

H40 GLASSFIBRE REINFORCED CONCRETE CLADDING/COMPONENTS

To be read with Preliminaries/ General Conditions.

TYPES OF CLADDING/ COMPONENTS

110 GRC CLADDING: Grade 18P Hand Spray Glass Reinforced Concrete by BCM GRC Ltd. Unit 22, Civic Industrial Park, Whitechurch. Shropshire SY13 1TT Manufactured in accordance with the Specification for the Manufacture and Testing of Glass Reinforced Concrete published by Glass Reinforced Concrete Association (as Clause see 610) and the Approved Manufacturers Scheme.

- Primary support structure: Structural steel frame and concrete foundations by others.
- GRC units:
 - Backing mix and production method: Grade 18P GRC Handspray Glass Reinforced Concrete.
 - Construction: single skin panel to be nominally 15- 18mm thickness. (To include GRC backing and stone face) 4 No cast in sockets (Min) to accept fixings. Panels to incorporate edge returns as required to meet the design specification.
 - Finish: To agreed sample
 - Fire rating: Non combustible
 - Additional performance requirements: None
- Fixings and fasteners: Panels to be manufactured with S/Steel cast in sockets to enable fixing to support barcketry by others
- Erection tolerances: As clause 760.
- Joints: 10mm nominal
- Cavity barriers: None
- Thermal insulation: Not required
- Air barrier: Not required
- Accessories/ Other requirements: None

GENERAL REQUIREMENTS/ PREPARATORY WORK

210 DESIGN

- GRC: Complete detailed design.
 - Compliance: To GRCA 'Specification for the manufacture, curing and testing of GRC products'.
- Related works: Coordinate in detailed design.

220 FIXINGS AND FASTENERS

- Design: Fixings and fasteners for lifting/ fixing into position to GRCA 'Guide to fixings for glassfibre reinforced concrete cladding'.
- Load bearing fixing type: To be agreed
 - Material: To be agreed
- Restraint fixing type: To be agreed
 - Material: To be agreed
- Extent of adjustment: To accommodate support structure and cladding fabrication/ installation tolerances.
- Method of fixing to primary support structure: Mechanical fixing suitable for primary structure.(To include isolation material where necessary)
 - Material: T.B.A.

- 240 INFORMATION TO BE PROVIDED DURING DETAILED DESIGN
- Submit the following GRC particulars:
 - A schedule of detailed drawings and dates for submission for comment.
 - A schedule of loads that will be transmitted from GRC to the support structure/ background.
 - Proposed fixing details and systems relevant to structural design and construction with methods of adjustment and tolerances.
 - A schedule of fabrication tolerances/ size tolerances.
 - A schedule of mix details with design limits of proportionality (LOP) and modulus of rupture (MOR) for each mix.
 - A detailed testing programme in compliance with Main Contract master programme.
 - A detailed fabrication and installation programme in compliance with Main Contract master programme.

- 250 PRODUCT CONTROL SAMPLES
- GRC samples: Before general manufacture obtain approval of appearance of fully tested compliant control samples.
 - Finish: Include all variations of face mix and applied surface finish

DESIGN/ PERFORMANCE REQUIREMENTS

- 310 INTEGRITY OF CLADDING
- Requirement: Determine sizes and thickness of cladding panels, sizes, number and spacing of fixings, configuration and location of stud frame support systems and incorporation of accessories to ensure the cladding system will resist factored dead, imposed and design live loads, and accommodate deflections and thermal movements without damage.
 - Wind loads: Calculate to BS 6399-2, Standard Method appropriate to location, exposure, height, building shape, and size, taking account of existing and known future adjacent structures.
 - Basic wind speed (V_b): {25} m/s.
 - Altitude factor (S_a): {1.125}
 - Direction factor (S_d): {1}.
 - Seasonal factor (S_s): 1.
 - Probability factor (S_p): 1.
 - Terrain and building factor (S_b): {1.73}.
 - External and internal size effect factors (C_a): 1.
 - External pressure coefficients (C_{pe}): As determined from BS 6399-2, clauses 2.4 and 2.5.
 - Internal pressure coefficients (C_{pi}): As determined from BS 6399-2, clause 2.6.
 - Dominant opening: {N/A}
 - Impact loads: To BS 8200:
 - Location and category { }
 - Temporary imposed loads: {0}

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 - Wind loads: Calculate to BS 6399-2 appropriate to location, exposure, height, building shape and size, taking account of existing and known future adjacent structures.

- 330 PANEL ACCURACY
- Finished dimensions of completed panels to be such that the cladding, when erected, complies with clause 760 and all sizes fall within the permissible deviations given in BS 8297, table 11.
 - Check the overall dimensions, straightness, squareness, twist and flatness of the moulds immediately before each reuse and of each unit as soon as possible after demoulding. Make adjustments to moulds as necessary.

TESTING

- 410 QUALITY CONTROL
- Production control standard: To BS EN 1169.
 - Quality control standard: To BS EN ISO 9001 or the GRCA Approved Manufacturers Scheme.
- 420 DRY MATERIALS
- Production samples: Take during manufacture.
 - Constituent samples: Take roving, sand, cement and facing material samples from each consignment. Store until test data has been processed.
 - Admixtures, curing agents, formwork release agents: Retain manufacturers' certificates.
- 430 WET MATERIALS
- Production samples: Take before production starts and when mix or equipment settings are changed.
 - Matrix consistency standard: To BS EN 1170-1.
 - Roving delivery rate: Bag test to GRCA, 'Specification for the manufacture, curing and testing of GRC products'.
 - Test boards: Take from each shift.
 - Fibre content standard: To BS EN 1170-2.
 - Thickness tests: At regular intervals over area of each production panel.
 - Values for compliance:
 - Minimum fibre content requirement (for all mixes): As mix design.
- 440 CURED MATERIALS
- Test board frequency: [One per day](#).
 - Curing: Under water.
 - Test for structural requirements:
 - Bending strength standard: To BS EN 1170-5.
 - Time: minimum 7 days or maximum 28 days after production.
 - Values for compliance: Minimum test board requirements are:
 - Spray-up (grade 18 or 18P):
 - Average LOP of 4 consecutive test samples: 8.0 N/mm².
 - Minimum LOP of individual test sample: 6.0 N/mm².
 - Average MOR of 4 consecutive test samples: 21.0 N/mm².
 - Minimum MOR of individual test sample: 15.0 N/mm².
 - Minimum bulk density (dry): 1800 kg/m³.
 - Minimum bulk density (wet): 2000 kg/m³.
 - Other tests: [None](#)
- 450 PRODUCTION NON-COMPLIANCE
- Extent of GRC at risk:
 - Failure of single test board: Material produced between previous complying test board and next complying test board.
 - Failure of consecutive groups of four boards: First and fourth test boards together with all intervening material.
 - Action in the event of production non-compliance: Submit proposals.

MATERIALS

- 510 GLASS FIBRE
- Type: Alkali-resistant continuous filament fibre.
- Compliance: To GRCA 'Specification for alkali resistant glassfibre rovings and chopped strands for reinforcement of cements and concretes'.
- 520 CEMENT
- Type: To BS EN 197-1, CEM 1 Portland cement.
- 530 SAND
- Type: Silica sand to GRCA 'Specification for the manufacture, curing and testing of GRC products', clause 2.3.
- 540 MIXING WATER
- Standard: To BS 3148.
- 550 ADMIXTURES
- Type: Submit proposals.
 - Calcium chloride based admixtures: Do not use if GRC contains cast-in steel.
- 560 PIGMENTS
- Type: Powder pigments or dispersions to BS EN 12878. Pigments to have proven successful use in GRC.
- 570 AGGREGATE FINISH
- Aggregate:
 - Type: [To be confirmed and agreed with project architect and client.](#)
 - Size: [Course grade.](#)
 - Application: [Spray applied face mix finish](#)
- 580G SURFACE COATING
- Coating: Water Seal
 - Manufacturer:
Cementone or equivalent.
 - Application: [Spray](#)

MANUFACTURE

610 GENERALLY

- Standard: To GRCA 'Specification for manufacture, curing and testing of GRC products' and BS EN 1169 for factory production.

615 MOULDS

- Material and construction: To accommodate the panel size, complexity and detail incorporated in the product.

620 CEMENTITIOUS SLURRY

- Mixing: In high shear mixer in accordance with the mixer manufacturer's instructions and loading sequence.

625 PREMIX GRC- N/A

- Mixing: In forced pan mixer, gradually incorporating AR fibres into cementitious slurry.

630 SPRAY-UP GRC

- Spraying: Use proprietary equipment that incorporates simultaneous deposition of known quantities of matrix and chopped glass fibre.

640 MIST COAT

- Mix: As backing mix without fibres
- Additives: Acrylic polymer may be included in mist coat slurry.
- Thickness: As thin as practicable.
- Pigments: None

645 FACE MIX

- Consolidation: To a uniform, consistent thickness appropriate for proposed finish and to prevent backing mix being visible once unit has cured.
- Thickness measurement: Check and record at regular intervals over entire unit.

650 BACKING MIX

- Consolidation: In thin layers of 3 - 4 mm to achieve the required thickness.
- Thickness measurement: Check and record total thickness of GRC at same locations as facing mix.

660 CONSOLIDATION

- Method: By towelling, tamping, rolling or vibration, combinations of these or by vacuum de-watering.
- Layers: Compact each sprayed layer and final layer before matrix has set.

670 STUD FRAME- N/A

- Fabrication: To GRCA 'Guide to fixings for reinforced concrete cladding'.
 - Material: **None**
 - Stud depth: **None**

- 680 CURING NON-POLYMER GRADE GRC- [N/A](#)
- Before demoulding: Cover filled mould with polythene immediately after spraying and compacting.
 - Temperature: Minimum 5°C, maximum 50°C.
 - Duration: Until component has gained sufficient strength for demoulding and transporting.
 - After demoulding:
 - Temperature: Minimum 16°C, maximum 30°C.
 - Duration: Minimum seven days.
 - Humidity: 95% relative humidity.

- 685 CURING POLYMER GRADE GRC
- Dry cure:
 - Protection: Polythene wrap units.
 - Temperature: Above film formation temperature but below 50°C.
 - Duration: 12 to 16 hours.
 - Shrinkage cracks: Prevent excessive heat and/ or preheated moulds drying out units prematurely and causing drying shrinkage cracks.

INSTALLATION (ADVICE ONLY)

710 GENERALLY

- Prefabrication: Complete products and attach fixing brackets in workshop wherever possible.
- Identification: Mark or tag products. Do not mark surfaces visible in the complete installation.
- Electrolytic corrosion: Isolate dissimilar metals.

720 SUITABILITY OF STRUCTURE

- Contractor's survey: To be carried out by Main Contractor.
 - Programme: To be agreed between Specialist Sub Contractor and Main Contractor.
 - Scope: Geometric survey of supporting structure, checking line, level and fixing points.
 - Coordinate: With surveys for adjacent cladding.
 - Give notice: If the structure will not allow the required accuracy or security of erection.
- Setting out: Establish erection datum points, lines and levels for a complete elevation at a time unless otherwise agreed.

730 INSTALLATION OF INTERFACES

- General: Locate flashings, closers etc. correctly with neat overlaps to cladding to form weatherproof junctions.

740 METALWORK

- Material standards and fabrication: As section Z11.

755 WELDING

- In situ welding: Permitted subject to completion of a 'hot work permit' form and compliance with its requirements.

760 ACCURACY OF ERECTION OF CLADDING

- Elevation joint widths: Within joint lengths, including in-line continuations across transverse joints, as follows:
 - Tolerance: Greatest width not to exceed least width by more than 50 %.
 - Variations: Evenly distribute, with no sudden changes.
- Offset in elevation: Between nominally in-line edges across transverse joints not to exceed 50 % width of joint.
- Offset in plan or section: Between flat faces or adjacent panels across joints not to exceed 50 % width of joint.
- Sealant joints width limitations: To recommendations of sealant manufacturer.
- Finished work: Square, regular, true to line and plane with satisfactory fit at junctions.

770 FIXING

- Torque figures and shim dimensions: Do not exceed fixing manufacturer's recommendations.
- Grouting: Fill at dowel positions to panel base supports with resilient filler as recommended by GRC manufacturer.
- Give notice: Before covering up load bearing fixings.

780 SEALANT JOINTING-

- Sealant:
 - Class to BS ISO 11600:
 - Colour: **to be agreed**
 - Other requirements:
 - Application: As section Z22.