ Cyclical loading applications
- ❖ Highly corrosive environments

#### Repair Applications

- ❖ Collision
- ❖ Corrosion
- ❖ Fire
- ❖ Age
- ❖ Overuse

#### Structural Benefits

- ❖ Recessed installation
- ❖ Strength increase
- ❖ Deformation & sag decrease
- ❖ Steel reinforcement stress reduction
- ❖ Crack and moisture control
- ❖ Service life increase

### SPECIFICATIONS

<b>Typical Data</b>	<b>Base Material</b>	Carbon fiber reinforced polymer in an epoxy matrix
	<b>Storage</b>	Product to be kept from direct sunlight
	<b>Shelf Life</b>	Unlimited
	<b>Color</b>	Black
	<b>Fiber Volumetric Content</b>	62%±3%
	<b>Minimum Tensile Modulus of Elasticity, ksi (GPa)</b>	18,000 (124.1)
	<b>Min. Shear Strength (perpendicular to bar), ksi (MPa)</b>	18 (124.1)
	<b>Minimum Bond Stress, ksi (MPa)</b>	1.4 (9.6)
	<b>Coefficient of Thermal Expansion</b>	Transverse: 41 to 58 x 10 <sup>-6</sup> Longitudinal: -4 to 0 x 10 <sup>-6</sup> /in/in/°F
	<b>Barcol hardness (ASTM D2583)</b>	48B to 55B

Bar Size Designation U.S. std. (Metric)	Nominal Bar Diameter in (mm)	Nominal Cross-Sectional Area in <sup>2</sup> (mm <sup>2</sup> )	Ultimate Guaranteed Tensile Strength ksi (MPa)	Ultimate Guaranteed Bar Tensile Strength kip <sup>1</sup> (kN)	Elongation at Ultimate Strain <sup>2</sup> (%)
#1 (4)	0.156 (3.96)	0.02 (12.3)	210 (1448)	4.0 (17.8)	1.17%
#2 (6)	0.250 (6.3)	0.05 (32)	210 (1448)	10.5 (46.7)	1.17%
#3 (10)	0.375 (9.5)	0.11 (71)	190 (1310)	20.9 (93.0)	1.06%
#4 (13)	0.500 (12.7)	0.20 (129)	170 (1172)	34.0 (151.2)	0.94%
#5 (16)	0.625 (15.9)	0.31 (199)	160 (1103)	49.6 (220.6)	0.89%
#6 (19)	0.750 (19.1)	0.44 (284)	160 (1103)	70.4 (313.2)	0.89%
#7 (22)	0.875 (22.2)	0.60 (387)	150 (1034)	90.0 (400.3)	0.83%
#8 (25)	1.00 (25.4)	0.79 (510)	145 (1000)	114.6 (509.5)	0.81%
#9 (29)	1.128 (28.7)	1.00 (645)	140 (965)	140.0 (622.8)	0.78%
#10 (32)	1.270 (32.3)	1.27 (819)	135 (931)	171.5 (762.6)	0.75%

<sup>1</sup>kip = 1,000 lb-force

<sup>2</sup>Calculated in accordance with ACI 440.6-08

**Lengths:** Eight foot (2.4 m) length standard. Custom lengths are available. **Bends and Hooks:** Available in most shapes.

## HOW TO USE

**Preparation** Protect the work area from standing water and inclement weather. Surfaces must be clean and sound. Spalling or other damaged concrete must be removed to solid material. Laitance must be removed. For strengthening or repair applications, cut a groove into sound concrete or masonry substrate using an appropriate saw or diamond blade. **\*\*\*Unless called for otherwise in the design, care must be taken not to cut through existing reinforcing steel, steel tendons, embedded pipe, electrical ducts, or other materials. Property damage, physical injury or death could result.\*\*\*** Clean the groove with compressed air and remove dust, laitance, grease, curing compounds, impregnations, waxes, foreign particles, loose materials and other bond inhibiting materials from the bonding surface prior to epoxy or bar installation. Prefabricated grooves may need additional preparation if smooth. Sand blast, shot blast or use other approved mechanical means to provide a clean, roughened texture to accept a good epoxy bond. Keep Fortec Carbon Bars from contamination. Store in a clean and dry area away from direct sunlight. Keep bars in original packaging until installation and protect from physical damage. Remove dust, dirt, and any other foreign materials. Remove water, grease, wax, oil or any other liquids with an appropriate solvent.

**Cutting** Bars may be cut to a desired length with a diamond blade. Wrap the bars with masking or duct tape and cut through the tape to minimize splintering.

**Epoxy Resin** Fortec Toughened #4020 Fast Hi-Mod Gel epoxy resin is recommended for horizontal, vertical and overhead applications. **Coverage** of Fortec Toughened #4020 Fast Hi-Mod Gel epoxy resins in slots with Fortec Carbon Rods: 1/4 in. diameter approx. 95 LF/gal. in 1/2 x 1/2 in. slots; 3/8 in. diameter: approx. 68 LF/gal. in 5/8 x 5/8 in. slots; and 1/2 in. diameter approx. 52 LF/gal. in 3/4 x 3/4 in. slots.

**Near Surface Mounted (NSM) Applications** Cut appropriate width grooves (approximately ¼-inch wider than the bar size) into the surface of the substrate to the design depth. Using the Fortec recommended cartridge gun, apply the mixed Fortec epoxy resin into the grooves approximately half the depth of the groove to provide a base for receiving the bars.

Fortec epoxies are packaged in cartridges with static mixers that can be injected directly into the grooves for horizontal, vertical, or overhead applications. Within the working time of the epoxy (which varies with temperature) press the Fortec Carbon Bars into the epoxy in the grooves. Apply additional epoxy over the rods to fill in the grooves. Force out any air voids that might be present and strike the surface with a trowel to provide a neat, finished installation.

**Anchoring Fortec Fabrics** To provide direct anchorage of Fortec Fabric applications, the fabric may be positively attached into grooves in the concrete or masonry at the ends. Cut appropriate sized grooves perpendicular to the fabric orientation into the concrete as described above. Fill the grooves with the Fortec Toughened #4020 Fast Hi-Mod Gel epoxy. Place the saturated fabric over the grooves, and press the Fortec Carbon Bars into the grooves for positive attachment. Fill in any voids in the groove and in the Fortec Fabric with additional epoxy and force out any air voids that might be present.

**Qualifications** Each structural and life safety application requires the design and certification of a licensed, professional engineer.

**Cautions** Caution must be used when handling CFRP rods. Gloves must be worn to protect against carbon dust skin irritation and exposed fiber ends. Caution must also be used when cutting the Fortec Carbon Bars to protect against airborne carbon dust and flying particles generated by the cutting procedure. Use of an appropriate, properly fitted NIOSH approved respirator is recommended. As with any cutting and adhesive operation, proper eye protection should be used. Always follow OSHA and site safety requirements.

**Keep Out Of Reach of Children - Keep Container Tightly Closed - Not For Internal Consumption – For Industrial Use Only**

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