Diameter Ø From 6.00mm & 32.00mm of Glass Fiber Reinforced Plastic Composites, High Strength & Light Weight Strengthening System for Buildings & Bridges Structures & Timber Structures

Build Strength® GFRP Rod Rebar, is Glass Fiber of Pultrusion Oriented, continuous carbon fiber filaments which are held in position by a lightweight, Laminates of **GLASS FIBER FIBER Build Strength® GFRP Rod Rebar** has robust handling and rapid wet-out characteristics which make it ideal for on-site strengthening of structural of buildings, bridges, beams, columns and marine structures. Additionally, **GLASS FIBER FIBER Build Strength® GFRP Rod Rebar** is compatible with all commonly used adhesive systems which can be applied using a variety of wet-out/adhesive infusion techniques.

Build Strength® GFRP Rod Rebar, is a Glass Fiber Laminates, composite materials are finding applications for the reinforcement of new and the strengthening of existing structures. The materials excellent resistance to most of forms of corrosions and the ability to dissipate energy as required in earthquake scenarios make them eminently suitable for a wide rage of applications and they contribute significantly to lowering life cycle costs and increasing safety.

Build Strength GFRP Rod Rebar, Specification Properties Data Sheet
Tensile Stress, Nominal Diameter & Cross Sectional Area, Modulus of Elasticity

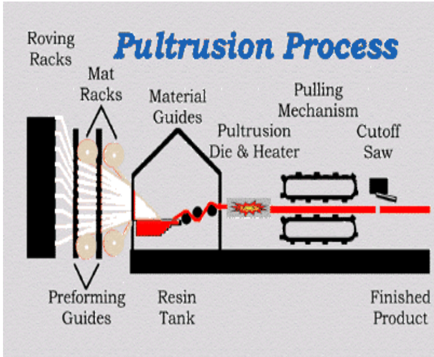
Bar Sizes of Build Strength GFRP Rod Rebar		Nominal Dia		Cross Sectional Area		Ultimate Tensile Strength	Guaranteed Tensile Strength	Tensile Modulus of Elasticity
mm	**inches**	mm	inches	mm2	in2	Mpa	Mpa	Gpa
6.00	**#2**	6.35	0.250	33.23	0.0515	950	860	43
9.00	**#3**	9.53	0.375	84.32	0.1310	900	820	43
12.00	**#4**	12.70	0.500	144.85	0.2240	860	750	43
16.00	**#5**	15.88	0.625	217.56	0.3370	800	710	43
19.00	**#6**	19.05	0.750	295.50	0.4580	750	660	43
22.00	**#7**	22.23	0.875	382.73	0.5930	710	640	43
25.00	**#8**	25.40	1.000	537.90	0.8340	670	600	43
32.00	**#10**	31.75	1.250	807.34	1.2510	620	560	43

Length of Build Strength GFRP Rod Rebar **3.0 meter, 6.0 meter or 12.0 meter**

Key Properties High Tensile Modulus, High Tensile Strength, High Thermal Conductivity, Light Weight, Electrical Conductivity, Excellent Fatigue Resistance, Excellent Corrosion Resistance, Low Friction and Wear, Low Thermal Expansion, Resistance to High Temperatures, Good Creep and Damping Properties, Transparent to X-Rays, Solvent Free Working Environment

Uses	***To Strengthening Reinforced Concrete & Timber Wood***
Loading Increase	Increasing of Support Live Load in Building & Traffic Growth on Bridges Vibrating Machinery on Roof Slabs Heavy Machinery in Commercial Building
Change Design for Structural System	Dismantlement of Walls & Columns or Slabs & Beam Reducing of Buildings & Bridges Weight
Design or Construction Defects	Insufficient Reinforcements & Structural Depth

Build Strength GFRP Rod Rebar & Diameter Size



Rod Rebar Pultrusion Process

Bond Stress:	10 – 12Mpa
Coefficient of Thermal Expansion:	Transverse Direction 21 – 23 x 10-6 /°C, Longitudinal Direction 9.07 x 10-6 /°C
Barcol Hardness:	65 per ASTM D2538
Specific Gravity:	2.0 per ASTM D792
Shear Stress:	Shear stress measured on 5/8” diameter bars using a double shear test fixture: 155 MPa

Summary of FRP Rebar Codes and Guidelines:

USA –	American Concrete Institute, 440H Committee Report – *Guide for the Design and Construction of Concrete Reinforced with FRP Bars*
Canada –	*Canadian Highway Bridge Design Code – Section 16, Fibre Reinforced Structures CSA Standards S806 Design and Construction of Building Components with FRP*
Japan –	Japan Society of Civil Engineers *Recommendations for Design and Construction of Concrete Structures Using Continuous Fiber Reinforcing Materials*
Europe –	International Federation of Structural Concrete (FIP) Task Group 9.3 FRP *Reinforcement for Concrete Structures*

Durability

Potential durability versus traditional steel reinforcement is one of the chief benefits of GFRP Rebar. In environments that would traditionally degrade steel reinforcement, there is little concern in the international research area that these same agents (low pH solutions) will degrade the quality of GFRP rebar. Typical Portland concrete pour water is very alkaline with a pH of approximately 13. In addition, it is presumed that any water that hydrates through the concrete also creates a high pH solution that could potentially degrade the rebar.

Most durability studies have focused on subjecting GFRP Rebars to alkaline solutions of 13pH at elevated temperatures to stimulate service lives on the order of 50 years.

Creep

When subjected to a constant load, all structural materials, including steel, may fail suddenly after a period of time, a phenomenon known as creep rupture. Creep tests indicate that if sustained stresses are limited to less than 60% of short term strength, creep rupture does not occur in GFRP rods.

**Stirrups,
Shapes and Bends**

Bends in **LaMaCo-Build Strength GFRP Rod Rebar** are fabricated by shaping over a set of molds or mandrels prior to curing of the resin matrix. Field bends are not allowed. All bends must be made at the factory. Research has shown that bends typically maintain 38% of ultimate tensile strength through the radius.

It is recommended that you work with the factory in the early stages of design, as not all standard bends and shapes are readily available.

The narrowest inside stirrup width is 10”. Bends are limited to shapes that continue in the same circular direction. Otherwise lap splices are required.

Design Consideration

FRP composite reinforcement has desirable performance advantages over other concrete reinforcing products. However, since the properties of the reinforcing products are different from those of steel reinforcement, the design of concrete reinforced with GFRP products will be also different in many cases. Design engineers should consider the appropriateness of reinforcing concrete with GFRP bars, keeping in mind the following basic points in their designs:

- **Direct substitution of FRP bars in a concrete member designed with steel bars is not possible in most cases.**
- **Lower modulus of elasticity of composite rebars will limit the applications**
- **Glass FRP bar is limited to a maximum sustained stress of 20% of the guaranteed design tensile strength based on ACI 440 design guidelines**
- **Current knowledge restricts the use of GFRP bars for:**

  Compression Reinforcement in both beams and columns

  Seismic Zones

  Moment Frames

  Zones where moment redistribution is required

  Structures subject to high temperature

- **Important Design Differences – GFRP vs Steel**

  Physical Properties
  Tensile strength
  Bond Strength to Concrete

  Stress Strain Curve

  GFRP is linear elastic to failure, Steel has ductility

  GFRP v.s. Steel – Physical Properties

  Tensile strength of GFRP significantly greater than steel
  Modulus of Elasticity for GFRP much lower than steel
  Bond strength to Concrete may differ

  Design differences for GFRP RC members :

  Deflection and crack widths may control design
  Failure mode should be compression failure of the concrete
  Strength reduction factor or safety factors differ
  Rebar spacing and cover may differ
  Lab splice length differ

  Tension Lap Splice Length

  Approximately 40 bar diameters for GFRP v.s. 30 bar diameters for steel.

Application Method

Surfaces Preparation

Reinforced concrete surfaces shall be clean, structurally sound and free from foreign materials, contaminants, oily and other debris. Concrete surfaces shall not more than 4% moisture content and the temperature of the substrate must be at least 3 ºC which above, the current dew point temperature.

Reinforced concrete surfaces shall be clean, structurally sound and free from foreign materials, contaminants, and oily and other debris. Concrete surfaces shall not more than 4% moisture content and the temperature of the substrate must be at least 3 ºC which above, the current dew point temperature.

For filing surface irregularities such as blowholes, honeycombs & etc. Please hacking or cutting – off unloose concrete, air blowing those dust, and clean all concrete surfaces, keep over night for dry.

Using patching method of Polymer Cementitious Mortar or pumping of High Strength Cementitious Grout. But only for concrete surfaces cracks 0.25mm, must be injected with Low Viscosity of Epoxy Resin for filled. Using high pressure Air-Less Pump for injecting and penetration into structural crack lines, to achieve load bearing and adhesion bonding system.

Once patching, pumping or injecting works have been done, before laying Carbon Fiber Fabric Sheet, all surfaces must be Hammer Test for Polymer Cementitious Mortar, High Strength Cementitious Grout and Pull-Off Test for Cracks Lines. For achievement of strength requirement please consult your local Engineer.

Over Head Application
<u>Vertical Application</u>

Applied on Over Head or Vertical Beam and Slab, either Primer, Adhesive & Resin, Waste of materials are approximately 15%.

Mixing of Primer

Use a low speed (300 to 500 rpm) electric drill fitted with a paint mixer or a wing type paddle Pour one unit of Part A & B into drum and mix for at least 3 minutes until the mix is uniform and free. Note: Once been mixed, the Primer must be applied within 30 minutes of Pot Life.

For Uneven Surfaces
<u>Mixing of Paste Putty</u>

Use a low speed (300 to 500 rpm) electric drill fitted with a paint mixer or a wing type paddle. Pour one unit of Part A & B into drum and mix for at least 5 minutes until the mix is uniform and free. Note: Once have been mixing, the Paste Putty must be applied within 60 minutes of Pot Life.

Easy Installation

The easy to use Glass Fiber GFRP Rod Rebar system components assure fast, user friendly installation. A complete system is installed in only three (3) steps to properly prepared surfaces within appropriate working conditions.

System Recommended Use Resin Component

Epo Bond 340 Adhevise is Epoxy Solvent Free
Two Component of Part A & Part B.
Sag Resistance until 6mm thick.
Up to 15 Mpa **Shear Strength**
Up to 4 Mpa **Peel Strength**
Suitable for applied on Over Head or Vertical Surfaces

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1. Roll "Epo Bond CF Primer"

Apply **Epo Bond CF Primer**, at rate applied 0.20 kg/m2 to 0.30 kg/m2, is a low viscosity of **Primer Resin** that can be applied using a roller.
(Wait for ½ to 1 hours curing)

2. Apply "Epo Bond 340 Adhesive"

Apply **Epo Bond 340 Adhesive**, at rate applied 0.34 kg/meter linear to 1.5 kg/meter linear, paste adhesive is a high solids, non sag paste Epoxy Based or Polyurethane Based material that is applied using a Spatula Tools to level concrete surfaces.
Note: Min of Thickness of Adhesive Shall be at least 0.5 mm
(Curing time: ½ hour to 4 hours depend of whether temperature)

3. Apply Carbon Fiber of "Build Strength® GFRP Rod Rebar"

Within the open time of the adhesive, place immediately the **Build Strength® GFRP Rod Rebar Profile** onto the adhesive surfaces, using roller or other tools to press the laminates into the adhesive until is forced out on both sides of the laminates.
Before the adhesive curing. Immediately remove surplus adhesive on both sides

Clamp The **Build Strength® GFRP Rod Rebar**. The joint component should be assembled and clamped as soon as the Adhesive has been applied. An even contact pressure throughout the joint area will ensure optimum cure.

LaMaCo Science Chemical

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