

Carbon Fiber Reinforced Polymer [CFRP] Strip Plate Ultra-High E-Modulus & Tensile Strength

Pioneer in CFRP,
Smart & Clever for Composites

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

Timber Strengthening

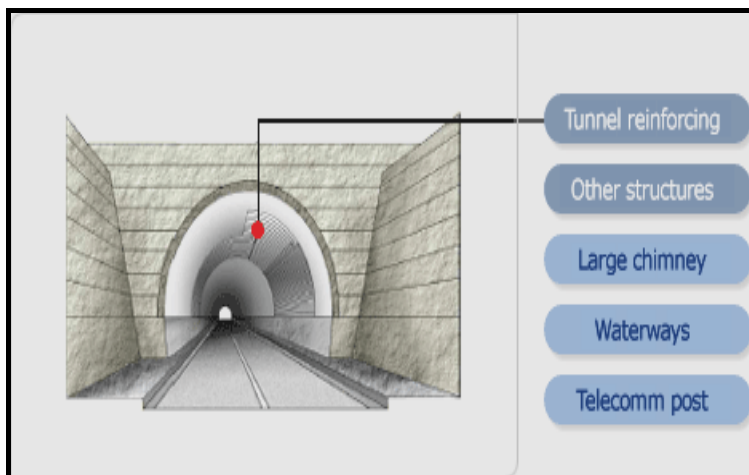
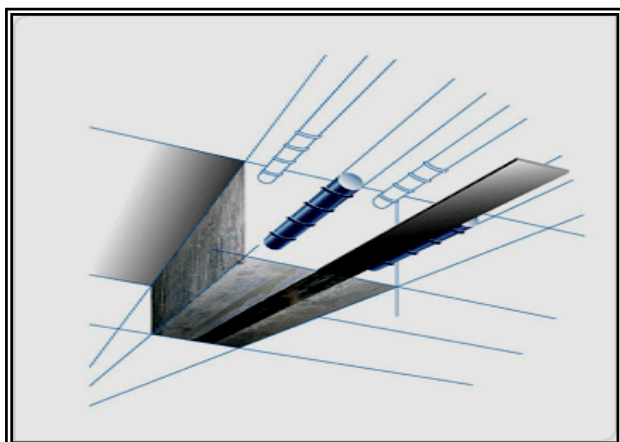


Build Strip HMS

Thickness & Wide Products List
Tensile Strength 3300 Mpa
E-Modulus 210 Gpa

- 5.00mm x 100mm x 50/m roll
- 3.00mm x 100mm x 100/m roll
- 2.00mm x 100mm x 100/m roll
- 1.40mm x 100mm x 100/m roll

- 5.00mm x 50mm x 50/m roll
- 3.00mm x 50mm x 100/m roll
- 2.00mm x 50mm x 100/m roll



Carbon Fiber Reinforced Polymer [CFRP] Ultra-High E-Modulus & Tensile Strength

Build Strip HMS

Is a type of Laminates Strip/Plate, Carbon Fiber of Putrusion Extruded Oriented, continuous carbon filaments which are held in position by a lightweight, of **Build Strip HMS®** 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 Strip HMS®** is compatible with the special adhesive system which can be applied using a variety of dry/wet-out/adhesive 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 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 Strip HMS Physical of Dry Carbon Fiber Properties

Tensile Strength	6000 Mpa	[Dry Carbon Fiber Yarn Filament]
E-Modulus	294 Gpa	[Dry Carbon Fiber Yarn Filament]
Density of Carbon Fiber	1.78 g/cm ³	[Dry Carbon Fiber Yarn Filament]
Elongation at Break	2.10-2.20%	

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

Build Strip HMS Test Method UK Design US Design

Tensile Strength	ASTM D3039	>3300 Mpa	478,600 psi
E-Modulus	ASTM D3039	210 Gpa.	30.46 x 10 ⁶ psi
Density Composite	ASTM D3039	1.55-1.65 g/cm ³	1.55-1.65 g/cm ³
Elongation at Break	ASTM D3039	1.70-2.20 %	1.70-2.20 %
Temperature Resistance	ASTM D3039	>150°C	>150°C
Fiber Volume Content	68% (by Weight)	[Carbon Fiber Yarn]	
Binder Volume Content	32% (by Weight)	[Resin]	

Select Thickness x Wide Of Below List Products

	Thickness [mm]	Width [mm]	Roll Size [Meter]	Weight [kg/Meter] or [kg/roll]	
Build Strip HMS 1050	5.00	100	50	0.800	40.000
Build Strip HMS 1030	3.00	100	100	0.480	48.000
Build Strip HMS 1020	2.00	100	100	0.320	32.000
Build Strip HMS 1014	1.40	100	100	0.224	22.400
Build Strip HMS 550	5.00	50	50	0.400	20.000
Build Strip HMS 530	3.00	50	100	0.240	24.000
Build Strip HMS 520	2.00	50	100	0.160	16.000
Build Strip HMS 514	1.40	50	100	0.112	11.200

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 overnight.

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 Adhesive

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 Carbon Fiber system components assure fast, user friendly installation. A complete system is installed in only four (4) steps to properly prepared surfaces within appropriate working conditions.

System Recommended Use Resin Component

Epo Adhesive Strip 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 applying on Over Head or Vertical Surfaces

1. Roll "Epo Bond Primer"

Apply **Epo Bond Primer**, applied at rate 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 Adhesive Strip"

Apply **Epo Adhesive Strip**; applied at rate 0.34 kg/meter linear to 1.5 kg/meter linear, paste adhesive is a high solid, non-sag 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 Strip HMS®"

Within the open time of the adhesive, place immediately the **Build Strip HMS®** laminates 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 Strip HMS®**. 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.

4. Apply Optional Topcoat

Where required, the Carbon Fiber high solids, high gloss, corrosion-resistant topcoat provides a protective/aesthetic outer layer. (Refer to Painting Manufacture)

Where required, the Carbon Fiber Strip Laminates to protection of Fireproofing system. Please call our technical for advice.

Note In the case of two layers and several layers of "Build Strip" of Carbon Fiber Strip Laminates. For multiple plies repeat steps 1, 2 and 3.



Build Strip HMS

CFRP Strip/Plate/Tape

System Recommended Use Epoxy Adhesive Component

Grade of Carbon Fiber	Grade of Adhesive Recommendation	Shear Strength	Peel Strength (Cleavage)
Build Strip HMS	Epo Adhesive Strip (Standard) High Shear & Peel Strength	15 N/mm ²	4 N/mm ²
Build Strip HMS	Epo Adhesive Strip 335 (Slow or Fast) Ultra High Shear & Peel Strength	35 N/mm ²	12 N/mm ²
Build Strip HMS	Epo Bond HT 110 (Slow or Fast) If application on High Temperature More Than > 100-130°C on Structure Reinforced	15 N/mm ²	4-6 N/mm ²

Consumptions of Epoxy Adhesive

Type of Strip Laminates	Require Approximately of Epoxy Adhesive Kg/Linear Meter	Epo Adhesive Strip 5 kg pack Coverage LM/pack	Epo Bond HT 110 5 kg pack Coverage LM/pack
All 50mm wide	0.30-0.45 kg Per linear meter	16.50 LM/pack	16.50 LM/pack
All 100mm wide	0.60-0.90 kg Per linear meter	7.50 LM/pack	7.50 LM/pack
All 120mm wide	0.75-1.05 kg Per linear meter	6.50 LM/pack	6.50 LM/pack
All 150mm wide	0.90-1.20 kg Per linear meter	5.00 LM/pack	5.00 LM/pack

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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.


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

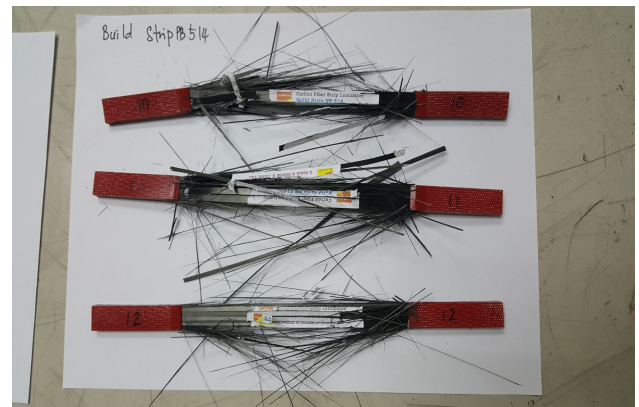
Achieving Test Result

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 Strip HMS 1050 or 550	3300	210	5.00	10	250	165,000
Build Strip HMS 1030 or 530	3300	140-165	3.00	10	250	99,000
Build Strip HMS 1020 or 520	3300	140-165	2.00	10	250	66,000
Build Strip HMS 1014 or 514	3300	140-165	1.40	10	250	46,200

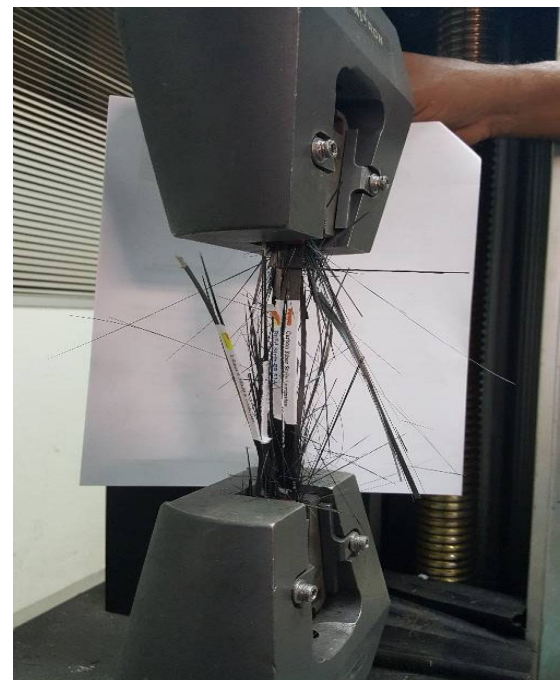
*Tensile capacity was calculated as $\frac{C}{A \times B}$



Specimen Sample: [Before Testing]
CFRP Strip 1.4mm x 10mm x 250mm



Specimen Samples: [Tested]
CFRP Strip 1.4mm x 10mm x 250mm



Testing Equipment, Method of Tester Installed,
Once Tested the CFRP Cured Laminates Breaking

ACI 440.3R-12

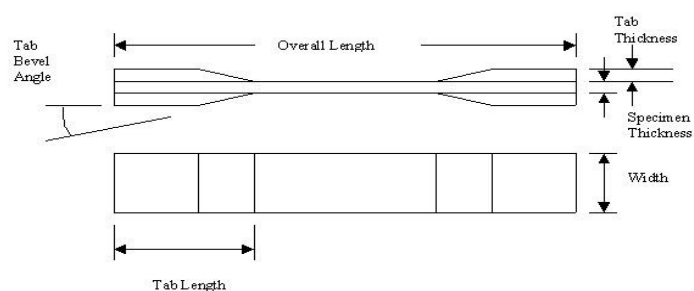
Guide Test Methods for Fiber-Reinforced Polymer (FRP) Composites for Reinforcing or Strengthening Concrete and Masonry Structures

Reported by ACI Committee 440



American Concrete Institute®

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,°
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 random-discontinuous	25 [1.0]	250 [10.0]	2.5 [0.100]	emery cloth	—	—
	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.)