TECHNICAL SPECIFICATIONS FOR GLASS FIBER REINFORCED CONCRETE (GFRC / GRC)

TECHNICAL INFORMATION

GFRC / GRC (Glass Fiber Reinforced Concrete) denotes coating of the facades, as shown in the projects, by manufacturing molds of the precast modules within the required dimensions and tolerances in the required manner in factory environment as well as curing, transport after curing to assembly location, assembly to its place by using suitable assembly elements and experienced staff in addition to using first-class materials and workmanship, filling appropriately the joints of PANEL FIBERTON HEAT INSULATED FACADE PANELS which are obtained by virtue of placing insulation material in required thickness into GFRC / GRC shell for insulation according to request with FIBERTON STEEL CARCASS SIDING ELEMENTS, FIBERTON DECORATIVE SIDING ELEMENTS ELEMENTS, GFRC / GRC URBAN AND LANDSCAPE FURNITURE, FIBERTON INDUSTRIAL PRECAST ELEMENTS by placing high doses of white or gray cement by spraying into the mold or by premix systems, required amount of special silica sand, water, and additives giving strength and elasticity to the concrete and giving features such as reduction of water requirement and giving water repellency and steel framework with required conditions into the shell formed by spreading the mortar into which glass fiber resistant to alkali (AR fiber) within the range of 3.0% 5.5% according to the required class is added in 12 to 18 mm thickness.

RELATED DOCUMENTS:

Manufacturer Company should have the related current TS EN 12467 certificate incident to precast production by using reinforced cement.

Manufacturer Company should be able to perform the TS EN 12467, TS EN 1170/1to8 (from 1 to 8) tests in the laboratory established within the company and keep the records thereof.

All productions to be made regarding GFRC / GRC should be performed in compliance with "Specification

For The Manufacture, Curing And Testing of GFRC / GRC Products and each and every step thereof must be tested and it must be proved that technical values furnished in this document hereby are provided.

Producers must currently be a member of the GRCA.

DEFINITIONS

Glass Fiber Reinforced Concrete

This is a special mortar consisting of 800-1000 dose of white cement with at least a rate of 85% of whiteness, silica sand in the required amount with at least 96% of pureness water, chemical additives and it can be provided for variable speeds specially produced for this work and which is added to the mortar by mixing with time adjustable automatic system mixer during production and reinforced with glass fiber which is alkali-resistant in certain amounts .

Fiberton Prekast ve Beton Yapı Elemanları San. Tic. A.Ş.

DEKKAP GRC PLUS EcoFibre

Ofis: Ali Nihat Tarlan Cad. Ali Nihat Tarlan Apt. No:101 D:9 Ataşehir / İSTANBUL
T: +90 216 575 42 77
F: +90 216 577 61 49

Fabrika: Sanibrahimli Mah.Kızılyaka Mevki No:71 Akdeniz / MERSİN
T: +90 324 645 4400
F: +90 324 645 4403

STEEL CARCASS (Frame) SYSTEM

The precast elements will be designed to withstand loads to take place before and after assembly (such as wind, building movements and drawdowns, earthquake, moisture and temperature tensions, panel's static loads, loads which will occur during transport and assembly and etc.). Wind

load used in precast design, unless the presence of contrary provision, have been taken as

+1,50kN/m^2 and to2,50Kn/m^2.

Steel frame will also get rid of the tensions which will occur in the shell due to moisture and heat differences without creating tension on the surface by virtue of flexible systems and damage to the GFRC / GRC shell must be avoided.

Profiles by which the carcass system is created will be galvanized.

All of the steel carcass system to be used in the panel system and welding areas must be protected against corrosion.

CURING

Curing should be done with acrylic polymer chemical curing agents included into the mixture during manufacturing process.

EARTHQUAKE RESISTANCE

The resistance of the product and the recommended link-anchoring systems must have been tested against the effect of the earthquake.

These tests must be performed to provide at least the vibration value taken into account in the earthquake calculations of the main structure.

FASTENERS

These are products developed to connect the precast elements to the main carrier in assembly of products carried to the construction site according to the project.

They are the elements designed to tolerate all fixed and moving loads as well as tension and stress that will occur during possible ground movements and which ensure the precast elements to remain safely in the facade.

All fasteners will be galvanized.

Screws and fastening elements to be used will be certified and stainless steel.

THERMAL INSULATION

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Rock wool, which is 5 cm and with 50 DNS density, placed in the GFRC shell in order to provide thermal insulation of panel system, should be made composite with noninflammable mesh and fixing elements. Thickness and density of rock wool to be applied according to regional needs must be changeable.

Declared value of thermal conductivity of rock wool used in the production of thermal insulation panels is (λ) 0,036 W/mK.

Conductivity value of the produced thermal insulated GFRC / GRC panel must be (λ) 0.8to1.2 W/mK. Inflexible oncrete based applications to disrupt the flexible structure of the GFRC shell which has a flexible anchoring system and which will prevent easy movement of the system in possible tensions should be avoided.

Petroleum derived combustible and flammable materials should not be used in insulation

Non-combustible, light weight, products with high insulation value should be used for insulation. (Rock wool, glass wool and etc.). Applications must be made into GFRC / GRC the shell in a homogeneous and monoblock way.

SHIPPING

Products manufactured in the factory environment will be transferred to the worksite in accordance with the transport regulations and will be unloaded by using the appropriate equipments. Loading, transport and unloading should be made by showing due diligence. Surfaces of precast elements should be made by taking necessary measures against any kind of contamination.

ASSEMBLY

Assembly should be made in the manner specified in the projects and with anchoring systems according to calculations . Damages that may occur during transport, unloading or assembly will be

repaired with the materials having the same quality and colors. Surface contaminations which may occur during the assembly will be cleaned with water or suitably qualified chemical cleaners and be made ready for caulking. Waterproofing of facades, repair and cleaning of works which have finished should be performed by considering the favorable weather conditions (WITHOUT PRECIPITATION

AND WITH AIR TEMPERATURE OVER 7 ETC.) in joints created between 0.5 to 15 mm by using

appropriate polyurethane sealant. All materials must be protected against rust by virtue of galvanized anchoring system.

Assembly will be terminated by the basic assembly equipments required for assembly by also making horizontal and vertical supports .

MEASUREMENT METHOD

This includes the precast elements or all of the molded surfaces without being covered by other materials. Gaps are not measured and the largest size from out-to-out is measured in products expressed in linear meter.

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GFRC / GRC MORTAR COMPONENTS

CEMENT

TS EN 197-1 certified cement is used in the production of concrete mortar used in the GFRC / GRC production. The cement type to be used in manufacturing will also be specified in the agreement.

SAND

It is the clean, dry and ready for use silica sand with required granulometry containing more than 96% silica.

FIBERGLASS

AR (alkali resistance) glass fiber to give high elastic performance to GFRC / GRC products and with features which will last longer in the concrete floor structure is used. Glass fiber has a life equal to concrete

with the superior alkali resistance thereof. The manufacturer must present the specification documents as well as the test and quality certificates to be used in the production of GFRC / GRC documents related to AR fiber.

ACRYLIC POLYMER

Acrylic polymers to be used for curing purpose and durability must be used within the specifications specified in the GFRC / GRC specifications.

SUPPLEMENTARY MATERIALS

A suitable plasticizer must be used in order to improve processability, reduce the curing time, obtain a high strength and a good quality of concrete in the concrete mix.

WATER

Water according to EN 1008 will be used in concrete mortar mix.

TECHNICAL SPECIFICATIONS OF THE GFRC / GRC (GLASS REINFORCED CONCRETE) PRODUCTS

PHYSICAL SPECIFICATIONS

GFRC / GRC shell will have the following values at the end of 28 days of setting. This result shall be sought in tests carried out. Decorative products should be in accordance with class and the mix design set

forth in GFRC / GRC specifications. This quality level should be sought in tests carried out and quality records will be kept by the manufacturer making its own tests and the necessary samples will be

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tested by independent laboratories. Carrying out tests and presenting test results to the administration is the responsibility of the manufacturer.

Color shade difference can be found between materials manufactured in all parts of the world in GFRC / GRC (Fiber Reinforced Concrete) produced by colored or natural color of white cement. Isolating this situation caused by chemical properties of the cement's raw material is not possible.

REFERANCE VALUES

	Symbol	Unit	Premix	Spray
Compressive strength	**fc**	*N/mm2*	*40 to 60*	*50 to 80*
Tensile strength	**fct**	*N/mm2*	*4 to 7th*	*5 to 10*
Ratio limit	**LOP**	*N/mm2*	*5 to 8*	*6 to 10*
Module of Rupture	**MOR**	*N/mm2*	*8 to 12*	*15 to25*
Expansion limit	**εu**	*‰*	*0.5 to 4*	*0.5 to 4*
Impact Resistance	**-**	*Nmm/mm2*	*10 to 15*	*10to25*
Elasticity module	**E**	*kN/mm2*	*10 to 20*	*10 to 20*
Density	γ	*Kg/dm3*	*1.9 to2.1*	*1.9 to2.1*
Coefficient of Thermal Expansion	**α T**	*/ °C*	*(1.0 to 1.5) x 10 -5*	*(1.0 to 1.5) x 10 -5*
Thermal conductivity	**λ**	*W/mK*	*0.8 to 1.2*	*0.8 to 1.2*
Fire resistance (DIN4102)	**-**	-	*A1 to A2*	*A1 to A2*
Shrinkage Value	**εcs**	*mm/m*	*1.0 to 2.0*	*1.0 to 2.0*
Swelling value	**K**	*mm/m*	*0.5 to 1.0*	*0.5 to 1.0*
Water absorption	**-**	*%*	*3 to 15*	*3 to 15*
Water vapor diffusion	γ	-	*50 to 200*	*50 to 200*

TOLERANCES

Measure deviations in the joints between panels must not exceed the tolerances provided below. Panel size ≤ 3 m / deviation of joints ± 2 mm
Panel size 3 m to 6 m / deviation of joints ± 4 mm Panel size ≥6 mt / deviation of joints ± 6 mm
Turning on the panel surface 30 cm from one side to other three sides / less than, 1.5 mm

DEFLECTION CRITERIA

The measure between the two support brackets that connect the panels to the building should not be greater than L/240. It should not exceed 2.5 cm in maximum. The smaller values of these should be used.

EYE TEST CRITERIA

Related controls will be performed by naked eye from 6 mt in the daylight. There may be a few differences between color shades in produced precast GFRC / GRC sourced from the feature of the cement.

1. Air gaps with diameter greater than 10 mm
2. Visible mold traces

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3. Visible form errors

4. Visible discrepancies

5. Visible Spots on the Panel

PRODUCTION PLANT'S ADEQUACY

Production plants must have TS EN 12467 production site standard qualification certificate. The production plant must have laboratory with capability and equipment for supervising the production.

The production plant must have a capacity to produce the amount of work within the agreed time as well as an open storage area where it can store ¼ of the amount of work.

The production plant must be big enough and able to protect all of the production process in a closed area from the direct effects of the sun and the wind (production, disassembly, curing, settling and quality control).

COMPANY'S ADEQUACY

The manufacturer companies which will do the Project Engineering and Production should have sufficient experience and technical knowledge.

The manufacturer company must have an updated TS EN 12467 TSE Certificate.

The manufacturer must have updated ISO 9001: 2000, ISO 14001 and ISO 18001 Certificates related to the production and they have to make production accordingly.

The manufacturer must currently be a member of the GRCA.

TESTS

TS-EN 12467
TS-EN 1170to1.2.3.4.6.7.8

All productions to be made regarding GFRC / GRC should be performed in compliance with "Specification For The Manufacture, Curing And Testing of GFRC / GRC Products and each and every step thereof must be tested and it must be proved that technical values furnished in this document hereby are provided.
The tests will be carried out within the periods specified in the standards. The employer or deputy may supervise the tests. In addition, the administration may request additional tests. It is employer's responsibility to make and present these tests.

APPLICATION PRINCIPLES

All production works, shall be in accordance with the regulation of the Ministry of Public Works and Housing as to buildings to be made in disaster areas (additional issue of Official Gazette dated September 2, 1997 number 23098), TS EN 12467 (Made by using fibertoreinforced cement to Product specifications and test methods) calculation values of loads for sizing of Structural Elements according to regulation number TS498, calculation values of TS500 reinforced concrete structures and regulations number TS9967 on Prefabricated concrete and buildings made in disaster areas.

WARRANTY

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The manufacturer company gives a warranty period of 24 months for production failures, except for failures caused by users.

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