

# Carbon Fiber Reinforced Polymer [CFRP] Wrap/Fabric Ultra High Tensile Strength

**Pioneer in CFRP,  
Smart & Clever for Composites**

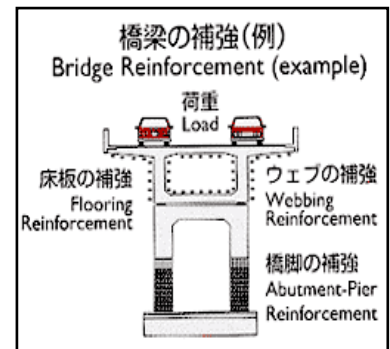
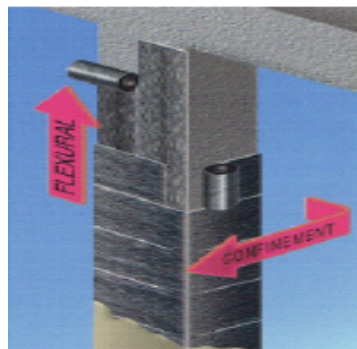
**Structural Strengthening  
Building & Civil Engineering  
[Column, Beam & Slab]**

**Timber Strengthening**

**Masonry Strengthening**



**[Original of Carbon Fiber Filament Yarn]**



**Build Wrap AAA 200** [200gm/m<sup>2</sup>]  
**Build Wrap AAA 230** [230gm/m<sup>2</sup>]  
**Build Wrap AAA 300** [300gm/m<sup>2</sup>]  
**Build Wrap AAA 450** [450gm/m<sup>2</sup>]  
**Build Wrap AAA 530** [530gm/m<sup>2</sup>]  
**Build Wrap AAA 600** [600gm/m<sup>2</sup>]

6 models weight fiber content

**Build Wrap AAA Ranges  
Carbon Fiber to Achieving the  
Ultra High Tensile Strength &  
E-Modulus Wrap Fabric Roll**

## **Carbon Fiber Reinforced Polymer [CFRP] Ultra High Tensile Strength [UHS]**

### **Build Wrap AAA**

Is a fabric sheet of longitudinal oriented, continuous carbon fiber filaments which are held in position by a lightweight, open mesh, glass scrim. **Build Wrap AAA®** 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, **Build Wrap AAA®** is compatible with all commonly used resin systems which can be applied using a variety of wet-out/resin infusion techniques.

Is a composite material 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 range of applications and they contribute significantly to lowering life cycle costs and increasing safety.

### **History Carbon Fiber**

Is produced by the controlled oxidation, carbonization and graphitisation of carbon-rich organic precursors which are already in fiber form. The most common precursor is polyacrylonitrile (PAN), because it gives the best carbon fiber properties, but fibers can also be made from pitch or cellulose. Variation of the graphitisation process produces either high strength fibers (@2,600°C) or high modulus fibers (@3,000°C) with other types in between. Once formed, the carbon fiber has a surface treatment applied to improve matrix bonding and chemical sizing which serves to protect it during handling

### **Key Properties**

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

### **Uses**

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***for Strengthening Reinforced Concrete  
Masonry, Timber Wood & Steel***

#### **Loading Increase**

Increase of Supporting Live Load in Building  
Increase of Supporting Traffic Growth on Bridges  
Vibrating Machinery on Roof Slabs  
Heavy Machinery in Commercial Building

#### **Change Design for Structural System**

Dismantlement of Walls & Columns  
Dismantlement of Slabs & Beam  
Reducing of Buildings & Bridges Weight

#### **Design or Construction Defects**

Insufficient Reinforcements  
Insufficient Structural Depth



# Build Wrap AAA

## CFRP Wrap/Fabric

### 6 types of weight for Build Wrap AAA Carbon Fiber Physical Properties

Products Grade	Build Wrap AAA200		Build Wrap AAA230		Build Wrap AAA300	
Carbon Fiber Weight	200	g/m <sup>2</sup>	233	g/m <sup>2</sup>	300	g/m <sup>2</sup>
Roll Width	500	mm	500	mm	500	mm
Roll Length	100	meter	100	meter	100	meter
Sheet Thickness	0.107	mm	0.120	mm	0.167	mm
Typical Binder Content	3.0	%	3.0	%	3.0	%
Total Roll Weight	10.00	kg	11.65	kg	15.00	kg

Products Grade	Build Wrap AAA450		Build Wrap AAA530		Build Wrap AAA600	
Carbon Fiber Weight	450	g/m <sup>2</sup>	530	g/m <sup>2</sup>	600	g/m <sup>2</sup>
Roll Width	500	mm	500	mm	500	mm
Roll Length	50	meter	50	meter	50	meter
Sheet Thickness	0.235	mm	0.276	mm	0.325	mm
Typical Binder Content	3.0	%	3.0	%	3.0	%
Total Roll Weight	22.50	kg	13.25	kg	15.00	kg

### Specification Properties Data Sheet

#### “Build Wrap AAA®” - Carbon Fiber Filament Yarn [Actual Dry Fiber] Properties

Typical of Carbon Fiber Properties	SI / Units UK design		US / Units US design	
Tensile Strength	<b>6,370</b>	Mpa	<b>923,650</b>	psi
Tensile Modulus	<b>294</b>	Gpa	<b>41.92 x 10<sup>6</sup></b>	psi
Ultimate Elongation	<b>2.20</b>	%	<b>2.20</b>	%
Density	<b>1.80</b>	g/cm <sup>3</sup>	<b>0.0650</b>	Ib/in <sup>3</sup>
Approximate Yield (12K)	<b>1.31</b>	m/g	<b>1,950</b>	Ft/Ib
Filament Diameter	<b>6.7</b>	µm	<b>0.265</b>	mil

### Properties, Cured Laminates, [Final Performance] Carbon Fiber Reinforced Polymer

Build Wrap AAA	Test Method	UK Design	US Design
Tensile Strength	ASTM D3039	>3900 Mpa	565,500 psi
E-Modulus	ASTM D3039	215 Gpa.	30.66 x 10 <sup>6</sup> psi
Flexural Strength	ASTM D790	1850 Mpa	268,250 psi
Fiber Volume [by weight]	ASTM D3039	70%	70%
Epoxy Resin Volume	ASTM D3039	30%	30%
Density Composite	ASTM D3039	1.60 g/cm <sup>3</sup>	1.60 g/cm <sup>3</sup>
Elongation at Break	ASTM D3039	>1.75 %	1.75%
Temperature Resistance	ASTM D3039	>150°C	>150°C

### Carbon Fiber Wrap/Fabric Sheet for Dry and Wet Lay up

Technical Data [Unidirectional]	Build Wrap AAA 200	Build Wrap AAA 300	Build Wrap AAA 450	Build Wrap AAA 600
Carbon Fiber Weight [g/m <sup>2</sup> ] main direction	200	300	450	600
Density [g/cm <sup>3</sup> ]	1.80	1.80	1.80	1.80
Elongation at Rupture [%]	2.20	2.20	2.20	2.20
Design Thickness [Fiber Weight/Density] [mm]	0.107	0.167	0.235	0.325
Theoretical Design Cross Section 100mm Width [mm <sup>2</sup> ]	107	167	235	325
Reduction Factor for Design [Manual Lamination/UD Sheet]	1.2 (recommended by LAMACO)	1.2 (recommended by LAMACO)	1.2 (recommended by LAMACO)	1.2 (recommended by LAMACO)
Tensile Force of 1000mm Width Ultimate [kN]	$\frac{107 \times 3900}{1.2} = 348$	$\frac{167 \times 3900}{1.2} = 543$	$\frac{235 \times 3900}{1.2} = 764$	$\frac{325 \times 3900}{1.2} = 1056$
Tensile Force of 1000mm Width at 0.6% $\epsilon$ for Design [kN]	208	325	458	633
<b>Application</b>	Flexural Enhancement (low quality of substrate) Axial Load Enhancement of Columns Replacement of Stirrups in Columns			



**Build Wrap AAA 300, apply on Slab**



**Build Wrap AAA 300, apply on Slab**



Surfaces Preparation, Apply of Epoxy Primer



Apply of **Build Wrap AAA 300** on Beam



Completed Apply of **Build Wrap AAA 300**

## **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 be more than 4% in moisture content and the temperature of the substrate must be at least 3°C (or) and above the current dew point temperature.

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For filing surface irregularities such as blowholes, honeycombs & etc. Please hack or cut off any unloose concrete, air blow excess dust, clean all concrete surfaces, and remain dry over night.

Use 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 to be filled. Using high pressure Air-Less Pump for injecting and penetration into structural crack lines, to achieve load bearing and adhesion bonding system.

Once patched, pumped or injected, before laying Carbon Fiber Laminates, all surfaces must be Hammer Tested 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 Vertical Application**

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 Mixing of Paste Putty**

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).

### **Mixing of Resin Wrap**

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 have been mixed, the Epoxy Resin or Polyurethane Resin must be applied within 60 minutes of Pot Life).

### **System Recommended Use Resin Component**

**Epo Resin Wrap** is Epoxy Solvent Free (Bisphenol-F)  
Two Component of Part A & Part B.  
Suitable for applying on Over Head or Vertical or Horizontal Surfaces

### Easy Installation

The easy to use Carbon Fiber Wrap/Fabric system components assure fast, user friendly installation. A complete system is installed in only six (6) steps to properly prepared surfaces within appropriate working conditions.

- 1. Preparation of Structure, Level the Un-even Surfaces with "Cem Strength"**  
Apply **Cem Strength**, applied at rate 2 kg/m<sup>2</sup> to 12 kg/m<sup>2</sup>, polymer cementitious mortar is a material that is applied using a squeegee or trowel to level uneven concrete surfaces. (Curing time: ½ hour to 4 hours depend of whether temperature)
- 2. Roll "Epo Bond Primer"**  
Apply **Epo Bond Primer**, applied at rate 0.20 kg/m<sup>2</sup> to 0.30 kg/m<sup>2</sup>, and applied using a roller. (Curing time: 2-4 hours)
- 3. Apply First Coat of "Epo Resin Wrap"**  
Apply **Epo Resin Wrap**, applied at rate 0.25 kg/m<sup>2</sup> to 1.00 kg/m<sup>2</sup>, is a high solids Epoxy Based Resin that can be applied using a roller to begin saturation of the fiber reinforcement sheet. (Curing time: ½ hour to 4 hours depend of whether temperature)
- 4. Apply Carbon Fiber Wrap/Fabric Sheet of "Build Wrap AAA"**  
The backbone of the Carbon Fiber composite strengthening system, carbon fiber fabric sheet, to be placed into the first layer of wet saturant and backing paper is removed. During the laying of Carbon Fiber Fabric Sheet, Keep the fiber direction properly.
- 5. Apply Second Coat of "Epo Resin Wrap"**  
Apply **Epo Resin Wrap**, applied at rate 0.25 kg/m<sup>2</sup> to 1.00 kg/m<sup>2</sup>, is a high solid Epoxy Based that can be applied using a roller to begin saturation of the fiber reinforcement sheet. (Curing time: ½ hour to 4 hours depend of whether temperature)
- 6. Note: Apply Optional Topcoat**  
Where required, the Carbon Fiber high solids, high gloss, corrosion-resistant topcoat provides a protective/aesthetic outer layer. (Refer to Manufacture)  
*In the case of two layers and several layers of "Build Wrap AAA" . For multiple plies repeat steps 3, 4 and 5. All direction of fiber overlapping must be at least 100mm*

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**Health & Safety** Some of the components of this product may be hazardous during mixing and application. Please consult the relevant Health & Safety Data Sheets, available from LAMACO Malaysia on request and sent with each delivery.



## LAMACO SYSTEM SDN BHD

Co. No. 1033557-M

407, Jalan Perusahaan 6, Taman Bandar Baru Mergong,  
05150 Alor Setar, Kedah. Malaysia

Tel : +60-4-734 5555 Fax : +60-4-772 4444

Http : [www.lamaco.com](http://www.lamaco.com) Email : [info@lamaco.com](mailto:info@lamaco.com)



: +60 19 4486611 +60 19 4786611

### Test Accordingly to ASTM D3039, Cured Laminates of CFRP Polymer Matrix Composite Products Putruccion Type of CFRP Strip/Plate/Tape

#### Achieving Test Result

Product Name	Tensile Strength [Mpa]	E-Modulus [Gpa]	A Fiber Thickness mm	B Fiber Width mm	Fiber Length mm	C Max Tensile Load [kN]
Build Wrap AAA200	3900	215	0.107	25	250	10,432
Build Wrap AAA230	3900	215	0.120	25	250	11,700
Build Wrap AAA300	3900	215	0.167	25	250	16,282
Build Wrap AAA450	3900	215	0.235	25	250	22,912
Build Wrap AAA530	3900	215	0.276	25	250	26,910
Build Wrap AAA600	3900	215	0.325	25	250	31,688

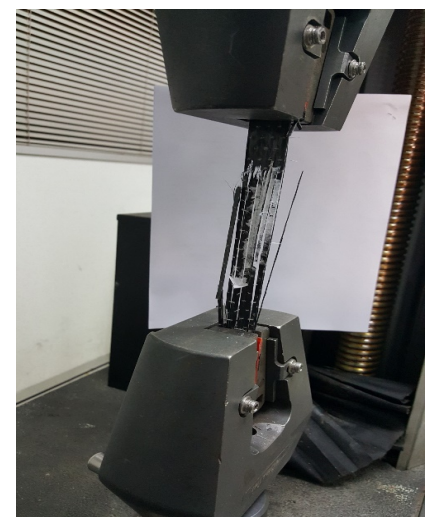
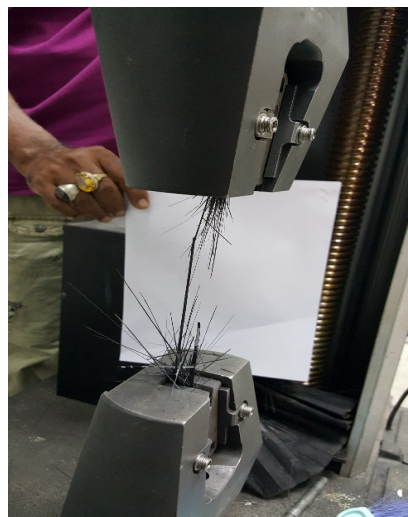
\*Tensile capacity was calculated as  $\frac{C}{A \times B}$



Specimen Sample: CFRP Wrap for 300gm/m<sup>2</sup>

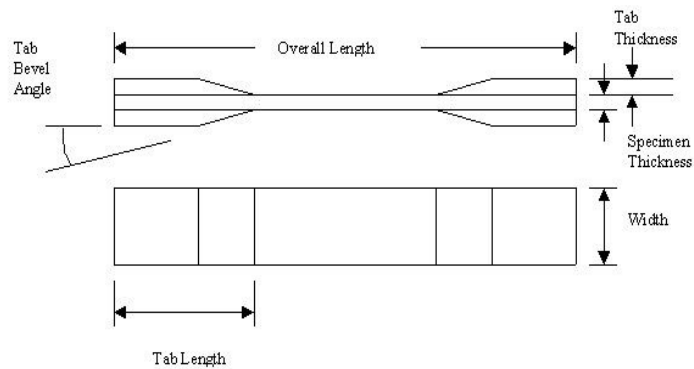


Sample Tested: CFRP Wrap for 300gm/m<sup>2</sup>



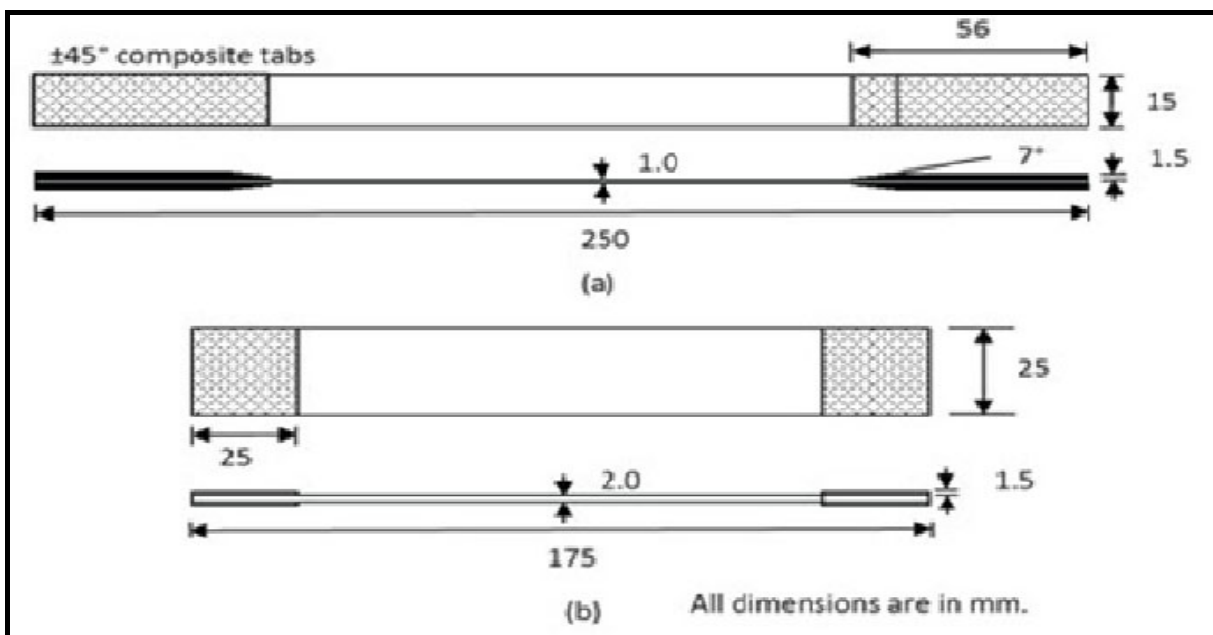
Tensile Strength Testing Equipment, Method of Tester Installation,  
Once Tested the CFRP Cured Laminates or CFRP Pultrusion Laminates Breaking

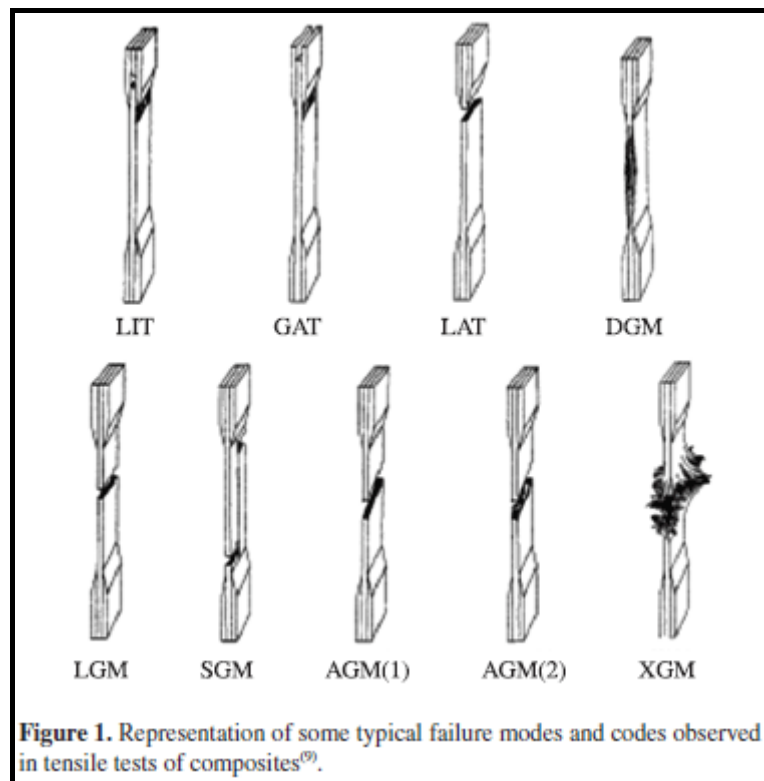
## Composite tensile specimen for measurement of longitudinal properties $E_1$ and $S_L^{(+)}$



Fiber Orientation	Width, mm [in.]	Overall Length, mm [in.]	Thickness, mm [in.]	Tab Length, mm [in.]	Tab Thickness, mm [in.]	Tab Bevel Angle <sup>1</sup>
0° unidirectional	15 (0.5)	250 (10.0)	1.0 (0.040)	56 (2.25)	1.5 (0.062)	7 or 90
90° unidirectional	25 (1.0)	175 (7.0)	2.0 (0.080)	25 (1.0)	1.5 (0.062)	90
balanced and symmetric	25 (1.0)	250 (10.0)	2.5 (0.100)	emery cloth	—	—
random-discontinuous	25 (1.0)	250 (10.0)	2.5 (0.100)	emery cloth	—	—

Specimen geometry for ASTM D3039/D3039M-08 standard tensile test. (Dimensions from ASTM D3039/D3039M-08. Copyright ASTM International. Reprinted with permission.)





ACI 440.3R-12

**Guide Test Methods for Fiber-Reinforced Polymer (FRP) Composites for Reinforcing or Strengthening Concrete and Masonry Structures**

Reported by ACI Committee 440



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