

**Project:** **BCM GRC Ltd Indicative Specification**

Architectural specification: **Section H40: Glass fibre reinforced concrete cladding / components**

To be read with all other sections of the Architect's specification, together with other Consultants' documentation and the Preliminaries / General Conditions.

This specification is supplementary to the Project Preliminaries / General Conditions and applies to the architectural work.

In the event of any conflict with other requirements obtain formal clarification from the CA, Design Engine Architects.

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### **GENERAL REQUIREMENTS**

- 01 SCOPE OF SPECIFICATION
- This section of the specification is Descriptive and includes requirements for glass reinforced concrete cladding / components, fixings and support framing and will be subject to Specialist Contractor design.
  - The specification must be read with the Architect's Key Reference Schedule, Architect's drawings and other relevant sections of the Architect's specification, including section A, Architectural general requirements.
  - The work is to be fully integrated with, and make provision for, work in connection with structural and services installations as applicable.
- 02 DESCRIPTION
- The work includes:
    - TBC
    -
  - Refer also to Structural and Services Engineers' documentation.

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- See section A regarding air-tightness, thermal continuity, fire / acoustic performance as applicable.

**03 PRIMARY REFERENCES**

- Carry out the work in accordance with this specification and those prepared by the Structural and Services Engineers and all applicable legislation / regulations / industry standards, including:
  - BS 8297 CP for design and installation of non-loadbearing pre-cast concrete cladding
  - BS EN 1169 Precast concrete products – general rules for factory production control of glass reinforced cement products
  - BS EN 1170 Precast concrete products. Test methods for glass fibre reinforced cement
  - BS EN 1991 Actions on structures
  - BS EN 14649 Precast concrete products Test methods for strength retention of glass fibres in cement and concrete

Glass Reinforced Concrete Association:

- Specifiers' guide.
- Specification for the manufacture and testing of glass reinforced concrete published.
- Methods of testing glass reinforced concrete material.

Manufacturer's recommendations

**04 DURABILITY**

- Service life, as defined in BS 7543 / BS ISO 15686, of the work in this section is to be not less than **TBC (typically 25-60yrs)**

**05 PERFORMANCE**

- Generally as clauses 03 and 04, and particular requirements where specified.
- Performance, certification, validation: Provide independently certified test certificates of performance, durability for the glass fibre reinforced concrete cladding and associated components, relevant for application to this project.

**06 INTERFACES / CO-ORDINATION**

- Co-ordinate details, setting out and installation with related work / incorporated components – refer to Architect's drawings.
- The relationships between the grc components and surrounding construction / finishes are shown on the Architect's drawings and include components which require careful detailing, fabrication, setting out and installation to ensure the required appearance while achieving the specified performance including prevention of damage or disfigurement from gases expelled from the fume cupboard chimneys.
- Incorporate details, materials, components, etc., to ensure continuity of appearance and performance, all to details to be approved by the CA.

**07 SUBMITTALS**

- Submit samples for approval to be confirmed by the CA before ordering, to demonstrate the appearance of each type of component.
- Prepare control samples of the first completed area of each type of cladding / component using methods and materials agreed from samples and reference panels, including typical details and relationships with adjacent work.
- Do not proceed without the CA's acceptance of the appearance of samples, reference panels and control samples.

## TYPES OF CLADDING/ COMPONENTS

### 100 GRC COMPONENTS GENERALLY

- Glass reinforced concrete: Grade 18P GRC.
- Manufacturer: BCM GRC Ltd, Unit 22 Civic Industrial Park, Whitchurch, Shropshire, SY13 1TT.
- Standard: Specification for the manufacture and testing of glass reinforced concrete published by the Glass Reinforced Concrete Association (GRCA) and in accordance with the Approved Manufacturers Scheme (AMS).
  - The work is to be carried out by a Full member of the GRCA and which has an appropriately audited QA/QC process in place.
- Primary support structure: Structural steel frame and concrete foundations – refer to Structural Engineer's documentation.
- Backing mix and production method: Grade 18P GRC simultaneous spray GRC.
- Construction:
  - Single skin panels, nominal thickness 15 – 18mm including GRC backing and stone face.
  - Minimum four cast-in sockets to accept fixings.
  - Panels to incorporate edge returns as indicated on the drawings.
- Finish: TBC
- Fire rating: A2,S1,D0
- Additional performance requirements: \_\_\_\_\_
- Fixings and fasteners: Panels to be manufactured with cast-in stainless steel sockets to enable fixing to support bracketry / aluminium / galvanized steel subframe to Specialist Contractor's design. (Check- Project specific)
- Joints: 10mm nominal. (Structural deflections and tolerances to be checked)
- Joint filler: Low modulus polysulphide sealant to match samples to be approved by CA prior to starting work.
- Accessories / other requirements: \_\_\_\_\_

### 110 GRC RAINSCREEN CLADDING

- Generally as clause 100 and as follows.
- Description: Precast stone (GRC) rainscreen cladding to façade.
- Locations: Refer to GA Elevations.
- Build-up:
  - External skin: GRC precast stone panels, secretly mechanically fixed to aluminium or galvanised steel sub-frame (Check matches with 100 Above) with thermally broken fixings to Specialist Contractor design.
  - Breather membrane TBC
  - Insulation: TBC
- Vapour control layer, as section P10, clause 230.
- Internal skin: Blockwork as section F10.
- Internal finish: Wet plaster as section M20.
- Joints: As shown on drawings.
- Blockwork: As EWS-01A.
- U-Value: 0.14 W/m<sup>2</sup>K
- Fixing: Secret Mechanical fixing
- Note: Sequencing of works to rainscreen at base of chimneys to be confirmed.
- Note: Cementitious board at base to interface with WPS-01 and WPS-02 as per details.

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#### **GENERAL REQUIREMENTS/ PREPARATORY WORK**

##### **205 CONTRACTOR'S DESIGN**

- Design responsibility: Complete the detailed design in accordance with the design intent shown on the Architect's drawings and to achieve the required performance.
  - Coordinate with the detailed design of related and adjacent work.
- Structural and fire requirements: To Structural and Fire Engineer's requirements.
  - Design: Complete the design in accordance with the designated code of practice as clause 100 and to satisfy specified performance criteria.
- Functional requirements: See section A regarding requirements for the external envelope as applicable, including requirements for impact resistance.
  - Refer to drawings and submit proposals for mitigating the various conditions likely to be encountered.
- Additional requirements: Protection from anti-freeze / de-icing chemicals likely to be used in adjacent paving.

##### **220 FIXINGS AND FASTENERS**

- Design: Fixings and fasteners for lifting / fixing into position to be in accordance with the GRCA "Guide to fixings for glass fibre reinforced concrete cladding".
- Fixing types: To Specialist Contractor's design, with sufficient three-dimensional adjustment to accommodate support structure and GRC component fabrication / installation tolerances.
  - Material: To meet the required service life.
  - Isolation of fixings: Separate dissimilar metals at risk of bimetallic corrosion with suitable plastic washers, sleeves etc.

##### **230 AIR BARRIER**

- Type: (TBC).
- Position: As shown on the drawings.
- Jointing to adjacent areas: Ensure continuity of air barrier to adjacent wall/ roof areas.

##### **240 INFORMATION TO BE PROVIDED DURING DETAILED DESIGN**

- Submit the following GRC particulars:
  - A schedule of detailed drawings and dates for submission for comment.

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- 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 limit 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.
  - Timing of submissions: To be agreed.
- 250 PRODUCT CONTROL SAMPLES
- GRC samples: Before general manufacture obtain approval of appearance of fully tested compliant control samples of each type of GRC component.
    - Finish: Include all variations of face mix and applied surface finish.
- 260 FIXING SAMPLES
- Fixings: At an agreed stage during detailed design, submit samples of fixings and support framing.
- 270 MOCK-UP
- Element: At an agreed stage during detailed design construct in approved location a mock-up of each type of GRC component, co-ordinated with adjacent construction / finishes.
  - Function: To confirm finishes and finalise details / relationships with adjacent work.
  - Inspection: Obtain approval of appearance before proceeding. Retain mock-up in undisturbed condition until completion of GRC installation.

**DESIGN/ PERFORMANCE REQUIREMENTS**

- 310 INTEGRITY
- Requirement: Determine sizes and thickness of panels, sizes, number and location of fixings and handling fixings, incorporation of accessories and components to ensure cladding installation and panels will resist factored dead, imposed and design live loads and accommodate deflections, shrinkage, creep, handling and thermal movements without damage.
  - Wind loads: Calculate to BS EN 1991, appropriate to location, exposure, height, building shape, and size, taking account of existing and known future adjacent structures.
  - Impact loads: Visible surfaces of cladding to meet the requirements of BS 8297 clause 12.2.5.
  - Temporary imposed loads: Inspection, cleaning and maintenance loads including as required to adjacent materials / surfaces.
  - Service life of the GRC cladding: As clause 04.
  - Secondary components, fixings, accessories / incorporated components: Submit details together with required maintenance regime, replacement periods and methods of replacement.
- 330 PANEL ACCURACY
- Finished dimensions of completed panels: Within the permissible deviations given in BS 8297, table 11 subject to matching approved samples and control samples and achieving the required relationships with adjacent work as shown on the drawings.

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- Accuracy of moulds: Check overall dimensions, straightness, squareness, twist and flatness of 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: 28 days after production.
- Tests for other requirements:
  - Absorption and dry density standard: To BS EN 1170-6.
  - Time: Minimum 7 days, maximum 28 days after production.
- Values for compliance: Minimum test board requirements are:
  - Spray-up (grade 18 or 18P):
    - Average limit of proportionality (LOP) of 4 consecutive test samples: 8.0 N/mm sq.
    - Minimum LOP of individual test sample: 6.0 N/mm sq.
    - Average modulus of rupture (MOR) of 4 consecutive test samples: 21.0 N/mm sq.
    - Minimum MOR of individual test sample: 15.0 N/mm sq.
    - Minimum bulk density (dry): 1800 kg/m cu.
    - Minimum bulk density (wet): 2000 kg/m cu.
  - Other tests: **TBC**

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.

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- 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 ALKALI-RESISTANT GLASS FIBRE**

- Standards: To BS EN 15422 and GRCA "Specification for alkali resistant glass fibre rovings and chopped strands for reinforcement of cements and concretes".
- Type: Alkali-resistant, continuous filament glass fibre.

#### **520 CEMENT**

- Standard: 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'.

#### **540 MIXING WATER**

- Standard: To BS EN 1008.

#### **550 ADMIXTURES**

- Type: Submit proposals.
- Calcium chloride based admixtures: Do not use if GRC contains cast-in steel.

#### **560 PIGMENTS**

- Standard: To BS EN 12878.
- Type: Powder pigments or dispersions.
- General: To have proven successful use in GRC.

#### **570 AGGREGATE FINISH**

- To be agreed following submission of sufficient representative samples for review / agreement by CA.
- Application: Spray applied face mix finish.

#### **580 SURFACE COATING**

- Coating: Water and chemical resistant matt / non-staining impregnating sealer to GRC manufacturer's recommendations and approval of samples by CA.
- 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.



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 trowelling, 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- (if Applicable)

- Fabrication: Specialist Contractor's design in accordance with the GRCA 'Guide to fixings for reinforced concrete cladding'.

685 CURING POLYMER GRADE GRC

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

690 HANDLING AND TRANSPORTATION

- Ensure finished components are handled and transported carefully to prevent damage, discolouration or other blemishes.
- Use packaging, stillages, protection, lifting devices, etc that do not inhibit curing and to ensure finished components are not damaged in any way.
- Components with damaged / blemished finished surfaces are not to be re-dressed or incorporated in the works.

## **INSTALLATION**

710 GENERALLY

- Prefabrication: Complete products and attach fixings 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:
  - Programme: To be agreed and co-ordinated with Main Contract programme.

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- 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 INSTALLATION
- Joint widths: Within joint lengths, including in-line continuations across transverse joints, as follows and subject to agreement of samples and control samples:
    - Tolerance: Greatest width not to exceed least width by more than 25%.
    - Variations: Evenly distribute, with no sudden changes.
  - Offset in elevation: Between component edges across transverse joints not to exceed 15%.
  - Offset in plan or section: Between flat faces of adjacent units across joints not to exceed 20% width of joint.
  - Sealant joints width limitations: To recommendations of sealant manufacturer.
  - Finished work: 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 loadbearing fixings.
- 780 SEALANT JOINTING
- Sealant: To GRC manufacturer's recommendations and fully compatible with GRC and all contact materials.
    - Ensure compatibility by testing samples and use primer / other preparation where recommended by the manufacturers.
    - Class to BS EN ISO 11600.
    - Colour: To be confirmed by CA.
    - Application: As section Z22.

End of section H40.