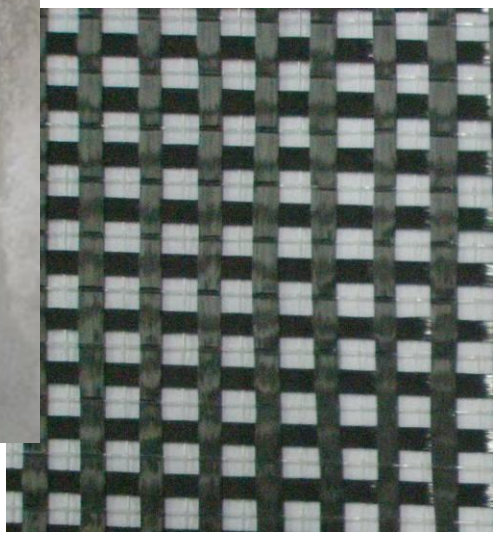
TECHNICAL BULLETIN No.: 326.01

DRIZORO® CARBOMESH

BIAXIAL CARBON-FIBRE FABRIC SYSTEM FOR REPAIR AND STRUCTURAL STRENGTHENING



DESCRIPTION

DRIZORO® CARBOMESH is a biaxial (0°/90°) carbon-fibre fabric with high strength and elasticity modulus for repair and structural strengthening of concrete, brick, masonry, wood, stone and steel structures.

DRIZORO® CARBOMESH is bonded on the structure surface by cement-based mortar ***CONCRESEAL® CARBOFIX*** or by epoxy-based structural adhesive ***MAXEPOX® CS*** (Technical Bulletin No. 290), providing a composite laminar system applied in-situ.

There are three different types of biaxial carbon-fibre fabric depending on the weight:

- ***DRIZORO® CARBOMESH 160***
- ***DRIZORO® CARBOMESH 300***

APPLICATION FIELDS

- Repair and strengthening of damaged structures by accidents, pathologies, impacts, explosions and old buildings subject to dynamic loads such as earthquakes.
- Strengthening of concrete elements due to changes in construction uses, rectification of project design, faults and defects in execution works.
- Restoration of bearing elements, changes in structural systems, rehabilitation of historical buildings: walls, vaults, domes, slabs, etc.
- Confining of beam-columns joints for increasing the ductility.
- Shear and torsion strengthening of beams.
- Improvement of beams for Serviceability Limit State under working loads.
- Adaptation to new regulations.

ADVANTAGES

- The use of ***CONCRESEAL® CARBOFIX*** allows the application on wet surface, provides a high thermal resistance and similar fire resistance than concrete.
- Suitable for flexural, shear and compressive strength of structural elements.
- Low thickness with a minimum increase of the cross-section on the structure. Keeps the geometry and appearance of the strengthened elements.
- Long lasting. It is highly resistant to abrasion, not affected by corrosion process, withstands marine environments and freeze-thaw cycles.
- Economical system with no maintenance. Very easy and quick to use, saving labour costs and reducing use of auxiliary tools.

APPLICATION INSTRUCTIONS

Surface preparation

Before applying ***DRIZORO® CARBOMESH***, conveniently prepare the surface to ensure good adhesion to the surface by grinding with diamond abrasive disc or sandblasting, in order to remove remains of paint, gypsum, efflorescence, plaster, grout surface, greases, oils, concrete release, as well as de-moulding agents, curing agents or any coating, which could affect the adhesion. Optimal surface texture is a rough surface with open-pore.

Concrete: it must be solid and surface mechanical properties should be verified by tests. Thus, minimum pull-off strength should be greater than 1,0 MPa, according to EN 1542 standard.

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In case of repair, use a suitable structural repair mortar of class R4 (EN-1504/3) such as ***MAXREST®*** (Technical Bulletin no. 2) or ***MAXRITE® 500/700/S/F*** range (Technical Bulletins nos. 50, 51, 57 and 240, respectively). If rebars are corroded, remove all concrete around structural reinforcement affected by corrosion. These reinforcements should be cleaned of rust and scale and then, coated with oxide converter and anti-corrosive protection ***MAXREST® PASSIVE*** (Technical Bulletin No. 12).
Repair cracks of the size greater than 0,3 mm by using a low viscosity, epoxy-based resin injection such as ***MAXEPOX® INJECTION*** (Technical Bulletin No. 78) or ***MAXEPOX® INJECTION –R*** (Technical Bulletin No. 79) according to temperature.

Corners and edges in beams and pillars must be rounded (chamfered) to a radius greater then 3 cm, with a desirable of 50 cm to prevent a significant reduction in the tensile strength of the system.

Brick, stone and mortar masonry:
Substrate must be solid, clean and free of elements which could affect the adhesion. In case of repair, use a suitable structural repair mortar of class R4 (EN-1504/3) such as ***MAXREST®*** (Technical Bulletin no. 2) or ***MAXRITE® 500/700/S/F*** range (Technical Bulletins nos. 50, 51, 57 and 240, respectively).

Fissures and cracks must be sealed by using a cement-based injection mortar such as ***MAXGROUT® INJECTION*** or ***MAXINJECTION® CAL*** according to substrate characteristics.

Wood: it must be solid and free of any biological attack. It should be protected in accordance with local Wood Structures Code. Sand the surface, vacuum the dust and repair any damage with a suitable epoxy-based mortar such as ***MAXEPOX® -W*** or ***MAXEPOX® JOINT*** (Technical Bulletins Nos. 207 and 237, respectively).

Steel: Prepare surface by dry shot or sand blasting to Sa 2½ grade (near to white metal) according to Swedish Standard SIS 055900, in order to remove fats, oils, paints and other pollutants that may affect the adhesion of the system. In case of additional protection against corrosion, apply ***MAXEPOX® AC*** or ***MAXREST® PASSIVE*** (Technical Bulletins Nos. 121 and 237, respectively).

Cutting of *DRIZORO® CARBOMESH*
Using a scissor or utility cutter, cut a sheet to the specified length according to the drawing and work plan. Fabric sheets must be handled and stored with care to prevent it from becoming contaminated or damaged.

Placing of *DRIZORO® CARBOMESH*
DRIZORO® CARBOMESH is bonded on the structure surface with cement-based mortar ***CONCRESEAL® CARBOFIX*** or with epoxy-based adhesive ***MAXEPOX® CS*** over concrete, wood and steel.

Application with epoxy-based adhesive ***MAXEPOX® CS***:
Ambient temperature must be higher than 5°C and surface moisture content less than 4%.
Prime surface firstly with ***MAXPRIMER®-C. MAXPRIMER®-C*** is mixed using an electric hand mixer or spatula in clean container at a weight ratio of main agent/hardener of 4:1 to produce a product with uniform consistency. Pour component B into component A and mix using a low speed drill (300-400 rpm. maximum), until achieving a homogeneous product in colour and appearance. Using a clean roller or brush, apply one or two layers depending on substrate porosity, in a uniform manner with a consumption from 0,20 to 0,35 kg/m^2 per layer (standard 0,25 kg/m^2). The primer must be perfectly dry and tack-free before proceeding next step.
Maximum surface unevenness is about 5 mm measured with a ruler of 2,0 meter length, or about 2 mm measured with a ruler of 0,3 meter length. If after primer application, concavities, gaps or pinholes up to 5 mm are seen on the surface, ***MAXEPOX® -CP*** putty must be applied to smooth the concrete surface prior to the application of the resin and the carbon-fibre sets.

MAXEPOX®-CP is mixed a weight ratio of main agent/hardener of 2:1. Pour component B into component A and mix using a low speed drill (300-400 rpm. maximum), until achieving a homogeneous product in colour and appearance. Using a clean trowel o spatula, apply to all indents, defects or pinholes with a total consumption from 0,5 to 1,5 kg/m^2. Generally, the putty is applied to small areas, but it can also be applied to level uneven concrete surfaces. The applied putty must become tack-free (no longer sticky) when touched before progressing onto the next stage.

MAXEPOX®-CS is mixed using an electric hand mixer in clean container at a weight ratio of main agent/hardener of 4:1 to produce a product with uniform consistency. Pour component B into component A and mix using a low speed drill (300-400 rpm. maximum) until achieving a homogeneous product in colour and appearance. Apply one coat of ***MAXEPOX®-CS*** with a consumption 0,5 kg/m^2 and place ***DRIZORO® CARBOMESH*** within 20 minutes maximum. The sheets are applied by pressing then onto the resin. The sheets should be smoothed longitudinally, either from one end to the other. Any air trapped between the fabric sheets should be removed by firmly pressing with an “air removal roller” over the length of the fabric sheets. This will help also the resin to fully impregnate the carbon-fibres. Wait approximately 45 minutes to allow the resin impregnate into the carbon-fibre fabric sheet before proceeding to the next stage.

Finally, apply the over-coating resin of ***MAXEPOX® -CS*** with a consumption 0,4-0,6 kg/m^2.

When multiple layers of carbon-fibre sheets haven been specified, repeat the above procedure until getting the desired number of layers. Thus, when different layers are applied, a maximum of 3 layers to the vertical surface, and a maximum of 2 layers to horizontal surface is recommended to be applied in any one day in order to prevent slippage or separation.

When connecting two carbon-fibre fabric sheets in the fibre longitudinal direction, the fabric sheets are recommended overlap by at least 10 cm. When applying two carbon-fibre fabric sheets next to each other (side by side), a 10 cm overlap is recommended to ensure that there is no surface uncovered by carbon-fibre.

To improve the bonding property for finish mortar over ***DRIZORO® CARBOMESH System***, silica sand (***DRIZORO® SILICA:*** up 2,5 mm diameter) should be spread over the before the over-coating resin hardens. A standard spraying quantity is 1 kg/m^2.

Application with the ***CONCRESEAL® CARBOFIX*** cement-based mortar:
A 25 kg bag of ***CONCRESEAL® CARBOFIX*** requires from 4,5 to 5,0 litres (16-20%) of water, depending on existing ambient conditions and desired consistency. Pour the required amount of water in a clean container and then slowly add ***CONCRESEAL® -CARBOFIX*** to mix, using a slow speed electric drill (400-600 rpm) fitted with a disc mixer for about 1-2 minutes until achieving a smooth, lump-free and homogeneous mortar of dry consistency. Allow the mixture to rest for 3 to 5 minutes to fully wet out all the powder, and remix briefly before applying. Mix only the amount of material that can be place in about 20-30 minutes. To restore the workability, remix the mortar but never add more water.

Once substrate has been repaired, dampen thoroughly the entire surface, and then start the application once the surface acquires a matte appearance. If it is dry, proceed to saturate it with water again. Apply a thin and uniform layer of ***CONCRESEAL® CARBOFIX*** on the substrate using a straight edge trowel with a consumption of 3,0-4,0 kg/m^2, making sure that application thickness is 2,0 mm. approximately. Place ***DRIZORO® CARBOMESH*** into the fresh mortar ensuring that fabric is completely embedded. Once it has dried (12-18 hours), apply a second coat of ***CONCRESEAL® CARBOFIX*** with a consumption of 3,0-4,0 kg/m^2 directly over the top of the first reinforced layer.
In case of apply several layers, repeat the above procedure in successive layers.

When connecting two carbon-fibre fabric sheets in the fibre longitudinal direction, the fabric sheets are recommended overlap by at least 10 cm. When applying two carbon-fibre

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fabric sheets next to each other (side by side), a 10 cm overlap is recommended to ensure that there is no surface uncovered by carbon-fibre.

Protective finish coating
DRIZORO® CARBOMESH can be covered with a suitable ***DRIZORO®*** finish coating ***MAXSHEEN® ELASTIC, MAXSEAL® FLEX*** or ***MAXURETHANE® 2C***, or for exposed areas to mechanical impacts; ***MAXREST®***, ***MAXRITE® 500/700/S/F***, ***CONCRESEAL® PLASTERING***.

Application Conditions
Do not apply when rain, contact with water, condensation, dampness and dew is expected within the first 24 h after the application.

The optimum temperature range for application is from 10 ºC to 30 ºC. Do not apply with substrate and/or ambient temperature is at or below 5°C, or when temperatures are expected to fall below 5 °C within 24 h after application. Do not apply to frozen or frost-covered surfaces. If the temperature is above 35 º C, avoid direct exposure to sun and apply the system on shade areas. Temperatures at high temperature lead a quick-setting between components and heat production, so the pot life is greatly reduced.
Ambient and surface temperature must be at least 3 ºC higher than dew point. Do not apply with R.H. higher than 85 %.

Curing
Prevent rapid drying of ***CONCRESEAL® CARBOFIX*** and protect from extreme heat (> 30°C) and direct sunlight to maintain its moisture for at least 2 hours after the application, spraying a fine mist of water, without causing the washing or by using polyethylene sheeting or damp burlaps. Total curing time for ***CONCRESEAL® CARBOFIX*** is 28 days. Lower temperatures and/or higher R.H. values increase the curing time.

Complete curing time for ***MAXEPOX®-CS*** varies from 5 to 14 days depending on the type of resin used (***-W/-S***) and ambient/substrate temperature (see Technical Data Table). Observe the total curing time for the system before putting into service the strengthened element.

Cleaning
All mixing and application tools, and equipment must be cleaned immediately with water (***CONCRESEAL® CARBOFIX***) or ***MAXEPOX® SOLVENT*** (epoxy-based adhesives) after use. Once product hardens, this can only be removed by mechanical means.

PACKAGING

DRIZORO® CARBOMESH 160 and ***210***. Rolls of 100 m length, and 50 cm or 100 cm width. ***DRIZORO® CARBOMESH 300***. Rolls of 50 m length, and 100 cm width.

MAXPRIMER®-C, ***MAXEPOX® -CP*** and ***MAXEPOX® -CS*** are supplied in pre-weighted sets of 5 and 15 kg. Two version are available; ***-S*** suitable for temperatures between 15 and 35 °C, and **–W**, suitable for temperatures between 15 and 35 °C

CONCRESEAL® CARBOFIX is supplied in 25 kg bags. It is available in standard grey colour.

CONSUMPTION

PRODUCT	CONSUMPTION PER SHEET (kg/m^2)
Primer ***MAXPRIMER® -C***	0,2 - 0,35 (Standard value: 0,25)
Levelling putty ***MAXEPOX® -CP***	0,5 -1,5 (Depends on repair volume)
Adhesive / Mortar ***MAXEPOX® -CS*** ***CONCRESEAL® CARBOFIX***	0,9-1,0 6,0-8,0

These figures are for guidance only and may vary depending on porosity, texture and conditions for substrate, and application method. Perform a preliminary test on-site to ascertain the total consumption exactly under jobsite conditions.

IMPORTANT INDICATIONS

- Concrete must be sound and provide a minimum compressive strength at 28 days of at least 15 N/mm^2, measured with a 15 x 30 cm cylinder.
- For application on masonry, and plastering and rendering mortars check surface adhesion.
- Do not add solvents, thinners, additives aggregates or any other non-specified compound. Do not use leftovers from previous mixes.
- For other uses not specified on this Technical Bulletin or further questions, consult the Technical Department.

STORAGE

DRIZORO® COMPOSITE has an indefinitely shelf life when is stored in its original packaging.
MAXPRIMER® C, ***MAXEPOX® CP*** and ***MAXEPOX® CS*** have a shelf life of twelve months when are stored in its original packaging.
CONCRESEAL® CARBOFIX, has a shelf life of twelve months in its original packaging.

These storage times are given for a dry and covered place, protected from frost and direct sunlight, with temperatures between 5 and 30 °C.

Storage at temperatures below 5 °C may lead the crystallisation of product components. Should this happen, it must be heated slowly at moderate temperature (30-40°C) while it is regularly stirred until achieving its homogeneous and original lump-free appearance.

SAFETY AND HEALTH

DRIZORO® COMPOSITE is not a toxic product but skin and eye contact must be avoided. Carbon-fibre fabric is a highly conductive material so it must be kept away from electrical cables and devices in order to avoid risk of electric shocks or short-circuiting.

CONCRESEAL® CARBOFIX is not a toxic product but is an abrasive composition. Avoid direct contact with skin and eyes, and breathing dust.

MAXPRIMER® C, ***MAXEPOX® CP*** and ***MAXEPOX® CS*** are not a toxic product but skin and eye contact must be avoided. Use rubber gloves and safety goggles when handling, mixing and applying the product. In case of contact with skin, wash affected area with soap and water. In case of contact with eyes, rinse immediately thoroughly with clean water but do not rub. If the irritation persists, seek medical assistance.
Works site must be well ventilated at all times. Primer, putty and resin are flammable. Avoid using fire near epoxy-based materials. Resin mixing should be minimised, particularly during warm weather. Mixed resin tends to build up heat so that large quantities may lead to excessive or even abnormal heating of the mixture.

Consult the Material Safety Data Sheet for ***DRIZORO® CARBOMESH, MAXPRIMER® C***, ***MAXEPOX® CP, MAXEPOX® CS*** and ***CONCRESEAL® CARBOFIX***.

Disposal of the product and its packaging should be carried out according to the current official regulations and it is the responsibility of the final user of the product.

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TECHNICAL DATA

Product characteristics for *DRIZORO® CARBOMESH* biaxial carbon-fibre fabric		
Product name	***DRIZORO® CARBOMESH 160***	***DRIZORO® CARBOMESH 300***
Appearance and colour	Black, biaxial (0°/90°) carbon-fibre fabric sheet	
Weight, (g/m^2)	160 ± 5%	300 ± 5%
Density, (g/cm^3)	1,80 + 5%	
Thickness, (mm)	0,04	0,09
Carbon-fibre filament characteristics		
Elasticity modulus, (MPa)	230.000	
Ultimate tensile strength, (MPa)	4.900	
Elongation at break, (%)	2,1	

Product characteristics for *CONCRESEAL® CARBOFIX*	
General appearance and colour	Grey powder
Maximum size of aggregate, (mm)	< 0,5
Density for powder, (g/cm^3)	1,35 ± 0,1
Density for mixed product, (g/cm^3)	1,85 ± 0,1
Mixing water, (%, by weight)	19 ±1
Application and curing conditions	
Minimum application temperature for substrate and ambient, (ºC)	> 5
Pot life at 20 ºC and 50 % R.H., (min)	20 – 30
Initial-final setting time at 20 ºC and 50 % R.H., (h)	3-4 / 5-6
Total curing time at 20 ºC and 50 % R.H., (d)	28
Cured product characteristics	
Compression strength at 28 days, EN 12190 (N/mm^2)	≥ 20
Flexural strength at 28 days, EN 196-1 (N/mm^2)	≥ 5,5
Elasticity modulus, EN13412 (N/mm^2)	< 10.000
Adhesion and break type, EN 1542 (N/mm^2)	≥ 1,5
Reaction to fire, EN 13501-1 (Euroclass)	A1

PRODUCTS		**PRIMER**		**LEVELLING PUTTY**		**ADHESIVE-RESIN**	
Product Name		***MAXPRIMER® -C***		***MAXEPOX ® -CP***		***MAXEPOX®-CS***	
Suitable for		Warm season (S)	Cool season (W)	Warm season (S)	Cool season (W)	Warm season (S)	Cool season (W)
Temperature range (°C)		15 – 35	5 – 15	15 – 35	5 – 15	15 – 35	5 – 15
Appearance	Main agent	Pale liquid		White putty		Green and thixotropic liquid	
	Hardener	Pale yellow liquid		Black putty		Pale yellow liquid	
Mixing ratio (by weigth)	Main agent	4		2		4	
	Hardener	1		1		1	
Specific Gravity (25ºC)	Main agent	1,15	1,13	1,50	1,51	1,12	1,14
	Hardener	0,96	0,97	1,85	1,73	0,96	0,97
Pot Life (1) (minutes)	30 ºC	90	-	50	-	70	-
	23 ºC	130	18	60	40	130	25
	15 ºC	> 180	40	> 180	60	> 180	60
	5 ºC	-	130	-	150	-	120
Tack-free Time (hours)	30 ºC	8,0	-	3,0	-	8,0	-
	23 ºC	11,0	3,0	5,5	3,5	11,0	4,0
	15 ºC	17,0	7,0	10,0	5,5	18,0	7,0
	5 ºC	-	15,0	-	10,0	-	18,0
Curing Time (days)	30 ºC	-	-	-	-	5	-
	23 ºC	-	-	-	-	7	5
	15 ºC	-	-	-	-	14	7
	5 ºC	-	-	-	-	-	14
Mechanical Properties (N/mm^2)							
Tensile Strength		-		-		> 29	
Flexural Strength		-		-		> 39	
Shear Strength		-		-		> 9,8	
Adhesive Strength		1,5 (Concrete break)		1,5 (Concrete break)		> 1,5 (Concrete break)	

(1) *Pot life* is determined by heat generation rising method.

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DRIZORO, S.A.U.
C/ Primavera 50-52 Parque Industrial Las Monjas
28850 TORREJON DE ARDOZ – MADRID (SPAIN)
Tel. 91 676 66 76 - 91 677 61 75 Fax. 91 675 78 13
e-mail: info@drizoro.com Web site: drizoro.com

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Nº ES021542 / ES021543

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