Hampstead Green - External Facade Cladding

Hampstead Green
London

Architectural Specification
Tender Issue
22/03/2016

Duggan Morris Architects
Unit 7
16–24 Underwood Street
N1 7JQ
London

A10 PROJECT PARTICULARS

A10.100 INTRODUCTION

A10.101 Procurement Method

a) The Architectural Specification reflects a design and build procurement method.

b) For design and build procurement the Trade Contractor shall:

i) Complete the works in accordance with the Design.

ii) Appoint specialist sub-contractor's as listed in clause A15.103 to complete the Detailed Design, manufacture and installation of the works.

A10.102 Contractual Terms

a) "Architectural Specification": Sections A - Z herein.

b) "System Reference Sheet - SRS": A list of project specific references, which provides a unique code to each material, product or system included in the Design, used as a link between the Design Drawings and Architectural Specification.

c) "Design": That prepared by the Architect as shown on the Design Drawings and in the Architectural Specification.

d) "Design Drawings":

i) For design and build procurement elements - Architect's drawings issued for tender depicting design and visual intent, plus typical details and arrangement of elements upon which the Detailed Design will be based.

e) "Detailed Design": Final manufacturing and installation details prepared by the Trade Contractor post contract as shown on the Working Drawings maintaining full compliance with the Architectural Specification.

f) "Trade Contractor's Proposals": The Trade Contractor's response to the Design.

g) "Working Drawings": Drawings prepared by the Trade Contractor (or a specialist sub-contractor), which finalise the engineering of every element and component of the works for manufacture and installation maintaining the design intent indicated on the Design Drawings.

h) "As-built Drawings": Detailed drawings showing the final installed works.

i) "Contract Drawings": The drawings listed in the Construction Contract.

j) "Evaluation": Joint reviews carried out during contract negotiations to agree Contract Drawings and specifications.

k) "Inspection": Inspection of systems and installations to check visual appearance of the works. Such inspection excludes checking the use of appropriate materials or methods of installation.

l) "A(a)ccepted, A(a)cceptance or A(a)cceptable": Acceptance by the Architect of submittals received from the Trade Contractor from a design intent perspective. Such acceptance does not imply or mean that the Architect accepts the submittal from a quality of fit for purpose perspective.

m) "Trade Contractor's Supplemental Information": Post contract documents of any kind submitted by the Trade Contractor to demonstrate compliance with the Contract documents.

n) "Inspecting Authority": Accredited independent body, firm or association, which is engaged to check and verify Architectural Specification compliance.

o) "Testing Authority": Accredited independent body, firm or association, which is engaged to carry out specific scientific tests to prove Architectural Specification compliance.

p) "works": The scope of work contracted.

A10.103 Common Arrangement of Work Sections

a) The Architectural Specification is arranged generally in accordance with the Common Arrangement of Work Sections for building works (CAWS) 2nd Edition, published by the Construction Project Information Committee classification system.

b) The CAWS system consists of:

i) A Sections which provide general information, design responsibilities, quality requirements, etc. appertaining to all elements of the works.

ii) Sections B to Y, which provide detailed requirements appertaining to materials and workmanship requirements of individual elements of the works.

iii) Z Sections, which provide general materials and workmanship requirements appertaining to multiple Sections B to Y.

c) Where stated, performance criteria are the minimum acceptable standards.

d) The Trade Contractor shall comply with all clauses in the Architectural Specification.

A10.104 Other Information Sources

Take into account all relevant information contained in the following:

a) Planning permission and conditions.

b) Building Movement and Tolerances Report.
c) Wind Report.
d) Acoustic Report.
e) Fire Strategy Report.
f) Fire Strategy Drawings.
g) Façade Consultant's Report and Specification.
h) Access for Maintenance Report.
i) Design Drawings.
j) Structural Engineer's documentation.
k) Services Engineer's documentation.
l) Vertical Transport Report.
m) Traffic Analysis Report.
n) Accessibility Report.
o) Specialist Lighting documentation.

A10.105 Copyright

The copyright of the Design Drawings and Architectural Specification are vested in the Architect.

A10.106 Disclosure

All information related to the project is to be treated as confidential and not be disclosed to any Third Party without written consent.

End of Section

A15 DESIGN RESPONSIBILITY (DESIGN AND BUILD)

A15.100 COMPLIANCE

A15.101 General Architectural Specification

a) Comply with the requirements of the Architectural Specification.

b) Where the Contract requires the Trade Contractor to provide and install named products or materials, they are to be new and installed in accordance with the Architectural Specification and manufacturer's recommendations to the satisfaction of the Architect.

c) The Trade Contractor shall comply with the standards of materials and workmanship stated in the Architectural Specification.

d) Complete the works in accordance with the Design Drawings and the Architectural Specification, such that it is acceptable to the Architect.

e) Where necessary, provide Working Drawings and technical information to demonstrate compliance with the Design Drawings and Architectural Specification and comply with the review process specified.

f) No portion of the works shall commence without acceptance of the required submittals by the Architect.

g) Provide additional structural elements or other materials to ensure a safe installation.

h) If the Contractor's Proposals include alternative materials, products or systems, the Trade Contractor shall confirm that the Design is not affected and full technical literature is submitted for review.

A15.102 Trade Contractor Design

a) Complete the Detailed Design without changing the function, performance or visual intent of the Design.

b) Provide warranties and, where appropriate, guarantees for all systems and products incorporated in the works.

c) Provide Trade Contractor’s Proposals that include drawings, calculations, methods, technical specifications and risk analysis (significant residual risk) detailing the proposed materials and systems in order that a technical appraisal can be made by the Architect.

d) Where the Architectural Specification requires the Trade Contractor to engage a specialist sub-contractor to complete the Detailed Design of elements of the works, this shall be carried out in compliance with the relevant clauses of the Architectural Specification.

e) Proposed alternative design solutions shall not alter the performance requirements, appearance or visual intent of the Design.

f) Provide a design risk assessment as part of the Detailed Design.

g) Provide Working Drawings and, where necessary, other relevant technical information. The Detailed Design shall reflect the Design.

h) Provide a complete design risk analysis as requested or as appropriate.

i) Where proprietary products are incorporated in the works, they shall be fit for purpose or shall be suitably modified and improved to comply with the Architectural Specification and their position in the works. Advise the Architect of any concerns regarding the suitability of such proprietary products.

j) Do not commence any manufacture or installation of any element of the works prior to receipt of written acceptance of submittals from the Architect.

k) Ensure compliance with CDM Regulation Designer Duties and carry out system risk analysis.

l) Install all items as recommended by the manufacturer ensuring that performance requirements are maintained for the service life periods stated in the Architectural Specification. Show all fixings and other necessary details on the Working Drawings.

m) Select and use materials, products and components that are appropriate and fit for purpose as intended by the manufacturer.

n) Carry out specified tests and any additional tests to demonstrate compliance with the Architectural Specification.

o) The Working Drawings are to be fully co-ordinated with all interfacing elements of the works whether part of the Trade Contractor's scope, or that of a Third Party.

p) Submit documents to Building Control as required.

q) Provide details, calculations and any other relevant information, documents and samples for submission to the Planning Authority and comply with Planning Permission requirements.

r) Accurately set out and co-ordinate the works.

s) If requested, provide structural/ deflection calculations and other relevant technical information for review to demonstrate compliance.

A15.103 Specialist Sub-contractors

a) The Trade Contractor shall appoint specialist sub-contractors to complete the Detailed Design for the following elements of the works:
   i) Cladding.
   ii) Curtain Walling.
   iii) [.....].
   iv) [.....].

A15.104 Performance Criteria

a) The Detailed Design shall comply with the performance criteria stated in the Architectural Specification.

b) The Trade Contractor's Proposals shall demonstrate compliance with performance criteria.

A15.105 Trade Contractor’s Proposals

a) The Contract documents will comprise an agreed combination of the Design Drawings, Architectural Specification and Trade Contractor’s Proposals following review with the Architect.

b) The Trade Contractor shall provide sufficient design personnel, prior to contract award for the purpose of reviewing and agreeing Contract documentation.

c) Trade Contractor’s Proposals include:
   i) Drawings to demonstrate compliance with the Design Drawings.
   ii) Summary of deviations from the Architectural Specification.
   iii) Proposed list of materials, manufacturers, suppliers and sub-contractors to be used.
   iv) Existing test certificates and list of specific tests included.
   v) Confirmation of guarantees and warranties to be provided.
   vi) Initial CDM risk analysis.

A15.106 Detailed Design

a) Adopt the Design Drawings, having checked buildability and performance issues, relevant regulations, codes of practice and manufacturers' recommendations for any products specified.

b) Comply with all relevant Statutory Rules, Regulations, Bye-laws, Codes of Practice, National Standards, Fire and Building Regulations, and any other enforceable rule or regulation applicable to the works.

c) The Detailed Design is represented by the Working Drawings and detailed product or system specifications.

d) The Working Drawings shall finalise every detail, fixing, junction, interface, assembly and tolerance allowance for manufacture and installation.

e) The Trade Contractor shall confirm relevant structural performance principles, showing the way in which loads are transmitted throughout the structure, taking full account of necessary tolerances.

A15.107 Supplemental Information

a) Provide all necessary supplemental information demonstrating design compliance to the satisfaction of the Architect.

b) Supplemental information shall demonstrate compliance with the design intent, functional and performance requirements of the Design.

c) Demonstrate full compliance with the Architectural Specification through relevant supplementary information.

A15.108 Architect Preferences

a) The Trade Contractor shall confirm, in the Trade Contractor's Proposals suitability of any materials, products or systems specified.

b) If, after review, the Architect accepts such alternative proposals the responsibility for them being fit for purpose shall remain with the Trade Contractor.

A15.109 System Tolerances

a) The Detailed Design shall take account of and maintain the dimensional tolerances shown in the Design to the satisfaction of the Architect.

b) Advise tolerance omissions, inconsistencies or incompatibilities while preparing the Working Drawings.

c) The Working Drawings shall determine how tolerances are to be maintained.

d) Carry out a detailed Site survey prior to commencement of manufacture where the programme allows. Where possible check existing Site dimensions allowing installations to proceed without the necessity to alter elements of the works. Where this is not possible, ensure that sufficient tolerances are allowed on the Working Drawings.

e) Allow sufficient tolerances to cater for all structural movements in the Working Drawings.

f) Inform the Architect in advance where specified tolerances are not being met.

g) Elements shall remain stable in their permanent position and not warp or twist, remaining firm, free from vibrations, knocking, rattles and/ or whistles.

h) The Trade Contractor shall monitor all tolerances during manufacture and installation, keeping records as evidence.

i) Report any setting out discrepancies and await instruction.

j) Where multiple tolerance solutions are determined for the same condition, the most stringent shall apply.

A15.110 Changing Design Intent

Should the Trade Contractor wish to propose a change to the design intent as shown on the Design Drawings, this shall form part of the Trade Contractor's Proposals and be substantiated with full technical back-up demonstrating why it is not achievable or desirable. Performance criteria shall not be changed unless agreed in advance with the Architect.

A15.200 PERFORMANCE REQUIREMENTS

A15.201 General

a) Maintain the stated performance criteria stated in the Architectural Specification and any other relevant tender/ contract specification or conditions.

b) Specified performance requirements are the minimum levels with which the Trade Contractor shall comply.

c) As a minimum, comply with the performance requirements stated in relevant British Standards, BS Codes of Practice, European Standards, Publicly Available Specifications (PAS) and British Board of Agrément (BBA) Certificates which are applicable to the works. In cases of conflict the most onerous shall apply.

A15.202 Design Life

Comply with BS ISO 15686: Part 1, Table B.1, 60 years and BS 7543 Table D.1.

A15.203 Service Life

a) The service life of individual primary and secondary components shall be as stated in the Architectural Specification and confirmed by the Trade Contractor.

b) Primary components are generally inaccessible and shall have a service life to match the design life.

c) Secondary components are generally accessible and as such require maintenance and/ or replacement from time to time.

d) The service life for specific secondary components shall be as Table D.1 of BS 7543 with the following exceptions and additions:

i) Laminated safety glass:
- Predicted service life (min. years): 25.
- Maintenance level to table 1 of BS 7543 - replaceable.

ii) Metal frames:
- Predicted service life (min. years): 60.
- Maintenance level to table 1 of BS 7543 - maintainable.

iii) PVDF/ PPC finishes:
- Predicted service life (min. years): 30.
- Maintenance level to table 1 of BS 7543 - maintainable.

iv) Stainless steel cladding:
- Predicted service life (min. years): 30.
- Maintenance level to table 1 of BS 7543 - replaceable.

v) Stone cladding:
- Predicted service life (min. years): 40.
- Maintenance level to table 1 of BS 7543 - maintainable.

vi) Gaskets (all):
- Predicted service life (min. years): 25 external.
- Predicted service life (min. years): 30 internal.
- Maintenance level to table 1 of BS 7543 - replaceable.

vii) Cladding support brackets:
- Predicted service life (min. years): 60.
- Maintenance level to table 1 of BS 7543 - maintainable.

viii) Flat roof construction:

- Predicted service life (min. years): 20-25.
- Maintenance level to table 1 of BS 7543 - maintainable.

ix) Green roofing:
- Predicted service life (min. years): 20-25.
- Maintenance level to table 1 of BS 7543 - maintainable.

x) Pitched metal roof:
- Predicted service life (min. years): 40.
- Maintenance level to table 1 of BS 7543 - maintainable.

xi) Stainless steel balustrading:
- Predicted service life (min. years): 40.
- Maintenance level to table 1 of BS 7543 - maintainable.

xii) Stove enamelled steel:
- Predicted service life (min. years): 40.
- Maintenance level to table 1 of BS 7543 - maintainable.

xiii) Internal painted galvanised steel:
- Predicted service life (min. years): 40.
- Maintenance level to table 1 of BS 7543 - maintainable.

xiv) Safety glass floor:
- Predicted service life (min. years): 40.
- Maintenance level to table 1 of BS 7543 - replaceable.

xv) Stone flooring:
- Predicted service life (min. years): 40.
- Maintenance level to table 1 of BS 7543 - replaceable.

xvi) Ironmongery:
- Predicted service life (min. years): 15.
- Maintenance level to table 1 of BS 7543 - replaceable.

e) Confirm Service Life compliance and maintenance requirements of the components in accordance with BS 7543 and BS ISO 15686.

f) Materials shall be used solely for the purpose intended by the manufacturer and shall satisfy the requirements of the Architectural Specification.

Structural Performance

A15.204 The Structural Engineer's documentation provides specific details of the structure, which take precedence over the general requirements stated herein.

A15.205 Movements and Tolerances

a) Take account of and incorporate the movements and tolerances of the structural design, including the application of dead and live loads, combination of loads, loads caused by prevailing or expected weather and environmental conditions, in all temporary and permanent conditions throughout the year without detriment to performance or visual intent.

b) The Detailed Design shall take into account torsional stresses in a safe manner.

c) Fixings shall be selected to provide adequate adjustment to prevent structural failure of any element or component.

d) Provide movement joints to accommodate anticipated design loads where they are agreed with the Structural Engineer, without detriment to the performance criteria or design intent.

e) All elements shall safely resist anticipated or specified static and dynamic loads, without permanent deformation of components, or the failure of systems, materials or seals arising.

f) Deflection shall be minimised and not cause failure or unacceptable visual consequence to adjoining elements.

A15.206 Accommodating Dead Loads

a) Accommodate all dead loads without detriment to visual intent or performance.

b) Accommodate all dead loads caused by fixtures or service attachments without detriment to visual intent or performance.

c) Assume the worse combination of loads when making calculations.

A15.207 Accommodating Live Loads

a) Accommodate all live loads without detriment to visual intent or performance.

b) Accommodate all impact loads during temporary and permanent conditions, without detriment to visual intent, performance and safety avoiding non-repairable damage.

c) Loads imposed during maintenance and replacement of elements and components.

d) Assume the worse combination of loads when making calculations.

A15.208 Accommodating Deflections

a) Do not exceed maximum deflection limits specified.

b) Deflection that is detrimental to the visual intent or performance criteria of the works or adjacent works shall not be acceptable.

c) All components, couplings and fixings shall accommodate deflections without permanent distortion, deformation or failure.

d) The Detailed Design shall accommodate differential structural movement from imposed loads imposed by adjacent/ adjoining elements.

A15.209 Accommodating Wind Loads

a) Determine wind load values to suit project location, prevailing topographical conditions and building type and shape in accordance with BS EN 1991: Part 1-4.

b) The Detailed Design shall accommodate and take account of particular special conditions which may be subjected to additional unusual wind pressures. Maximum pressure caused by wind gusts shall be calculated in accordance with BS EN 1991: Part 1-4.

c) Assume the worse combination of wind load cases when making calculation, including governing wind pressure coefficients derived from more than one wind regime.

A15.210 Preceding Work

Check preceding work for line, level and appropriate fixing points before proceeding with the installation. Should any be considered unsuitable, propose remedial action.

A15.211 Vibration

The Detailed Design shall take account of and accommodate any vibration caused by any external/ internal condition, occurrence or other event that may reasonably be foreseen, such that deterioration of any element or component does not arise during temporary or permanent conditions.

Environmental Performance

The Services Engineer's documentation provides specific details of mechanical, electrical and plumbing which take precedence over the general requirements stated herein.

A15.212 General

a) Local and prevailing environmental conditions shall be taken into account when completing the works.

b) Specific performance data for each element is contained in Sections B to Y of the Architectural Specification.

c) Acquire necessary and relevant meteorological and climate data.

d) The Trade Contractor shall take all measures necessary to protect both installed and delivered goods and materials, including their storage and installation whilst in climatically uncontrolled conditions during any season of the calendar year until Practical Completion or such times as the permanent climatic condition is operational.

e) All goods, materials, methods and working practices shall be suitable for local climatic conditions, without any adverse effect whatsoever to the final project, in terms of appearance, quality or function.

A15.213 Snow and Ice

Identify risks of snow, ice and icicles falling from high level and take sufficient precautions to prevent such an event occurring.

A15.214 Climatic Data

a) External climate: Summer:
   i) ******°C dry bulb.
   ii) ******°C wet bulb.

b) External climate: Winter:
   i) ******°C dry bulb.

c) Internal conditions:
   i) Summer: ******°C ±1°C.
   ii) Winter: ******°C ±1°C.
   iii) Humidity control: [Yes/No].

d) Internal climate during construction:
   i) ***Control as required to avoid deleterious effects on the works relating to temperature and humidity.***
   ii) Summer: ******°C to ******°C.
   iii) Winter: ******°C to ******°C.

Security

A15.215 General

If required and where appropriate, comply with the recommendations of the ***'Secured by Design' initiative published by the Association of Chief Police Officers and/or Security Consultant's documentation.***

Fire and Smoke

A15.216 General

a) Provide fire and/ or smoke stops where required by the Building Regulations, and the Statutory Authorities.

b) Provide appropriate fire stops, without any reduction in overall performance, at all junctions where required by the Statutory Authorities and/ or relevant Fire Regulations.

A15.217 Fire Protection

a) Comply with BS 476: Parts 20-24 and Clause 5 of Appendix A of the Approved Document to Part B of the Building Regulations in respect of fire performance and resistance.

b) Comply with Clause 8 of Appendix A of the Approved Document to Part B of the Building Regulations with regard to non-combustible materials.

c) Comply with Clause 9 of Appendix A of Part B of the Building Regulations with regard to materials of limited combustibility.

d) Generally as a minimum, the 'surface spread of flame' of internal surfaces and linings shall be performance rated using the method specified in BS 476: Parts 6 and 7 or BS EN 13501: Part 1. Where a Class 0 rating is required the material shall comply with Clause 13 of Appendix A of the Approved Document to Part B of the Building Regulations. Refer to Appendix A of the Approved Document to Part B of the Building Regulations generally.

e) Where certain composite and synthetic products/ materials are to be fire rated these shall be subject to the limitations specified in Appendix A of the Approved Document to Part B of the Building Regulations.

f) Provide official test certificates to confirm that the materials used in the works comply with the above.

g) Comply with all Statutory Authorities' and Fire Services' requests/ recommendations.

Corrosion Protection

A15.218 General

a) Take adequate protective measures to stop corrosion or any other deleterious effects to materials, products, components or systems, during manufacturing, delivery, storage and installation up to Practical Completion and for the guarantee and warranty periods.

b) No corrosion shall occur at points of connection (e.g. bolting, welding, screwing) including non-visible surfaces.

c) Where materials are cut on site, take adequate measures to avoid future corrosion.

d) For structural steelwork elements comply with BS 5493, BS EN ISO 12944: Parts 1-8 and BS EN ISO 14713 as appropriate, or the Structural Engineer's documentation.

e) Take note of and comply with the following environmental categories under BS EN ISO 12944: Part 2:

   i) External corrosion category:
      - Category C3.

   ii) Interior corrosion category:
      - Insulated/ heated spaces: C1.
      - Uninsulated/ unheated spaces: C2.

f) Protect all materials, products, components and systems to avoid all corrosion occurring from exposure to seawater, non-saline water, soil, high humidity, low or high temperatures, chemical acids and alkalis, abrasion and impact, fungi and bacteria.

g) Comply with the manufacturers' recommendations and longevity dates. Store appropriately before installation and protect appropriately after installation.

A15.219 Galvanising

Comply with BS EN ISO 14713: Part 1 with regard to periods to first maintenance as follows:

a) Very long (equal to or greater than 20 years).

A15.220 Electrolytic Protection

Where different metals connect or touch, take all necessary measures to avoid electrolytic corrosion in all temporary and permanent conditions.

Earth Bonding

A15.221 General

a) Bond extraneous conductive parts to earth. Such extraneous conductive parts are any which are likely to transmit a potential, including earth potential, and which do not form part of the permanent electrical installation. Every component can potentially be considered as an extraneous conductive part.

b) Comply with BS 7671 with regard to electrical continuity.

c) Provide equipotential bonding as defined by BS 7671 to maintain substantially equal potential.

d) Comply with BS EN 62305: Parts 1-4 and BS 7430 with regard to earthing connectivity. Provide test certificates for the Health and Safety File.

End of Section

A33 QUALITY AND SUSTAINABILITY

A33.100 TRADE CONTRACTOR SUBMITTALS

A33.101 General Process

a) Provide all submittals at the required time for review prior to commencement of the next stage of the works.

b) Provide a full list of all submittals as part of the Trade Contractor's Proposals.

c) Identification of Submittals:

i) Clearly identify each submittal with unique identification, project name, Architectural Specification reference and name of manufacturer. Transmittal forms shall be used to record full details of what, where and when items are being submitted.

d) Completeness of Submittals:

i) Every individual submittal shall be complete and clearly labelled in order to make identification simple.

e) Variations and Substitutions:

i) Should any submittal, product, material, component or system differ from the Design Drawings or Architectural Specification the Trade Contractor shall give notice of such change along with the reason why for consideration by the Architect.

f) Submission and Return of Working Drawings:

i) Allow for the period stated in the Contract for reviewing and commenting. Comply with the process outlined in the Contract for resubmission if "A" Status is not gained.

ii) Provide a detailed list of proposed Working Drawings or BIM model references.

g) Samples shall be a true representation of the final material or product to be incorporated in the works and not simply a similar likeness.

h) The Architect will confirm or otherwise acceptance of samples received.

i) For natural materials, or those which offer a considerable or subtle range of texture, colour of finish, supply a range of samples for review.

j) Where custom colours are specified, samples shall be submitted illustrating precise colours, textures, patterns and finishes for review by the Architect.

A33.102 Tender Submittals

Provide the submittals required at the time of tender.

A33.103 Post Contract Submittals

Provide samples, mock-ups, prototypes, quality benchmarks, calculations and test reports as required by the Architectural Specification along with any other relevant data.

A33.104 Pre-contract Samples

a) Provide the samples listed in the Architectural Specification to demonstrate suitable visual appearance and quality as required by the Design Drawings and Architectural Specification.

b) Pre-contract samples shall be retained as a record of materials agreed for Contract.

c) Include trade literature and technical specifications related to each sample.

A33.105 Post Contract Samples

a) Further samples of materials, products, components or systems provided by the Trade Contractor to ensure that quality and type have been maintained, matching or improving the pre-contract samples.

b) Post contract samples shall be retained and used to check that those incorporated in the works are the same or better.

c) Samples shall represent goods in their final form including applied surface finishes in accordance with the Architectural Specification.

A33.106 Mock-ups

a) Provide full size mock-ups for inspection by the Architect.

b) Erect mock-ups in an agreed location and construct them in such a way as to represent the size, shape, and general appearance of the required item, not using actual materials envisaged for the final solution.

c) The mock-up shall be used to indicate general visual intent including colour, size and co-ordination.

A33.107 Prototypes

a) Prototypes shall be manufactured and assembled at the point of manufacture or such other location where testing is carried out prior to commencement of manufacture.

b) Prototypes shall comprise full size, three-dimensional constructions listed in the Architectural Specification, comprising elements or sections as they are intended to appear in the works or as combinations of such elements or sections, incorporating actual materials to be used in the works, but not necessarily final production techniques. Working Drawings shall be prepared for each prototype prior to their manufacture.

c) Prototypes shall be used to facilitate a comprehensive inspection by the Architect in order to finalise the Detailed Design of that particular element prior to commencement of the manufacturing process.

d) Prototypes may also be used for testing purposes to ensure compliance with the performance requirements of the Architectural Specification through application of loads, representation of prevailing or likely climatic conditions and structural movements.

e) The Trade Contractor shall carry out modifications to prototypes as instructed by the Architect, which once accepted shall provide the basis to proceed to manufacture and installation.

f) Reviewing, amending and testing of prototypes shall be planned and carried out as part of the overall project programme.

A33.108 Quality Benchmarks

a) Predetermined elements/ sections of the works shall be installed in advance of the main installation as described in the Architectural Specification.

b) Benchmarks shall be reviewed and adjustments made by the Trade Contractor to the satisfaction of the Architect.

c) The benchmarks shall be protected during construction and used to check that all subsequent installations maintain the accepted quality.

A33.109 Working Drawings

a) The Trade Contractor shall provide Working Drawings for review by the Architect, as required by the Contract and Architectural Specification.

b) When requested, the Trade Contractor shall provide relevant structural, thermal/ acoustic calculations and other data, for review.

c) The Architect shall review the Working Drawings in respect of design/ visual intent and overall functional matters only, compliance with the Architectural Specification and the Design Drawings. The Detailed Design and construction of components shall remain the responsibility of the Trade Contractor.

d) The Working Drawings shall be fully dimensioned in metric, to an agreed scale appropriate to the detail, and include:

   i) Full size co-ordinated details and graphic representation describing materials, components and equipment, construction, finishes, provision for movements, fabrication and erection tolerances.

   ii) Layouts, locations and co-ordinated assemblies of all types of construction detail and junctions, details of materials, method of jointing, details of all Site connections and fixing and sealing methods, finishes and all pertinent information related to:

   - Method of fabrication and construction.
   - Proper relation to adjoining work.
   - Finishes.
   - Amplification of details.
   - Minor changes to the Design to suit actual conditions.

e) No manufacturing shall commence without the appropriate authorisation in accordance with the Contract.

f) Unless stated otherwise in the Contract the following codes shall be used by the Architect when reviewing the Working Drawings.

   i) "A" Status - Proceed with fabrication, manufacture and installation in accordance with the accepted Working Drawings.

   ii) "B" Status - Proceed with fabrication, manufacture and installation in accordance with the comments on the Working Drawings and re-submit to gain "A" Status.

   iii) "C" Status - Do not proceed with fabrication, manufacture or installation. Re-submit new Working Drawings for review until "A" or "B" status is achieved.

g) Provide all documentation, certification, and other relevant detailed information necessary to explain, clarify and support the Working Drawings to facilitate a complete review.

h) Working Drawings shall be based upon current Design Drawings , amended to reflect conditions on site.

i) Utilise manufacturer’s standard details as appropriate without changing the design intent.

j) The Working Drawings shall be prepared in English following project and contractual protocols.

k) The Design Drawings are confidential and shall not be utilised for any purpose other than carrying out contractual obligations on the project. No information shall be communicated to third parties without written authority from the Architect and Client.

l) Keep on Site a full set of current Design Drawings, Working Drawings and technical specifications.

m) Upon completion of the works, provide As-built Drawings, in accordance with the Conditions of Contract.

n) Fully co-ordinate the Working Drawings with interfacing elements whether they form part of the works or work by others.

A33.110 Product Data

Provide further technical information that is relevant to inform system characteristics, components, and materials incorporated in the works.

A33.111 Certifications

Provide independent certified test and compliance reports verifying the suitability of each element or component. Such reports shall include the chemical and physical properties for each element, component and material.

A33.112 QA/QC Programme

Provide a detailed QA/QC programme in accordance with the Contract.

A33.113 Pre-construction Testing Reports

a) Provide appropriate and relevant technical test reports confirming results of the various systems, components and materials prior to commencement of installation.

b) Such reports shall confirm and prove compliance with the technical requirements of the Architectural Specification.

A33.114 Maintenance/ Operation Manuals

a) Provide fully detailed maintenance and operation manuals for the systems incorporated in the works.

b) Include full product literature describing all physical characteristics, e.g. size, weight, finish, material analysis, electrical requirements and other information, such as load tables, test results, assessments and industry quality standards.

c) Include manufacturer's detailed information, catalogues, specifications, illustrations, diagrams and details.

A33.115 Technical Calculations

Provide technical calculations, to demonstrate and prove performance of various systems, components and/ or materials, incorporated in the works.

A33.116 Guarantees and Warranties

Provide certified copies of the guarantees and warranties as required by the Contract.

A33.117 Other

Prepare and submit CDM risk analysis (significant residual risk) for review.

A33.118 Review of Submittals

a) The Architect will review submittals for visual, design intent and general compliance with the Design. The Architect's review shall not be exhaustive and shall not relieve the Trade Contractor of the responsibility for any omission or deficiencies or from the responsibility to co-ordinate the work with that of others (which includes the taking of relevant Site dimensions as necessary).

b) Supplementary information concerning the technical performance of building systems, components and materials shall be stamped 'Record Document' by the Trade Contractor before submission.

c) Re-submittals shall be made in accordance with the Contract, identifying changes made since previous submittals.

A33.200 QUALITY CONTROL

A33.201 Introduction

a) Implement acceptable quality assurance and control systems to verify that the materials, products, components and systems are manufactured and installed in accordance with the Architectural Specification.

b) This requirement applies to the Trade Contractor's total supply chain. Certification in accordance with BS EN ISO 9000 is acceptable and shall be used as a basis to determine the minimum standards of monitoring.

A33.202 Testing Generally

a) Appoint accredited independent testing authorities, as appropriate to carry out tests to satisfy the Architectural Specification.

b) All testing shall be carried out by qualified personnel using validated and regularly calibrated equipment.

c) Issue and make available for inspection, when requested, test certificates and inspection results at all stages of the works.

d) Allow for re-testing or additional testing and any necessary remedial works should test results or inspections be unacceptable.

A33.203 Airtightness Fan Test

a) Prior to Practical Completion carry out an airtightness fan test upon completion of the external envelope and roofing to the satisfaction of the Architect and other relevant parties.

b) Comply with the Approved Document to Part L of the Building Regulations, CIBSE TM23 - “Testing of Buildings for Air Leakage" and BS EN ISO 9972 when carrying out this test and take all measures necessary to rectify any leakages that are detected and re-test in the event of failure.

A33.204 Standards

a) Unless specifically stated elsewhere in the Architectural Specification, the current version of British Standards and European Norms shall apply to the works. Should any applicable Standards be amended or withdrawn during the course of the works, the Trade Contractor shall notify the Architect and await clarification.

b) Should the Trade Contractor wish to substitute or amend these Standards in any way whatsoever this must be scheduled in the Trade Contractor's Proposals and only used if written acceptance is received from the Architect.

A33.205 Codes and Regulations

a) All materials, components, equipment and workmanship shall comply with all local authority codes and Building Regulations, British Standards, and any other regulations applicable to the works, together with all relevant statutory rules, regulations, bye-laws and other enforceable instruments in both the design and execution of the installation.

b) Unless stated otherwise, British Codes and Standards shall apply to the Building Design and Materials as listed herein.

A33.206 Submissions to Authorities

a) Comply with all local and statutory authority requirements with jurisdiction in the location of the works, including submissions, tests and proof of compliance.

b) Replace any material, product, component or system which are deemed unacceptable by the local or statutory authorities.

Safety

A33.207 CDM Regulations

a) The Detailed Design shall comply in all respects with current CDM Regulations, such that all those involved in the execution of the works are able to carry out their duties in a safe and healthy environment with minimal risk to personal welfare.

b) The Working Drawings shall only incorporate methods of manufacture, installation, maintenance and use that are safe and comply with all CDM and other relevant Health and Safety regulatory requirements. Where, as part of the completion of the Detailed Design, the Trade Contractor is unable to eliminate risk, there shall be an obligation to provide information on the risk to others.

c) Provide a full risk analysis including any elements determined as having significant residual risk.

Protection

A33.208 Damage to Goods

a) The Trade Contractor shall utilise his expertise and experience to anticipate potential damage to materials, products, components and systems being incorporated in the works and take measures to reduce the likelihood of damage occurring for any reason. Take proactive measures to minimise the risk of damage at all times until full Practical Completion.

b) Provide a report detailing protective measures that the Trade Contractor proposes during manufacture, packaging delivery, storage and installation up to Practical Completion.

c) Comply with the manufacturer's recommendations at all times in respect of storage, unpacking, installing and protecting all materials, products, components and systems until Practical Completion.

d) Goods damaged in any way, including scratches, dents or surface marking, are not acceptable.

A33.209 Delivery of Goods

All materials for use in the works shall be delivered to Site appropriately packaged and/ or crated to avoid damage, with each one clearly labelled stating source, quantity and content.

A33.210 Vermin and Insects

a) Take all necessary measures to protect the works against infestation at all times.

b) Implement the recommendations of Digest 415 produced by the Building Research Establishment.

A33.211 Toxic Mould

The occurrence of any, or threat of any growth, presence, release or dispersal of fungi, moulds, spores or mycotoxins is not acceptable.

Post Handover Responsibilities

A33.212 Maintenance Manual

Provide a fully detailed Maintenance Manual in accordance with the Contract to include comprehensive information in respect of all materials, products, components and systems incorporated in the works, all certifications, test/ inspection results, replacement processes, cleaning and maintenance requirements such that all warranties and guarantees remain valid.

A33.213 Training

In accordance with the Contract, train the user's staff in all aspects of the post handover operation and maintenance systems as detailed in the Maintenance Manual.

A33.214 Spares

a) Provide adequately packaged and labelled spares as stated in the Contract all of which are to be identical to the goods installed in the works.

b) Provide a comprehensive list of recommended spares not included in the Contract.

Materials and Workmanship

A33.215 General

a) Provide materials that are new, unused, and of the best merchantable quality to the satisfaction of the Architect.

b) Where possible, materials shall be easy to maintain and repair.

c) Materials, products, components and systems shall comply with the requirements of the European Union (EU) Construction Products Regulation and the LPC Design Guide for the Fire Protection of Buildings.

d) Foamed insulation shall not be manufactured using HFC, CFC and HCFC processes and shall provide zero Ozone Depletion Potential and a Global Warming Potential of less than 5.

A33.216 Health Hazards

No element or component part of the works shall constitute or be a potential health hazard. The Trade Contractor shall advise of any potential circumstance where this may arise, based on published research and legislation. The Trade Contractor shall accept the exclusions contained in the Contract.

A33.217 Deleterious Materials

The goods and materials listed below shall not be used in the works agreed in advance and in writing by the Architect:

a) Asbestos or asbestos-containing products in any form, as defined in the United Kingdom's The Control of Asbestos Regulations 2012, or any statutory modification or re-enactment.

b) Lead, where the metal or its corrosive products may be directly ingested, inhaled or absorbed. Applications of lead such as roofing, flashings, rainwater goods and copper alloy fittings containing lead, which are specifically required are acceptable, until equal or better alternatives are available.

c) Lead based paints and primers.

d) Expanded polystyrene or polyurethane core sandwich panels shall not be used in the works unless the Trade Contractor complies with all the recommendations of the LPC Design Guide for the Fire Protection of Buildings 2000 from the date of its first publication in December 1999 or any subsequent guidance which supersedes this guidance, or the Factory Mutual (FM) Approval standards, or the recommendations of independent fire consultants Arup Fire or Warrington Fire.

e) Urea formaldehyde foam or materials which may release formaldehyde beyond British Standard limits.

f) Pitch polymer DPC.

g) Materials incorporating mineral fibres, man-made or natural, having a diameter of no more than 3 microns and being 200 microns or less in length, or which contain any fibres not sealed, encapsulated, or otherwise stabilised to ensure that fibre migration is prevented. Regarding mineral wool insulation products, provide test evidence confirming that the materials fulfil the requirements of European Directive 97/69/EC and the CLP Regulation (EC) No 1272/ 2008 (The Classification, Labelling and Packaging of Substances and Mixtures) and consequently are not classified as a possible human carcinogen.

h) Chlorofluorocarbons or hydrochlorofluorocarbons or any goods and/ or materials containing the same (e.g. materials in which CFC, HCFC or HFA have been used as blowing agents).

i) The use of a species of hardwood from the tropical rainforests is not permitted unless it is obtained from sustainable resources.

j) High alumina cement in structural elements.

k) Wood wool slabs in permanent formwork to concrete or in structural elements.

l) Calcium chloride in admixtures for use in reinforced concrete.

m) Aggregates for use in reinforced concrete which do not comply with BS EN 12620 and aggregates for use in concrete which do not comply with the provisions of BS EN 1992.

n) Polychlorinated biphenyls (PCB), polychlorinated terphenyls (PCT) or any goods and/or materials containing the same.

o) Sea dredged aggregates that do not comply with the chloride limits specified in BS EN 206, BS EN 12620, BS EN 1744: Part 1 and BS 8500.

p) Lindane - wood treatment/ insecticidal spray.

q) Pentachlorophenol (PCP) or timber treated with Pentachlorophenol - biocide/ wood preservative.

r) Chromated Copper Arsenate (CCA) timber preservative treatment.

s) Tributyltin (TBT).

t) Gypsum board, 'drywall' or other wall covering material that has been contaminated with sulphur or any other toxic compound or contaminant.

u) Utilise the 'Good Practice in the Selection of Construction Materials 2011' published by the British Council for Offices (BCO) as a guide in regard to deleterious materials.

Workmanship

A33.218 Personnel

Use only skilled and appropriately trained persons to carry out the works.

A33.219 Structural Suitability

Carry out an appropriate structural survey to check line, level and other related items prior to commencement, of any subsequent installation. Report any anomalies which may make the structure unsuitable to proceed and propose remedial action.

A33.220 Setting Out

a) Establish an accurate permanent Base Reference Datum from which all positioned grids and levels are set out.

b) Agree setting out positions and markings with the Architect prior to commencement and retain all such information and marking throughout the period of the works as appropriate.

c) Plan positions of designated marks defining primary grid lines are to located within ±2mm tolerance from the Base Reference Datum.

A33.221 Tolerances

Carry out the works within the required tolerances stated in the Architectural Specification to the satisfaction of the Architect.

A33.222 Compatibility

The materials, products, components, systems and processes are to be compatible.

A33.223 Manufacturer's Instructions

Use and install all materials, products, components and systems strictly in accordance with the manufacturer's printed recommendations and instructions.

A33.224 Covering Up

a) Do not cover up any element of the works without written agreement from the Architect.

b) Provide the Architect with reasonable notice to facilitate his inspection and examination the work that requires covering up.

A33.225 Cutting

a) Cutting on Site shall be minimised. Where it does occur, submit details of methods, controls, etc. to the Architect for review.

b) All cutting shall be straight and free from burrs maintaining flush joints with no gaps or imperfections. Surfaces of base metal are to be protected appropriately.

c) All edges shall be smooth, free from sharp surfaces, snags or points.

A33.226 Deterioration

a) Take adequate measures to prevent any damage from combinations of atmospheric deterioration, atmospheric pollution, corrosion, wet rot, dry rot, fungi, mould, and pH factor of the adjacent elements.

b) Take measures to prevent chemical or electrolytic action occurring where dissimilar metals and/ or materials are joined together.

c) Materials shall not discolour, crack or be damaged by the worst possible combination of environmental conditions prevailing on Site.

d) All substrates shall be compatible with finished surfaces.

e) Remove superficial dust and friable materials during the application of finished surfaces and prevent contamination by dust and other debris.

A33.227 Accuracy

Install all elements of the works such that they are within stated tolerances, plumb or horizontal, lining up with adjacent components, in all directions all in accordance with the Architectural Specification.

A33.228 Method Statements

Provide a detailed Method Statement in accordance with the Contract paying particular attention to quality, workmanship, fabrication processes, fixing, securing, storing, handling, setting out, installation and protection.

A33.300 SUSTAINABILITY/ ENVIRONMENTAL REQUIREMENTS

A33.301 Sustainability Regimes

a) Comply with the Client's environmental and sustainability policy.

b) Where required by the Contract, carry out the works in accordance with the stated BREEAM/ LEED target rating.

c) MAT 03: Responsible Sourcing

   i) All external façade elements must be certified in accordance with an appropriate responsible sourcing scheme, such as BES 6001 or ISO 14001 (key process & supply chain).

   ii) All Steel (structure/light steel framing must be certified in accordance with an appropriate responsible sourcing scheme, such as BES 6001 or ISO 14001 (key process & supply chain).

d) Mat 04: Insulation – External Walls, Roof, Ground Floor and Services

   i) Where the insulation is Trade Contractor designed, it shall have a maximum thermal conductivity of at least 0.035 W/m²K, add specific thermal conductivities.

e) Comply with the Code for Sustainable Homes.

A33.302 Sourcing Sustainable Timber

a) All timber and wood based products used in the works shall be acquired from sustainable sources.

b) Avoid the use of tropical hardwoods (including but not limited to veneers, lippings and manufactured board). If this is unavoidable, inform the Architect in advance and wait instruction.

c) In the event that the use of tropical hardwoods is unavoidable they must be sourced from proven sustainable and known locations.

d) The Forest Stewardship Council's (FSC) Trademark or other label from an equivalent internationally recognised, globally applicable, independent certification system for good forest management shall be clearly used on all timber and timber-based products and be acceptable to the Architect.

e) Plywood shall be obtained from sustainable sources.

f) Provide the following information before placing orders for timber and timber products for acceptance by the Architect:

   i) Country of Origin.

   ii) Trade Name.

   iii) Botanical Name.

   iv) Wood Product Volume Category A (m³).

   v) Wood Product Volume Category B (m³).

   vi) Wood Product Volume Category R (m³).

   vii) Total Volume (m³), where timber is:

   - Category A: From an FSC certified forest.
   - Category B: From a known certifiable forest.
   - Category R: Recycled material.

End of Section

F10 BRICK/ BLOCK WALLING

The particular requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the general requirements specified in the A and Z sections and the particular requirements of other applicable Architectural Specification sections.

F10.100 COMPLIANCE AND SCOPE

COMPLIANCE

F10.101 General

a) Refer to and comply with Section A15.100 of the Architectural Specification regarding the Trade Contractor's design responsibility for this element of the works.

b) Complete the Detailed Design of this element of the works, maintaining the intent of the Design Drawings (A10.102 d) i)), where the Architect's role will be limited to checking compliance with quality, design and visual intent only.

c) Use the reference codes and accompanying descriptions listed on the System Reference Sheet (SRS) to identify materials, products, systems and components, when completing the Detailed Design.

SCOPE

Facing Brickwork

F10.102 Type BRK-101 Clay Facing Brickwork (Cladding Type 1)

Handmade brick special facing brickwork configured and to locations indicated on the Design Drawings.

a) Bricks:
   i) Manufacturer: Floren or acceptable equivalent.
   ii) Reference: Tronco.
   iii) Average compressive strength: To be confirmed.
   iv) Durability designation: F2.
   v) Active soluble salts content: S2.
   vi) Nominal work sizes shall be as indicated on the Design Drawings.
   vii) Typical bricks:
      - 60% white slurry for the typical bricks.
      - White calcium slurry and cream cement shall be applied to the face of the brick before firing to create a white wash effect.
      - The slurry and cement is fired onto the red clay body.
      - The level of calcium/ cement is controlled to provide a 60% coverage.

b) Bond: Half lap stretcher.

c) Mortar:
   i) Type: Cement: Lime: Sand mortar.
   ii) Compressive strength class: M4.
   iii) Colour shall be as accepted by the Architect through sampling.

d) Joint profile: Flush-pigmented mortar.

e) Special features:
   i) Prefabricated lintels (special brick shapes around the opening reveals and lintels) as indicated on the Design Drawings, refer to the Structural Engineer's documentation.
   ii) Prefabricated concrete sills (special L-shapes) for windows and threshold piece for loggias as indicated on the Design Drawings.

F10.103 Type BRK-105 Clay Facing Brickwork (Cladding Type 2)

Clay facing brickwork configured and to locations indicated on the Design Drawings.

a) Bricks:
   i) Manufacturer: Floren or acceptable equivalent.
   ii) Reference: Tronco.
   iii) Average compressive strength: To be confirmed.
   iv) Durability designation: F2.
   v) Active soluble salts content: S2.
   vi) Nominal work sizes shall be as indicated on the Design Drawings.
   vii) Typical bricks:
      - 60% white slurry for the Block C chamfers.

- White calcium slurry and cream cement shall be applied to the face of the brick before firing to create a white wash effect.
- The slurry and cement is fired onto the red clay body.
- The level of calcium/ cement is controlled to provide a 60% coverage.

b) Bond: Half lap stretcher.

c) Mortar:

i) Type: Cement: Lime: Sand mortar.

ii) Compressive strength class: M4.

iii) Colour shall be as accepted by the Architect through sampling.

d) Joint profile: Flush-pigmented mortar.

e) Special features:

i) Chamfered brick slip lintel panels, nominally sized as indicated on the Design Drawings, refer to the Structural Engineer's documentation.

ii) Prefabricated concrete sills and special L-shapes, for loggias as indicated on the Design Drawings:

iii) Prefabricated parapet coping piece. Special L-shape piece for blocks A, C and D as indicated on the Design Drawings.

F10.104 Type BRK-111 Clay Facing Brickwork (Cladding Type 3)

Clay facing brickwork configured and to locations indicated on the Design Drawings.

a) Bricks:

i) Manufacturer: Floren or acceptable equivalent.

ii) Reference: Tronco (with increased mortar slurry finish).

iii) Average compressive strength: To be confirmed.

iv) Durability designation: F2.

v) Active soluble salts content: S2.

vi) Nominal work sizes shall be as indicated on the Design Drawings.

vii) Typical bricks:

- 90% white slurry for the typical bricks.
- White calcium slurry and cream cement shall be applied to the face of the brick before firing to create a white wash effect.
- The slurry and cement is fired onto the red clay body.
- The level of calcium/ cement is controlled to provide a 90% coverage.

b) Bond: Half lap stretcher.

c) Mortar:

i) Type: Cement: Lime: Sand mortar.

ii) Compressive strength class: M4.

iii) Colour shall be as accepted by the Architect through sampling.

d) Joint profile: Flush-pigmented mortar.

e) Special features:

i) Chamfered brick slip panels as indicated on the Design Drawings, refer to the Structural Engineer's documentation.

ii) Prefabricated concrete sills and special L-shapes piece for loggias as indicated on the Design Drawings.

F10.105 Type BRK-115 Clay Facing Brickwork (to Loggias)

Clay facing brickwork configured and to locations indicated on the Design Drawings.

a) Bricks:

i) Manufacturer: Floren or acceptable equivalent.

ii) Reference: Tronco.

iii) Average compressive strength: To be confirmed.

iv) Durability designation: F2.

v) Active soluble salts content: S2.

vi) Nominal work sizes shall be as indicated on the Design Drawings.

vii) Typical bricks:

- 60% white slurry for the typical bricks.

- White calcium slurry and cream cement shall be applied to the face of the brick before firing to create a white wash effect.
- The slurry and cement is fired onto the red clay body.
- The level of calcium/ cement is controlled to provide a 60% coverage.

b) Bond: Half lap stretcher.

c) Mortar:

i) Type: Cement: Lime: Sand mortar.

ii) Compressive strength class: M4.

iii) Colour shall be as accepted by the Architect through sampling.

d) Joint profile: Flush-pigmented mortar.

e) Special features:

i) Concealed IPS brick slip panel for access and maintenance to RWP as indicated on the Design Drawings.

ii) Prefabricated concrete sills (special L-shapes) for windows and threshold piece for loggias as indicated on the Design Drawings.

F10.106 Type BRK-121 Clay Facing Brickwork (Brick Slips)

Clay facing brickwork configured and to locations indicated on the Design Drawings.

a) Bricks:

i) Manufacturer: Floren or acceptable equivalent.

ii) Reference: Tronco.

iii) Average compressive strength: To be confirmed.

iv) Durability designation: F2.

v) Active soluble salts content: S2.

vi) Nominal work sizes shall be as indicated on the Design Drawings.

vii) Brick slips for adhesion to brick soffit cladding system in accordance with the manufacturer's recommendations.

viii) Typical bricks:

- 60% white slurry for the Block C chamfers.
- White calcium slurry and cream cement shall be applied to the face of the brick before firing to create a white wash effect.
- The slurry and cement is fired onto the red clay body.
- The level of calcium/ cement is controlled to provide a 60% coverage.

b) Bond: Half lap stretcher.

c) Mortar:

i) Type: Cement: Lime: Sand mortar.

ii) Compressive strength class: M4.

iii) Colour shall be as accepted by the Architect through sampling.

d) Joint profile: Flush-pigmented mortar.

F10.107 Type BRK-125 Clay Facing Brickwork (Chamfered)

Clay facing brickwork configured and to locations indicated on the Design Drawings.

a) Bricks:

i) Manufacturer: Floren or acceptable equivalent.

ii) Reference: Tronco.

iii) Average compressive strength: To be confirmed.

iv) Durability designation: F2.

v) Active soluble salts content: S2.

vi) Nominal work sizes shall be as indicated on the Design Drawings.

vii) Typical bricks:

- 60% white slurry for the typical bricks.
- 90% white slurry to lintels to Block B.
- White calcium slurry and cream cement shall be applied to the face of the brick before firing to create a white wash effect.
- The slurry and cement is fired onto the red clay body.
- The level of calcium/ cement is controlled to provide a 60% coverage.

b) Bond: Half lap stretcher.

c) Mortar:
   i) Type: Cement: Lime: Sand mortar.
   ii) Compressive strength class: M4.
   iii) Colour shall be as accepted by the Architect through sampling.
d) Joint profile: Flush-pigmented mortar.
e) Special features:
   i) Prefabricated concrete sills and special L-shapes piece for loggias as indicated on the Design Drawings.

Engineering Brickwork

F10.108 Type BRK-201 Engineering Brickwork

Engineering brickwork configured and to locations indicated on the Design Drawings.

a) Engineering bricks:
   i) Manufacturer: Shall be nominated by the Trade Contractor and comply with performance requirements.
   ii) Reference: Shall be nominated by the Trade Contractor and comply with performance requirements.
   iii) Type: HD.
   iv) Engineering bricks shall be manufactured in accordance with BS EN 771: Part 1, BS EN 772: Part 3 and BS EN 772: Part 7, Engineering Class [A/ B].
   v) Bricks shall be solid.
   vi) Average compressive strength: Greater than or equal to 125 N/mm².
   vii) Water absorption: Equal to or less than 4.5%.
   viii) Durability designation: F2.
   ix) Active soluble salts content: S2.
   x) Nominal work sizes shall be 215mm x 102.5mm x 65mm or as otherwise indicated on the Design Drawings.
b) Bond: Half stretcher.
c) Mortar:
   i) Type: Cement: Lime: Sand mortar.
   ii) Compressive strength class: M4.
   iii) Joint profile: Flush.

Common Blockwork

F10.109 Type BLK-301 Common Blockwork

Common blockwork configured and to locations indicated on the Design Drawings.

a) Blocks:
   i) Concrete common blocks.
   ii) Manufacturer: Tarmac Ltd. or acceptable equivalent.
   iii) Reference: Hemelite Standard.
   iv) Type: Loadbearing solid, block units.
   v) Nominal face size shall be 440mm x 215mm.
   vi) Thickness: 100mm.
   vii) Average compressive strength: 3.6N/mm².
   viii) Category: 1.
   ix) Thermal properties: Thermal conductivity (maximum) certified by UKAS accredited laboratory at 3% moisture content to BS 874-2.1: 0.38 W/mK.
b) Bond: Stretcher, unless indicated otherwise by the detail shown on the Design Drawings.
c) Mortar:
   i) Type: Cement: Lime: Sand mortar.
   ii) Compressive strength class: M4.
d) Joint profile: Half lap stretcher bond.

F10.200 QUALITY AND WORKMANSHIP

SUBMITTALS

F10.201 Tender Submittals

A design response shall be submitted with the Tender proposal, including the following:

a) Pre-contract samples, where specified.

b) A list of tests to be included.

c) Proposed QA/ QC programme.

d) A list of Working Drawings to be submitted.

e) A summary of any proposed deviations from the Architectural Specification and Design Drawings.

f) Outline technical specifications/ data sheets of proposed materials/ systems.

g) A list of proposed suppliers and sub-contractors.

F10.202 Pre-contract Samples

The following pre-contract samples shall be provided:

a) Not required.

F10.203 Post Contract Samples

The following post contract samples shall be provided:

a) 3 No. samples of each type of brick.

b) 3 No. samples of each type of block.

c) Prior to commencement of the works, a sample panel, nominally 3000mm x 3000mm, of each type of masonry walling, with all options of mortar specified, shall be constructed on Site in an agreed location using randomly selected masonry units but rejecting any that are damaged. Prior to commencement of construction for that type, acceptance from the Architect shall be obtained and if a panel is rejected, further sample panels of each type shall be constructed until acceptance is obtained from the Architect.

F10.204 Mock-ups

The following mock-ups shall be provided:

a) Not required.

F10.205 Prototypes

The following prototypes shall be provided:

a) Test certification that complies with all performance requirements and warranty providers' requirements, shall be submitted. If test certification is not submitted a prototype (including testing) will be required for the external cladding including all components and finishes.

F10.206 Quality Benchmarks

In locations to be agreed with the Architect, provide the following quality benchmarks:

a) First 10m² of each type of masonry walling incorporating, where possible, accessories as identified in Section F30 of the Architectural Specification including all interfacing with adjacent substrates/ finishes.

TESTING

F10.207 General

a) Refer to Section A33 for the general requirements for testing and the approach to off-Site and on-Site testing.

b) Provide independently certified test data and Agrément certificates that demonstrate that the proposed systems meet the performance requirements of the Architectural Specification.

c) Where data from previous independently certified tests and Agrément certificates demonstrate that the proposed systems meet the performance requirements of the Architectural Specification, off-Site independent testing need not be undertaken.

d) Acceptance shall only be given to materials that comply with the standards set out in the Architectural Specification. Inform the Architect of test results for materials not complying. The official certification of test results shall be given after acceptance and before manufacture of the materials.

e) Undertake all on-Site testing specified herein, which shall be carried out by an independent testing body accredited by the United Kingdom Accreditation Service (UKAS).

F10.208 Testing of Masonry

a) Sampling and testing shall be carried out in accordance with BS EN 1052 and BS EN 772 as applicable with further testing and sampling being performed if the materials do not comply with the Architectural Specification.

b) As soon as the masonry has been accepted, validated documentary evidence of testing shall be provided or the Testing Body shall be instructed to undertake testing for compressive strength, absorption percentage, soluble salt content, drying shrinkage or moisture expansion, durability and density and tolerance in dimensions.

On-Site Testing

F10.209 Testing of Mortar

Undertake testing for compressive strength of mortars as described in Section Z21 of the Architectural Specification.

F10.210 Air Permeability - Exfiltration

a) Provide actual air exfiltration results from tests for acceptance. Refer to Section A33 for the 'Airtightness Fan Test' of the building envelope.

b) Air exfiltration rates shall be within the limits specified. Any areas of excessive air leakage identified shall be rectified at the Trade Contractor's expense.

F10.211 Acoustic Testing

a) The works shall be tested in accordance with BS EN ISO 10140 to verify that the quoted minimum sound reduction specifications are met by the works as a whole. Tests shall commence at a time agreed with the Architect and results shall be submitted in writing to the Architect within three weeks of the completion of the tests.

b) Site sound insulation tests shall be undertaken in accordance with the requirements of the Acoustic Report and witnessed by the Architect to determine the installed sound level difference and apparent sound reduction index in one-third octave bands in accordance with BS EN ISO 10140.

ARCHITECTURAL AND FUNCTIONAL REQUIREMENTS

F10.212 General

a) Brickwork shall form walls of half brick, brick, brick and a half thickness or skins of wall as indicated on the Design Drawings.

b) Blockwork shall form internal or external walls, or skins of walls as indicated on the Design Drawings.

c) Walls shall be to dimensions and arrangement indicated on the Design Drawings.

d) Works shall include all required masonry accessories to complete the works, meet performance requirements and suit service conditions. Refer also to Section F30 of the Architectural Specification.

e) Blockwork which is to receive a rendered or plastered finish, shall have a recessed mortar joint, to provide a key.

f) Blockwork designated as required to be airtight shall be regularly inspected to ensure that all bed joints and perpends are fully filled with mortar that has been tooled on the outer face to ensure that the mortar is fully compressed. Airtight sealant shall be applied at all abutments and interfaces to other works and components.

g) Unless otherwise specified, mortar shall be a cement:lime:sand mix of designation confirmed by the Trade Contractor to suit performance requirements both above and below the damp-proof course (DPC).

i) Refer to Table NA.2. of NA to BS EN 1996: Part 1-1 for details of mortar designations.

ii) There shall be no colour difference between exposed mortar above or below the DPC.

F10.213 Consistency for Fair-faced Work

a) Agree with the manufacturer and the Architect, methods for ensuring that the supply of masonry units to remain visible is of a consistent, even colour/ texture range, batch to batch and within batches.

b) Check each delivery for consistency of appearance with previous deliveries and with accepted samples or reference panels. Do not use materials which do not match accepted appearances/ samples until accepted by the Architect.

c) Mix units from different packs and deliveries that vary in colour to avoid undesirable variations, patches, horizontal stripes and racking back marks in the finished work.

MATERIALS AND COMPONENTS

F10.214 Bricks

a) Clay bricks shall be manufactured in accordance with BS EN 771: Part 1.

b) Concrete bricks shall be manufactured in accordance with BS EN 771: Part 3.

c) Special shapes and sizes of clay and calcium silicate bricks shall be manufactured in accordance with BS 4729.

F10.215 Blocks

a) Concrete blocks shall be manufactured in accordance with BS EN 771: Part 3.

b) Limit individual block weights to 20kg (44lb) for single person handling. Under exceptional circumstances, where a heavier block is required, carry out a risk assessment to comply with the CDM regulations.

F10.216 Mortar

a) Refer to Section Z21 of the Architectural Specification.

b) Masonry mortar shall be as specified and in accordance with BS EN 1996.

c) Sand for facework mortar shall be in accordance with BS EN 13139 and be from one source to ensure consistency of colour and texture. Samples of sand proposed shall be submitted in accordance with the requirements of the Architectural Specification identifying the name of supplier, the pit the material came from, sieve analysis and maximum aggregate size, which shall be agreed with the Architect.

d) As an alternative to that specified, ready-mix mortar may be submitted for the acceptance of the Architect.

PERFORMANCE

F10.217 General

The works shall comply with the general performance requirements of Section A15 of the Architectural Specification in addition to the following specific performance requirements.

Structural

F10.218 Loads

The works shall be designed and installed to achieve adequate and satisfactory performance with regard to building use category in accordance with BS EN 1996, PD 6697 and BS EN 1991: Part 1.

F10.219 Design Loads

a) Masonry work shall withstand the loads as specified without affecting the system's ability to meet the specified performance. Unless otherwise stated, the works shall also be designed to comply with all prevailing relevant British Standards as appropriate, including, but not necessarily limited to BS 6180 and BS 6399.

b) When calculating design loads the worst combination shall be considered, taking account of the fact that the pressure coefficients at various locations may determine more than one design criterion.

c) Masonry work shall be capable of accommodating its self-weight and masonry accessories.

F10.220 Imposed Gravity Loads

The works shall be capable of accommodating loads imposed by adjacent and/or interfacing elements that bear onto, are suspended from or are fixed to the system.

F10.221 Live Loads

The works shall be capable of accommodating the following live loads without any reduction in performance:

a) All loads resulting from movements of the building structure.

b) A horizontal line load applied to the works, due to the occupants, in accordance with BS 6180 and BS 6399.

c) Known impact loads, or transferred impact loads.

d) Wind loads.

e) Horizontal and vertical loads of similar magnitude to those that are imposed upon adjacent or attached elements.

F10.222 Wind/ Air Pressure Loads

a) Refer to the requirements in Section A15 of the Architectural Specification.

b) Calculated pressure loads shall include the effect of internal air pressures within the building, taking into account the presence of significant openings, which might arise occasionally within the building enclosure.

F10.223 Specific Movements and Deflections

a) Refer to the Structural Engineer's documentation and the Building Movement and Tolerances Report.

b) The works shall be designed in accordance with the recommendations of BS EN 1996 and, in the case of low-rise buildings, the recommendations of BS 8103: Part 2.

c) The works shall be designed and installed to allow for and withstand all deflections and tolerances of the main structural elements under all design loads or combination of loads without damage or reduction in the performance of the works.

d) All fixings shall be capable of providing the correct degree of movement required for the circumstances involved, to suit deflections specified and to provide adequate stability for the works.

e) Movement joints shall be provided to accommodate all movements of the building structure in accordance with BS EN 1996.

f) At junctions with adjoining work, control joints shall be located as indicated on the Design Drawings.

F10.224 Thermal Movement

a) Allow for local thermal movements exerted due to climatic conditions.

b) The works, including masonry accessories, shall be designed to accommodate changes in dimension and shape of its components resulting from changes in service temperatures and from differential surface temperatures between the inside and outside of the building without any reduction in the specified performance. The design shall cater for all temporary and permanent conditions envisaged for the works.

c) The annual surface temperature ranges for the materials used in the works shall be confirmed during the Detailed Design period, both for external surface temperatures and internal temperatures when the building is in normal use and when empty or out of use. Due regard shall be made to the effects of orientation of the building towards the sun.

F10.225 Inertial Loads

The works shall be capable of accommodating inertial loads arising due to the acceleration/ deceleration of moving elements which interface with the works.

Environmental

F10.226 Moisture Movement

a) The works shall withstand movement without permanent deformation or any reduction in the specified performance:

i) Due to changes in the moisture content of its components, resulting from variations in the moisture content of the air.

ii) Due to the expansion of absorbed or retained moisture caused by freezing.

b) Allowance shall be made to control the flow of any water that may enter the works and for directing this water to the outside, such that no water remains internally, or that elements designed to remain dry become wet.

F10.227 Thermal Performance Requirements

a) Detail the works to minimise thermal bridging in any area of the system.

b) The maximum permitted thermal transmittance (U-value) for the works, taking into account the complete wall assembly, shall be ***0.35W/m²K or better/ in accordance with the Thermal Modelling Report.***

c) The average U-value throughout the works shall comply with the above requirements and meet all Statutory requirements as well as Approved Document Part L of the Building Regulations.

d) Submit thermal calculations for the various components and the overall thermal performance of the proposed works to comply with the specified requirements.

F10.228 Air Permeability - Infiltration

a) The Detailed Design shall control airflow from the outside to the inside of the building. Air infiltration shall be distributed and not concentrated at any one location.

b) The works including all interfaces shall be constructed to maintain, or assist with the maximum air infiltration rate of interfacing external wall systems, or achieve a maximum air infiltration rate of 1.5m³/hr/m² when used in isolation of other external wall systems.

c) Test at a minimum pressure of 600Pa when tested generally in accordance with the CWCT Standard for Systemised Building Envelopes. The specified performance requirements shall not be exceeded in both the initial and repeat tests.

d) Provide actual air leakage results from tests for acceptance.

F10.229 Air Permeability - Exfiltration

a) The Detailed Design shall control airflow from the inside to the outside of the building. Air exfiltration shall be distributed and not concentrated at any one location.

b) The works including all interfaces shall be constructed to achieve compliance with Approved Document Part L of the Building Regulations.

c) Provide actual air exfiltration results from tests for acceptance.

F10.230 Capillarity

Water migration caused by capillarity shall be prevented in areas that are designed to remain dry.

F10.231 Weather and Water Penetration Resistance

The works, including flashings and junctions with adjacent parts of the building, shall be weatherproof and watertight under all conditions, with full allowance made for deflections and other movements, ensuring the prevention of water leakage onto the internal face of the works and any other part of the system that may be adversely affected.

Acoustic

F10.232 General

a) Refer to the Acoustic Report.

b) The works shall effectively insulate the internal areas of the building from high levels of external noise.

c) The works shall achieve single value weighted sound reduction value(s) to BS EN ISO 717: Part 1 as stated in the Acoustic Report.

d) Evidence shall be provided to confirm that the acoustic requirements have been met.

Fire

F10.233 General

a) Refer to the Fire Strategy Report.

b) Where fire ratings of systems are indicated, these shall be deemed to be for integrity and insulation.

c) Unless stated otherwise in the Fire Strategy Report, the works shall comply with BS 7974 and with Approved Document Part B of the Building Regulations and all other relevant British Standards and other codes specifically detailed in the Approved Document, including testing to BS 476.

F10.234 Reaction to Fire

Materials shall be either non-combustible or not easily ignitable with low flame spread characteristics and shall not produce excessive quantities of smoke or toxic gases under combustion, confirmed by testing in accordance with the appropriate parts of BS 476, unless otherwise stated.

F10.235 Fire Resistance

a) Where a floor or wall in the building is a fire-resisting separation, the junction between the works and the floor or wall shall maintain the integrity and insulation of the fire compartmentation, to prevent fire spread. Materials used to complete the junction shall accommodate movement between the works and other elements and their fire resisting performance shall not be affected by water from sprinkler discharge.

b) Horizontal/ vertical cavity barriers and fire/ smoke stopping shall be provided within the works, including at the junction of the works with all other fire resisting elements of the building, in compliance with Approved Document Part B of the Building Regulations.

c) All fire/ smoke barriers/ stops shall be positively fixed in position, in accordance with the manufacturers' recommendations, in such a manner that they shall not become dislodged in the event of a fire. The fixing shall secure the barrier/ stop in position for a period at least equal to that required for the compartment wall or floor against which the works abut.

d) Ensure a tight fit between the works and cavity barriers to prevent fire and smoke penetration.

Durability

F10.236 General

a) The performance criteria shall be satisfied for the full service life of the works, as stated in the Architectural Specification, provided always that the maintenance has been carried out as specified.

b) Selected materials shall be durable and satisfy the requirements of the Architectural Specification for the service life of the works.

c) Exposure to sunlight during the lifetime of the works shall not reduce the performance or visual appearance of any element/ component. Take into consideration expected solar performance under varying conditions of solar radiation and air velocity.

d) The works shall perform throughout the service life without failure resulting from defects in design, materials or workmanship. Failure shall be defined as breakage, disengagement of components, deflection beyond stated values, reduction in performance or unacceptable change in appearance including breakage.

e) The works shall comply with Section 5 of Approved Document Part A of the Building Regulations, with regard to accidental damage/ robustness.

f) Corrosion or staining resulting from water running from one material to another shall be prevented.

F10.237 Abrasion Resistance

The works shall resist abrasion from agreed cleaning methods and maintenance systems without any noticeable change in surface appearance.

F10.238 Impact Resistance

a) Generally, surfaces shall be sufficiently hard to resist heavy impacts from hand-held objects without any noticeable change to the surface appearance.

b) The extent of any damage determined through testing shall be recorded and, where possible, quantified. Samples shall also be submitted to the Architect.

WORKMANSHIP

F10.239 General

a) Site installation shall be carried out in accordance with BS EN 1996 and BS 8000: Part 0 and BS 8000: Part 3.

b) Materials and components shall be clean and not damaged or unduly wet.

c) Masonry shall be built uniform and level within the tolerances specified.

d) Quoins and jambs shall be plumbed as the work advances and the head of all walls shall be laid level.

e) Cutting of materials shall only be done by a power-driven masonry saw. They shall then be wet hosed down to remove any slurry and dried prior to laying. Cut faces shall not be exposed unless agreed with the Architect.

f) Where they are incorporated into the works, the reveal edges to service openings shall be treated as fair-faced.

g) Head restraints shall be provided as required in accordance with Section F30 of the Architectural Specification, fixed to top courses, which consist only of full size, uncut units. Cut materials that reduce the structural or fire-rating integrity of the wall shall not be used.

F10.240 Handling and Site Storage

a) Materials shall be delivered to Site suitably packaged to prevent damage and contamination and shall be clearly identified with type, grade, date of manufacture, etc.

b) Materials shall be checked, handled and stored in accordance with the recommendations of BS 8000: Part 0 and BS 8000: Part 3.

c) Labels or packaging shall not be removed until time for use.

d) Materials shall be inspected before use and any that are cracked, damaged or contaminated shall be rejected.

e) Masonry units shall be stored in stable stacks clear of the ground, clearly identified by type, strength, grade, etc., protected from adverse weather, moisture, staining and contamination with earth and other foreign materials and kept clean and dry. Air shall be allowed to circulate around units.

f) All materials and components shall be stacked, before and after delivery to Site, in such a manner that they will not be damaged in any way through excessive stresses or by atmospheric deterioration. Particular attention shall be paid to the finished surfaces.

g) Block units shall be handled carefully to prevent chipping, breakage, soiling or other damage. Lifting shall be executed using wide-belt type slings wherever possible; wire rope or ropes containing tar or other substances that might cause staining shall not be used. If required, wood rollers shall be used and a cushion provided at the end of wood slides.

F10.241 Laying of Masonry Units

a) Masonry units shall be laid on a full bed of mortar, properly jointed with other work, to correct lines and levels.

b) Mortar shall be applied to obtain full vertically aligned perpend joints. Slushing of perpend joints or furrowing of bed joints shall not be allowed.

c) Courses shall be maintained to uniform widths.

d) Vertical and horizontal joints shall be equal and of the same thickness.

e) Except where indicated otherwise, all intersections, external corners and internal corners shall be fully bonded.

f) After the mortar has taken initial set, units shall not be adjusted. If adjustment is necessary, mortar shall be completely removed and replaced.

g) Any excess mortar shall be removed as the work proceeds.

h) Unless dictated by the confines of the Site, overhand laying shall be avoided and shall be subject to acceptance of the Architect.

i) Cavities shall be kept clear of excess mortar and debris by placing battens in the cavity, which shall be cut slightly narrower than the cavity width, supported on wall ties and raised between levels by attaching wires at the ends.

j) Rack back when raising quoins and other advance work. Do not use toothing.

k) No part of the work shall be raised more than 1.2m above another at any time.

l) In facework, complete each lift in one period of operation.

m) Any one leaf of a wall shall not be carried up more than 1500mm high in one day, unless permitted by the Architect.

n) Locations for equal levelling of cavity wall leaves shall be as follows:

   i) Each course containing vertical twist type ties or other rigid ties.

   ii) Every third tie course for double triangle/ butterfly ties.

   iii) Courses in which lintels will be bedded.

o) The gauge shall be based on the combined height of four courses of masonry unit including bed joint with a tolerance of ±2mm.

F10.242 Control Joints

a) Standard joint details and locations shall be indicated on the Design Drawings.

b) Refer to Section F30 of the Architectural Specification.

c) The works shall be divided into panels separated by control joints, which shall be located such that the length of each panel is nominally 6m, or as indicated on the Design Drawings.

d) Where possible, vertical control joints shall coincide with the structural support elements and shall utilise proprietary sleeved tie anchors, as specified in Section F30 of the Architectural Specification.

e) Control joints not indicated on the Design Drawings shall be at junctions with a column or different material and shall be restricted to the corner of abutting walls where possible.

f) Joint fillers, sealants and/or fire stops shall be in accordance with the respective manufacturer's written instructions/ recommendations.

F10.243 Mortar Joints

a) Masonry shall be well buttered with mortar before being laid and filled at each course.

b) The thickness of mortar joints shall be consistent in appearance and density.

c) Carry out tooling of joints while the mortar is thumbprint hard.

d) Any excess mortar that extrudes from the joints of fair-faced units shall be removed as work proceeds and not smeared on to the face of the works. Washing or scrubbing of the finished face with proprietary cleaners or acids shall not be permitted. Instead, smears shall be removed by gentle brushing off with a soft brush and water only to avoid staining of the surface of the works.

F10.244 Finishes

a) Keyed finish: Where indicated on the Design Drawings, rake out joints to a nominal depth of 10mm to receive render/ plaster as the work proceeds.

b) Fair-faced finish: Where indicated on the Design Drawings, the works shall have a fair-faced finish with all joints finished neatly to the specified profile.

F10.245 Services

Service penetrations through the works shall be provided in accordance with the Services Engineer's documentation and the fire integrity of the works shall be maintained in compliance with the relevant British Standards.

F10.246 Fire Stopping

Fire and smoke stops shall be positively fixed in position in such a manner that they shall not become dislodged in the event of a fire and shall remain in position for a period at least equal to that required for the compartment wall or floor against which the works abut.

F10.247 Scaffolding

Putlog scaffolding shall not be permitted to facework.

F10.248 Lintels

Full-length block units shall occur immediately under lintel ends.

F10.249 Working in Adverse Weather

a) Frozen materials shall not be used.

b) Masonry units shall not be laid when the air temperature is at or below 3°C unless mortar has a minimum temperature of 4°C when laid and walling is protected. Mortar shall not be laid on frozen or frost covered surfaces.

c) Temperature of the work shall be maintained above freezing until mortar has fully hardened.

d) Mortar damaged by frost shall be raked out and replaced. When instructed, damaged work shall be rebuilt.

e) Newly erected work shall be protected from rain and snow and drying out too rapidly in hot conditions and dry winds.

F10.250 Cleaning

a) Work shall be immediately cleaned down prior to completion or prior to the handing over of any part of the work and left clean, to the acceptance of the Architect.

b) Wire brushes, acid type cleaning agents or other cleaning compounds with caustic or harsh constituents shall not be used.

F10.251 Site Dimensions and Setting Out

a) Site dimensions shall be taken as necessary to ensure a proper fit between the masonry and adjacent work and to achieve specified installation tolerances.

b) The Trade Contractor shall be responsible for the true and proper setting out of the works, the correctness of position, levels, dimensions and alignment of all walling including openings.

c) Before work commences on Site, proposed methods for dimensional setting out and crosschecking with other trades to achieve the required accuracy shall be submitted.

d) All controlling dimensions, particularly at interfaces with surrounding elements, shall be observed and all dimensions shall be checked on Site.

e) Setting-out dimensions shall be determined from grid lines as indicated on the Design Drawings.

f) All formers as necessary shall be provided to achieve the required opening sizes and tolerances.

F10.252 Tolerances

a) The maximum permissible/ acceptable deviation from the required dimension of the masonry shall be in accordance with Table 2 of BS 8000: Part 3.

b) Notwithstanding the provisions of BS 8000, tolerances shall be reduced when, for the purposes of fit and/or appearance, the tolerances within BS 8000 would fail to meet the design intent and dimensional criteria required by the works.

End of Section

F30 ACCESSORIES/ SUNDRY ITEMS FOR BRICK/ BLOCK/ STONE WALLING

The particular requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the general requirements specified in the A and Z sections and the particular requirements of other applicable Architectural Specification sections.

F30.100 COMPLIANCE AND SCOPE

COMPLIANCE

F30.101 General

a) Refer to and comply with Section A15.100 of the Architectural Specification regarding the Trade Contractor's design responsibility for this element of the works.

b) Complete the Detailed Design of this element of the works, maintaining the intent of the Design Drawings (A10.102 d) i)), where the Architect's role will be limited to checking compliance with quality, design and visual intent only.

c) Use the reference codes and accompanying descriptions listed on the System Reference Sheet (SRS) to identify materials, products, systems and components, when completing the Detailed Design.

F30.200 QUALITY AND WORKMANSHIP

SUBMITTALS

F30.201 Tender Submittals

A design response shall be submitted with the Tender proposal, including the following:

a) Pre-contract samples, where specified.

b) A list of tests to be included.

c) Proposed QA/ QC programme.

d) A list of Working Drawings to be submitted.

e) A summary of any proposed deviations from the Architectural Specification and Design Drawings.

f) Outline technical specifications/ data sheets of proposed materials/ systems.

g) A list of proposed suppliers and sub-contractors.

F30.202 Pre-contract Samples

Not required.

F30.203 Post Contract Samples

Provide the following post contract samples:

a) Minimum 3 No. of each accessory type.

F30.204 Mock-ups

The following mock-ups shall be provided:

a) Not required.

F30.205 Prototypes

The following prototypes shall be provided:

a) Test certification that complies with all performance requirements and warranty providers' requirements, shall be submitted. If test certification is not submitted a prototype (including testing) will be required for the external cladding including all components and finishes.

F30.206 Quality Benchmarks

In locations to be agreed with the Architect, provide the following quality benchmarks:

a) The first installation of each element co-ordinated with the requirements for quality benchmarks in other masonry sections of the Architectural Specification.

TESTING

F30.207 Generally

a) Independently certified test result data shall be provided for each accessory type demonstrating that it meets the requirements of the Architectural Specification.

b) In the case where test results for a material or product are not available, testing at an independent testing laboratory acceptable to the Architect shall be undertaken to demonstrate compliance with the Architectural Specification .

c) Test certificates shall not relieve the Trade Contractor of responsibilities to meet the requirements of the Architectural Specification with regard to the performance and integrity of materials and products used within the works.

d) Compressible fire seals shall be tested to demonstrate their capability of withstanding 50% compression with recovery proven over 20,000 cycles.

e) Compressible fire seals shall be tested at a recognised laboratory to demonstrate their capability to withstand structural movement, in shear.

f) Seals shall be tested at a recognised laboratory for gaps up to 200mm for 3 hours' fire resistance and gaps up to 100mm for 4 hours' fire resistance and the depth of individual seals shall be verified in these tests.

ARCHITECTURAL AND FUNCTIONAL REQUIREMENTS

F30.208 Generally

a) Accessories shall be provided as necessary to meet the performance requirements and maintain the stability of the work in accordance with the recommendations of BS EN 1996 and BS 8000.

b) Only elements suitable for the application and capable of accommodating differential movement between elements as necessary shall be used. Frequency of ties shall be increased as necessary to withstand loading and adequately restrain insulation.

c) During construction, exposed ends of wall ties shall be adequately protected from damage.

MATERIALS AND COMPONENTS

Ties, Restraints and Support Systems

F30.209 Internal Head Restraint Ties

Concealed type internal head restraint ties with slotted holes and debonding PVC sleeve.

a) Dimensions: To satisfy details indicated on the Design Drawings.

b) Conformance:

i) BS EN 845: Part 1.

ii) CE Marked.

c) Material: Austenitic stainless steel, grade 1.4301.

d) Indicative product: Ancon IHR-B.

F30.210 Surface Mounted Channels/ Slots

Proprietary cast-in masonry support channel/ slot.

a) Dimensions: To satisfy details indicated on the Design Drawings.

b) Conformance:

i) BS EN 1090: Part 1.

ii) CE Marked.

c) Material: Austenitic stainless steel, grade 1.4301.

d) Fixing: M8 stainless steel bolts fixed at the following centres:

i) 900mm centres to concrete columns.

ii) 450mm centres to blockwork.

F30.211 Channel/ Slot Ties

Proprietary tie for use with surface mounted channel.

a) Dimensions: To satisfy details indicated on the Design Drawings.

b) Conformance:

i) BS EN 1090: Part 1.

ii) CE Marked.

c) Material: Austenitic stainless steel, grade 1.4301.

d) End types: Full bond with blockwork.

e) Additional requirements: Install at maximum 450mm centres.

F30.212 Slip Ties

General purpose slip ties for movement joints to internal walls.

a) Dimensions: 250mm long.

b) Conformance:

i) BS EN 845: Part 1.

ii) CE Marked.

c) Material: Austenitic stainless steel, grade 1.4301.

d) Indicative product: Ancon PPS.

e) Fixing centres: 450mm maximum centres.

F30.213 Wall Ties

a) Suitable wall ties free from sharp, pointed edges.
b) Conformance:
    i) BS EN 845: Part 1.
    ii) CE Marked.
c) Material: Austenitic stainless steel, grade 1.4301.
d) Wall ties shall be British Board of Agrément (BBA) certified.
e) Where required, ties shall include stainless steel insulation fixing roses/ retention clips.
f) Where required, ties shall achieve the performance requirements.

F30.214 Wall Starters

Proprietary stainless steel wall starter.

a) Dimensions: To satisfy details indicated on the Design Drawings.
b) Conformance: BS EN 845: Part 1.
c) Material: Austenitic stainless steel, grade 1.4301.

F30.215 Bed Joint Reinforcement

Proprietary stainless steel bed ladder-type joint reinforcement.

a) Width: To satisfy block thickness.
b) Conformance:
    i) BS EN 845: Part 3.
    ii) CE Marked.
c) Material: Austenitic stainless steel, grade 1.4301.
d) Frequency: In accordance with the manufacturer's recommendations.
e) Other information: 90° corners shall be formed with factory prefabricated return pieces.

F30.216 Wind Posts

Proprietary intracavity stainless steel channel profile wind post.

a) Dimensions: To satisfy zones indicated on the Design Drawings.
b) Conformance:
    i) Design: BS EN 1993.
    ii) Manufacture: BS EN 1090: Part 1.
c) Material: Austenitic stainless steel, grade 1.4301.
d) Form: Rolled stainless steel with system compatible joint tangs.
e) Frequency: Refer to the Structural Engineer's documentation.
f) Indicative product: 'U' Channel as manufactured by IG.

F30.217 Wind Posts

Proprietary perpend stainless steel angle profile windpost.

a) Dimensions: To satisfy zones indicated on the Design Drawings.
b) Conformance:
    i) Design: BS EN 1993.
    ii) Manufacture: BS EN 1090: Part 1.
c) Material: Austenitic stainless steel, grade 1.4301.
d) Form: Rolled stainless steel angle with system compatible joint tangs.
e) Frequency: Refer to the Structural Engineer's documentation.
f) Indicative product: WP2 Wind Post as manufactured by Ancon.

F30.218 General

a) Suitable sliding anchors shall be provided.
b) Suitable dovetail slot ties shall be provided.
c) Material: Austenitic stainless steel, grade 1.4301.
d) Suitable angle supports in galvanised mild steel shall be provided.

F30.219 Lintels

a) Dimensions: As indicated on the Design Drawings plus manufacturer's minimum bearing.
b) Conformance: BS EN 845: Part 2.
c) Indicative manufacturer/ reference: To be confirmed.
d) Smooth surface required where associated blockwork receives paint finish.

Joints

F30.220 Movement Joints

Suitable movement joints shall be provided with or without sealant.

a) The thickness of the filler shall match the design width of the joint.

b) Refer to Section Z22 of the Architectural Specification for sealants.

Insulation

F30.221 General

a) The insulation shall be inert, durable, rot-proof and vermin-proof and shall not be degradable by moisture, temperature or water vapour unless the Detailed Design of the system protects the insulation from the need for such requirements.

b) The insulation shall not bulge, sag, delaminate or detach during its installation or when in situ during the service life of the works.

c) Insulation shall be CFC and HFC free, shall have zero Ozone Depleting Potential (ODP) and have a Global Warming Potential (GWP) of less than five.

d) Insulation shall achieve an A or A+ rating as defined in the BRE Green Guide to Specification.

e) All insulation shall comply with all relevant British Standards and be British Board of Agrément (BBA) certified.

Fire Prevention

F30.222 Fire Prevention Joints

a) Suitable fire stopping shall be provided using inorganic products with the same fire resistance ratings as the wall elements. Fire stopping materials shall be non-combustible when tested in accordance with BS 476.

b) Fire stopping materials shall:

i) Be compatible with adjacent materials with which they come in contact

ii) Be stable at ambient temperatures.

iii) Not harden or crack with age.

iv) Accommodate all reasonable building movement and live load deflection, as specified within the Architectural Specification, without loss of seal and reduction in fire insulation performance

c) Cavities around openings shall be closed using proprietary thermal or fire resisting insulated cavity closers.

d) Cold applied joint sealants shall be in accordance with BS EN 14188: Part 2.

e) Preformed and compressible joint seals shall be in accordance with BS EN 14188: Part 3.

f) Refer also to the requirements of BS 6093.

Damp-proofing

F30.223 DPC/ Cavity Trays

a) Damp-proofing shall meet the requirements of BS 8215.

b) The membrane shall be impermeable, rot-proof and resistant to specified extremes of movement and environmental temperatures. The membrane shall be moisture resistant, vapour permeable and airtight where necessary.

c) Membranes shall be compatible with, and maintain the performance requirements of, interfacing damp-proofing and gas resistant systems.

d) Membranes shall be lapped at least 100mm and bonded according to the manufacturer's recommendations.

e) Materials generally shall be in accordance with BS 743, BS 6398, BS 6515 and BS 8215.

f) Polymeric materials shall be in accordance with BS 6398.

g) Polyethylene shall be in accordance with BS 6515.

h) Elastomer based (EPDM) materials shall be in accordance with BS 6014.

i) Where specified, bitumen DPC shall meet the requirements of BS 6398.

j) Suitable cavity trays, junction cloaks and stop ends shall be provided.

F30.224 Weepholes

Suitable perpend joint plastics weepholes shall be provided.

Ventilation

F30.225 Ventilation

a) Suitable ventilation ducts shall be provided.

b) Suitable white plastic cavity ventilators shall be provided.

Sills/ Coping Units/ Dressings

F30.226 Sills

Suitable sills shall be provided.

a) Conformance: BS 5642: Part 1.

b) Colour and finish shall be agreed with the Architect based on submitted samples.

F30.227 Coping Units

Suitable coping units shall be provided.

a) Conformance: BS 5642: Part 2.

b) Finish, colour and texture shall be agreed with the Architect based on submitted samples.

F30.228 Dressings

Suitable cast stone dressings shall be provided.

a) Conformance:

i) BS 1217, Grade A.

ii) UK Cast Stone Association (UKCSA) recommendations.

b) Surface absorption shall be agreed to comply with conformance.

c) Finish and colour shall be agreed with the Architect based on submitted samples.

Fixings

F30.229 General

a) Fixings shall be of austenitic stainless steel or wrought/ continuously cast copper alloy.

b) Fixings shall be of the type, size, strength and number necessary to prevent any lateral displacement or pulling apart of the construction and to resist all loads likely to occur during the design life of the building.

PERFORMANCE

F30.230 General

The works shall comply with the general performance requirements of Section A15 of the Architectural Specification and the requirements for masonry as specified in the relevant section of the Architectural Specification.

WORKMANSHIP

Installation

F30.231 General

a) Unless specified otherwise, the works shall be installed in accordance with the manufacturer's written recommendations, BS 8000 and all other relevant British Standards.

b) If frames are not to be built in as the work proceeds, openings shall be formed using rigid templates and accurately fabricated to the required size.

c) Ties and damp-proofing shall be kept free from debris and mortar. Jointing, fixings, damp-proofing, etc. shall be installed in a neat and workmanlike manner.

F30.232 Cavity Fill

Cavities shall be filled up to 225mm below ground level DPC with concrete mixed in accordance with BS 8500: Parts 1 and 2 and BS EN 206, designated mix GEN 3 or Standard mix ST4, high workability.

F30.233 Fixings

Where exposed to view, fill pockets with bedding mortar, neatly finished flush.

Ties, Restraints and Support Systems

F30.234 Restraint Ties

Where restraint ties do not have a proprietary debonding sleeve, before building into the joint one half of the length shall be debonded by wrapping with polyethylene sheet.

F30.235 Wall Ties

a) Wall ties shall be bedded by at least 50mm into the bed joint of each leaf.

b) Wall ties shall slope towards the outside with the drip centred on the cavity.

c) Wall ties shall be spaced in accordance with the recommendations of BS EN 845: Part 1, BS EN 1996 and BS 8000: Part 3.

d) Additional wall ties shall be provided to sides of openings in accordance with BS EN 1996.

e) The frequency of wall ties shall be increased as necessary to withstand loading and adequately restrain the walls.

f) During construction all exposed ends of wall ties shall be protected from damage.

F30.236 Bed Joint Reinforcement

a) Bed joint reinforcement shall be concealed within the joint.

b) The reinforcement shall be approximately 40-50mm less in width than the wall or leaf.

c) Bed joint reinforcement shall be laid on an even bed of mortar in a continuous strip with 225mm laps at joints and full laps at angles, shall be kept back 20mm from the face of the external work and 12mm from the face of the internal work and the mortar joint shall be finished to the normal thickness.

F30.237 Lintels

Unless specified otherwise, prefabricated steel lintels shall be bedded on mortar used for adjacent work with a bearing of at least 150mm .

F30.238 Building Trough Lintels

a) Trough lintels shall be laid on a full bed of mortar the same as used for adjacent work. Packing, where required, shall be slate.

b) Temporary shuttering with polystyrene gaskets, or acceptable equivalent, shall be used to separate blocks.

c) Shutter ends, install the reinforcement using plastic spacers, or acceptable equivalent, and pour concrete in accordance with the manufacturer's written recommendations.

d) Hand tamp the concrete in accordance with the trough lintel block manufacturer's written recommendations.

e) When the concrete has set, gaskets shall be removed and joints shall be pointed to match adjacent walls.

f) Units shall be positioned accurately, true to line and level.

g) Hollow section trough concrete blockwork units shall be cut to match the wall thickness and the bond of the blockwork. The quality and finish of trough lintel blocks shall completely match the blockwork.

h) Construction of trough lintels shall be in accordance with the block manufacturer's written recommendations.

i) Concrete infill and reinforcement shall be in accordance with the block manufacturer's written recommendations.

j) End bearings of 190/ 220mm shall be provided on walls.

Joints

F30.239 Movement Joint with Sealant

a) Build in filler as the work proceeds ensuring no projections into cavities and correct depth of joint to receive sealant system.

b) Prepare joints and apply sealant in accordance with Section Z22 of the Architectural Specification.

F30.240 Movement Joint without Sealant

a) Build in filler as the work proceeds, completely filling the joint but without projecting into cavities.

b) Where the filler is fire resistant, compress, insert and slide it into place in the open joint.

c) Where recommended in writing by the manufacturer, install with accessories or adhesives.

Insulation

F30.241 Cavity Wall Insulation

a) During the course of construction, insulation shall be kept dry and free from mortar droppings, grout and other debris in accordance with BS 8000.

b) External cavity wall insulation:

i) In locations to suit the blockwork coursing, stainless steel fasteners shall be impaled through the insulation slab, using a minimum of five fasteners for each insulation slab.

ii) Insulation slabs shall be situated against the inner leaf.

iii) When three courses of blockwork have been built up, partial fill cavity slabs shall be moved against the blockwork, ensuring that the fasteners are fully engaged into blockwork joints and mortar. Fasteners shall be bedded and the fourth course then added. The procedure shall be repeated with successive insulation slabs and blockwork courses.

c) The full cavity insulation shall be stored, handled and installed in accordance with relevant standards, ensuring that no gaps are left in the insulation layer.

d) Partial cavity insulation shall be fixed steadfastly to the inner leaf, while ensuring that:

i) Board edges do not become damaged.

ii) Boards are close butted at closures and at horizontal and vertical joints.

iii) Joints between boards are kept clean, dry and free from any debris.

iv) The residual cavity is not blocked or bridged by of insulation offcuts.

e) Each course of insulation shall be located and secured before building up inner leaf above level of previous course of insulation.

Damp-proofing

F30.242 DPC/ Cavity Trays

a) DPC and cavity trays shall be installed in accordance with BS 8215 and BS 8000.

b) Damp-proofing shall be built in carefully in accordance with the manufacturer's written recommendations, ensuring completely watertight installation.

c) Laps shall be sealed with DPC and/ or cavity trays using adhesive/ mastic/ torching in accordance with the manufacturer's written recommendations to ensure a completely watertight installation.

d) DPC/ cavity trays shall be bedded on an even bed of fresh mortar. They shall not, under any circumstances, be bedded dry.

e) DPC/ cavity trays shall extend through the entire width of the wall, including any surface finish and shall not, under any circumstances, be bridged by mortar.

f) Unless otherwise specified, the width of DPC/ cavity trays shall allow for a 5mm projection on both sides of the masonry.

g) Joints between cavity trays shall be fully sealed. During and after the formation of the joint, preparatory support/ jointing boards shall be obtained from the cavity tray manufacturer and placed across it.

h) High frequency welded, factory fabricated preformed cloaks shall be used at all changes in direction and in order to terminate all discontinuous cavity trays above and below openings.

i) Projections within the cavity, such as columns, wind posts and cavity barriers, that occur at the same level as recurrent cavity trays shall be fully sealed using preformed cloaks.

j) Confirmation that the detailing complies with all current legislation shall be obtained from the preformed DPC/ cavity tray manufacturer.

F30.243 Weepholes

a) Perpends at 900mm centres shall be left fully open in the course immediately above the base of the cavity, external openings and stepped DPC. No fewer than two weepholes over openings shall be provided.

b) Weepholes of 10mm diameter in the horizontal joint shall be neatly formed immediately above the base of the cavity, external openings and stepped DPC at 900mm centres coincidental with perpends. Weepholes shall not be blocked. No fewer than two weepholes over openings shall be provided.

c) Form with plastics perpend units in accordance with the manufacturer's written recommendations immediately above the base of the cavity, external openings and stepped DPC. No fewer than two weepholes over openings shall be provided.

Ventilation

F30.244 Ventilating Ducts

a) Ventilating ducts shall be installed across the cavity, sloping away from the inner leaf, fully bedded in the mortar to seal the cavity.

b) A stepped DPC/ cavity tray shall be formed over the duct, extending 150mm on both sides and with stop ends.

Sills/ Dressings

F30.245 Sills

Bed joints shall be left open under one-piece sills except under end bearings. On completion, joints shall be pointed with mortar to match adjacent work.

F30.246 Dressings

a) Cast stone dressings shall be laid on a full bed of colour matched mortar.

b) All joints shall be filled and neatly finished flush.

End of Section

G13 LIGHT STEEL FRAMING SYSTEMS

The particular requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the general requirements specified in the A and Z sections and the particular requirements of other applicable Architectural Specification sections.

G13.100 COMPLIANCE AND SCOPE

COMPLIANCE

G13.101 General

a) Refer to and comply with Section A15.100 of the Architectural Specification regarding the Trade Contractor's design responsibility for this element of the works.

b) Complete the Detailed Design of this element of the works, maintaining the intent of the Design Drawings (A10.102 d) i)), where the Architect's role will be limited to checking compliance with quality, design and visual intent only.

c) Use the reference codes and accompanying descriptions listed on the System Reference Sheet (SRS) to identify materials, products, systems and components, when completing the Detailed Design.

SCOPE

Light Steel Framing Systems

G13.102 Type SFS-101 Light Steel Framing System

Loadbearing metal section stud wall system, such as Steel Framing System (SFS) by voestalpine Metsec plc or acceptable equivalent, forming a backing wall between or across the external face of perimeter elements of the primary structure, or an internal backing wall, to receive cladding externally and linings internally, comprising:

a) Loadbearing metal section stud walling:

   i) Vertical and horizontal primary sections, head and base tracks, intermediate studs, joists, runner channels, bracing, ties, angles, cleats, reinforcement, bracketry (adjustable as required) and other necessary requirements formed from corrosion resistant metalwork.

   ii) Framing shall span between structure, fixed back to structural frame at each floor.

   iii) Additional supports shall be provided at window openings, services penetrations and other such positions, as required.

   iv) Where deflection head details shall be exposed and visible to the building user under normal building use, they shall comply with the visual intent and be incorporated into the system as indicated on the Design Drawings. Where they are not indicated, propose options for acceptance by the Architect, whilst complying with the requirements of the Architectural Specification.

b) Suitable damp-proof course/ membrane to all base and head channels laid against building structure and other interfaces as required.

c) Where not provided as part of the cladding system(s), provide suitable sheathing board(s) and/ or intermediate pattresses, insulation and cover plates to external column faces, slab edges and other locations as required, to provide continuous, rigid external lining suitable to receive external cladding. Sheathing boards, where required, shall be continuous past the floor structure.

d) Where not provided as part of the cladding system(s), include insulation either independent of or fixed to the cavity face of the sheathing board. The Trade Contractor shall determine the type, thickness and density of the insulation to maintain thermal performance requirements.

e) Where not provided as part of the cladding or lining system(s), include insulation as required (within the framework) and internal board lining to achieve the acoustic requirements. The Trade Contractor shall determine the type, thickness and density of the insulation to maintain acoustic performance requirements.

f) Where not provided as part of the cladding or lining systems, include all necessary breather membranes, vapour control layers and air barriers.

g) Co-ordinate internal and external interfacing works with the relevant contractor, to enable their installation to suitably interface with the loadbearing metal section stud wall system as required to maintain performance requirements, as indicated on the Design Drawings.

   i) The works shall accommodate interfacing systems in a manner acceptable to the manufacturers.

   ii) The Trade Contractor shall liaise with the interfacing contractors regarding the design of the system and setting-out requirements and shall factor all components into any necessary calculations.

h) Fixings shall be:

   i) Concealed unless accepted otherwise by the Architect.

   ii) Fixed directly to the structure:

- Provide and install all fixing devices, including framing, bearing brackets and movement fixings and carry out all necessary preparation work such as drilling, plugging, screwing, bolting, cutting for anchor bolts or sockets to be cast-in, making good, including grouting-in of anchor bolts, and fixing whatsoever necessary.
- All fixings shall be to the slab edge face condition, to be co-ordinated with the superstructure design.
- Submit details of all fixings for review and acceptance by the Architect.

i) The system shall include all necessary components and accessories to complete the fabrication and installation.

G13.200 QUALITY AND WORKMANSHIP

SUBMITTALS

G13.201 Tender Submittals

A design response shall be submitted with the Tender proposal, including the following:

a) Pre-contract samples, where specified.

b) A list of tests to be included.

c) Proposed QA/ QC programme.

d) A list of Working Drawings to be submitted.

e) A summary of any proposed deviations from the Architectural Specification and Design Drawings.

f) Outline technical specifications/ data sheets of proposed materials/ systems.

g) A list of proposed suppliers and sub-contractors.

G13.202 Pre-contract Samples

The following pre-contract samples shall be provided:

a) 300mm x 300mm sample of each type to specified substrate.

G13.203 Post Contract Samples

The following post contract samples shall be provided:

a) Sample of flat plate (approximately 500mm square) coated with each type of protective coating and architectural finish specified.

b) Following acceptance by the Architect, this sample shall be kept at the works and used as a reference to establish consistency of finished work during the course of the application and shall be a point of reference regarding quality of finish to be achieved.

G13.204 Mock-ups

The following mock-ups shall be provided:

a) Not required.

G13.205 Prototypes

The following prototypes shall be provided:

a) Test certification that complies with all performance requirements and warranty providers' requirements, shall be submitted. If test certification is not submitted a prototype (including testing) will be required for the external cladding including all components and finishes.

G13.206 Quality Benchmarks

In locations to be agreed with the Architect, provide the following quality benchmarks:

a) First 9m² or 5m of each type.

TESTING

G13.207 General

a) Refer to Section A33 of the Architectural Specification for the general requirements for testing and the approach to off-Site and on-Site testing.

b) Off-Site testing:

i) Submit any previously derived test data for the proposed backing wall system. Refer also to the testing requirements included in sections for the external cladding and internal linings interfacing with the works specified herein.

c) On-Site testing:

i) The Trade Contractor shall include for all on-Site testing specified herein. Refer also to the testing requirements included in sections for the external cladding and internal linings interfacing with the works specified herein.

d) Where data from previous independently certified tests and Agrément certificates demonstrate that the proposed systems meet the performance requirements of the Architectural Specification, off-Site independent testing need not be undertaken.

e) Provide certificates from a United Kingdom Accreditation Service (UKAS) accredited laboratory acceptable to the Architect confirming that the wall constructions meet the performance requirements.

On-Site Testing

G13.208 Air Permeability - Exfiltration

a) Provide actual air exfiltration results from tests for acceptance. Refer to Section A33 of the Architectural Specification for the 'Airtightness Fan Test' of the building envelope.

b) Air exfiltration rates shall be within the limits specified. Any areas of excessive air leakage identified shall be rectified at the Trade Contractor's expense.

G13.209 Testing of Fixings

As the work proceeds, allow for structural fixings to be proof load tested as required and witnessed by the Structural Engineer.

G13.210 Thermal Performance Testing

a) Thermography testing shall be carried out to ensure that insulation is continuous using a suitable thermal imaging method to be proposed by the Trade Contractor. The testing method shall be subject to acceptance by the Architect.

b) Insulation shall be proven to be continuous. Any areas of excessive heat loss identified shall be rectified at the Trade Contractor's expense.

ARCHITECTURAL AND FUNCTIONAL REQUIREMENTS

G13.211 General

a) The components of the entire assembly shall be covered by a single source warranty. Therefore, approval shall be obtained from the manufacturer for all materials to be used.

b) The Detailed Design shall allow for the fixing of components integral to the system as recommended in writing by the manufacturer, and without detriment to the performance.

c) The Detailed Design shall allow for the subsequent fixing of external cladding systems and/ or internal lining systems of varying materials described elsewhere in the Architectural Specification and as indicated on the Design Drawings.

d) Joints:

i) Methods of jointing components within the system shall be in accordance with the manufacturer's recommendations, ensuring that the design intent requirements of the external cladding systems and internal lining systems are maintained.

ii) Movement joints shall accommodate all specified movements whilst maintaining the overall system performance.

e) Where required, the works shall be sealed at interface conditions, including where penetrations occur, to maintain the air permeability/ fire and acoustic performance.

f) Where required, the works shall include all necessary barriers and stops to meet the requirements of the Architectural Specification.

g) Determine the type, thickness and density of insulation and any integral or separate overlay to meet the requirements of the Architectural Specification.

G13.212 Services

a) Systems shall accommodate services, such as those required by the Services Engineer, in a concealed manner acceptable to the Architect.

b) Locations/ positioning of services shall be agreed with the Architect where not indicated on the Design Drawings.

c) Provide all necessary seals, gaskets and support framing where services penetrate or interface with the works.

MATERIALS AND COMPONENTS

Metalwork

G13.213 General

a) Refer to Section Z11 of the Architectural Specification.

b) Structural steelwork shall comply with the Structural Engineer's documentation.

c) Refer to Section Z30 of the Architectural Specification for general finishes to metalwork.

Sheathing Boards

G13.214 General

a) Propose suitable sheathing boards with regard to the requirements of interfacing systems, the following are indicative examples only and are not deemed exhaustive.

b) Sheathing board shall meet the requirements of PD CEN/TR 12872, as applicable.

G13.215 Particleboard

Cement bonded particleboard to BS EN 634 and BRE Digest 477 Part 3 of suitable class(es) and thickness(es).

G13.216 Fibre Cement Board

Fibre cement board to BS EN 12467 of suitable class(es) and thickness(es).

G13.217 Calcium Silicate Board

Fibre reinforced calcium silicate board products of suitable class(es) and thickness(es).

G13.218 Glass Granulate Board

Resin bonded recycled glass granulate board products of suitable class(es) and thickness(es).

G13.219 Bitumen Impregnated Fibreboard

Bitumen impregnated fibreboard shall only be used in conjunction with cavity barriers in accordance with Approved Document Part B of the Building Regulations.

G13.220 Plywood

a) Plywood used in the works shall achieve the following minimum requirements:
   i) Service class 3 in accordance with BS EN 636.
   ii) Minimum class 3 (WBP) bond quality in accordance with BS EN 314, in thickness to suit the design and performance requirements.
   iii) Plywood durability shall be minimum Use Class 3 in accordance with BS EN 335 unless otherwise accepted by the Architect.
   iv) Dimensional tolerances shall be in accordance with BS EN 315.
b) Finish shall be suitable for its location, sanded where finished or unsanded where not visible.
c) Preservative treatment shall be as Section Z12 of the Architectural Specification and in accordance with TRADA recommendations.

Fixings

G13.221 General

a) Refer to Section Z20 of the Architectural Specification.
b) Fixing components shall comply with all statutory requirements and shall be acceptable to the Structural Engineer in terms of strength and type and shall be designed to achieve the requirements of the Architectural Specification. Select suitable components and fixings in accordance with the requirements of the Architectural Specification.
c) Where necessary, fixing components shall be capable of adequate three-dimensional adjustment.
d) Fixings shall not interfere with profiles of internal linings, flooring and finishes.
e) Only suitable materials shall be used.
f) Fixings shall be inherently corrosion resistant or fully protected to prevent corrosion.
g) The type, size and positioning of all bolts, anchors, brackets, screws, rivets and nuts shall be shown on the Working Drawings, together with full details of their installation technique and torque settings, where appropriate.
h) Visible fixings shall be of a type agreed with the Architect prior to installation.

G13.222 Cleats, Angles, Brackets and Other Components

a) Galvanised mild steel fixing components used in the fixing assemblies shall comply with BS 7668, BS EN 10029, BS EN 10210, BS EN 10025: Parts 1-4 and BS EN 10025: Part 6 and rolled sections shall be used wherever practicable or appropriate. Steel sections used shall be hot dip galvanised to the requirements of BS EN ISO 1461 after all cutting, drilling for holes and welding has been complete
b) High grade austenitic stainless steel exterior quality fixing components used in the fixing assemblies shall comply with BS EN 10088, BS EN 10084, BS EN 10250: Part 4, BS EN 10095, BS EN 10048, BS EN 10051, BS EN ISO 9445: Parts 1 and 2 and BS 8298: Parts 1, 2, 3 and 4.
c) All non-visible supporting aluminium sub-constructions shall be corrosion protected. Mill finished aluminium shall not be used. Aluminium sub-constructions shall be separated from concrete by bitumen paint or similar acceptable method. Austenitic stainless steel to BS EN 10088 may be used in lieu of aluminium for any supporting sub-constructions.
d) Fixing bolts, nuts, screws and washers shall be manufactured from austenitic stainless steel complying with BS EN ISO 3506: Parts 1 and 2. All screw fixings and attachments shall be secured against vibrating loose.

G13.223 Fixings, Bolts, Anchors, Screws, Rivets, Shear Pins, Nuts, Washers and Other Components

a) Mild steel in accordance with BS 4190, BS EN ISO 4016, BS EN ISO 4034 and BS EN ISO 898: Parts 1 and 2.
b) Austenitic stainless steel complying with BS EN ISO 3506: Parts 1 and 2.
c) Aluminium alloy of appropriate grade complying with BS EN 754: Parts 3-5, BS EN 755: Parts 1-9, BS EN 573: Part 3, BS EN 515 and BS EN 12020: Parts 1 and 2.

Sealants and Gaskets

G13.224 Sealants

a) Refer to Section Z22 of the Architectural Specification.

b) Sealant products shall be used in accordance with the system manufacturer's recommendations, to suit the service conditions.

c) Sealant shall not leak or bleed causing any discolouration and run-off staining.

G13.225 Gaskets

a) Refer to Section Z36 of the Architectural Specification.

b) Gaskets shall be made of either Ethylene Propylene material (EPDM/ EP) or of Silicone.

Damp-proof Courses

G13.226 Damp-proof Courses

Provide suitable damp-proof courses in either polyethylene to BS 6515 or polymeric material to BS 6398.

Membranes

G13.227 Breather Membrane

a) Membranes shall be water resistant, water vapour permeable and manufactured from non-woven, spunbonded high density polyethylene, or acceptable equivalent.

b) Membranes shall be certified to an internationally recognised Agrément Certificate to the acceptance of the Architect.

c) Vapour resistance of the breather membrane shall be not greater than that of the substrate it is protecting.

d) Membranes shall be of limited combustibility and achieve Class 0 propagation and surface spread of flame, unless the Detailed Design of the system protects the membrane from the need for such requirements.

G13.228 Vapour Control Layers/ Air Leakage Barrier

a) High performance reinforced membranes of metal foil or plastics, protected both sides by rigid facings/ linings to meet the performance criteria specified. Foil adhered to plasterboard shall not be accepted.

b) The product shall perform as an air barrier.

c) Membranes shall be certified to an internationally recognised Agrément Certificate to the acceptance of the Architect.

d) Vapour resistance of the material shall be correct for the specific application.

e) Include all necessary tapes, seals and accessories to provide a fully vapour and air sealed system at joints, perimeter conditions and penetrations.

f) Membranes shall be of limited combustibility and achieve Class 0 propagation and surface spread of flame, unless the Detailed Design of the system protects the membrane from the need for such requirements.

Insulation

G13.229 Materials

a) Mineral fibre products shall comply with BS EN 13162.

b) Extruded polystyrene (XPS) products shall comply with BS EN 13164.

c) Rigid polyurethane foam (PUR) products shall comply with BS EN 13165.

d) Phenolic foam (PF) products shall comply with BS EN 13166.

e) Cellular glass (CG) products shall comply with BS EN 13167.

f) Rigid polyisocyanurate foam (PIR) products shall comply with BS 4841.

G13.230 Particular Requirements

a) Insulation behind cladding elements shall be inert, durable, rot-proof and vermin-proof and shall not be degradable by moisture, extreme temperatures or water vapour, unless the Detailed Design of the system protects the insulation from the need for such requirements.

b) The insulation shall not bulge, sag, delaminate or detach during its installation or when in situ during the life of the works.

c) All combustible foam products shall be fire resistant modified.

d) Insulation shall be a minimum of Euroclass A2.

e) Insulation shall have zero Ozone Depleting Potential (ODP), be CFC and HFC free and have a Global Warming Potential (GWP) of less than five. Refer also to Section A33 of the Architectural Specification.

f) Insulation shall be selected to meet the recommendations of 'The Green Guide to Specification' and shall have a minimal environmental impact when assessed using BREEAM criteria.

g) The selected insulation shall comply with all relevant British Standards and be British Board of Agrément (BBA) certified.

h) Expanded polystyrene (EPS) shall not be permitted within the works.

PERFORMANCE

G13.231 General

The works shall comply with the general performance requirements of Section A15 of the Architectural Specification in addition to the following specific performance requirements.

Structural

G13.232 General

The works installation shall transfer all loads to the building structure in a statically determined manner. Work requiring mechanical fixing shall ensure that failure of any fixing shall not lead to progressive failure of others.

G13.233 Specific Movements

a) Refer to the Building Movement and Tolerances Report.

b) The works shall be capable of accommodating loads imposed upon the system by defined movements of its supporting structure and/ or other adjacent elements.

G13.234 Deflections

a) Accommodate the structural movements indicated in the Building Movement and Tolerances Report, in particular mid-span deflections of slab edge beams.

b) The works shall not deflect under loading in any way that is detrimental to any element of the works or adjacent structural or building elements.

c) The works shall accommodate defined differential structural movements arising from any loads imposed by adjacent structures.

d) The magnitude of the allowable deflections shall be reduced if they are detrimental to any part of the works, its support structure or internal finishes.

G13.235 Design Loads

a) The system shall be designed to withstand the loads as specified below without affecting the system's ability to meet the specified performance requirements and/ or the exceptional loads specified herein. Unless otherwise stated, the system shall also be designed to comply with all prevailing relevant British Standards as appropriate, including, but not necessarily limited to BS 6180 and BS 6399.

b) When calculating design loads the worst combination shall be considered, taking account of the fact that the pressure coefficients at various locations may determine more than one design criterion.

c) The works shall be capable of accommodating the self-weight gravity loads of the system including all of its framing and supporting system.

G13.236 Imposed Gravity Loads

The works shall be capable of accommodating loads imposed by adjacent and/ or attached elements that bear onto, are suspended from or fixed to the system. Refer to the Design Drawings for information on such elements and/ or required load capacities. No elements from other trades shall be fixed to and/ or supported by the system, unless accurately specified, indicated on the Design Drawings and/ or agreed by the Architect.

G13.237 Live Loads

The works shall be capable of accommodating the following live loads without any reduction in performance:

a) Applied loads acting on the surface of the works arising from maintenance and cleaning operations. The works shall sustain safely, without reduction in performance and without permanent deformation to any component, a static 500N load applied through a square of 100mm sides.

b) Loads applied to the works in accordance with BS 6180 and BS 6399.

c) Increased weight due to unintended water absorption, snow and ice.

d) Known impact loads, or transferred impact loads, that occur during the service life, without deterioration in performance and without sustaining non-repairable damage.

e) Loads imposed during replacement of system components.

f) Wind loads.

g) Horizontal and vertical loads of similar magnitude to those that are imposed upon adjacent or attached elements. Refer to the Design Drawings for information on such elements and/ or required load capacities.

G13.238 Wind/ Air Pressure Loads

Calculated pressure loads shall include the effect of internal air pressures within the building, taking into account the presence of significant openings, which might arise occasionally within the building enclosure.

G13.239 Thermal Movement

a) Allow for local thermal movements exerted due to climatic conditions.

b) The works, including all necessary support structure, shall be designed to accommodate changes in dimension and shape of its components resulting from changes in service temperatures and from differential surface temperatures between the inside and outside of the building without any reduction in the specified performance. The design shall cater for all temporary and permanent conditions envisaged for the works.

c) The annual surface temperature ranges for the materials used in the works shall be confirmed by the Trade Contractor during the Detailed Design period, both for external surface temperatures and internal temperatures when the building is in normal use and when empty or out of use. Due regard shall be made to the effects of orientation of the building towards the sun.

d) Ensure that thermal movements do not result in unacceptable levels of audible noise.

G13.240 Inertial Loads

The works shall be capable of accommodating inertial loads arising due to the acceleration/ deceleration of moving sections including opening panels, doors and vents of the building or enclosure. Advise the Architect regarding the motion requirements for such elements.

G13.241 Exceptional Loads

There is no requirement to make provision for exceptional loads,

Environmental

G13.242 Moisture

a) Light steel framing erected on the perimeter of the building and temporarily exposed to the weather shall have a corrosion protective system to the appropriate standard.

b) The works shall withstand movement without permanent deformation or any reduction in the specified performance:

i) Due to changes in the moisture content of their components, resulting from variations in the moisture content of the air.

ii) Due to the expansion of absorbed or retained moisture caused by freezing.

c) Provision shall be made to control the flow of any water that may enter the system and for directing this water to the outside, such that no water remains internally.

G13.243 Thermal Performance Requirements

The average thermal transmittance (U-value) for the works shall be derived from the combined system of the light steel framing system and the particular rainscreen/ cladding system for which it provides support.

G13.244 Air Permeability/ Infiltration

a) The Detailed Design shall minimise airflow from the outside to the inside of the building through joints/ junctions to control concentrated airflow.

b) The works shall resist the passage of air such that its air leakage rates, if measured in accordance with the CWCT Standard, shall not be exceeded in both the initial and repeat tests.

c) The works including all interfaces shall be constructed to achieve a maximum air infiltration rate of 1.5 m^3/ hr/ m^2.

d) Performance requirements shall be tested at a minimum pressure of 600Pa when tested generally in accordance with the CWCT Standard for Systemised Building Envelopes. The specified performance requirements shall not be exceeded in both the initial and repeat tests.

e) Air leakage shall be distributed and not concentrated at any one location.

f) Provide actual air leakage results from tests for acceptance by the Architect.

G13.245 Condensation

a) No condensation shall occur on internal surfaces or adjacent surfaces of the works under the temperature and humidity conditions listed in Section A15 of the Architectural Specification.

b) Determine the interstitial condensation risk of the works as recommended in BS 6229 but with the calculation method modified to conform to BS 5250 to ensure that damage due to interstitial condensation does not occur. Submit calculations to the Architect for agreement based on the atmospheric data given.

c) The calculated amount of winter interstitial condensate shall not exceed 0.5kg/ m^2 for non-fibrous and closed cell insulation materials and 0.35kg/ m^2 for fibrous insulation materials. Calculated annual net retention shall not exceed 5% of winter condensation.

G13.246 Capillarity

Prevent water migration, caused by capillarity, to areas that are designed to remain dry.

G13.247 Weather and Water Penetration Resistance

a) The works shall be weatherproof and watertight, thus ensuring the prevention of water leakage onto the internal face of the works, and any other part of the system that may be adversely affected.

b) The works, including flashings and junctions with adjacent parts of the building, shall be weatherproof and watertight under all conditions, with full allowance made for deflections and other movements, ensuring the prevention of water leakage onto the internal face of the works and any other part of the system that may be adversely affected.

c) The Detailed Design of the works shall not be based on a single line of defence. The cavities between the lines of defence shall be drained to the exterior. Wet applied seals for the purpose of preventing the ingress of water shall not be accepted, and all such seals and gaskets shall be 'dry'.

d) The Detailed Design and construction of the works shall be such that all rigid or fixed joints shall remain rigid and accommodate all thermal, building structure or other movements and any applicable loads without compromising its watertightness. All movement joints shall also be finally designed and constructed to accommodate such loads or movements without compromising the works' watertightness.

G13.248 Local Factors

a) Visit the Site in order to become familiar with local requirements. Local microclimatic conditions shall be taken into account and grades of materials assessed as suitably durable for the location shall be selected.

b) An assessment of microclimatic conditions shall be made with due allowance for any factors likely to have an adverse effect on materials intended for the works. More appropriate materials shall be substituted if adverse effects are predicted.

Acoustic

G13.249 General

a) The works shall provide the sound insulation levels specified below, which are to be achieved on Site for each type, inclusive of all service penetrations and interfaces with other elements.

b) The Weighted Sound Reduction Index (Rw) shall be defined according to BS EN ISO 717.

c) Provide certificates from a United Kingdom Accreditation Service (UKAS) accredited laboratory acceptable to the Architect confirming that the works meet the laboratory performance requirements.

d) The underside lining of all exposed works shall provide a good standard of sound absorption to minimise internal reverberant sound levels:

i) The internal lining and treatment shall be capable of achieving a mean sound absorption co-efficient of 0.7-0.8 when tested in accordance with BS EN ISO 354.

e) Provide evidence that the acoustic performance requirements can be achieved.

f) The works, including all interfaces, shall be constructed so that any necessary expansion joints are designed to permit noiseless movement.

g) Air movement across the works shall not cause audible rattling, whistling or other attention catching noise.

Fire

G13.250 General

a) Refer to the Fire Strategy Report.

b) Unless stated otherwise in the Fire Strategy Report, the works shall be in compliance with BS 7974. and with Approved Document Part B of the Building Regulations and all other relevant British Standards and other codes specifically detailed in the Approved Document, including testing to BS 476.

G13.251 Reaction to Fire

Materials shall be either non-combustible or not easily ignitable with low flame spread characteristics and shall not produce excessive quantities of smoke or toxic gases under combustion, confirmed by testing in accordance with the appropriate Parts of BS 476, unless otherwise stated.

G13.252 Fire Resistance

a) Where a floor or wall in the building is a fire-resisting separation, the junction between the works and the floor or wall shall maintain the integrity and insulation of the fire compartmentation, to prevent fire spread. Materials used to complete the junction shall accommodate movement between the works and other elements and their fire resisting performance shall not be affected by water from sprinkler discharge.

b) Horizontal/ vertical cavity barriers and fire/ smoke stopping shall be provided within the works, including at the junction of the works with all other fire resisting elements of the building, in compliance with Approved Document Part B of the Building Regulations.

c) All fire/ smoke barriers/ stops shall be positively fixed in position, in accordance with manufacturers' recommendations, in such a manner that they shall not become dislodged in the event of a fire. The fixing shall secure the barrier/ stop in position for a period at least equal to that required for the compartment wall or floor against which the works abut.

Durability

G13.253 General

a) Selected materials shall be durable and satisfy the requirements of the Architectural Specification for the design life of the works.

b) The works shall perform throughout its design life without failure resulting from defects in design, materials or workmanship. Failure is defined as breakage, disengagement of components, deflection beyond stated values, reduction in performance or unacceptable change in appearance including breakage.

c) Accidental Damage/ Robustness: The works shall comply with Section 5, meeting requirement A3 of Approved Document Part A of the Building Regulations.

d) Electro-chemical corrosion or staining resulting from water running from one material to another shall be prevented.

WORKMANSHIP

G13.254 General

a) Where applicable, the works shall be carried out in accordance with the manufacturer's recommendations.

b) Make due allowance for the sequencing of the whole works and all interfaces.

c) Operatives shall be trained in the installation of the works and, where applicable, be recommended by the system manufacturer.

Storage

G13.255 General

a) Do not deliver components to Site until required or until there is suitable storage space and do not remove protective packaging/ covering until immediately before required for fixing.

b) Adequate storage shall be provided for all components to maintain them free from damage and in conditions suitable for their required moisture content.

c) All elements of framework and associated components shall be stored on Site such that they shall not be damaged, distorted or weathered unevenly.

d) All finished components shall be carefully packed in stillages or crates such that they are suitably separated and protected to prevent scratching, scuffing, or other surface damage.

e) All materials shall be stored on Site in accordance with the manufacturer's recommendations.

Preparation

G13.256 General

a) Before commencing installation, survey the structure, checking dimensions, line, level and fixing points before commencement and report immediately to the Architect if the structure is unsuitable to receive the works.

b) All loose material shall be removed.

c) Noggings, bearers, etc. required to provide fixing points for heads running parallel with, but offset from main structural supports, or to support fixtures, fittings and services, shall be accurately positioned and securely fixed. After fixing boards, the positions of noggings and bearers shall be marked for following trades.

d) All works shall be carried out in accordance with the manufacturer's materials and workmanship recommendations.

Installation

G13.257 General

a) The works shall be installed using continuous profiles, being free from marks, defects, flaws, steps, waves, or damage of any nature.

b) The works shall be set out in the correct position, within tolerance, and in the correct relationship to the building structure.

c) Acceptance shall be obtained from the Architect and Structural Engineer before drilling or cutting parts of the structure, other than where indicated on the Working Drawings.

d) Where applicable, isolating tape, plastic washers or other suitable means shall be used to prevent bi-metallic corrosion between dissimilar metals.

e) The works shall be installed square, regular to line, level and plane at all junctions fitting to the stated tolerances.

f) Do not cut, drill or otherwise alter the work of others to accommodate the system installation without first seeking the acceptance of the Architect.

g) Do not alter prefinished surfaces except where shown on the Working Drawings or otherwise agreed with the Architect.

h) Fix in unjointed lengths. Where running joints are unavoidable, undertake in accordance with the manufacturer's recommendations.

i) The fixing, jointing and finishing of the works, where not specified otherwise, shall be as recommended by the manufacturer.

G13.258 Loadbearing Wall Systems

a) Loadbearing wall systems shall be fixed in accordance with the manufacturer's recommendations.

b) Studs shall be positioned at equal centres, maintaining sequence across openings. Additional studs shall be provided as necessary to ensure suitable support with regard to the service conditions.

c) Provide support for handrails and/ or equipment, fixtures and fittings and provide additional support framing and fixing points within the system.

G13.259 Sheathing Board

a) Sheathing board shall be installed in accordance with the manufacturer's recommendations to comply with the requirements of the Architectural Specification.

b) Provide all necessary movement joints whilst maintaining the performance of the system.

c) Fix boarding with long edges vertical and centred on supports. Leave a clear expansion gap between adjacent boards to manufacturer's recommendations. Fill as necessary with suitable sealant.

d) Fastenings shall not protrude above the surface of the board.

e) Cement particleboard shall not be used in direct contact with non-anodised or uncoated aluminium, copper or lead.

G13.260 Fixings

a) Refer to Section Z20 of the Architectural Specification.

b) All fixings shall be installed in accordance with the manufacturer's recommended procedure.

G13.261 Adhesives

Refer to Section Z20 of the Architectural Specification.

G13.262 Sealants

a) Refer to Section Z22 of the Architectural Specification.

b) Acoustic/ air pressure sealant shall be applied to perimeter junctions with walls, floors and ceilings, air gaps around openings and other potential leakage points including framing members and around fire stops.

c) Fire sealants shall be applied as required to meet the requirements of the Architectural Specification.

d) Sealants shall not compromise the integrity of the works.

e) Apply as a continuous bead unless specified or recommended otherwise by the manufacturer.

G13.263 Breather Membrane

a) Breather membranes shall be installed in accordance with the manufacturer's recommendations to comply with the requirements of the Architectural Specification.

b) Before fixing, the moisture content of the substrate shall be checked and shall be below 20%.

c) Material shall be fixed carefully and neatly to provide a fully sealed membrane free from tears, punctures and sagging to provide a complete barrier to water, snow and wind blown dust/ particles.

d) Staples shall be used for fixing at maximum 250mm centres along all supports. Sheets shall only be lapped at supports. Horizontal laps shall be minimum 100mm, vertical laps shall be minimum 150mm and staggered to shed water away from the substrate and structure. Ensure that the membrane is secured at the reveals/ perimeters of all openings.

e) All joints and edges, including around pipes, ducts, etc. shall be sealed with adhesive tape as recommended by the membrane manufacturer.

f) Immediately before covering over, membranes shall be checked for perforations and any found shall be repaired or replaced to the satisfaction of the Architect.

G13.264 Vapour Control Layer/ Air Barrier

a) The rolls of vapour/ air barrier material shall be handled carefully to avoid puncturing and to prevent damage and shall not be stored on end. For long-term storage the rolls shall be protected from ultraviolet light indoors and under non-translucent covers.

b) Prevent damage to the vapour/ air barrier material during the construction stage and from becoming wet due to adverse weather conditions.

c) Programme the installation so that it can be completed successfully in a short period of time to provide a contiguous vapour barrier with the minimum number of joints.

d) Material shall be fixed carefully and neatly to provide a fully sealed barrier free from tears, punctures and sagging.

e) Joints in the vapour barrier shall be in a direction to maximise performance and suit the configurations of the works, insulation and backing in order to offer a continuous bearing surface to maintain the integrity of the joint.

f) Sides and ends of sheets shall only be lapped where fully supported and by not less than 150mm. Secure at not more than 250mm centres. Form and continuously seal laps as recommended by the manufacturer.

g) Substrates shall be primed as necessary to achieve a full bond.

h) Joints in a second layer, if required, shall be staggered by half a sheet.

i) All penetrations by pipes, ducts, structural members and other components shall be completely sealed with adhesive tape as recommended by the sheet manufacturer.

j) Jointing tape shall be double sided sealant tape with vapour resistivity not less than the vapour control sheeting, as recommended by the sheet manufacturer.

k) Supervision shall be maintained during the installation of the vapour/ air barrier material to ensure its integrity.

l) Immediately before covering over, membranes shall be checked for tears and perforations and any damage found shall be repaired or the membrane replaced in accordance with the manufacturer's recommendations and to the satisfaction of the Architect.

G13.265 Insulation

a) Accurately cut boards to accommodate abutments and configurations.

b) Lay evenly, with no lipping at joints.

c) Material shall fit tightly with closely butted joints, fittings and abutments, no gaps shall be left.

d) Keep dry and secure as the work proceeds, ensuring continuity and leaving no gaps.

G13.266 Fire and Smoke Barriers

a) Material shall be cut to fit tightly, achieve correct compression and be securely fixed along all edges. All joints shall be wired or stapled together to provide a complete barrier to smoke and flame. Where proprietary systems are installed, they shall be in accordance with the manufacturer's recommendations.

b) A complete barrier shall be formed; there shall be no gaps.

c) Sealants shall not compromise the integrity of the works.

G13.267 Acoustic Barriers

a) Material shall be cut to fit tightly, achieve correct compression and be securely fixed along all edges. All joints shall maintain a complete barrier to sound. Where proprietary systems are installed, they shall be in accordance with the manufacturer's recommendations.

b) Sealants shall not compromise the integrity of the works.

G13.268 Fire and Smoke Stopping

a) Install/ apply products in accordance with the manufacturer's recommendations, refer to Section Z22 of the Architectural Specification where applicable.

b) All openings through the works shall be framed out on all sides and cross-braced on two opposite sides where possible.

G13.269 Temporary Protection

Finished areas shall be adequately protected from damage by subsequent building operations and other factors.

Adverse Weather

G13.270 Working in Adverse Conditions

a) If unavoidable wetting of the construction occurs, take prompt action to minimise and make good any damage.

b) Provide temporary covers as required to keep unfinished areas dry.

c) Suspend work in severe or continuously wet weather unless an effective temporary enclosure is provided over the working areas, or if the performance of the system will not be impaired.

Workmanship Tolerances

G13.271 Installation Tolerances

a) The works shall maintain the planning grid and distribute tolerances equally to achieve the following:

i) Vertical walls maintaining the offset (ceiling to floor) within ±3mm of its notional setting-out position.

ii) Straight lines and flat planes in all directions.

iii) A final finished surface position within 5mm of its notional position when measured in accordance with BS 8212.

b) All dimensions shall be checked on Site prior to commencement of installation.

c) The installation shall accommodate all required tolerances including differences between actual Site dimensions and dimensions shown on the Design Drawings.

d) Account shall be taken of the installation tolerance requirements such that repetitive units are accurately located, relative to gridlines.

e) The works shall be erected in alignment and in relation to established lines and grades as indicated on the Design Drawings.

f) The maximum variation in height of any part of the works from given datum shall be ±3mm.

g) The maximum offset in plane, level or section between any two adjacent sections shall be ±2mm.

h) The maximum variation in plan shall not exceed ±1mm per metre length.

i) Cut-outs for interfacing works shall comply with the dimensions indicated on the Design Drawings ±3mm.

j) Permissible tolerances shall be considered in isolation and not compounded. The most onerous tolerance shall apply.

k) A detailed list of tolerances to which the works are to be installed shall be submitted for review by the Architect prior to commencement of installation. As a minimum this shall include the following:

   i) Position on plan.

   ii) Level.

   iii) Alignment.

   iv) Plumbness.

l) Analysis of the erection sequence and overall method statement shall be produced to satisfy the Architect that the installation tolerances stated shall be met.

End of Section

H11 GLAZED CURTAIN WALLING/ CLADDING

The particular requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the general requirements specified in the A and Z sections and the particular requirements of other applicable Architectural Specification sections.

H11.100 COMPLIANCE AND SCOPE

COMPLIANCE

H11.101 General

a) Refer to and comply with Section A15.100 of the Architectural Specification regarding the Trade Contractor's design responsibility for this element of the works.

b) Complete the Detailed Design of this element of the works, maintaining the intent of the Design Drawings (A10.102 d) i)), where the Architect's role will be limited to checking compliance with quality, design and visual intent only.

c) Use the reference codes and accompanying descriptions listed on the System Reference Sheet (SRS) to identify materials, products, systems and components, when completing the Detailed Design.

SCOPE

Stick Glazed Curtain Wall Systems

H11.102 Type EWS-101 Curtain Wall System

Capped stick built curtain walling system configured as indicated on the Design Drawings.

a) Indicative manufacturer: Schüco.

b) Concealed corrosion resistant support components, secured to the structural frame.

c) 'Stick' framing:

  i) Mullions and transoms formed from extruded aluminium profiles; thermally broken and separated, and with integral drainage slots/ channels.

  ii) Reinforced using concealed methods, as required.

d) Infill panels, arranged and located as indicated on the Design Drawings, mechanically secured to the 'stick' framing using methods that shall be concealed in the finished works.

e) Applied finish(es) to glass infill panels where indicated on the Design Drawings.

f) Visible gaskets shall be RAL 7044 in colour.

g) Externally, junctions between infill panels, co-ordinated with the 'stick' framing shall be finished with cover caps:

  i) Nominal sizes and profiles shall be as indicated on the Design Drawings.

  ii) Where not indicated on the Design Drawings locations and appearance of joints between cover caps shall be consistent and to the acceptance of the Architect.

h) Fire and smoke stopping as required, this shall be concealed in the finished works.

i) Acoustic stopping as required, this shall be concealed in the finished works.

j) Integration of stainless steel components associated with maintenance access equipment. Locations, type and mounting of components shall be co-ordinated with and advised by the Maintenance Access Equipment specialist to the acceptance of the Architect.

k) The works shall incorporate/ accommodate profiles, finished to match the framing, as indicated on the Design Drawings, compatible with selected blinds.

l) Visible metalwork shall be RAL 7044 coloured powder coat finished with matt appearance.

H11.103 Type EWS-111 Frameless Curtain Wall System

Capless stick built curtain walling system with integrated opening windows, configured as indicated on the Design Drawings.

a) Indicative manufacturer: Schüco.

b) Concealed corrosion resistant support components, secured to the structural frame.

c) Capless stick built curtain walling system:

  i) 'Stick' framing:

    - 'Stick' framing consisting of mullions and transoms formed from extruded aluminium profiles; thermally broken and separated, and with integral drainage slots/ channels.
    - Reinforced using concealed methods, as required.

  ii) Externally, junctions between infill panels, co-ordinated with the 'stick framing', shall be finished/ sealed with black sealants/ seals/ gaskets.

d) Infill panels, arranged and located as indicated on the Design Drawings, secured using methods that shall generally be concealed in the finished works, provide a flush 'frameless' appearance across the system when viewed externally. Where structural silicone bonding is proposed:

i) Structural silicone shall be black and shall obscure the frame behind, where an enamelled applied finish to the perimeter of the glazing is not used.

e) Applied finish(es) to glass infill panels where indicated on the Design Drawings.

f) Visible gaskets shall be black.

g) Fire and smoke stopping as required, this shall be concealed in the finished works.

h) Acoustic stopping as required, this shall be concealed in the finished works.

i) The works shall incorporate/ accommodate profiles, finished to match the framing, as indicated on the Design Drawings, compatible with selected blinds.

j) Visible metalwork shall be RAL 7044 coloured powder coat finished with matt appearance.

Integrated Doorsets

H11.104 Type DRS-301 Integrated Doorset

Integrated hinged, manually operated doorsets with functionality as indicated on the Design Drawings, to match and form an integral part of the surrounding curtain walling system.

a) Extruded aluminium profiles; thermally broken and separated; finished to match the interfacing curtain walling.

b) Finish/ colour: Powder coated, RAL 7044 colour to the acceptance of the Architect through sampling.

c) Safety glass infill, glass shall have the same visual intent as the interfacing curtain walling system.

d) Ironmongery and hardware:

i) Brush finished stainless steel ironmongery and hardware from the manufacturer's/ supplier's range to suit the required functionality and service conditions, to the acceptance of the Architect.

ii) Ironmongery and hardware shall include restrictors with hold open functionality, and self closing devices, which shall be concealed.

iii) Weather-stripped at head, jambs and sills with black coloured compression seals.

Infill Panels

H11.105 General

Infill panels (glass units, and other panels 'glazed' into the framing of the specified systems) are integral to these systems, as specified herein and as indicated on the Design Drawings.

H11.106 Type GL-101 Glass Infill Panel

a) Single glazed clear low iron glass units (safety glass where required).

b) Units shall have the following nominal visual attributes. Other attributes shall be determined to achieve the performance requirements:

i) Light transmission factor shall be not less than 80%.

ii) Total solar transmission (G-value) shall be not greater than 0.45.

H11.200 QUALITY AND WORKMANSHIP

SUBMITTALS

H11.201 Tender Submittals

A design response shall be submitted with the Tender proposal, including the following:

a) Pre-contract samples, where specified.

b) A list of tests to be included.

c) Proposed QA/ QC programme.

d) A list of Working Drawings to be submitted.

e) A summary of any proposed deviations from the Architectural Specification and Design Drawings.

f) Outline technical specifications/ data sheets of proposed materials/ systems.

g) A list of proposed suppliers and sub-contractors.

H11.202 Post Contract Response

The post contract response shall include:

a) Samples where specified.

b) Details of the testing procedures and equipment intended for use in the testing process.

c) Test data to demonstrate compliance with the performance requirements.

d) Submittals associated with the QA/ QC process.

e) Working Drawings.

f) Detailed technical specifications reflecting materials/systems being installed.

g) A list of suppliers and sub-contractors being used.

h) For bespoke designs, state the spacings of drainage outlets within framing and demonstrate the adequacy and suitability of such spacings.

i) Provide method statements for:

  i) Fabrication and installation methods, including proposals to achieve the specified tolerances. This shall demonstrate a clear understanding of the construction programme, the effects of the building structure and interfacing works.

  ii) Removal and replacement of system components for acceptance by the Architect, as a preclude to the Maintenance Manual, refer to Section A33 of the Architectural Specification.

j) Glass and glazing:

  i) Risk assessments documenting the risk of failure and the consequences of failure of the selected glass units.

  ii) Risk assessment for overhead glazing shall be undertaken in accordance with Section 7 of CIRIA Document C632.

  iii) Thermal stress calculations.

  iv) Light and solar radiant heat factors:

    • Data sheets for project specific glass build-ups in accordance with BS EN 410 (light transmittance, radiant transmittance of glazing) with tolerances of ±3% for flat glazing, shall be submitted in respect of solar and visible light performance confirming compliance with the Architectural Specification.

  v) Structural silicone glazing:

    • Documentary evidence that the selection of sealant takes into account any relevant recommendations by the sealant manufacturer as to the use of the sealant.

    • Test certificates to confirm compatibility of the sealant used with all substrate materials including aluminium, finishes, glass, glass coatings, gaskets, setting blocks, backing rods, etc., which shall relate to tests carried out by the sealant manufacturer.

k) Structural:

  i) Submit structural calculations.

  ii) Submit calculated system dead loads.

  iii) Submit wind/ air pressure calculations.

l) Actual air leakage results from tests shall be provided for acceptance by the Architect.

m) Thermal:

  i) Thermal calculations shall be submitted for the various components and the overall thermal performance of the proposed works, to demonstrate compliance with the performance requirements.

  ii) Thermal transmittance (U-value/ U-factor) shall be calculated/ assessed using the methods defined in BS EN ISO 12631 and guidance from the CWCT.

  iii) Where applicable, linear and/ or point thermal transmittances shall be calculated for thermal bridges through the elements in accordance with BS EN ISO 10211 and guidance from the CWCT.

n) Condensation:

  i) Carry out a condensation risk assessment of the specified works and interfaces with the work of others and submit calculations to demonstrate that the risk of condensation, under specified conditions, has been eliminated.

  ii) Computer generated finite element analysis (FEA), to demonstrate that the condensation risks of the building configuration have been fully analysed, and condensation risk eliminated.

o) From initial results of acoustic testing, provide detailed acoustic assessment of each cladding type for review.

p) Evidence shall be provided that the acoustic performance requirements given herein can be achieved.

q) Before work begins on Site the proposed method of dimensional setting-out and cross-checking with adjacent trades and elements, to satisfy the accuracy requirements, shall be submitted to the Architect.

r) After completion of on-Site testing, prepare and submit a report to the Architect, which shall include proposals for remedial measures, if any leaks/ defects or other failures occur.

s) Copies of the final testing certificates for earth bonding and lightning protection shall be incorporated in the Health and Safety File.

H11.203 Pre-Contract Samples

The following pre-contract samples shall be provided:

a) Examples of proposed types of finish and colours on representative extrusions and sheeting.

b) 300mm x 300mm sample of proposed glass type in specified finish to the acceptance of the Architect.

c) Proposed fixings visible in the finished works.

d) All proposed sealants and gaskets where coloured and visible in the completed works.

e) Proposed ironmongery and hardware.

f) Operating mechanisms, switches and controls, including mounting.

H11.204 Post Contract Samples

The following post contract samples shall be provided:

a) Examples of accepted types of finish and colours on representative extrusions and sheeting.

b) Bespoke extrusions at least 300mm in length.

c) 1200mm x 1200mm sample of proposed glass type in specified finish to the acceptance of the Architect.

d) Samples of all proposed applied finishes on separate 500mm x 500mm glass samples.

e) Accepted manifestation.

f) Infill panels (other than glass) 800mm x 500mm integrated with representative framing sections.

g) Accepted fixings visible in the finished works.

h) Accepted ironmongery and hardware.

i) Operating mechanisms, switches and controls, including mounting.

H11.205 Mock-ups

The following mock-ups shall be provided:

a) 1000mm x 1000mm mock-up of each system type in accepted finish.

H11.206 Prototypes

The following prototypes shall be provided:

a) Test certification that complies with all performance requirements and warranty providers' requirements, shall be submitted. If test certification is not submitted a prototype (including testing) will be required for the external cladding including all components and finishes.

H11.207 Quality Benchmarks

In locations to be agreed with the Architect, provide the following quality benchmarks:

a) First installed full height structural bay of each type of system including all interfaces with adjacent structures/ finishes.

TESTING

H11.208 Generally

a) Refer to Section A33 of the Architectural Specification for the general requirements for testing.

b) Off-site testing:

i) Data from previous independently certified tests, including static and dynamic results, and Agrément certificates, may be provided by the Trade Contractor for the acceptance of the Architect to demonstrate that the proposed systems meet the performance requirements of the Architectural Specification.

ii) If suitable data to demonstrate compliance with the performance requirements is not available, prototypes of each type shall be provided, which shall be independently tested in accordance with the testing criteria indicated in the Architectural Specification.

c) On-site testing: All on-Site testing specified herein shall be undertaken.

d) Testing of the works shall be in accordance with the requirements of the CWCT Standard Test Methods for Building Envelopes.

e) Test certificates shall not relieve the Trade Contractor of responsibilities to meet the requirements of the Architectural Specification.

H11.209 Results/ Certificates

a) As soon as they are available, tests and inspection results shall be submitted.

b) Certificates relating to the materials used in the work shall be submitted as confirmation of tests carried out in accordance with the relevant British Standards, and/ or other national standards as appropriate.

c) Until the end of the defects liability period, records of all inspections and tests performed, material certification, inspection and test plans, drawings and any other documentation to substantiate conformity with the Architectural Specification, including those carried out by sub-contractors, shall be maintained.

d) Records shall be stored in such a way that they are identifiable to the component to which they refer and are retrievable.

e) The records shall be available for inspection by the Architect with copies of records being given to the Architect upon request and they shall be submitted to the Architect at the end of the defects liability period.

Off-site Testing

H11.210 Prototype Testing

a) The prototypes shall be mounted in test rigs, which shall have the same conditions of attachment and support as elements of the works, with a supporting structure similar in stiffness to that supporting the works. The prototypes to be tested shall not be influenced by the test chamber.

b) The Testing Authority shall witness the installation and dismantling of the prototypes, record any variations to the agreed details on a set of the prototype assembly drawings prepared by the Trade Contractor and shall also record test failures.

c) Details of all jointing, sealing and glazing techniques, materials used, type, number and size of drainage/ ventilation apertures and section properties of the framing members shall be provided.

d) At least 7 days' notice shall be given to the Architect prior to the erection and dismantling of the prototype construction, so that the Architect may observe the assembly and dismantling of the test prototypes.

e) Prior to testing, ensure that all chemically curing sealants are given sufficient time to achieve their proper cure as recommended by the sealant manufacturer.

f) Prior to the beginning of the test, the external face of the specimen shall be thoroughly washed using a mild additive-free detergent and then rinsed.

g) An independent laboratory acceptable to the Architect shall carry out/ certify the testing.

h) The prototypes shall be tested as necessary to demonstrate that the works are capable of accommodating the building movements while maintaining the performance of the works.

H11.211 Initial Safety Testing

a) Purpose: Carry out initial safety (robustness) tests to establish confidence in the proposed design for the Architect, by showing that under failed conditions the panels are robust enough that they shall not fall out. The exact sizes of required stainless steel casting may be deduced from this test.

b) Method:

i) Make up the equivalent of two full size panels and simulate surrounding panels.

ii) Break, with a centre punch, each of the panes on panel 1.

iii) A pulse lateral load shall then be applied by means of a pressure box to investigate the robustness of the broken assembly when subjected to a nominal wind load. The test shall investigate the manner of the breakage of the inner and outer glass panes.

iv) Repeat the test with panel 2.

c) The testing shall be carried out with representatives of the Architect present. The Architect shall then, in consultation with the Building Control Officer, comment upon the robustness of the system.

H11.212 Off-Site Test Sequence

a) The installation and dismantling of the prototypes shall be witnessed by the Testing Authority, who shall record any variations to the agreed details on a set of the prototype assembly drawings prepared by the Trade Contractor and shall also record the extent of water penetration into the system.

b) Pre-testing:

i) Prior to the full test sequence, the prototypes shall be pre-tested under static pressure at 50% maximum design wind load, followed by water penetration test at 50% of the pressure specified for final tests.

ii) Deficiencies that are observed in the samples during testing shall be recorded and appropriate corrections made.

c) The testing sequence shall be in accordance with the CWCT Standard for Systemised Building Envelopes Sequence B procedures.

d) Further tests shall be carried out in accordance with the CWCT Standard for Systemised Building Envelopes Discretionary Test procedures.

e) Each test shall not be carried out unless all previous tests in the sequence have been passed to the satisfaction of the Testing Authority.

f) If any modification is made to the prototype, undertake repeat testing as detailed in the relevant CWCT procedures.

g) If any modification is undertaken that, in the opinion of the Testing Authority or witness, invalidates earlier test results, the sequence shall commence again at the first test (this requirement is not applicable to glass breakage during the wind resistance safety test when replacement of a pane of glass may be carried out without re-starting the whole sequence).

H11.213 Air Permeability Testing

a) Air Infiltration:

i) The works shall resist the passage of air such that its air leakage rates, if measured in accordance with the CWCT Standard, shall not be exceeded in both the initial and repeat tests.

ii) The prototypes shall be tested to determine the air infiltration per unit area for fixed panels, and per unit joint length for any opening lights. A check for regions of concentrated air leakage shall be made after the air permeability test has been completed and such areas marked upon the prototype drawings.

iii) Testing shall be carried out in accordance with BS EN 12153, for cladding, and BS EN 1026, for windows and doors, to a test pressure of 600 Pa or 0.25 of the design wind pressure, whichever the greater.

b) In addition, an air exfiltration test shall be carried out on the prototype in accordance with Section A33.

H11.214 Weatherproofing/ Watertightness Testing

a) Carry out testing adopting either static or dynamic procedures, as appropriate to the system type and anticipated conditions:

i) Static: In accordance with BS EN 12155, for cladding, BS EN 1027, for windows and doors, and the requirements of the CWCT Standard for Systemised Building Envelopes for the static test method.

ii) Dynamic: In accordance with the requirements of the CWCT Standard for Systemised Building Envelopes or BS EN 13050, for testing for water penetration using the dynamics method. Dynamic testing shall be undertaken using a propeller engine.

b) During the test or within 15 minutes of completion of the test there shall be no leakage into the internal face of the works at any time.

c) Following the test there shall be no standing water in locations intended to drain.

H11.215 Wind Resistance Testing

a) Carry out a serviceability test in accordance with BS EN 12179, for cladding, and BS EN 12211, for windows and doors, as modified by the CWCT Standard for Systemised Building Envelopes. The peak test pressure shall be 1.0 times the design wind pressure.

b) Carry out a safety test in accordance with the CWCT Standard for Systemised Building Envelopes. The peak test pressure shall be 1.5 times the design wind pressure.

c) Performance under testing:

i) At both positive and negative applications of the peak test pressure:

- There shall be no permanent damage to framing members, glass or glazing panels or anchors.
- Framing members shall not buckle, panels shall remain securely held, glass and glazing shall not be damaged and gaskets shall not be displaced.
- The glass itself shall not deflect such that edge cover is insufficient to restrain the glass under peak test pressure or such that spacers become visible.

ii) Permanent deformation to wall framing members shall not exceed 1/500 of the span measured between points of attachment to the building one hour after the loading to the positive and negative peak test pressure has been removed.

iii) Loads created by specified test conditions shall be accommodated safely, without detriment to the overall design, structural integrity and performance of the works.

iv) Permanent fixings of any component shall be capable of resisting the combined dead load and maximum wind load with a factor of safety of at least 1.5.

H11.216 Impact Testing

a) Impact testing shall be carried out in accordance with CWCT Technical Note TN 76, conforming to the category requirements specified.

b) Soft body impact testing to glazed elements shall be carried out in accordance with BS EN 12600, conforming to the category requirement specified.

c) Soft body impact testing to non-glazed elements shall be carried out in accordance with BS EN 13049, conforming to the category requirements specified.

d) Manual attack testing shall be carried out in accordance with LPCB standard LPS 1175, conforming to the category requirements specified.

e) A test for resistance to impacts from manual attack on security glazing shall be carried out in accordance with BS EN 356, conforming to the category requirements specified.

f) The façade prototype shall be tested with a prototype of the applicable maintenance access equipment, which shall technically and physically represent the proposals for the works. The testing shall be undertaken with loadings, movements, and the like representative of use and Site conditions to calculate/ establish impacts on the façade.

g) The extent of any damage determined through testing shall be recorded and, where possible, quantified with samples being submitted to the Architect.

H11.217 Acoustic Testing

a) Initial advance test:

i) The glass configurations shall be identified and any acoustically enhanced configurations that may be necessary to meet the requirements of the Architectural Specification shall be incorporated.

ii) Immediately following the appointment of the curtain walling sub-contractor, laboratory acoustic tests of the proposed glass configurations shall be arranged using similar framing to that intended with similar dimensions and mass per metre run of framing. Such prototypes shall not be used as visual samples and shall not include glass coatings or heat treatments, but shall be used to confirm compliance with the specified acoustic data.

b) Testing to establish the sound reduction indices shall be carried out in accordance with BS EN ISO 10140, conforming to the requirements specified.

c) Testing flanking transmission:

i) The works shall be tested for flanking transmission with a partition meeting the façade at a mullion.

ii) The works shall be tested for flanking transmission at a junction with the floor/ ceiling slabs.

iii) Testing shall be undertaken in accordance with BS EN ISO 10848: Part 2 and rated in accordance with BS EN ISO 717: Part 1. The test method is designed for suspended ceilings but may for this purpose and in the absence of any other International Test Standards, be adapted to establish the flanking performance of a cladding system. The simulated wall and floor constructions shall not influence the results of these junction tests.

iv) Any acoustic tests shall commence at a time agreed with the Architect, in a recognised independent laboratory with a comprehensive test report being submitted, in writing, to the Architect within three weeks of completion of the tests.

v) Where existing test data is available from a recognised independent laboratory, it shall be considered acceptable providing the tests have been carried out for the exact system being offered. Test data for similar constructions may be accepted if supporting computations are offered to account for any differences between the proposed and tested construction.

H11.218 Structural Silicone Testing

Structural silicone testing shall be undertaken in accordance with European Technical Approvals Guideline 002 (ETAG 002).

H11.219 Operating Forces (Doors and Windows)

a) Operating forces for windows shall be tested in accordance with BS EN 12046: Part 1.

b) Operating forces for doors shall be tested in accordance with BS EN 12046: Part 2.

On-Site Testing

H11.220 Thermal Performance Testing

a) Infra-red thermography testing in accordance with BS EN 13187 shall be carried out to ensure that there are no irregularities in the thermal properties of components constituting the external envelope using a suitable thermal imaging method as defined in the CWCT Technical Note TN 45. The testing method shall be subject to acceptance by the Architect.

b) Any areas that are proven not to achieve the performance requirements shall be rectified

H11.221 Air Permeability - Exfiltration

a) Refer to Section A33 of the Architectural Specification for the 'Airtightness Fan Test' of the building envelope.

b) Air exfiltration rates shall be within the limits specified.

H11.222 Weatherproofing and Watertightness Testing

a) The weathertightness of the works shall be tested using the Site hose test carried out in accordance with the CWCT Standard for Systemised Building Envelopes.

b) If a different method is proposed, details of the testing system and a proposed method statement shall be submitted to the Architect for acceptance at least one month prior to the proposed testing on Site.

c) Prior to testing it shall be ensured that the works have been completed to a stage where the integrity of the system can be tested, that obvious defects have been made good and that the works have been cleared of all materials, debris and dust.

d) Testing shall be carried out when all works are complete including that of all associated trades and interfacing trades. This shall exclude works that, if completed, would inhibit the visual inspection of on-Site testing.

e) Performance under testing:

i) There shall be no leakage through the works at any time during the test or within 15 minutes of completion of the test.

ii) If any leaks/ defects occur, mark the location on the works and drain water completely. Prepare a report to be submitted to the Architect, together with proposals for remedial measures. Any part of the works that is adversely affected shall be replaced or repaired; the design intent shall be maintained.

iii) After making good any defects, retest locally to verify integrity of repair.

iv) At completion of the test there shall be no standing water in locations intended to remain dry. Certify the waterproof integrity of the works.

v) Invite the Architect to witness the tests.

H11.223 Acoustic Testing

Site sound insulation measurements may be undertaken by the Architect in accordance with BS EN ISO 140: Part 5 and BS EN ISO 16283: Part 1 to check compliance with the acoustic performance requirements.

H11.224 Testing of Fixings

As the work proceeds, structural fixings shall be proof load tested as required and witnessed by the Architect.

ARCHITECTURAL AND FUNCTIONAL REQUIREMENTS

H11.225 General

a) The works generally shall be designed, constructed and installed in accordance with the recommendations of the Centre for Window and Cladding Technology (CWCT) Standard for Systemised Building Envelopes, CWCT Technical Updates and CWCT Technical Notes.

b) Systems shall be designed and installed as complete integrated systems.

c) Systems shall include all necessary support structure, bracketry, fixing rails and plates, angles, cleats, cramps, grouting, fixings and fastenings, screws, bolts, nuts, washers, rivets, distance pieces, clips, anti-rotation pins, vapour control membranes, insulation, damp-proof membranes, breather and other membranes, air barriers, firestops and cavity barriers, acoustic breaks, pressed metal components, closures, seals and sealants, gaskets, fillers, tapes, spacers, packers, shims, isolators, drainage channels, waterbars, glazing bridges and all other accessories and components necessary to complete the works.

d) All moving parts requiring lubrication shall have grease caps, which shall be inconspicuous in the finished works, shall be easily maintained and shall not cause oil drips during operation.

H11.226 Achieving Performance

a) Systems shall comply with all applicable performance criteria during the service life of the works, and also be sufficiently rigid to safely withstand any forces that may act on them during fabrication, transportation, storage, erection on Site and other applicable activities.

b) During the Detailed Design the Trade Contractor shall take into consideration these non-exhaustive architectural and functional requirements, when achieving the performance.

c) Work requiring mechanical fixing shall ensure that failure of any fixing shall not lead to progressive failure of others.

d) All components, couplings and fixings shall be capable of accommodating performance without permanent distortion, deformation or failure.

e) No elements from other trades shall be fixed to and/ or supported by the works, unless accurately specified, indicated on the Design Drawings and/ or agreed by the Architect.

f) The Detailed Design shall take into account the ambient temperature at the time of the respective operations of fabrication, assembly and erection, with appropriate allowances being made for any dimensional changes resulting therefrom.

g) The Detailed Design and construction of the works shall be such that all rigid or fixed joints shall remain rigid and accommodate all specified thermal, building structure or other movements and any applicable loads without compromising its watertightness. All movement joints shall also be finally designed and constructed to accommodate such loads or movements without compromising the system's watertightness.

h) Movement and deflections:

i) The requirement for any movement joints within the works shall be ascertained to achieve the performance criteria while maintaining the overall system performance.

ii) Movement joints shall accommodate the maximum movement and range of movements that can be derived from the specified and determined design loads and movements. Under maximum movements the joints shall meet all the performance requirements of the Architectural Specification.

iii) It shall be ensured that the works accommodate all movement of the joints in a manner that does not compromise the system’s integrity or appearance.

iv) Movement joints shall appear as similar to the standard system joint as possible.

i) Light, and solar radiant heat factors:

i) Optical and thermal performance values for glass infill panels shall be confirmed by the Trade Contractor during the Detailed Design, which shall be completed in conjunction with other members of the design team as applicable. Values shall be provided, as follows, for light factors and solar radiant heat factors and confirmation of coatings, to achieve the performance and visual requirements defined by the Architectural Specification, to the acceptance of the Architect.

ii) Light factors:

- Light transmission factor.
- External light reflectance.
- Internal light reflectance.
- UV radiation transmittance.
- Colour rendering index.

iii) Solar radiant heat factors:

- Solar radiant heat transmittance.
- External solar radiant heat reflectance.
- Solar radiant heat absorptance/ external.
- Solar radiant heat absorptance/ internal.
- Solar factor (G-value).
- Shading coefficient.

iv) The requirement for low emissivity (Low E) coatings.

v) The requirement for high performance coatings.

j) Weather and watertightness:

i) Systems shall be based on pressure equalisation principles, unless accepted otherwise by the Architect.

ii) The Detailed Design of the works shall not be based on a single line of defence. The cavities between the lines of defence shall be ventilated and drained to the exterior.

iii) Allowance shall be made to control the flow of any water that may enter the system and for directing this water to the outside, such that no water remains internally.

iv) Systems shall be drained with precipitation draining to the outside in all instances. Water paths shall be indicated on the Working Drawings.

v) The works shall prevent infiltration due to ice dams/ water back-up.

vi) Rainwater ponding shall not be permitted on any element of the works.

vii) Wet applied seals for the purpose of preventing the ingress of water shall not be accepted with the exception of the structural silicone seals or wet seals used for sealing the works against adjacent interfacing systems.

viii) Weather seals shall be provided at all interfacing connections.

k) Vapour barriers shall always be installed on the warm side of the thermal insulation to provide a continuous air and vapour tight seal at all interfacing joints, between opening elements and fixed elements, and intersections between the system and other interfacing systems/ building structure.

l) Allow for the fact that the works shall be erected in all extremes of weather conditions throughout the year and that the building may not be climatically controlled during construction. Damage to materials as a result of Site conditions shall be the Trade Contractor's responsibility.

m) Corrosion protection:

i) Ensure that protective measures are taken to avoid any corrosion or any deleterious effects caused by manufacturing, finishing, transportation, storage and installation of systems/ products/ materials/ components.

ii) Ensure full resistance to any corrosion for components that are secured or bolted to each other, paying particular attention to the surface damage caused by such bolting or securing.

iii) Ensure full resistance in repair of corrosion protection to cope with the Site cutting of components, especially at boundary and external conditions.

n) Components for earth bonding and lightning protection shall be concealed or inconspicuous in the finished works, and clearly indicated on the Working Drawings, for acceptance by the Architect. Methods shall not impair the performance or the visual characteristics of the interfacing works.

H11.227 Fixings

a) Fixings shall be concealed unless accepted otherwise by the Architect.

b) Visible fixings, where permitted, shall have an appearance and finish to the acceptance of the Architect.

c) Where necessary, fixings/ fixing devices shall be capable of providing adequate adjustment to suit building movement, accommodate tolerances, and prevent system/ installation failure.

H11.228 Fixing to Structure

a) Systems shall be mechanically fixed to the structure and shall include all necessary sub-constructions/ assemblies including but not limited to, framing, fixing devices, brackets, cleats, angles, anchors, bolts, fixings, sockets and other components.

b) Works shall include all necessary preparation such as drilling, plugging, screwing, bolting, cutting, chasing, forming recesses/ mortices, casting-in/ grouting-in and making good.

c) Fixing shall be co-ordinated with the superstructure design.

d) Mechanical fixing devices shall be austenitic stainless steel of a suitable grade.

H11.229 Secondary Support

a) A structural steel cladding support system shall be provided, as necessary, having due regard for any requirements in excess of that indicated in the Structural Engineer's documentation and also any requirements indicated on the Design Drawings. The support structure shall include all necessary sub-constructions/ assemblies including, but not limited to, framing, brackets, cleats, angles and other components.

b) Where the Trade Contractor deems that the support system shall need to be visible in the finished works, inform the Architect at Tender return. Post Contract award the visual intent shall be finalised in conjunction with the Architect.

H11.230 Framing

a) Unless nominal dimensions representing the visual intent are indicated on the Design Drawings, framing shall utilise the minimum cross section necessary to maintain rigidity and performance.

b) Framing shall include a glazing chamber separated by two seals. The glazing chamber shall be ventilated and drained to the outside and the system shall comprise:

i) One seal outside the glazing chamber designed to prevent water ingress into glazing or other chambers to substantially inhibit water penetration and to prevent heavy wetting of the back seal. Designs with full width gasket seals shall incorporate capillarity breaks to prevent the ingress and entrapment of water between surfaces in continuous contact.

ii) One seal at the back of the glazing chamber, which shall act as a vapour tight air seal that will minimise air permeability up to limits as specified. If subjected to light wetting in localised patches the back seal shall prevent the ingress of this water to the inside face of the works.

iii) Openings in the framing shall comply with current glazing recommendations in size, spacing and location and shall be provided to the exterior of the frames in order to ventilate around the infill panels, creating a drainage system for any water or moisture. All draining shall be provided at the lowest level of the glazing rebates or framing system cavities to positively prevent any residue water from remaining within.

c) Section profiles shall have rebate depths, widths and edge clearance suitable for the service conditions, taking into account the infill panel, glass unit manufacturer (where applicable), the provisions of BS 6262 and other industry requirements as deemed applicable by the Trade Contractor.

d) Framing profiles shall be assembled using composite framing profiles with a proven continuous thermal break material.

e) Framing profiles shall be detailed to incorporate necessary sealing gaskets, vapour, air or other seals, gaskets within the glazing rebates, connections for thermal break strips, setting blocks, connection spigots, corner cleats, clip-in profiles, glazing beads where applicable to the design, fixing brackets and other necessary components.

f) Frames shall be sufficiently accurately cut and jointed to prevent the display of unfinished metal.

g) Location and appearance of drainage slots shall be to the acceptance of the Architect.

H11.231 Integrated Opening Windows/ Lights/ Vents

a) Opening elements shall be integrated into the systems as described with functionality as indicated on the Design Drawings.

b) Opening windows/ lights/ vents, including operating forces and associated ironmongery, shall be in accordance with BS EN 12046: Part 1.

c) Unless indicated otherwise on the Design Drawings, the opening elements shall be integrated such that sight lines created by the framing for the fixed elements, when in the closed position, are maintained. The appearance of additional framing when in this position shall not be accepted.

d) Junctions between the opening and fixed element framing shall include a minimum of two perimeter sealing gaskets inserted into corresponding grooves into the framing profiles, as detailed above.

e) Opening lights shall not disengage from the fixed areas of the works when open (including at any incremental point between closed and fully open) or closed under any of the specified loads.

f) Opening lights shall not be capable of removal from the fixed areas of the works, when fastened in the closed position, except by deliberate action from the interior of the building or from actuation by the BMS system.

g) Hinge mechanisms for opening lights shall be selected to ensure that electrical continuity is maintained. Any limitations in this respect shall be stated in the Tender.

h) Where electromechanically operated opening elements shall be fitted with electrically powered actuators geared to open and close the windows automatically, and to retain them safely open. Where required, for fire/ smoke control, wiring from control panel to opening element shall be fire rated in accordance with BS 5839 and BS EN 54 and shall include standby batteries for continuous operation of vents for a 3-hour period in the event of loss of mains power.

H11.232 Integrated Doorsets

a) Doors and associated ironmongery shall achieve a ***heavy duty*** category as defined in BS EN 1192 and BS 6375: Part 2. Doors shall also comply with and not compromise other stated performance criteria for the works.

b) Evidence shall be provided to demonstrate that the doors, including ironmongery, have been tested to meet the acceptance criteria given in BS EN 1192 and BS 6375: Part 2.

c) Automatic doors shall be in accordance with BS 7036: Part 0 and BS EN 16005.

d) The maximum opening pressures required to open fire rated or non-fire rated doors on disabled access routes shall be in accordance with the requirements of BS 8300.

e) Access/ Security:

i) It shall not be possible to gain unauthorised entry through doors/ doorsets by removal of any component that would allow access.

ii) Co-ordination of access control and security equipment into the works shall be allowed for. Refer to the Services Engineer's documentation.

iii) Mastering requirements shall be advised by the Architect.

f) Where required to provide make-up air to aid smoke clearance in accordance with the Fire Strategy Report, doorsets shall be electromechanically operated by activation of the fire alarm system.

g) Thresholds shall drain water to the outside of the building.

h) All external doors shall be fully weatherstripped.

i) Anti finger-trap prevention measures shall be employed, as required.

j) Locations of fire escape doorsets shall be as indicated on the Design Drawings.

H11.233 Glass Infill Panels, Generally

a) Glass infill panels of each type may be required for both vertical and/ or inclined conditions, as indicated on the Design Drawings. The Detailed Design shall take into consideration such uses, to derive suitable solutions whilst maintaining the visual intent.

b) The selection of the glass type, thicknesses, any interlayers, coatings (including acoustic coatings), build-up, mode of breakage and containment of the glass panels shall be undertaken to meet the requirements of the Architectural Specification and paying full attention to safety requirements to minimise the risk to persons, both during construction and during the service life of the works. Unless accepted otherwise by the Architect, all inner panes shall be safety glass.

c) Where required, safety glass shall be used. Refer to Section Z25 of the Architectural Specification.

d) Under no circumstances shall monolithic toughened glass be used in overhead situations.

e) Visible glass edges shall be arrised and ground and polished.

f) Applied coatings (such as but not necessarily limited to low emissivity ((low E)), high performance, acoustic) shall maintain the appearance/ hue of the glass.

g) When used in like coloured glass, interlayers shall maintain the appearance/ hue of the glass.

h) All specified attributes/ criteria are nominal values.

i) The works shall be designed to ensure that the glazing does not crack or distort or is damaged in any way through differences of temperature on the surfaces of the glazing.

j) Applied finishes:

i) Where indicated on the Design Drawings, glass infill panels shall receive applied finishes, as specified.

ii) Where required, glass infill panels shall have safety manifestation to comply with the requirements of the Architectural Specification. Method, patterns and colours shall be to the acceptance of the Architect.

H11.234 Structural Silicone Bonding and Maintenance

a) Bonding:

i) Structural silicone bonding shall be in accordance with European Technical Approvals Guideline 002 (ETAG 002) and BS EN 13022.

ii) The weakest element in the line of stress shall have a minimum strength of 600kPa or 6 times the design strength, whichever is the greater. This criterion shall be proven with a statistical confidence of 99%.

iii) Glazing requiring structural silicone bonding shall be glazed under controlled factory conditions without any need for Site applied structural bonding sealant, unless accepted otherwise by the Architect.

iv) The design of structural sealant glazing shall limit the design tensile stress of sealants to 138kPa.

b) Maintenance:

i) An on-going inspection/ maintenance programme for the structural silicone shall be documented, with accepted Testing Authorities employed to carry out inspections, which shall include the following:

- Cleaning: Acceptable detergents and methods to be used shall be specified.
- Inspection: Forms shall be provided to be filled out periodically, each pre-dated with the inspection date and an adequate quantity for the design life of the building. Forms shall state the full procedure for the inspection.
- Forms for periodic cut-out of structural seals and weather seals shall be provided to check Shore hardness and tensile properties of the seal.

ii) Each of the procedures shall clearly state pass/ fail criteria and indicate action required when a failure is thus obtained. The Testing Authority shall provide a report based on its findings to the Architect with recommendations for any remedial works.

H11.235 Gaskets

a) All visible gaskets shall be coloured as described.

b) Visible room side glazing gaskets shall have factory-formed corners.

c) Other gaskets shall have overlapping joints with appropriate sealant in between.

d) The internal gasket/ sealant line of the complete envelope, including all interfacing connections, shall provide a continuous vapour and air seal.

e) Gaskets shall not leak or bleed causing any discolouration or staining.

H11.236 Seals/ Sealants

a) Seals/ sealants shall be colour co-ordinated with colours of interfacing components, to the acceptance of the Architect.

b) Seals/ sealants shall not leak or bleed causing any discolouration or staining.

H11.237 Services Integration

a) Systems shall accommodate services, as indicated in the Services Engineer's documentation and/ or as indicated on the Design Drawings.

b) Locations/ positioning of services shall be agreed with the Architect, where not indicated on the Design Drawings.

c) Services, such as wiring/ wireways pipework, etc. leading to and from user interfaces, shall be concealed within the finished works, unless indicated or specified otherwise.

d) Provide necessary seals, gaskets, grommets, support framing, etc. where services penetrate or interface with the works.

H11.238 Maintenance Access Equipment Components

a) Stainless steel restraint sockets, bracketry and other components, provided by or for the Maintenance Access Equipment specialist, in accordance with the requirements of applicable standards, shall be integrated into the works.

b) The locations, type and mounting of components shall be co-ordinated with and advised by the Maintenance Access Equipment specialist to the acceptance of the Architect.

H11.239 Pressed Metal Components/ Accessories

a) Systems shall incorporate all necessary pressed metal components/ accessories including flashings, copings, cappings, sills, reveals and returns.

b) Components shall be formed from fully welded and/ or sealed pressed aluminium sheets, in a temper suitable for the particular type of application and degree of forming to be used and sufficiently thick to provide a visually flat surface free from distortion and permanent deformation. The alloy shall also be selected to satisfy the requirements of the required finishing process.

c) Systems shall include purpose made prefabricated corner pieces for changes in direction as indicated on the Design Drawings. Cut corners at changes in direction shall not be acceptable.

d) Components shall be of finish, colour and texture to the acceptance of the Architect where not specified.

e) Systems shall include concealed support as required.

f) Insulation shall be included as required, including anti-drumming insulation to the underside.

g) Joints:

i) Joints shall include concealed continuous sealed gaskets with recessed/ folded interconnecting or lapped joints to provide continuation and a neat flush external appearance, unless indicated otherwise on the Design Drawings. Simple butt straps shall not be accepted.

ii) Locations shall be as indicated on the Detailed Design, or to the acceptance of the Architect.

H11.240 Maintenance

a) Maintenance shall be undertaken safely for operatives, building users and other people adjacent to the building during maintenance operations.

b) Systems shall permit ease of cleaning within the parameters stipulated by the Design.

c) Demountability:

i) Elements of the works shall be individually and independently removable ensuring access for maintenance and/or replacement of infill panels and other system components in the event of breakage/ damage.

ii) Disruption due to maintenance shall be minimised.

iii) Progressive dismantling shall be minimised.

iv) The removal of cladding components/ assemblies shall not affect the performance or safety of adjacent or any other part of the works.

MATERIALS AND COMPONENTS

Metalwork and Finishes

H11.241 Metalwork

Refer to Section Z11.

H11.242 Finishes

a) Refer to Section Z30 for general finishes to metalwork.

b) Refer to Section Z31 for powder coatings.

Glass

H11.243 Generally

Refer to Section Z25.

Fixings

H11.244 Generally

a) Refer to Section Z20.

b) Fixings shall be inherently corrosion resistant or fully protected to prevent corrosion.

Adhesives

H11.245 Generally

Refer to Section Z20.

H11.246 Structural Silicone

Structural silicone used for bonding shall be in accordance with ETAG 002, BS EN ISO 12631, BS EN 15434 and BS EN ISO 11600.

Sealants

H11.247 Generally

Refer to Section Z22.

Gaskets

H11.248 Generally

a) Refer to Section Z36.

b) Gaskets shall be made of either Ethylene Propylene Diene Monomer (EPDM), Ethylene Propylene material (EP) or of Silicone to suit the service conditions.

Membranes

H11.249 Generally

a) Membranes shall be inert, durable, rot-proof, vermin-proof, not degradable by moisture and resistant to specified extremes of movement and environmental temperatures.

b) Membranes shall be certified to an internationally recognised Agrément Certificate to the acceptance of the Architect.

H11.250 Damp-proof Membranes (DPM)

a) Membranes shall be water resistant/ impermeable, vapour permeable and airtight as necessary to suit the service conditions.

b) Unless detrimental to the performance of the system DPM shall be manufactured from Ethylene Propylene Diene Monomer (EPDM) or acceptable equivalent.

c) Membranes shall be of limited combustibility and achieve Class 0 propagation and surface spread of flame, unless the Detailed Design of the system protects the membrane from the need for such requirements.

H11.251 Breather Membranes

a) Membranes shall be water resistant, water vapour permeable to suit the service conditions. Vapour resistance of the breather membrane shall be not greater than that of the substrate it is protecting.

b) Unless detrimental to the performance of the system, breather membranes shall be manufactured from non-woven, spunbonded high density polypropylene, or acceptable equivalent.

c) Membranes shall be of limited combustibility and achieve Class 0 propagation and surface spread of flame, unless the Detailed Design of the system protects the membrane from the need for such requirements.

H11.252 Vapour Control Layer/ Air Leakage Barrier

a) Layers shall be resistant to water vapour transfer and air, to suit the service conditions.

b) High performance reinforced membranes of metal or plastics, protected both sides by rigid facings/ linings.

c) Foil adhered to plasterboard shall not be accepted.

d) Include all necessary tapes, seals and accessories to provide a fully sealed system at joints, perimeter conditions and penetrations.

Insulation

H11.253 Generally

a) The insulation shall be inert, durable, rot-proof and vermin-proof and not be degradable by moisture, temperature or water vapour unless the Detailed Design of the system protects the insulation from the need for such requirements.

b) There shall be no bulging, sagging, detachment or delamination during installation of the works or when in situ throughout the life of the works.

c) Insulation shall be a minimum of Euroclass A2.

d) Expanded polystyrene or polyurethane core sandwich panels shall not be used in the works unless the Trade Contractor complies with all the recommendations of the LPC Design Guide for the Fire Protection of Buildings 2000 from the date of its first publication in December 1999 or any subsequent guidance which supersedes this guidance, or the Factory Mutual (FM) Approval standards, or the recommendations of independent fire consultants Arup Fire or Warrington Fire.

e) Insulation shall be CFC and HFC free, shall have zero Ozone Depleting Potential (ODP) and have a Global Warming Potential (GWP) of less than five. Refer also to Section A33 of the Architectural Specification.

f) Insulation shall achieve an A or A+ rating as defined in the BRE Green Guide to Specification.

g) All insulation shall comply with all relevant British Standards and be British Board of Agrément (BBA) certified.

PERFORMANCE

H11.254 Generally

a) The works shall comply with the general performance requirements of Section A15 of the Architectural Specification in addition to the following specific performance requirements.

Structural

H11.255 Generally

a) Unless stated otherwise, systems shall be designed in accordance with the current relevant and applicable British Standards and/ or Eurocodes.

b) Refer to the Structural Engineer's documentation.

c) The works shall accommodate the most onerous combination of movements, deflections and loads while maintaining the overall performance and without sustaining system failure or any permanent deformation. When calculating design loads the worst combination shall be considered, taking account of the fact that the pressure coefficients at various locations may determine more than one design criterion.

d) Movements, deflections and loads shall be transmitted/ transferred safely to the points of support/ building structure in a statically determined manner.

e) Stresses shall be avoided. Any stresses shall be understood as a result of the Detailed Design and shall be accommodated safely.

f) The works shall accommodate movements, deflections and loads without levels of noise likely to be intrusive in and around the completed building.

H11.256 Building Movements and Deflections

a) The works shall accommodate the following:
   i) Movements and deflections, including associated tolerances, of the building structure as stated in the Building Movement and Tolerances Report.
   ii) Movements and deflections, including associated tolerances, of adjacent building elements impacting on the works.
   iii) Movements and deflections, including associated tolerances, of the systems themselves specified herein.
   iv) Differential movements and deflections.
   v) Movements and deflections in permanent and temporary conditions.
   vi) Movements and deflections of any joint, whether designed to permit movement and deflection or not.
   vii) Cyclic movements and deflections over the service life of the works.

b) Movements and deflections include:
   i) Those under the application of all static and dynamic design loads; including dead, live, wind/ air pressure loads and impacts.
   ii) Settlement, shrinkage, creep, twisting and racking.
   iii) Changes in dimension and shape.
   iv) Effects of moisture due to changes in the moisture content of system components used in the works, resulting from variations in the moisture content of the air and/or due to the expansion of absorbed or retained moisture caused by freezing.
   v) Thermal effects:
      - Due to climatic conditions.
      - Due to orientation of the works towards the sun. In particular for overhead and sloped glazing.
      - Due to changes in service temperatures and differential surface temperatures.

H11.257 Dead Loads

The works shall accommodate the following:

a) The system/ component and final assembly dead load (self-weight gravity load), which shall be accommodated locally without causing deflections or movements that adversely affect any system/ component.

b) The dead loads imposed by/ derived from any permanent fixtures, elements or services attached to the works.

c) The dead loads imposed by/ derived from any adjacent elements that bear onto, are suspended from or are fixed to the system.

H11.258 Live/ Imposed Loads

The works shall accommodate the following:

a) All inertial loads resulting from movements and deflections of the building structure and system support structure.

b) Loads, due to the occupants/ users of the building, in accordance with BS 6180, BS EN 1991 and PD 6688.

c) Wind/ air pressure loads.

d) Loads from snow, ice and unintended water absorption, in accordance with BS EN 1991: Part 1-3.

e) Loads arising from the maintenance and cleaning operations:
   i) A static 500N load applied through a square of 100mm sides.
   ii) Loads imposed during replacement of system components and the components of interfacing systems.
   iii) Loads/ pressures associated with normal maintenance and access.

f) Accidental loads imposed by persons falling against or onto the works.

g) Loads arising from moving elements of the works, such as integrated opening elements/ doors.

h) Known impact loads, or transferred impact loads, which occur during its service life, without deterioration in performance and without sustaining non-repairable damage.

i) Horizontal and vertical loads of similar magnitude to those that are imposed upon adjacent/ attached elements. Information on such elements and/ or required load capacities shall be as indicated on the Design Drawings.

j) Rooflights/ overhead/ horizontal/ inclined systems:

i) Performance requirements in accordance with BS 5516: Parts 1 and 2. as a minimum. Where performance criteria conflict with BS EN 1991: Part 1-1 the more onerous shall apply.

ii) Overhead glazing/ panels in canopies and in roofs with maintenance access and unspecified general access shall, as a minimum, be designed to accommodate a concentrated load of 1.2kN acting over an area of 200mm x 200mm.

iii) Overhead glazing/ panels in roofs with cradle access above shall, as a minimum, be designed in accordance with the loads specified in BS EN 1991: Part 1-3. The specified concentrated load of 1.8 kN shall be taken as acting over an area of 50mm x 50mm.

iv) Refer to Section Z25 of the Architectural Specification.

H11.259 Wind and Air Pressure Loads

The works shall accommodate the following:

a) Wind loads:

i) Refer to Section A15 of the Architectural Specification.

ii) The works shall withstand without permanent deformation, the effects of wind loads where appropriate (i.e. external conditions or internal areas subject to external wind pressure).

iii) Canopies shall be constructed in accordance with the recommendations of BRE Digests 284 and 406, in particular mindful of the varying consequences of subsequent partial and full blocking.

b) Air pressure loads within the building shall also be calculated, taking into account the presence of openings in the building enclosure.

c) Systems shall be designed to eliminate vibration, noise and fatigue caused by wind action.

H11.260 System Deflections

a) The works when carrying full design loads, and at both positive and negative applications of the peak test pressure, shall not exceed the deflection limits stated by the CWCT.

b) Calculations of deflections for structural aluminium shall comply with BS EN 1999: Part 1-1 and PD 6702: Part 1.

Environmental

H11.261 Thermal Performance

a) The works shall be designed to minimise thermal/ cold bridging in any area of the system.

b) ***The maximum thermal permitted transmittance (U-value) for the various areas of the works shall be in accordance with Part L of the Building Regulations. OR

c) ***The maximum thermal permitted transmittance (U-value) for the various areas of the works shall be the following:

i) Double glazed vision and translucent area for external façades: 2.2 W/m²K or better.

ii) Area weighted average U-value for solid panels, metal cladding and metal spandrel panels: 0.28 W/m²K or better.

iii) Area weighted average U-value for the works (double glazed vision area and frames): 1.2 W/m²K or better.

d) The average U-value through the works shall be in accordance with the above requirements and meet all Statutory requirements as well as Part L of the Building Regulations.

H11.262 Light, and Solar Radiant Heat Factors (Glass)

a) Light transmission and reflectance of the glazing shall be in accordance with the Daylight Analysis Report.

b) Solar radiant heat factors shall be compliant with the specified 'Thermal Performance Requirements'.

c) The Detailed Design shall take into consideration calculated solar performance under varying conditions of solar radiation and external/ internal air velocity.

H11.263 Air Permeability - Infiltration

a) The works shall control airflow through the system from the outside to the inside of the building. Permitted airflow shall be distributed and not concentrated at any one location.

b) The works including all interfaces shall achieve a maximum air infiltration rate of:

i) Fixed lights:1.5 m³/hr/m².

ii) Opening lights/ smoke vents: 2.0 m³/hr/per metre length.

iii) Framed and rebated doors: 2.0 m³/hr/per metre length of opening.

H11.264 Air Permeability - Exfiltration

a) The works shall control airflow through the system from the inside to the outside of the building. Permitted airflow shall be distributed and not concentrated at any one location.

b) The works including all interfaces shall achieve a maximum air exfiltration rate in accordance with the Thermal Modelling Report at documented pressures.

H11.265 Air Permeability - Façade Floor

The joint between the façade cladding and the structural slab at each floor level shall be sealed in accordance with the Services Engineer's documentation. Requirements for fire and smoke stopping shall be maintained.

H11.266 Condensation

a) Only under extreme conditions where the relative humidity is in excess of that stated in the Services Engineer's documentation, shall condensation be permitted to form, either on internal or external surfaces, or interstitially within the construction, such that it may lead to degradation of performance, damage or staining under the specified conditions.

b) Condensation shall be permitted in non-visible drained and ventilated rebates provided it does not have a deleterious effect on performance or durability.

c) The interstitial condensation risk of the works shall be determined in accordance with BS 5250 and other governing codes and standards.

H11.267 Capillarity

Prevent water migration caused by capillarity to areas that are designed to remain dry.

H11.268 Weather/ Water Penetration Resistance

a) Resistance to water penetration when tested shall be in the test pressure class 600 Pa or 0.25 the design wind pressure, whichever is the greater, in accordance with the requirements of the CWCT Standard for Systemised Building Envelopes for testing for water penetration by the static and dynamic test method.

b) The works shall be weatherproof and watertight and water leakage onto the internal face of the works and any other part of the system that may be adversely affected shall be prevented.

c) The works (including flashings and junctions with adjacent parts of the building) shall be weatherproof and watertight under all conditions allowing for all deflections and other movements.

H11.269 Local Requirements

a) The Site shall be visited to ensure familiarity with local conditions and requirements. Take into account the local microclimatic conditions and assess the material grades for suitability for the location. Only suitable materials shall be selected.

b) Local microclimatic and atmospheric conditions shall be assessed, with due allowance for any factors likely to have an adverse effect on materials intended for the works. If adverse effects are predicted, more appropriate materials shall be substituted.

c) Obtain any additional meteorological and climate data considered necessary in order to fulfil contractual obligations.

Acoustic and Noise

H11.270 Acoustic

a) Refer to the Acoustic Report and achieve all the performance criteria identified therein.

b) The internal areas of the building shall be effectively insulated from levels of external noise.

i) Specified performance sound reduction value(s) shall be achieved, inclusive of all service penetrations and interfaces with other elements.

ii) The measured noise exposure of each façade shall have been used in conjunction with the specified internal noise criteria to derive the façade sound insulation requirements of the works.

c) Flanking transmission:

i) The works shall provide internal sound reduction between floors. The system shall provide specified weighted standardised flanking level difference at junctions of the façade with the floor/ ceiling slabs.

ii) The works shall provide internal sound reduction between adjoining areas on the same floor. The system shall provide specified weighted standardised flanking level difference where partitions meet the façade at a mullion.

H11.271 Noise

a) The works shall not creak, rattle, whistle or produce other sounds such that levels of noise are likely to be intrusive in and around the completed building.

b) Wind/ air movement generated noise:

i) The necessary provisions are required to eliminate vibration, noise and fatigue caused by wind action and/ or vortex shedding of the façade elements.

ii) The works shall resist the generation and transmission of noise when exposed to wind. Wind generated airborne noise shall not exceed at target level of 35dB (A) at a distance of 1m from the façade, unless stated otherwise in the Acoustic Report .

iii) Wind generated noise shall not exceed a level which is 5 dB below the building services noise limits for adjacent spaces, when measured at the nearest, normally occupied position, whether or not windows, where applicable, are open.

c) The works shall accommodate movements, deflections and loads without levels of noise likely to be intrusive in and around the completed building.

d) Rain or hail striking against any surfaces of the façade systems shall not result in attention catching noise.

Fire and Smoke

H11.272 Fire

a) Refer to the Fire Strategy Report and achieve all the performance criteria identified therein.

b) All elements of the works shall be either non-combustible or not easily ignitable with low flame spread characteristics.

c) No element of the works shall produce excessive quantities of smoke or toxic gases.

d) Surface spread of flame:

i) Where necessary, the external wall shall meet unprotected limitations under requirement B4 “External Fire Spread” of the Building Regulations.

ii) Unless otherwise specified, all materials used internally and externally (with the exception of sealants and gaskets) shall have a Class 0 surface spread of flame classification as defined in Approved Document Part B of the Building Regulations, when tested in accordance with BS 476: Parts 6 and 7.

e) Fire and smoke stopping:

i) Cavity barriers shall be provided in the external wall and for fire stopping, as specified, at the junction of the external wall with all other fire-resisting elements of the structure, to meet the requirements of Approved Document Part B of the Building Regulations.

ii) Fire and smoke stops shall be positively fixed in position in such a manner that they shall not become dislodged in the event of a fire and shall remain in position for a period at least equal to that required for the compartment wall or floor against which the works abut.

f) Fire resistance:

i) Comply with functional requirement B4 of the Building Regulations.

ii) Where fire-resisting glass is required, comply with the specified fire ratings and Section Z25 of the Architectural Specification. Beadings, gaskets, etc. shall be suitable for the fire rating to be achieved.

iii) Each floor in the building shall be a fire-resisting compartment floor and the junction of the floor and the cladding shall preserve the integrity and insulation of compartmentation, to prevent fire spread from floor to floor. Therefore, materials used to complete the junction shall accommodate movement between slab edge and cladding and their fire resisting performance shall not be affected by water from sprinkler discharge.

iv) In accordance with the guidance in Section 12 of Approved Document Part B of the Building Regulations, any insulation in the external wall construction that is exposed in a ventilated cavity shall be of limited combustibility.

g) Ventilation shall be provided to the firefighting shafts, detailed in accordance with the guidance in BS 9999.

h) Openable vents within the stair enclosure shall have an area of at least 15% of the horizontal cross-sectional area of the stair enclosure, at every storey level above ground level.

i) Lobbies to the firefighting stairs above ground level shall be provided with openable vents with a free area of at least 25% of the horizontal cross-sectional area of the firefighting lobby, with the vent(s) sited as near to the ceiling as is practicable.

j) Provide [60] minute floor to floor fire separation at the perimeter of each level. Details of suitable products shall be submitted, including fire test information complying with BS 476: Part 20, test method.

H11.273 Smoke

Smoke control provision shall be maintained in accordance with BS 9999 and BS EN 12101: Part 2 and as required by the Building Control Officer and/ or the Fire Brigade respectively.

Security

H11.274 General

a) Refer to the Security Report.

b) The works shall comply with the recommendations of the ‘Secured by Design’ initiative as produced by the Association of Chief Police Officers. Refer to the Secured by Design Certification schedule.

c) The works shall accommodate manual attack in accordance with LPCB standard LPS 1175: Classification Level 3.

d) Burglar resistance to pedestrian doorsets, windows, curtain walling, grilles and shutters shall be in accordance with BS EN 1627: Resistance Class 6.

e) Security glazing shall resist impacts from manual attack in accordance with BS EN 356: Category of resistance PA8.

Durability

H11.275 Generally

a) The performance criteria shall be satisfied for the full service life of the works, as stated in Section A15 of the Architectural Specification, providing that the maintenance has been carried out as specified.

b) Exposure to sunlight during the service life of the works shall not result in degradation of appearance or performance.

c) The works shall resist abrasion from accepted cleaning methods and maintenance systems without any noticeable change in the surface appearance.

d) Surfaces shall be sufficiently hard to resist heavy impacts from hand-held objects without any noticeable change in the surface appearance.

H11.276 Impact Load Resistance

The works shall accommodate the following:

a) Impact loads in accordance with CWCT Technical Note TN 75:

i) Exposure category B.

ii) Safety class: The Trade Contractor shall complete a risk assessment for each system and shall confirm the risk class, as defined in TN 75, for each location.

iii) Serviceability class: 1.

b) Soft body impact loads to glazed elements: Classification 1 in accordance with BS EN 12600.

c) Soft body impact loads to non-glazed elements: Internal classification I-5 and External classification E-5 in accordance with BS EN 14019.

d) Impact loads in accordance with CWCT Technical Note TN 66: Class 1 (should necessary performance exceed this, the system shall be designed as a floor).

Sustainability Requirements

H11.277 General

a) Refer to Section A33 of the Architectural Specification.

b) Refer to the Sustainability Report for the strategies that shall be adopted and a record of which Credits are targeted.

WORKMANSHIP

H11.278 General

a) The works generally shall be fabricated and installed in accordance with the CWCT Curtain Wall Installation Handbook.

b) Where applicable, the works shall be carried out in accordance with the manufacturer's recommendations.

c) Operatives shall be trained, experienced and appropriately skilled in the installation of the works and, where applicable, be recommended by the system/ product manufacturer.

d) Where preceding work is complete before fabrication, the Trade Contractor shall take Site measurements. If these measurements indicate that the dimensions indicated on the Working Drawings are unachievable, the Trade Contractor shall propose, to the Architect, remedial measures to rectify the situation and seek acceptance from the Architect before proceeding.

e) Where applicable and practical, fabrication and assembly shall take place in properly equipped workshops with Site work restricted to fixing.

f) Works shall be formed true to shape/ detail, continuous (where applicable), accurate in size, free from distortions, marks, irregularities, flaws, steps, waves, rolling marks, imprints, scratches, defects or damage of any nature to configurations indicated on the Working Drawings.

g) Materials/ components that are damaged or have any other physical imperfections shall not be used in the works.

h) Damaged units shall not be repaired unless accepted by the Architect.

i) Materials/ components with prefinished surfaces shall not be altered unless accepted by the Architect.

j) Where permitted by the manufacturer, materials/ components shall be cut neatly and accurately without damage. Cut edges shall be kept to a minimum.

k) Joints shall be fabricated so that the assembly shall be tight and close fitting to produce rigid materials/ components free from distortion.

l) The glazing works shall be set out such that all framing members are installed in the correct position, within tolerance, and in the correct relationship to the building structure.

m) The finished work shall be true to line, level and plane with a satisfactory fit at all junctions.

Inspection/ Preparation

H11.279 Inspection

a) Before commencing installation, the structure shall be surveyed.

b) Dimensions, line, level and fixing points shall be checked.

c) The Architect shall be informed immediately if the structure is unsuitable to receive the works.

d) If the structure/ substrate is unsuitable, remedial action to make the structure suitable shall be proposed.

H11.280 Suitability of Base/ Backing

a) All cutting, chasing, plugging, making good and other necessary procedures required to the substrate or to the adjacent works, that cannot/ should not be undertaken after the installation of the works, shall be completed.

b) Tolerances of the structure/ substrate shall be suitable to permit the required configuration and specified tolerances of the finished systems/ products.

c) All surfaces to be covered shall be firmly fixed, dry, smooth, without depressions, voids or protrusions, clean and free from frost, unacceptable curing compounds, release agents and other surface contaminants.

Fabrication/ Installation

H11.281 General

a) Allowance for future moisture and temperature movement shall be made.

b) Where permitted by the manufacturer, materials/ components shall be cut neatly and accurately without damage. Cut edges shall be kept to a minimum.

c) Materials/ components intended to be installed in 'running lengths' shall be subject to the following:

i) Straight runs between angles or ends of runs shall be formed in single unjointed lengths wherever possible. Where running joints are unavoidable, obtain acceptance for location and method of jointing from the Architect.

ii) All joints at angles shall be mitred or to the acceptance of the Architect.

d) Materials/ components from the same production batch shall be used in the same area to prevent banding, patchiness or other visual variations.

e) Interfacing works shall not be cut, drilled or otherwise altered to accommodate the system installation unless accepted by the Architect.

f) The works, when installed, shall not be subject to warping or twisting and shall be rigid, firm, free from vibration, knocking, rattles, squeaks and other noises.

H11.282 Doors

a) Doors shall be set out and installed with the head, jamb and bottom clearances required by the fittings/ ironmongery manufacturer.

b) Fittings/ ironmongery shall be carefully assembled and fixed using matching fastenings supplied by the manufacturer.

H11.283 Fixing Requirements

a) Refer to Section Z20 of the Architectural Specification.

b) Fixings and fastenings shall be installed and positioned as recommended by the manufacturer. Where visible, positions shall be to the acceptance of the Architect.

c) The works shall be fixed securely to prevent pulling away, bowing or other movement during use and without causing stress or distortion. Include additional bracing and stiffening as required.

d) Isolating tape, plastic washers or other suitable means shall be provided to prevent bi-metallic corrosion between dissimilar metals, or between preservative treated timber and metal.

H11.284 Packings

a) Suitable tight packings shall be provided to take up tolerances and prevent distortion.

b) Packings shall be of non-compressible, rot-proof and non-corrosive materials/ components that maintain the performance of the systems/ products with which they interface.

c) Packings shall not intrude into zones that are to be filled with sealant or areas required for drainage. The performance of the works and interfacing systems shall be maintained.

d) Packers and shims shall not be visible in the finished works.

H11.285 Sealants

Refer to Section Z22 of the Architectural Specification.

Protection and Completion

H11.286 Protection

Finished areas shall be adequately protected from damage until Practical Completion.

H11.287 Cleaning

a) At Practical Completion of the works, or when otherwise agreed with the Architect, all exposed areas/ surfaces of the works shall be cleaned.

b) Cleaning materials and methods shall be as recommended/ accepted by the system/ product manufacturer, where applicable.

c) Materials or methods that could alter the character of the exposed finishes shall not be used.

d) Adjacent surfaces shall be protected from damage due to cleaning operations.

H11.288 Completion

a) Defects shall be repaired without delay, to minimise damage and nuisance.

b) The works shall not be used for any purpose, except testing, until Practical Completion.

c) On Practical Completion, the works shall be checked for damage and defects. All damaged or defective materials/ components shall be replaced.

d) Operable systems shall be checked for satisfactory operation. Adjust and lubricate as necessary to ensure correct functioning.

Tolerances

H11.289 General

Tolerances shall be measured against the relevant Base Reference Datum, Location Reference Point, Location Reference Plane; Location Reference Surface or Reference Element.

a) All elements shall be set out to their correct position as indicated on the Working Drawings, within ±2mm.

b) Generally, elements shall not deviate in size by more than ±1mm from the dimension as indicated on the Working Drawings. Thickness/depth (extrusion and pressed metal tolerances nominally) shall not deviate by more than ±0.5mm.

c) Vertical elements shall be plumb, within ±2mm or 0.1% of the height, whichever is the lesser.

d) Horizontal elements shall be level, within ±2mm or 0.1% of the length, whichever is the lesser.

e) The straightness of any flat plane or surface, including bow, an edge or lineal element shall not deviate by more than 2mm from a 3000mm straightedge and 1mm from a 1000mm straightedge. For flat planes and surfaces the tolerance shall be applied in any direction. For edges or lineal elements the straightedge shall be placed in any direction parallel to the long axis of the element.

f) The maximum offset in plane or level between any two adjacent sections shall be ±1mm.

g) The average width of any panel to panel joint shall be within ±1mm of the nominal joint. Any variation shall be equally distributed with no sudden changes or steps.

h) The maximum deviation between adjacent panel surfaces either side of an expressed joint shall be 1mm.

i) The cross-section of any element shall not be twisted by more than 1° from the intended alignment.

j) Dimensional and location tolerances at interfacing works shall as a maximum be ±2mm to the dimensions indicated on the relevant Working Drawings. Final tolerances shall be co-ordinated and agreed with performance being maintained.

k) Account shall be taken of the installation tolerance requirements such that repetitive elements are accurately located, relative to grid lines.

l) Deviations from lines, planes and verticality shall be limited to long wave formations of minimum wave length of 20m length with a rate of exchange not exceeding 1:1000 and a maximum amplitude of 3mm. Measured from an optical or laser reference line.

m) Sufficient analysis of the erection sequence shall be undertaken to ensure that the tolerances can be achieved.

n) Permissible tolerances shall be considered in isolation and not compounded.

o) Where an element/ component is subject to more than one applicable tolerance, the most onerous tolerance shall apply.

p) Make due allowance for building movements and deflections.

q) Tolerances stated shall be measured and monitored at a mean temperature.

r) Performance shall be maintained within tolerances.

End of Section

H42 PRECAST CONCRETE PANEL CLADDING/ FEATURES

The particular requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the general requirements specified in the A and Z sections and the particular requirements of other applicable Architectural Specification sections.

H42.100 COMPLIANCE AND SCOPE

COMPLIANCE

H42.101 General

a) Refer to and comply with Section A15.100 of the Architectural Specification regarding the Trade Contractor's design responsibility for this element of the works.

b) Complete the Detailed Design of this element of the works, maintaining the intent of the Design Drawings (A10.102 d) i)), where the Architect's role will be limited to checking compliance with quality, design and visual intent only.

c) Use the reference codes and accompanying descriptions listed on the System Reference Sheet (SRS) to identify materials, products, systems and components, when completing the Detailed Design.

SCOPE

Cladding Built-up Front Weathered Systems

H42.102 Type EWS-451 Precast Concrete Panel Cladding

Homogeneous precast concrete cladding system configured as indicated on the Design Drawings, comprising:

a) Support structure: Steel frame/ concrete slab.

b) Precast concrete cladding components including panels, external cornices, parapets, reveals, sills, fins and other architectural features.

i) Manufacturer: Cambridge Architectural Precast Ltd. or acceptable equivalent.

ii) Material: C50 mix design using 10mm and 3-0 Red Granite fines with white cement.

iii) Finish as indicated on the Design Drawings:

- Polished.
- Acid etched.
- For finishes to sills, refer to the Sills Schedule.

iv) There shall be no uneven distribution of aggregate across any visible faces of the concrete.

v) Surfaces shall be free of cracks, air voids/ blowholes, honeycombing, segregation and other defects.

vi) Improvement to the surface by carefully removing all fins and other projections, thoroughly washing it down and then filling the most noticeable surface blemishes with a cement and fine aggregate paste to match the colour of the original concrete.

vii) Careful selection of release agent to ensure that the concrete surface does not become stained or discoloured.

viii) After the concrete has been properly cured, the face shall be rubbed down, where necessary, to produce a smooth and even surface.

ix) Constituent materials of the mix shall provide a pink colour to the acceptance of the Architect through sampling.

c) Changes in direction shall be achieved using panels that are factory formed to suit the configurations. Preformed return ends shall be provided where possible, but symmetrical mitred joints may be offered for acceptance by the Trade Contractor.

d) Exposed arrises shall have chamfered edges to a profile acceptable to the Architect.

e) Joints between components:

i) Sealed with flexible hidden sealant as accepted by the Architect through sampling.

ii) Joints shall be concealed as indicated on the Design Drawings.

iii) The rear of joints shall be filled using tight fitting and fully bonded factory profiled insulation, suitably taped at joints and shall incorporate other accessories, as required, to maintain the performance of the system.

H42.200 QUALITY AND WORKMANSHIP

SUBMITTALS

H42.201 Tender Submittals

A design response shall be submitted with the Tender proposal, including the following:

a) Pre-contract samples, where specified.

b) A list of tests to be included.

c) Proposed QA/ QC programme.

d) A list of Working Drawings to be submitted.

e) A summary of any proposed deviations from the Architectural Specification and Design Drawings.

f) Outline technical specifications/ data sheets of proposed materials/ systems.

g) A list of proposed suppliers and sub-contractors.

H42.202 Post Contract Response

The post contract response shall include:

a) Samples where specified.

b) Test data to demonstrate compliance with the performance requirements.

c) Submittals associated with the QA/ QC process.

d) Working Drawings.

e) Detailed technical specifications reflecting materials/ systems being installed.

f) A list of suppliers and sub-contractors being used.

g) Provide method statements for:

  i) Fabrication and installation methods, including proposals to achieve the specified tolerances. This shall demonstrate a clear understanding of the construction programme, the effects of the building structure and interfacing works.

  ii) Removal and replacement of system components for acceptance by the Architect, as a preclude to the Maintenance Manual, refer to Section A33 of the Architectural Specification.

h) Provide actual air leakage results from tests for acceptance by the Architect.

i) Thermal:

  i) Thermal calculations shall be submitted for the various components and the overall thermal performance of the proposed works, to demonstrate compliance with the performance requirements.

  ii) Thermal transmittance (U-value/ U-factor) shall be calculated/ assessed using the methods defined in BS EN ISO 12631 and guidance from the CWCT.

  iii) Where applicable, linear and/ or point thermal transmittances shall be calculated for thermal bridges through the elements in accordance with BS EN ISO 10211 and guidance from the CWCT.

j) Condensation:

  i) Carry out a condensation risk assessment of the specified works and interfaces with the work of others and submit calculations to demonstrate that the risk of condensation, under specified conditions, has been eliminated.

k) Evidence shall be provided that the acoustic performance requirements given herein can be achieved.

l) Before work begins on Site the proposed method of dimensional setting-out and cross-checking with adjacent trades and elements, to satisfy the accuracy requirements, shall be submitted to the Architect.

m) After completion of on-Site testing, prepare and submit a report to the Architect, which shall include proposals for remedial measures, if any leaks/ defects or other failures occur.

n) Copies of the final testing certificates for earth bonding and lightning protection shall be incorporated in the Health and Safety File.

H42.203 Pre-contract Samples

The following pre-contract samples shall be provided:

a) 300mm x 200mm sample(s) of proposed cladding panels with specified finishes and textures.

b) All other proposed precast concrete features required for the design intent. Sizes as accepted by the Architect.

c) Proposed fixings visible in the finished works.

H42.204 Post Contract Samples

The following post contract samples shall be provided:

a) 600mm x 400mm sample(s) of accepted cladding panels with specified finishes and textures, as applicable, and indicated joint relationship with adjacent panels, including insulation infill.

b) All other accepted precast concrete features required for the design intent. Sizes as accepted by the Architect.

c) Various extrusions/flashings a minimum of 300mm in length.

d) Accepted fixings visible in the finished works.

H42.205 Mock-ups

The following mock-ups shall be provided:

a) 2 No. 1000mm x 1000mm size panels including required finish with the joints as indicated on the Design Drawings to the acceptance of the Architect.

H42.206 Prototypes

The following prototypes shall be provided:

a) Test certification that complies with all performance requirements and warranty providers' requirements, shall be submitted. If test certification is not submitted a prototype (including testing) will be required for the external cladding including all components and finishes.

H42.207 Quality Benchmarks

In locations to be agreed with the Architect, provide the following quality benchmarks:

a) First completed full height structural bay of each type of system including interfaces with adjacent structures/ finishes.

TESTING

H42.208 General

a) Refer to Section A33 of the Architectural Specification for the general requirements for testing.

b) Off-Site testing:

i) The Trade Contractor may provide data from previous independently certified tests to demonstrate that the Trade Contractor's proposed systems meet the performance requirements of the Architectural Specification. The information shall be to the entire satisfaction of the Architect.

ii) If suitable data to demonstrate compliance with the performance requirements is not available, provide prototypes of each type and have them independently tested in accordance with the testing criteria indicated in the Architectural Specification.

iii) Independently certified test data, as applicable, shall include static and dynamic results, and Agrément certificates.

c) On-Site testing: The Trade Contractor shall include for all on-Site testing specified herein.

d) The works shall be tested in accordance with the requirements of the CWCT Standard Test Methods for Building Envelopes.

e) Test certificates shall not relieve the Trade Contractor of responsibilities to achieve the requirements of the Architectural Specification.

H42.209 Results and Certificates

a) Tests and inspection results shall be submitted immediately they are available.

b) Submit certificates relating to the materials used in the work as confirmation of tests carried out in accordance with the relevant British Standards, and/ or other national standards as appropriate.

c) Maintain, until the end of the defects liability period, records of all inspections and tests performed, material certification, inspection and test plans, drawings and any other documentation to substantiate conformity with the Architectural Specification, including those carried out by sub-contractors.

d) The records shall be stored in such a way that they are identifiable to the component to which they refer and are retrievable.

e) The records shall be available for inspection by the Architect and copies of records shall be given to the Architect upon request. At the end of the defects liability period they shall be submitted to the Architect.

Off-Site Testing

H42.210 Testing of Prototypes

a) The prototypes shall be mounted in test rigs, which have the same conditions of attachment and support as elements of the works, with a supporting structure similar in stiffness to that supporting the works. The prototypes to be tested shall not be influenced by the test chamber.

b) The Testing Authority shall witness the installation and dismantling of the prototypes, record any variations to the agreed details on a set of the prototype assembly drawings prepared by the Trade Contractor and shall also record test failures.

c) Provide details of all jointing and sealing methods, materials used, type, number and size of drainage/ ventilation apertures, as applicable, and properties of the support members.

d) The Architect shall be given at least 7 days' notice prior to the erection and dismantling of the prototype construction, as the Architect may elect to observe the assembly and dismantling of the test prototypes.

e) Tests shall not be carried out without prior notice of at least 7 days being given to the Architect.

f) Prior to testing, sufficient time shall be allowed to permit all chemically curing sealants to achieve their proper cure as recommended by the sealant manufacturer.

g) Before the test is begun, the external face of the specimen shall be thoroughly washed using a mild additive-free detergent and then rinsed.

h) Testing shall be carried out/ certified by an independent laboratory acceptable to the Architect.

i) The prototypes shall be tested for air permeability, water leakage and wind load resistance, plus additional structural loading tests as necessary to demonstrate that the works are capable of accommodating the building movements while maintaining the performance of the works.

j) Details of the testing procedures shall be provided to the Architect for review and comment.

H42.211 Standard Test Apparatus and Calibration

Submit details of the following equipment intended for use in the testing process:

a) Test chamber.

b) Air system.

c) Water spray system.

d) Pressure measuring apparatus.

e) Airflow-metering system.

f) Water flow-metering system.

g) Deflection measuring devices.

h) Calibration.

H42.212 Off-Site Test Sequence

a) The Testing Authority shall witness the installation and dismantling of the prototypes, record any variations to the agreed details on a set of the prototype assembly drawings prepared by the Trade Contractor and shall also record the extent of water penetration into the system.

b) Test Sequence:

i) Preliminary testing:

- Prior to the full test sequence, the prototypes shall be pre-tested under static pressure at 50% maximum design wind load, followed by water penetration test at 50% of the pressure specified for final tests.
- Deficiencies observed in the samples during testing shall be recorded and appropriate corrections made.

ii) The testing sequence shall be followed in accordance with the CWCT Standard for Systemised Building Envelopes Sequence B procedures.

iii) Further tests shall be carried out in accordance with the CWCT Standard for Systemised Building Envelopes Discretionary Test procedures.

c) No test shall be carried out unless all previous tests in the sequence have been passed to the satisfaction of the Testing Authority.

d) If any modification is made to the prototype, repeat testing shall be undertaken as detailed in the relevant CWCT procedures. However, if any modification is undertaken that, in the opinion of the Testing Authority or witness, invalidates earlier test results, the sequence shall commence again at the first test.

H42.213 Air Permeability Tests

a) Air Infiltration:

i) The works shall resist the passage of air such that its air leakage rates, if measured in accordance with the CWCT Standard, shall not be exceeded in both the initial and repeat tests.

ii) The prototypes shall be tested to determine the air infiltration per unit area for fixed panels, and per unit joint length for any opening lights. A check for regions of concentrated air leakage shall be made after the air permeability test has been completed and such areas marked upon the prototype drawings.

iii) Testing shall be carried out in accordance with BS EN 12153, for cladding, and BS EN 1026, for windows and doors, to a test pressure of 600 Pa or 0.25 of the design wind pressure, whichever the greater.

b) In addition, an air exfiltration test shall be carried out on the prototype to check the performance in relation to the whole building's air leakage test requirements.

H42.214 Weatherproofing and Watertightness Tests

a) Tests shall be carried out adopting either the static or the dynamic procedures, as appropriate to the system type and expected conditions, set out below:

i) Static Test Method carried out in accordance with BS EN 12155, for cladding, BS EN 1027, for windows and doors, and the requirements of the CWCT Standard for Systemised Building Envelopes for the static test method.

ii) Dynamic Test Method carried out in accordance with the requirements of the CWCT Standard for Systemised Building Envelopes or BS EN 13050, for testing for water penetration using the dynamics method. Dynamic testing shall be undertaken using a propeller engine.

iii) Resistance to water penetration when tested shall be in the test pressure class 600 Pa or 0.25 the design wind pressure, whichever is the greater, in accordance with the requirements of the CWCT Standard for Systemised Building Envelopes for testing for water penetration by the static and dynamic test method.

b) Performance under Testing:

i) There shall be no leakage into the internal face of the works at any time during the test or within 15 minutes of completion of the test.

ii) At the completion of the test there shall be no standing water in locations intended to drain.

H42.215 Wind Resistance Tests

a) A serviceability test shall be carried out in accordance with BS EN 12179, for cladding, and BS EN 12211, for windows and doors, as modified by the CWCT Standard for Systemised Building Envelopes.

b) A safety test shall be carried out in accordance with the CWCT Standard for Systemised Building Envelopes.

c) The peak test pressure shall be 1.5 times the design wind pressure for the 'Safety' test, and 1.0 times the design wind pressure for the 'Serviceability' test.

d) Performance under Testing:

i) At both positive and negative applications of the peak test pressure, there shall be no permanent damage to support structure, cladding panels or sub-construction. At both positive and negative applications of the peak test pressure, there shall be no permanent damage to supports or cladding panels or anchors. Support members shall not buckle, panels shall remain securely held and gaskets/ seals shall not be displaced.

ii) After loading to the positive and negative peak test pressure, permanent deformation to wall framing members shall not exceed 1/500 of the span measured between points of attachment to the building one hour after the loading has been removed.

iii) The loads created by specified test conditions shall be accommodated safely, without detriment to the overall design, structural integrity and performance of the works.

iv) The permanent fixings of any component shall be capable of resisting the combined dead load and maximum wind load with a factor of safety of at least 1.5.

H42.216 Impact Testing

a) Impact testing shall be carried out in accordance with CWCT Technical Note TN 76, conforming to the category requirements specified.

b) A manual attack test shall be carried out in accordance with LPCB standard LPS 1175, conforming to the category requirements specified.

c) The façade prototype shall be tested with a prototype of the applicable maintenance access equipment, which is to technically and physically represent the proposals for the works. The testing shall be undertaken with loadings, movements and the like, representative of use and Site conditions to calculate/ establish impacts on the façade.

d) The extent of any damage determined through testing shall be recorded and, where possible, quantified. Samples shall also be submitted to the Architect.

H42.217 Acoustic Testing

Testing to establish the sound reduction indices shall be carried out in accordance with BS EN ISO 10140, conforming to the requirements specified.

H42.218 Testing of Fixings

a) General:

i) The specific test methods and number of tests shall be appropriate to the scope design and complexity of the project. As a minimum each type of anchor or fixing shall have at least 15 No. tests carried out to destruction. Each panel shall be tested to ultimate failure.

ii) A selected number of panels shall have their fixings subjected to pull-out and shear testings using the principles of BS 5080: Parts 1 and 2.

iii) The fixings shall be subjected to test loading of design load times a factor of 1.1 for both pull-out and shear. The direction of the test loads shall be consistent with the design principles and shall allow for the most onerous design conditions. The type of test (shear, pull-out) shall be dictated by the nature of the anchor/ fixing (i.e. support and/ or gravity). Where appropriate, for instance, tests shall be performed in different loading directions to simulate positive and negative wind loading with a gravity load applied.

iv) The frequency of the panels to be tested shall be as follows:

- 1 in every 5 panels manufactured for the first 50 panels.
- 1 in every 20 panels manufactured for the remainder of the works.

v) Arrange for test reports to be produced at appropriate intervals by the Independent Testing Authority and submitted to the Architect for review. If any of the fixings show a displacement (as defined by BS 5080: Parts 1 and 2) of more than 0.1mm, bring this to the attention of the Architect immediately.

vi) Submit to the Architect for review proposals for these tests, which are to be suitably modified to allow for the primary bracket design. Depending on the initial test results, the frequency of testing may be reviewed and modified with prior agreement.

b) Stone: The actual number of tests to be performed and the test conditions (i.e. bedding/ rift orientation, dry, wet, cyclic loading, freeze-thaw cycles) shall be determined by a construction professional based on the approval test data and available technical performance data available for the particular fixing(s).

H42.219 Precast Concrete/ Reconstituted Stone

a) Sampling and testing of the concrete shall be carried out in accordance with BS 8500: Parts 1 and 2 and BS EN 206 and the relevant Parts of BS 1881. Provide detailed sampling and testing proposals with the Tender for review.

b) As the works proceed, test results shall be submitted weekly for review.

On-Site Testing

H42.220 Thermal Performance Testing

a) Infra-red thermography testing in accordance with BS EN 13187 shall be carried out to ensure that there are no irregularities in the thermal properties of components constituting the external envelope, using a suitable thermal imaging method as defined in CWCT Technical Note TN 45. The testing method shall be subject to acceptance by the Architect.

b) Any areas that are proven not to achieve the performance requirements shall be rectified.

H42.221 Air Permeability - Exfiltration

a) Refer to Section A33 for the 'Airtightness Fan Test' of the building envelope.

b) Air exfiltration rates shall be within the limits specified.

H42.222 Weatherproofing and Watertightness Testing

a) The weathertightness of the works shall be tested using the Site hose test carried out in accordance with the CWCT Standard for Systemised Building Envelopes.

b) If a different method is proposed, details of the testing system and a proposed method statement shall be submitted to the Architect for acceptance, at least one month prior to the proposed testing on Site.

c) Prior to testing it shall be ensured that the works have been completed to a stage where the integrity of the system can be tested, that obvious defects have been made good and that the works have been cleared of all materials, debris and dust.

d) Testing shall be carried out when all works are complete, including that of all associated trades and interfacing trades. This shall exclude works that, if completed, would inhibit the visual inspection of on-Site testing.

e) Performance under testing:

i) There shall be no leakage through the works at any time during the test or within 15 minutes of completion of the test.

ii) If any leaks/ defects occur, mark the location on the works and drain water completely. Prepare a report to be submitted to the Architect, together with proposals for remedial measures. Any part of the works that is adversely affected shall be replaced or repaired; the design intent shall be maintained.

iii) Locally retest and verify the repair integrity after making good any defects.

iv) At completion of the test:

- There shall be no standing water in areas that are to remain dry.
- Certify the waterproof integrity of the works.

v) Invite the Architect to witness the tests.

H42.223 Acoustic Testing

Site sound insulation measurements may be undertaken by the Architect in accordance with BS EN ISO 140: Part 5 and BS EN ISO 16283: Part 1 to check compliance with the acoustic performance requirements.

H42.224 Testing of Fixings

a) As the work proceeds, structural fixings shall be proof load tested as required and witnessed by the Architect.

b) Undertake the following inspections as work proceeds:

i) Inspection of every fixing into concrete and check torques.

ii) Inspections to ensure that fixings do not restrain any intended movements and generate locked up stresses.

ARCHITECTURAL AND FUNCTIONAL REQUIREMENTS

H42.225 General

a) Systems shall be designed and installed as complete integrated systems.

b) Systems shall include all necessary reinforcement, support structure, bracketry, fixing rails and plates, angles, cleats, cramps, grouting, fixings and fastenings, screws, bolts, nuts, washers, rivets, distance pieces, clips, vapour control membranes, insulation, damp-proof membranes, breather and other membranes, air barriers, firestops and cavity barriers, acoustic breaks, pressed metal components, closures, seals and sealants, gaskets, fillers, tapes, spacers, packers, shims, isolators, drainage channels, waterbars, and all other accessories and components necessary to complete the works.

H42.226 Achieving Performance

a) Systems shall comply with all applicable performance criteria during the service life of the works, and also be sufficiently rigid to safely withstand any forces that may act on them during fabrication, transportation, storage, erection on Site and other applicable activities.

b) During the Detailed Design, the Trade Contractor shall take into consideration these non-exhaustive architectural and functional requirements, when achieving the performance.

c) Work requiring mechanical fixing shall ensure that failure of any fixing shall not lead to progressive failure of others.

d) All components, couplings and fixings shall be capable of accommodating performance without permanent distortion, deformation or failure.

e) No elements from other trades shall be fixed to and/ or supported by the works, unless accurately specified, indicated on the Design Drawings and/ or agreed by the Architect.

f) The Detailed Design shall take into account the ambient temperature at the time of the respective operations of fabrication, assembly and erection, with appropriate allowances being made for any dimensional changes resulting therefrom.

g) The Detailed Design and construction of the works shall be such that all rigid or fixed joints shall remain rigid and accommodate all specified thermal, building structure or other movements and any applicable loads without compromising its watertightness. All movement joints shall also be finally designed and constructed to accommodate such loads or movements without compromising the system's watertightness.

h) Movement and deflections:

i) The requirement for any movement joints within the works shall be ascertained to achieve the performance criteria while maintaining the overall system performance.

ii) Movement joints shall accommodate the maximum movement and range of movements that can be derived from the specified and determined design loads and movements. Under maximum movements the joints shall meet all the performance requirements of the Architectural Specification.

iii) It shall be ensured that the works accommodate all movement of the joints in a manner that does not compromise the system’s integrity or appearance.

iv) Movement joints shall appear as similar to the standard system joint as possible.

i) Allow for the fact that the works shall be erected in all extremes of weather conditions throughout the year and that the building may not be climatically controlled during construction. Damage to materials as a result of Site conditions shall be the Trade Contractor’s responsibility.

j) Weather and watertightness:

i) The Detailed Design of the works shall not be based on a single line of defence. The cavities between the lines of defence shall be ventilated and drained to the exterior. A free draining and ventilated cavity shall be provided to the rear of the cladding panels to suit the requirements of BS 8297.

ii) Allowance shall be made to control the flow of any water that may enter the system and for directing this water to the outside, such that no water remains internally.

iii) Wet applied seals for the purpose of preventing the ingress of water shall not be accepted with the exception of wet seals used for sealing the works against adjacent interfacing systems.

iv) The works shall prevent infiltration due to ice dams/ water back-up.

v) Rainwater ponding shall not be permitted on any element of the works.

vi) Weather seals shall be provided at all interfacing connections.

k) Vapour barriers shall always be installed on the warm side of the thermal insulation to provide a continuous air and vapour tight seal at all interfacing joints, between opening elements and fixed elements, and intersections between the system and other interfacing systems/ building structure.

l) Allow for the fact that the works shall be erected in all extremes of weather conditions throughout the year and that the building may not be climatically controlled during construction. Damage to materials as a result of Site conditions shall be the Trade Contractor's responsibility.

m) Corrosion protection:

i) Ensure that protective measures are taken to avoid any corrosion or any deleterious effects caused by manufacturing, finishing, transportation, storage and installation of systems/ products/ materials/ components.

ii) Ensure full resistance to any corrosion for components that are secured or bolted to each other, paying particular attention to the surface damage caused by such bolting or securing.

iii) Ensure full resistance in repair of corrosion protection to cope with the Site cutting of components, especially at boundary and external conditions.

n) Components for earth bonding and lightning protection shall be concealed or inconspicuous in the finished works, and clearly indicated on the Working Drawings, for acceptance by the Architect. Methods shall not impair the performance or the visual characteristics of the interfacing works.

H42.227 Precast Concrete/ Reconstituted Stone Cladding

a) Cladding components:

i) Determine the appropriate constituent materials and mix proportions to meet the requirements of the Architectural Specification.

ii) The works shall comprise the following, as necessary:

- A facing mix suitable to achieve the required visual appearance for all visible faces of the installed works, for the full panel depth.
- A facing mix suitable to achieve the required visual appearance for all visible faces of the installed works, and suitable panel structure/ backing mix.
- Pre-manufactured embedded facings, to achieve the required visual appearance for all visible faces of the installed works, with a suitable panel structure mix.

iii) Finished visible faces shall be uniform in colour, texture and appearance throughout the works.

iv) Surfaces shall be free from discolouration caused by contamination from release agent, grout leakage, rust staining or other sources.

v) Cover spacers shall not be used without acceptance by the Architect .

b) Integral insulation:

i) Insulation shall be bonded/ mechanically fixed to the rear of panels or integrated within panels of sandwich construction, as proposed by the Trade Contractor.

ii) Exposed surfaces of insulation shall be sealed with an appropriate facing material and suitably taped at joints.

c) The works shall include all necessary recesses/ apertures to accommodate services and fittings.

d) Incorporate suitable cast-in components, including fixing points for windows, doors and other attachments as indicated on the Detailed Design.

e) Lifting eyes, as necessary, shall be concealed from view once installed.

H42.228 Fixings

a) Fixings shall be concealed unless accepted otherwise by the Architect.

b) Visible fixings, where permitted, shall have an appearance and finish to the acceptance of the Architect.

c) Where necessary, fixings/ fixing devices shall be capable of providing adequate adjustment to suit building movement, accommodate tolerances and prevent system/ installation failure.

H42.229 Fixing to Structure

a) Systems shall be mechanically fixed to the structure and shall include all necessary sub-constructions/ assemblies including but not limited to, framing, fixing devices, brackets, cleats, angles, anchors, bolts, fixings, sockets and other components.

b) Works shall include all necessary preparation such as drilling, plugging, screwing, bolting, cutting, chasing, forming recesses/ mortices, casting-in/ grouting-in and making good.

c) Fixing shall be co-ordinated with the superstructure design.

d) Mechanical fixing devices shall be austenitic stainless steel of a suitable grade.

H42.230 Secondary Support

a) Provide a structural steel cladding support system, as necessary, having due regard for any requirements in excess of that indicated in the Structural Engineer's documentation and also any requirements indicated on the Design Drawings. The support structure shall include all necessary sub-constructions/ assemblies including, but not limited to, framing, brackets, cleats, angles and other components.

b) Where the Trade Contractor deems that the support system shall need to be visible in the finished works inform the Architect at Tender return. Post Contract award the visual intent shall be finalised in conjunction with the Architect.

H42.231 Gaskets

a) All visible gaskets shall be coloured as described.

b) Gaskets shall not leak or bleed causing any discolouration or staining.

H42.232 Seals/ Sealants

a) Sealants shall be colour co-ordinated with colours of interfacing components, to the acceptance of the Architect.

b) Sealant shall not leak or bleed causing any discolouration or staining.

H42.233 Services Integration

a) Systems shall accommodate services, as indicated in the Services Engineer's documentation and/ or as indicated on the Design Drawings.

b) Locations/ positioning of services shall be agreed with the Architect, where not indicated in the Design Drawings.

c) Services, such as wiring/ wireways pipework, etc. leading to and from user interfaces shall be concealed within the finished works, unless indicated or specified otherwise.

d) Provide necessary seals, gaskets, grommets, support framing, etc. where services penetrate or interface with the works.

H42.234 Maintenance Access Equipment Components

a) Stainless steel restraint sockets, bracketry and other components, provided by or for the Maintenance Access Equipment specialist, in accordance with the requirements of applicable standards, shall be integrated into the works.

b) The locations, type and mounting of components shall be co-ordinated with and advised by the Maintenance Access Equipment specialist to the acceptance of the Architect.

H42.235 Pressed Metal Components/ Accessories

a) Systems shall incorporate all necessary pressed metal components/ accessories including flashings, copings, cappings, sills, reveals and returns.

b) Components shall be formed from fully welded and/ or sealed pressed aluminium sheets, in a temper suitable for the particular type of application and degree of forming to be used and sufficiently thick to provide a visually flat surface free from distortion and permanent deformation. The alloy shall also be selected to satisfy the requirements of the required finishing process.

c) Systems shall include purpose made prefabricated corner pieces for changes in direction as indicated on the Design Drawings. Cut corners at changes in direction shall not be acceptable.

d) Components shall be of finish, colour and texture to the acceptance of the Architect where not specified.

e) Systems shall include concealed support as required.

f) Insulation shall be included as required, including anti-drumming insulation to the underside.

g) Joints:

i) Joints shall include concealed continuous sealed gaskets with recessed/ folded interconnecting or lapped joints to provide continuation and a neat flush external appearance, unless indicated otherwise on the Design Drawings. Simple butt straps shall not be accepted.

ii) Locations shall be as indicated on the Detailed Design, or to the acceptance of the Architect.

H42.236 Maintenance

a) Maintenance shall be undertaken safely for operatives, building users and other people adjacent to the building during maintenance operations.

b) Systems shall permit ease of cleaning within the parameters stipulated by the Design.

c) Demountability:

i) Elements of the works shall be individually and independently removable, ensuring access for maintenance and/ or replacement of infill panels and other system components in the event of breakage/ damage.

ii) Disruption due to maintenance shall be minimised.

iii) Progressive dismantling shall be minimised.

iv) The removal of cladding panels/ components shall not affect the performance or safety of adjacent or any other part of the works.

MATERIALS AND COMPONENTS

Metalwork and Finishes

H42.237 Metalwork

Refer to Section Z11.

H42.238 Finishes

Refer to Section Z30 for general finishes to metalwork.

Concrete/ Monolithic Reconstituted Stone

H42.239 Cement

a) Cement shall be in accordance with BS EN 197: Part 1.

b) Cement shall be sulphate resisting where contact with the ground is made, or as otherwise required.

H42.240 Aggregate

a) Fine and coarse aggregate shall be provided from one source.

b) Fine aggregate:

i) Manufactured sands from coarse aggregate or dust-free, silt-free, salt-free natural sand shall be in accordance with BS EN 12620.

ii) Variation in fineness modulus from mix design limited to ± 0.20% for facing mixes.

c) Coarse aggregate shall be in accordance with BS EN 12620 and shall be normal weight.

d) The amount of organic impurities shall be limited.

e) Restrict deleterious reactive materials with alkalis in cement, in accordance with BS EN 12620.

H42.241 Pigments

a) Pigments shall be in accordance with BS EN 12878.

b) Synthetic mineral oxide shall be stable at high temperatures, resistant to ultraviolet light and alkali resistant.

H42.242 Water

a) Water shall be in accordance with BS EN 1008.

b) Water shall be clean, fresh, potable and free from impurities.

H42.243 Admixtures

a) Admixtures that have been tested and accepted in mix designs shall be used.

b) Air-entraining admixtures shall comply with BS EN 934: Part 3.

c) Water-reducing admixtures shall comply with BS EN 934.

d) Calcium chloride or admixtures containing chloride ions or other salts shall not be permitted.

H42.244 Concrete Mixes

a) The concrete mix shall use suitable constituent materials to provide precast concrete components compliant with the requirements of the Architectural Specification and as accepted by the Architect through sampling.

b) Mix Design:

i) The design mixes for each type and class of concrete shall be determined by either laboratory trial batch methods or Site experience methods, in accordance with BS EN 1992, to suit the specified finish.

ii) If the trial batch method is used, an independent testing body shall be employed, which is accredited by the United Kingdom Accreditation Service (UKAS), acceptable to the Architect, for preparing and reporting the proposed mix designs. The testing laboratory shall not be the same as that used for Site quality control testing.

iii) Only concrete of accepted mix designs shall be used.

iv) The concrete shall not be placed until the design mix for the class and type of concrete is accepted by the Structural Engineer.

Pointing Mortars

H42.245 General

a) Refer to Section Z21.

b) Determine suitable mix proportions/ ratios to comply with the requirements of the Architectural Specification.

H42.246 Sand

a) Sand for facework mortar shall comply with BS EN 13139 and shall be from one source to ensure consistency of colour and texture. Submit samples of sand proposed in accordance with the requirements of the Architectural Specification and identify:

i) Name of supplier.

ii) The pit the material came from.

iii) Sieve analysis.

iv) Maximum aggregate size: To be agreed with the Architect.

b) Ready-mix mortar may be used, subject to the prior acceptance of the Architect.

Reinforcement

H42.247 General

a) Stainless steel reinforcement shall be in accordance with BS 6744.

b) Carbon steel reinforcement shall be in accordance with BS 4449, BS 4482 and BS 4483 as appropriate.

c) High tensile alloy steel bars for the prestressing of concrete shall be in accordance with BS 4486.

d) Where required and applicable reinforcement shall be galvanised, refer to Section Z30.

Fixings

H42.248 General

a) Refer to Section Z20.

b) Fixings shall be inherently corrosion resistant or fully protected to prevent corrosion.

Adhesives

H42.249 General

Refer to Section Z20.

Sealants

H42.250 General

Refer to Section Z22.

Gaskets

H42.251 General

a) Refer to Section Z36.

b) Gaskets shall be made of either Ethylene Propylene Diene Monomer (EPDM), Ethylene Propylene material (EP) or of Silicone to suit the service conditions.

Membranes

H42.252 General

a) Membranes shall be inert, durable, rot-proof, vermin-proof, not degradable by moisture and resistant to specified extremes of movement and environmental temperatures.

b) Membranes shall be certified to an internationally recognised Agrément Certificate to the acceptance of the Architect.

H42.253 Damp-proof Membranes (DPM)

a) Membranes shall be water resistant/ impermeable, vapour permeable and airtight as necessary to suit the service conditions.

b) Unless detrimental to the performance of the system, DPM shall be manufactured from Ethylene Propylene Diene Monomer (EPDM) or acceptable equivalent.

c) Membranes shall be of limited combustibility and achieve Class 0 propagation and surface spread of flame, unless the Detailed Design of the system protects the membrane from the need for such requirements.

H42.254 Breather Membranes

a) Membranes shall be water resistant, water vapour permeable to suit the service conditions. Vapour resistance of the breather membrane shall be not greater than that of the substrate it is protecting.

b) Unless detrimental to the performance of the system, breather membranes shall be manufactured from non-woven, spunbonded high density polypropylene, or acceptable equivalent.

c) Membranes shall be of limited combustibility and achieve Class 0 propagation and surface spread of flame, unless the Detailed Design of the system protects the membrane from the need for such requirements.

H42.255 Vapour Control Layer/ Air Leakage Barrier

a) Layers shall be resistant to water vapour transfer and air, to suit the service conditions.

b) High performance reinforced membranes of metal or plastics, protected both sides by rigid facings/ linings.

c) Foil adhered to plasterboard shall not be accepted.

d) Include all necessary tapes, seals and accessories to provide a fully sealed system at joints, perimeter conditions and penetrations.

Insulation

H42.256 General

a) Insulation shall be inert, durable, rot-proof and vermin-proof and shall not be degradable by moisture, temperature or water vapour unless the Detailed Design of the system protects the insulation from the need for such requirements.

b) Insulation shall not bulge, sag, delaminate or detach during its installation or when in situ during the service life of the works.

c) Insulation shall be a minimum of Euroclass A2.

d) Insulation shall have zero Ozone Depleting Potential (ODP), be CFC and HFC free and have a Global Warming Potential (GWP) of less than five. Refer to Section A33 of the Architectural Specification.

e) Insulation shall achieve an A or A+ rating as defined in the BRE Green Guide to Specification, which can be viewed at www.bre.co.uk/greenguide.

f) The selected insulation shall comply with all relevant British Standards and be British Board of Agrément (BBA) certified.

PERFORMANCE

H42.257 General

Performance shall be achieved at the correct design wind pressures and associated test pressures, which shall be specifically calculated for the building.

Structural

H42.258 General

a) Unless stated otherwise, systems shall be designed in accordance with the current relevant and applicable British Standards and/ or Eurocodes.

b) Refer to the Structural Engineer's documentation.

c) The works shall accommodate the most onerous combination of movements, deflections and loads, while maintaining the overall performance and without sustaining system failure or any permanent deformation. When calculating design loads the worst combination shall be considered, taking account of the fact that the pressure coefficients at various locations may determine more than one design criterion.

d) Movements, deflections and loads shall be transmitted/ transferred safely to the points of support/ building structure in a statically determined manner.

e) Stresses shall be avoided. Any stresses shall be understood as a result of the Detailed Design and accommodated safely.

f) The works shall accommodate movements, deflections and loads without levels of noise likely to be intrusive in and around the completed building.

H42.259 Building Movements and Deflections

a) The works shall accommodate the following:

   i) Movements and deflections, including associated tolerances, of the building structure as stated in the Building Movement and Tolerances Report.

   ii) Movements and deflections, including associated tolerances, of adjacent building elements impacting on the works.

   iii) Movements and deflections, including associated tolerances, of the systems themselves specified herein.

   iv) Differential movements and deflections.

   v) Movements and deflections in permanent and temporary conditions.

   vi) Movements and deflections of any joint, whether designed to permit movement and deflection or not.

   vii) Cyclic movements and deflections over the service life of the works.

b) Movements and deflections include:

   i) Those under the application of all static and dynamic design loads; including dead, live, wind/ air pressure loads and impacts.

   ii) Settlement, shrinkage, creep, twisting and racking.

   iii) Changes in dimension and shape.

   iv) Effects of moisture:

      • Due to changes in the moisture content of system components used in the works, resulting from variations in the moisture content of the air.

      • Due to the expansion of absorbed or retained moisture caused by freezing.

   v) Thermal effects:

      • Due to climatic conditions.

      • Orientation of the works towards the sun.

      • Changes in service temperatures and differential surface temperatures.

H42.260 Dead Loads

The works shall accommodate the following:

a) The system/ component and final assembly dead load (self-weight gravity load), which shall be accommodated locally without causing deflections or movements that adversely affect any system/ component.

b) The dead loads imposed by/ derived from any permanent fixtures, elements or services attached to the works.

c) The dead loads imposed by/ derived from any adjacent elements that bear onto, are suspended from or are fixed to the system.

H42.261 Live Loads

The works shall accommodate the following:

a) All inertial loads resulting from movements and deflections of the building structure and system support structure.

b) Loads, due to the occupants/ users of the building, in accordance with BS 6180, BS EN 1991 and [PD 6688].

c) Wind/ air pressure loads.

d) Loads from snow, ice and unintended water absorption, in accordance with BS EN 1991: Part 1-3.

e) Loads arising from the maintenance and cleaning operations:

   i) A static 500N load applied through a square of 100mm sides.

   ii) Loads imposed during replacement of system components and the components of interfacing systems.

   iii) Loads/ pressures associated with normal maintenance and access.

f) Accidental loads imposed by persons falling against or onto the works.

g) Loads arising from moving elements of the works, such as integrated opening elements/ doors.

h) Known impact loads, or transferred impact loads, that occur during its service life, without deterioration in performance and without sustaining non-repairable damage.

i) Horizontal and vertical loads of similar magnitude to those that are imposed upon adjacent or attached elements. Refer to the Design Drawings for information on such elements and/ or required load capacities.

H42.262 Wind/ Air Pressure Loads

The works shall accommodate the following:

a) Wind loads:

   i) Refer to the Wind Report.

   ii) The works shall withstand without permanent deformation, the effects of wind loads where appropriate (i.e. external conditions or internal areas subject to external wind pressure).

b) Air pressure loads within the building shall also be calculated, taking into account the presence of openings in the building enclosure.

c) Systems shall be designed to eliminate vibration, noise and fatigue caused by wind action.

H42.263 System Deflections

a) The works when carrying full design loads, and at both positive and negative applications of the peak test pressure, shall not exceed 3/ 1000 if its clear span in a direction normal to the plane of that element.

b) Calculations of deflections shall recognise the criteria contained in BS 8297.

Environmental

H42.264 Thermal Performance Requirements

a) Detail the works to minimise thermal/ cold bridging in any area of the system.

b) The maximum thermal permitted transmittance (U-value) for the various areas of the works shall be in accordance with the Thermal Modelling Report.

c) The average U-value through the works shall comply with the above requirements and shall meet all Statutory requirements as well as Approved Document Part L of the Building Regulations.

H42.265 Air Permeability - Infiltration

a) The works shall control airflow through the system from the outside to the inside of the building. Permitted airflow shall be distributed and not concentrated at any one location.

b) The works including all interfaces shall achieve a maximum air infiltration rate of 1.5 $m^3/hr/m^2$.

H42.266 Air Permeability - Exfiltration

a) The works shall control airflow through the system from the inside to the outside of the building. Permitted airflow shall be distributed and not concentrated at any one location.

b) The works including all interfaces shall achieve a maximum air exfiltration rate in accordance with the Thermal Modelling Report at documented pressures.

H42.267 Condensation

a) Except under extreme conditions where the relative humidity is in excess of that stated in the Services Engineer's documentation, condensation shall not form, either on internal or external surfaces, or interstitially within the construction, such that it may lead to degradation of performance, damage or staining under the specified conditions.

b) Condensation shall be permitted in non-visible drained and ventilated rebates subject to condensation not having a deleterious effect on performance or durability.

c) The interstitial condensation risk of the works shall be determined in accordance with BS 5250 and other governing codes and standards.

H42.268 Capillarity

Water migration caused by capillarity shall be prevented to areas that are designed to remain dry.

H42.269 Weather and Water Penetration Resistance

a) The works shall be weatherproof and watertight, ensuring the prevention of water leakage onto the internal face of the works and any other part of the system that may be affected adversely.

b) The works (including flashings and junctions with adjacent parts of the building) shall be weatherproof and watertight under all conditions with full allowance made for deflections and other movements.

Acoustic and Noise

H42.270 Acoustic

a) Refer to the Acoustic Report.

b) The works shall insulate the internal areas of the building from levels of external noise.

i) Specified performance sound reduction value(s) shall be achieved.

ii) The measured noise exposure of each façade shall have been used in conjunction with the specified internal noise criteria to derive the façade sound insulation requirements of the works.

c) Other performance criteria as identified in the Acoustic Report.

H42.271 Noise

a) The works shall not creak, rattle, whistle or produce other sounds that levels of noise likely to be intrusive in and around the completed building.

b) Wind/ air movement generated noise:

i) The necessary provisions are required to eliminate vibration, noise and fatigue caused by wind action and/ or vortex shedding of the façade elements.

ii) The works shall resist the generation and transmission of noise when exposed to wind. Wind generated airborne noise shall not exceed at target level of 35dB (A) at a distance of 1m from the façade, unless stated otherwise in the Acoustic Report .

iii) Wind generated noise shall not exceed a level that is 5dB below the building services noise limits for adjacent spaces, when measured at the nearest, normally occupied position, whether or not windows, where applicable, are open.

c) The works shall accommodate movements, deflections and loads without levels of noise likely to be intrusive in and around the completed building.

d) Rain or hail striking against any surfaces of the façade systems shall not result in attention catching noise.

Fire

H42.272 General

a) Refer to the Fire Strategy Report.

b) Elements of the works shall be either non-combustible or not easily ignitable with low flame spread characteristics, and shall not produce excessive quantities of smoke or toxic gases.

c) Surface spread of flame:

i) External areas shall meet unprotected limitations under requirement B4 ‘External Fire Spread’ of the Building Regulations.

ii) All materials used internally and externally shall have a Class 0 surface spread of flame classification (unless otherwise specified) when tested in accordance with BS 476: Parts 6 and 7.

d) Fire and smoke stopping:

i) Provide all cavity barriers to meet the requirements of Approved Document Part B of the Building Regulations.

ii) Fire and smoke stops shall be positively fixed in position in such a manner that they will not become dislodged in the event of a fire.

Security

H42.273 General

a) Refer to the Security Report.

b) The works shall comply with the recommendations of the 'Secured by Design' initiative as produced by the Association of Chief Police Officers. Refer to the Secured by Design Certification schedule.

c) The works shall accommodate manual attack in accordance with LPCB standard LPS 1175: Classification Level 3.

Durability

H42.274 General

The performance criteria shall be satisfied for the full service life of the works, as stated in the Architectural Specification, provided always that maintenance has been carried out as specified.

H42.275 Weathering and Contamination

a) The flow of rainwater over the surface of the cladding shall be controlled.

b) The works shall be procured, detailed and installed so that the performance is not impaired and so that the visual appearance shall age uniformly and shall minimise pattern staining, streaking or shading owing to rainwater, airborne pollutants and wind.

c) Refer to 'Appearance Matters. Series No. 6. The Weathering of Concrete Buildings' published by the British Cement Association (BCA).

H42.276 Abrasion Resistance

The works shall resist abrasion from agreed cleaning methods and maintenance systems, without any noticeable change in surface appearance.

H42.277 Impact Resistance

The works shall accommodate the following:

a) Generally, surfaces shall be sufficiently hard to resist heavy impacts from hand-held objects, without any noticeable change to the surface appearance.

b) Known impact loads, or transferred impact loads, that occur during its service life, without deterioration in performance and without sustaining non-repairable damage.

c) Impact loads in accordance with CWCT Technical Note TN 75:

i) Exposure category B.

ii) Safety class: The Trade Contractor shall complete a risk assessment for each system and confirm the risk class, as defined in TN 75, for each location.

iii) Serviceability class: 1.

d) Impact loads from maintenance access equipment including Building Maintenance Units (BMU). Both in-plane and out-of-plane forces shall be applied to the works.

Sustainability Requirements

H42.278 General

a) Refer to the A.700 series clauses.

b) Refer to the Sustainability Report for the strategies that shall be adopted and a record of which Credits are targeted.

Earth Bonding and Lightning Protection

H42.279 General

a) Refer to the Services Engineer's documentation.

b) Electrical continuity shall be achieved between conductive parts such that the works will be electrically continuous as required by BS 7671.

c) All extraneous conductive parts of the works shall be effectively bonded to earth. An extraneous conductive part is defined as being that part that is liable to transmit a potential, including earth potential, and not forming part of the electrical installation. Each component shall constitute an extraneous conductive part.

d) Equipotential bonding shall be provided to ensure that the various exposed conductive parts and extraneous conductive parts as defined by BS 7671 shall be at a substantially equal potential.

e) Earth bonding/ connecting shall comply with BS EN 62305: Parts 1-4 and BS 7430.

WORKMANSHIP

H42.280 General

a) Where applicable, the works shall be carried out in accordance with the manufacturer's recommendations.

b) Operatives shall be trained, experienced and appropriately skilled in the installation of the works and, where applicable, be recommended by the system/ product manufacturer.

c) Where preceding work is complete before fabrication, the Trade Contractor shall take Site measurements. If these measurements indicate that the dimensions indicated on the Working Drawings are unachievable, the Trade Contractor shall propose, to the Architect, remedial measures to rectify the situation and seek acceptance from the Architect before proceeding.

d) Works shall be formed true to shape/ detail, continuous (where applicable), accurate in size, free from distortions, marks, irregularities, flaws, steps, waves, rolling marks, imprints, scratches, defects or damage of any nature to configurations indicated on the Working Drawings. All works shall be true to detail with continuous profiles, free from marks, defects, flaws, steps, waves, or damage of any nature.

e) Materials/ components that are damaged or have any other physical imperfections shall not be used in the works.

f) Damaged units shall not be repaired unless accepted by the Architect.

g) Materials/ components with prefinished surfaces shall not be altered unless accepted by the Architect.

h) Where permitted by the manufacturer, materials/ components shall be cut neatly and accurately without damage. Cut edges shall be kept to a minimum.

Inspection/ Preparation

H42.281 Inspection

a) Before commencing installation, the structure shall be surveyed.

b) Dimensions, line, level and fixing points shall be checked.

c) The Architect shall be informed immediately if the structure is unsuitable to receive the works.

d) If the structure/ substrate is unsuitable, remedial action to make the structure suitable shall be proposed.

H42.282 Suitability of Base/ Backing

a) All cutting, chasing, plugging, making good and other necessary procedures required to the substrate or to the adjacent works, that cannot/ should not be undertaken after the installation of the works, shall be completed.

b) Tolerances of the structure/ substrate shall be suitable to permit the required configuration and specified tolerances of the finished systems/ products.

c) All surfaces to be covered shall be firmly fixed, dry, smooth, without depressions, voids or protrusions, clean and free from frost, unacceptable curing compounds, release agents and other surface contaminants.

Fabrication/ Installation

H42.283 General

a) Allowance for future moisture and temperature movement shall be made.

b) Where permitted by the manufacturer, materials/ components shall be cut neatly and accurately without damage. Cut edges shall be kept to a minimum.

c) Materials/ components intended to be installed in 'running lengths' shall be subject to the following:

   i) Straight runs between angles or ends of runs shall be formed in single unjointed lengths wherever possible. Where running joints are unavoidable, obtain acceptance for location and method of jointing from the Architect.

   ii) All joints at angles shall be mitred or to the acceptance of the Architect.

d) Materials/ components from the same production batch shall be used in the same area to prevent banding, patchiness or other visual variations.

e) Interfacing works shall not be cut, drilled or otherwise altered to accommodate the system installation unless accepted by the Architect.

f) The works, when installed, shall not be subject to warping or twisting and shall be rigid, firm, free from vibration, knocking, rattles, squeaks and other noises.

H42.284 Precast Concrete/ Reconstituted Stone

a) Moulds:

   i) Deviations shall be controlled to comply with the Architectural Specification.

   ii) Moulds shall be maintained in clean, sound condition and inspected carefully for defects before each re-use. Damaged moulds shall not be repaired and re-used if this impairs the surface appearance or performance of the units.

   iii) Moulds shall be constructed to prevent loss of grout.

   iv) Demoulding shall be permitted without damage to units.

v) Evenly coat with a suitable release agent, which shall not be permitted to touch the reinforcement. Application shall be such as to prevent puddling or concentrations in the corners.

vi) Moulds shall be constructed of mould lining that is an impervious material suitable to provide the consistency of finish required and selected to provide crisp edge details as indicated on the Design Drawings. The mould linings shall not be of steel unless agreed with the Architect. Materials for fillets, etc. required to achieve features to be chosen to provide a finish identical to the finish to the body of the unit.

vii) Any joints and fixings in mould linings shall be sealed to prevent grout loss defects and shall be such as to result in no visible change in plane of the concrete and no change in the finish whatsoever.

viii) The mould linings shall have no variations in stiffness that may produce differences in vibration across the mould surface.

ix) The mould linings shall be replaced after the agreed maximum number of casts, or upon discovery of damage or defects, whichever is the sooner.

x) Moulds for features, etc. shall not have any splits, cracks or other defects.

xi) Moulds that have been previously used shall be repaired and the edges resealed before they are assembled. Moulds, which in the opinion of the Trade Contractor have deteriorated to an extent such that they will not produce the specified finish, shall not be used for that class or a higher class of finish.

xii) Moulds shall be cut in such a manner that reinforcement and built-in components passing through the moulds are maintained in position; the joint shall be tight and shall not permit grout loss.

xiii) Formers for profiled work, chamfers, splays, rebates, curved troughs and other features shall be rigidly and evenly fixed to the formwork along the complete length and shall not permit grout loss.

xiv) Moulds shall be designed to be consistent with the geometry and as indicated on the Design Drawings, subject to the acceptance of the Architect. The lines of joints between units shall form smooth curved lines consistent with the geometry and as indicated on the Design Drawings, subject to the acceptance of the Architect. The number of make-up pieces shall be kept to a minimum.

b) Reinforcement:

i) Cutting and bending, where applicable, shall be in accordance with BS 8666.

ii) At the time of placement, reinforcement shall be clean, free of corrosive pitting, loose materials and substances that adversely affect appearance and/ or performance of the precast concrete components.

iii) Reinforcement shall be fixed accurately and securely using tying wire, accepted steel clips, or tack welding if permitted. Wire or clips shall not encroach into the concrete cover.

c) Batching and Mixing:

i) Plant shall comply with BS EN 206 and BS 8500: Parts 1 and 2.

ii) Volumetric batching of concrete shall not be permitted.

iii) The constituent materials of the concrete shall be measured accurately by weight within the tolerance limits of BS EN 206 and BS 8500: Parts 1 and 2.

iv) Concrete shall be mixed to distribute fine and coarse aggregate evenly.

d) Casting:

i) Before casting, ensure that moulds have been checked to be free of all dust, reinforcement clippings or other debris.

ii) Constituent materials and pre-manufactured facings, where applicable, shall be placed, compacted and consolidated to achieve a monolithic component construction.

iii) Reinforcement shall be accurately and securely positioned to maintain suitable concrete cover. Cover spacers shall not be permitted on visible surfaces.

iv) The concrete shall be a suitable temperature at the time of placement.

v) Units shall be cast in an enclosure to maintain a controlled ambient temperature.

vi) Concrete segregation shall be prevented by placing in forms.

vii) Manufacture units to required profiles and sizes. Execute work accurately to specified tolerances and free of broken/ chipped edges. Edges shall be straight and with clean accurate arrises.

viii) Ensure that faces visible in the finished works match the required finish/ appearance, as determined through sampling

ix) Mark each panel with an identification mark, which shall be concealed in the finished works, corresponding to the Working Drawings and date cast.

e) Curing:

i) Maintain units in moulds within a suitable temperature range.

ii) Only demould components when their properties enable them to be handled and where visual and performance characteristics required will be achieved after the curing process is complete.

iii) After demoulding keep the surfaces of the components damp and within a suitable temperature range.

iv) Protect the components from adverse conditions until suitable properties have been achieved.

v) Cure like components under identical conditions.

vi) During curing, store units in a manner to prevent distortion and damage.

f) Components shall be protected from sun and drying winds until they are at least 5 days old.

g) Components shall not be delivered to Site until at least 14 days after casting.

h) Quality of Finishes:

i) The finishes shall be consistent throughout the Contract. Components that have arrises or faces, which are broken, chipped, cracked, crazed, honeycombed, irregular, inconsistent, stained or otherwise marred such that their appearance or performance is significantly impaired, shall not be accepted.

ii) Precast components may be rejected for reasons as follows:

- Exceeding specified tolerances.
- Chipped, spalled, cracked or otherwise damaged during construction operations.
- Surfaces exposed to view that develop surface finish deficiencies.
- Ragged or irregular edges.
- Excessive air voids on exposed surfaces.
- Casting lines evident from different placements.
- Visible form joints or irregular surfaces.
- Stains on panel surfaces.
- Non-uniformity of colour or texture.
- Areas of back-up concrete, where applicable, bleeding through the facing concrete.
- Foreign material embedded in the face.
- Visible repairs.
- Reinforcement shadow lines.
- Visible cracks.

H42.285 Production Control Units

a) The first unit of each type produced shall be inspected by the Architect, and if its appearance is accepted, shall be clearly marked and kept safely at the factory as an appearance control standard for subsequently produced units.

b) Discard and replace or correct any precast units that do not appear identical to the accepted samples. Remedial process to correct units shall only be undertaken with acceptance from the Architect and where visual and performance requirements shall be maintained for the duration of the service life.

c) The finishes indicated for the works shall be established to the grades accepted for the samples submitted and passed for inclusion into the works.

H42.286 Inspection

All completed units shall be carefully inspected and checked for a match with accepted sample(s) or control unit(s) and compliance with the Architectural Specification before dispatch to Site. Arrangements shall be made for the Architect to inspect completed units in the factory.

H42.287 Records

a) Complete records for each unit shall be kept, including the following information:

i) Unique identification number.

ii) Correlation with records of mixes including batch numbers.

iii) Date of each stage of manufacture.

iv) Dates and results of all tests, checks and inspections.

v) Dimensions related to specified levels of accuracy.

vi) Specific location in the finished work.

vii) Details of any damage and making good.

viii) Any other pertinent data, i.e. if the unit is an accepted production control unit.

b) Records shall be available for inspection by the Architect on request.

H42.288 Bricks

a) Materials delivered warm from the manufacturing process shall not be used until cold.

b) Materials shall be clean.

c) Damaged bricks shall not be used.

d) Bricks shall only be cut using a power-driven masonry saw, wet hosed down to remove any slurry and then dried prior to incorporation into the precast concrete cladding components.

e) Cut faces shall not be exposed in the finished works, unless agreed otherwise by the Architect.

H42.289 Stone

a) Stone shall be cut, dressed, worked and finished by skilled masons, in accordance with the Working Drawings before delivery. Evidence of previous experience and details of work previously carried out shall be provided.

b) Cutting, dressing, working and finishing of the stone shall not adversely affect performance and the results obtained through testing.

c) Permissible variations for the finishing of the stone shall be as accepted by the Architect through range sampling, prior to commencing production.

d) Remedial work such as patching and filling during fabrication shall not be undertaken, without acceptance by the Architect as part of the sampling process.

e) No saw marks shall be visible on the finished surface of the stone units, unless accepted otherwise by the Architect.

H42.290 Vapour Control Layers

a) Vapour control layers shall be fixed to ensure continuity of vapour control on the warm side of thermal insulation.

b) Lay as the work proceeds ensuring continuity.

c) Lap sides and ends of sheets and seal in accordance with the manufacturer's recommendations.

d) Seal with adhesive tape to pipes, ducts, structural members, etc. that pass through.

e) Carefully check for tears and punctures and seal them with adhesive tape before covering.

H42.291 Fixing Requirements

a) Refer to Section Z20.

b) Fixings and fastenings shall be installed and positioned as recommended by the manufacturer. Where visible, positions shall be to the acceptance of the Architect.

c) The works shall be fixed securely to prevent pulling away, bowing or other movement during use and without causing stress or distortion. Include additional bracing and stiffening as required.

d) Isolating tape, plastic washers or other suitable means shall be provided to prevent bi-metallic corrosion between dissimilar metals, or between preservative treated timber and metal.

H42.292 Packings

a) Suitable tight packings shall be provided to take up tolerances and prevent distortion.

b) Packings shall be of non-compressible, rot-proof and non-corrosive materials/ components that maintain the performance of the systems/ products with which they interface.

c) Packings shall not intrude into zones that are to be filled with sealant or areas required for drainage. The performance of the works and interfacing systems shall be maintained.

d) Packers and shims shall not be visible in the finished works.

H42.293 Sealants

a) Refer to Section Z22.

b) Apply in a continuous bead.

H42.294 Insulation

a) Accurately install to accommodate abutments and configurations.

b) No lipping at joints.

c) Fit tightly ensuring continuity, no gaps shall be left.

H42.295 Fire and Smoke Barriers

a) Material shall be cut to fit tightly, achieve correct compression and be securely fixed along all edges. All joints shall be wired or stapled together to provide a complete barrier to smoke and flame. Where proprietary systems are installed, they shall be in accordance with the manufacturer's recommendations.

b) A complete barrier shall be formed; there shall be no gaps.

H42.296 Pressed Metal Components

Joints in pressed metal components shall be installed in accordance with the recommendations/ guidelines set out in 'Profiled Sheet Metal Roofing and Cladding: A Guide to Good Practice' published by the National Federation of Roofing Contractors, and 'Profiled Metal Roofing Design Guide' published by the Metal Cladding and Roofing Manufacturers Association.

Protection and Completion

H42.297 Protection

Finished areas shall be adequately protected from damage until Practical Completion.

H42.298 Cleaning

a) At Practical Completion of the works, or when otherwise agreed with the Architect, all exposed areas/ surfaces of the works shall be cleaned.

b) Cleaning materials and methods shall be as recommended/ accepted by the system/ product manufacturer, where applicable.

c) Materials or methods that could alter the character of the exposed finishes shall not be used.

d) Adjacent surfaces shall be protected from damage due to cleaning operations.

H42.299 Completion

a) Defects shall be repaired without delay, to minimise damage and nuisance.

b) The works shall not be used for any purpose, except testing, until Practical Completion.

c) On Practical Completion, the works shall be checked for damage and defects. All damaged or defective materials/ components shall be replaced.

Tolerances

H42.2100 General

Tolerances shall be measured against the relevant Base Reference Datum, Location Reference Point, Location Reference Plane; Location Reference Surface or Reference Element.

a) All elements shall be set out to their correct position as indicated on the Working Drawings, within ±2mm.

b) Generally, elements shall not deviate in size by more than ±1mm from the dimension as indicated on the Working Drawings.

c) Vertical elements shall be plumb, within ±2mm or 0.1% of the height, whichever is the lesser.

d) Horizontal elements shall be level, within ±2mm or 0.1% of the length, whichever is the lesser.

e) The straightness of any flat plane or surface, including bow, an edge or lineal element shall not deviate by more than 2mm from a 3000mm straightedge and 1mm from a 1000mm straightedge. For flat planes and surfaces the tolerance shall be applied in any direction. For edges or lineal elements the straightedge shall be placed in any direction parallel to the long axis of the element.

f) The maximum offset in plane or level between any two adjacent sections shall be ±1mm.

g) The average width of any panel to panel joint shall be within ±1mm of the nominal joint. Any variation shall be equally distributed with no sudden changes or steps.

h) The maximum deviation between adjacent panel surfaces either side of an expressed joint shall be 1mm.

i) The cross-section of any element shall not be twisted by more than 1° from the intended alignment.

j) Dimensional and location tolerances at interfacing works shall as a maximum be ±2mm to the dimensions indicated on the relevant Working Drawings. Final tolerances shall be co-ordinated and agreed with performance being maintained.

k) Account shall be taken of the installation tolerance requirements such that repetitive elements are accurately located, relative to grid lines.

l) Deviations from lines, planes and verticality shall be limited to long wave formations of minimum wave length of 20m length with a rate of exchange not exceeding 1:1000 and a maximum amplitude of 3mm. Measured from an optical or laser reference line.

m) Sufficient analysis of the erection sequence shall be undertaken to ensure that the tolerances can be achieved.

n) Permissible tolerances shall be considered in isolation and not compounded.

o) Where an element/ component is subject to more than one applicable tolerance, the most onerous tolerance shall apply.

p) Make due allowance for building movements and deflections.

q) All tolerances stated shall be measured and monitored at a mean temperature.

r) Performance shall be maintained within tolerances.

End of Section

L10 WINDOWS/ ROOFLIGHTS

The particular requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the general requirements specified in the A and Z sections and the particular requirements of other applicable Architectural Specification sections.

L10.100 COMPLIANCE AND SCOPE

COMPLIANCE

L10.101 General

a) Refer to and comply with Section A15.100 of the Architectural Specification regarding the Trade Contractor's design responsibility for this element of the works.

b) Engage a specialist sub-contractor in accordance with clause A15.103, to complete the Detailed Design of this element of the works, maintaining the intent of the Design Drawings (A10.102 d) i)), where the Architect's role will be limited to checking compliance with quality, design and visual intent only.

c) Use the reference codes and accompanying descriptions listed on the System Reference Sheet (SRS) to identify materials, products, systems and components, when completing the Detailed Design.

SCOPE

Windows

L10.102 Type EWS-201 Aluminium/ Timber Framed Composite Window System (Apartment Loggias)

Modular side hung and fixed panel aluminium and timber composite window system with integral doorset, set into structural openings of various sizes fixed back to the structural frame.

a) Size and configuration: As indicated on the Design Drawings.

b) Indicative product reference: Futura + manufactured by Idealcombi.

c) Composite framing (main framing and sub-framing/ sash, where applicable):

i) Externally:

- Exterior frame/ sash cladding: Extruded aluminium profiles acceptable to the Architect and mitred at corners.
- Finish: Anodized or powder coated to approved sample RAL 7044 or similar, to the acceptance of the Architect through sampling.

ii) Internally:

- Interior frame/ sash section: Redwood timber (Pinus species). Quality optimised finger joint timber with 149mm overall depth of frame.
- Factory finished, 2 No. coats of micro porous paint, colour white to the acceptance of the Architect.

d) Glazing/ infill panels (Type GL-101) shall be accommodated by the framing, arranged and located as indicated on the Design Drawings. Panels shall be internally dry glazed using gaskets, the rebate shall be formed from aluminium.

e) Applied finish(es) to glazing panels, to locations indicated on the Design Drawings.

f) Opening elements with methods of operation as indicated on the Design Drawings.

g) Integrated hinged, manually operated doorsets with functionality as indicated on the Design Drawings, to match and form an integral part of the surrounding composite window system.

h) The ironmongery/ accessories provided shall be from the manufacturer's proprietary range to the acceptance of the Architect through sampling including opening handles to operate a fully concealed multipoint locking safety bolt mechanism. Restrictors required to all windows.

L10.103 Type EWS-211 Aluminium Window System

Tilt turn window inward opening, slim profile aluminium window system set into structural openings of various sizes fixed back to the structural frame.

a) Size and configuration: As indicated on the Design Drawings.

b) Indicative product reference: Futura + manufactured by Idealcombi.

c) Factory finished aluminium frames and external matching metal sills.

d) Glazing/ infill panels (Type GL-101) shall be accommodated by the framing, arranged and located as indicated on the Design Drawings.

e) Applied finish(es) to glazing panels, to locations indicated on the Design Drawings.

f) Opening elements with methods of operation as indicated on the Design Drawings.

g) The ironmongery/ accessories provided shall be from the manufacturer's proprietary range to the acceptance of the Architect through sampling.

i) No trickle vents, ironmongery to include restrictors, opening handles and concealed multi-point locking safety bolt mechanism with night vent position.

h) Finish: Polyester powder coated, RAL colour 7044 to the acceptance of the Architect.

L10.104 Type EWS-215 Aluminium Window System

Communal window and doors, slim profile aluminium window system with integral doorset, set into structural openings of various sizes fixed back to the structural frame.

a) Size and configuration: As indicated on the Design Drawings.

b) Indicative product reference: ADS 90.Si as manufactured by Schüco.

c) Factory finished aluminium frames and external matching metal sills.

d) Glazing/ infill panels (Type GL-101) shall be accommodated by the framing, arranged and located as indicated on the Design Drawings.

e) Applied finish(es) to glazing panels, to locations indicated on the Design Drawings.

f) Opening elements with methods of operation as indicated on the Design Drawings.

g) Integrated hinged, manually operated doorsets with functionality as indicated on the Design Drawings, to match and form an integral part of the window system.

h) The ironmongery/ accessories provided shall be from the manufacturer's proprietary range to the acceptance of the Architect through sampling.

i) All external doors to be linked to BMS system for access control and in a fire emergency. Allow for openings handles and concealed multi-point locking safety bolt mechanism with restrictors to enable night time ventilation. No trickle vents.

i) Finish: Polyester powder coated***, RAL colour 7044 to the acceptance of the Architect.

Rooflights

L10.105 Type RFL-101 Rooflight (Communal Stairwell)

Proprietary electrically operated glazed opening rooflight system to locations indicated on the Design Drawings, comprising:

a) Size and configuration: As indicated on the Design Drawings.

b) Indicative product reference: GV Hinged X Vent as manufactured by Glazing Vision Ltd.

c) Thermally broken aluminium frames with clear double glazed, hermetically sealed unit.

d) Glazing build-up shall be confirmed by the Trade Contractor to suit nominal zones and performance requirements.

e) Powder coated finish to exposed metal surfaces, to RAL colour confirmed by the Architect and accepted through sampling.

f) Fully weathered insulated framed aluminium kerb/ upstand to dimensions and profiles as indicated on the Design Drawings, including all flashing ensuring a watertight system.

g) Concealed operating mechanism.

h) Security fixing bolts to fix rooflight to top of upstand in accordance with the manufacturer's recommendations.

i) Electronic operation linked, where required, to the Building Management System, as indicated on the Design Drawings and the Services Engineer's documentation.

L10.200 QUALITY AND WORKMANSHIP

SUBMITTALS

L10.201 Tender Submittals

A design response shall be submitted with the Tender proposal, including the following:

a) Pre-contract samples, where specified.

b) A list of tests to be included.

c) Proposed QA/ QC programme.

d) A list of Working Drawings to be submitted.

e) A summary of any proposed deviations from the Architectural Specification and Design Drawings.

f) Outline technical specifications/ data sheets of proposed materials/ systems.

g) A list of proposed suppliers and sub-contractors.

L10.202 Post Contract Response

The post Contract response shall include:

a) Samples where specified.

b) Test data to demonstrate compliance with the performance requirements.

c) Submittals associated with the QA/ QC process.

d) Working Drawings.

e) Detailed technical specifications reflecting materials/ systems being installed.

f) A list of suppliers and sub-contractors being used.

g) Provide method statements for:

i) Fabrication and installation methods, including proposals to achieve the specified tolerances. This shall demonstrate a clear understanding of the construction programme, the effects of the building structure and interfacing works.

ii) Removal and replacement of system components for acceptance by the Architect, as a preclude to the Maintenance Manual, refer to Section A33 of the Architectural Specification.

h) Glass and glazing:

i) Risk assessments documenting the risk of failure and the consequences of failure of the selected glass units.

ii) Risk assessment for overhead glazing shall be undertaken in accordance with Section 7 of CIRIA Document C632.

iii) Thermal stress calculations.

iv) Light and solar radiant heat factors:

- Data sheets for project specific glass build-ups in accordance with BS EN 410 (light transmittance, radiant transmittance of glazing) with tolerances of ±3% for flat glazing, shall be submitted in respect of solar and visible light performance confirming compliance with the Architectural Specification.

i) Structural:

i) Submit structural calculations.

ii) Submit calculated system dead loads.

iii) Submit wind/ air pressure calculations.

j) Provide actual air leakage results from tests for acceptance by the Architect.

k) Thermal:

i) Thermal calculations shall be submitted for the various components and the overall thermal performance of the proposed works, to demonstrate compliance with the performance requirements.

ii) Thermal transmittance (U-value/ U-factor) shall be calculated/ assessed using the methods defined in BS EN ISO 12631 and guidance from the CWCT.

iii) Where applicable, linear and/ or point thermal transmittances shall be calculated for thermal bridges through the elements in accordance with BS EN ISO 10211 and guidance from the CWCT.

l) Condensation:

i) Carry out a condensation risk assessment of the specified works and interfaces with the work of others and submit calculations to demonstrate that the risk of condensation, under specified conditions, has been eliminated.

ii) Computer generated finite element analysis (FEA), to demonstrate that the condensation risks of the building configuration have been fully analysed, and condensation risk eliminated.

m) Evidence shall be provided that the acoustic performance requirements given herein can be achieved.

n) Before work begins on Site the proposed method of dimensional setting-out and cross-checking with adjacent trades and elements, to satisfy the accuracy requirements, shall be submitted to the Architect.

o) After completion of on-Site testing, prepare and submit a report to the Architect, which shall include proposals for remedial measures, if any leaks/ defects or other failures occur.

p) Copies of the final testing certificates for earth bonding and lightning protection shall be incorporated in the Health and Safety File.

L10.203 Pre-contract Samples

The following pre-contract samples shall be provided:

a) Samples of framing and sill members minimum 300mm long.

b) Glass samples of each type 300mm x 300mm minimum size.

c) Typical operating handle.

d) Typical 'trickle' ventilator.

L10.204 Post Contract Samples

The following post Contract samples shall be provided:

a) Samples of framing and sill members minimum 300mm long in the accepted colour and finish.

b) Glass samples of each proposed type 500mm x 500mm minimum size.

c) Typical ironmongery components in the proposed materials and finishes to include operating handle, hinge and locking device.

L10.205 Mock-ups

The following mock-ups shall be provided:

a) An arrangement of components and systems forming a visual and conceptual model of the works including interfaces with adjacent components and structure.

L10.206 Prototypes

The following prototypes shall be provided:

a) Test certification that complies with all performance requirements and warranty providers requirements, shall be submitted. if test certification is not submitted a prototype (including testing) will be required for the external cladding including all components and finishes.

L10.207 Quality Benchmarks

In locations to be agreed with the Architect, provide the following quality benchmarks:

a) The first fully installed and completed part of the works.

TESTING

L10.208 General

To demonstrate compliance with the Architectural Specification, include for testing by a fully accredited independent testing specialist or alternatively provide independently certified test data.

L10.209 Windows Testing Requirements

a) Where required, carry out project specific tests, providing certification demonstrating that the windows have been tested to meet the minimum performance criteria specified and the following:
   i) Air permeability: To BS EN 1026 up to a pressure of 600Pa.
   ii) Watertightness: To BS EN 1027 up to a pressure of 600Pa.
   iii) Wind resistance: To BS EN 12211. To satisfy maximum gust conditions subject samples to at least five cycles of positive pressure and then repeat with negative pressure. All results shall meet the maximum deflection values as specified.
   iv) Testing data for fire, acoustics, solar and other results to satisfy the performance requirements specified herein as required.
   v) Acceptance testing: For all finishes as specified.
   vi) Site hose testing: As specified.

b) Should the submitted test data not be to the satisfaction of the Architect, laboratory tests shall be carried out to satisfy the requirements of the Architectural Specification. All tests shall be agreed with the Architect.

c) The Trade Contractor shall not be relieved of his responsibilities regarding the performance and service life requirements of the works through the provision of test certificates.

L10.210 Site Hose Testing

a) Carry out a Site water hose test in accordance with the recommendations of the CWCT Standard for Systemised Building Envelopes.

b) Remedial work and re-testing:
   i) Make joints watertight to satisfy the requirements of the Architectural Specification where any leakage has occurred.
   ii) Re-test any repaired joints following the same procedures as carried out previously once any remedial work has been completed. In the event of further leakage being found further remedial measures shall be taken and testing repeated until all joints in the designated area are deemed to be satisfactory.

c) Extent of testing: At locations to be agreed with the Architect a minimum of 5% by length of all critical joints shall be tested.

L10.211 Acoustic Testing

To be carried out in accordance with BS EN ISO 10140.

L10.212 Rooflight Testing

Testing shall be carried out on single pitch, glazed rooflights in accordance with the recommendations of the Advisory Committee for Roofsafety publication ACR(M)001 'Test for Non-Fragility of Large Element Roofing Assemblies'.

ARCHITECTURAL AND FUNCTIONAL REQUIREMENTS

L10.213 General

a) The works generally shall be designed, constructed and installed in accordance with BS 6375 and the following:
   i) Timber windows shall be in accordance with BS 644.
   ii) Aluminium windows shall be in accordance with BS 4873.

iii) Operation and strength characteristics: To BS 6375: Part 2 and BS EN 12046: Part 1 and with all the performance criteria specified herein.

b) The components of the entire assembly shall be covered by a single source warranty. Therefore, approval shall be obtained from the manufacturer for all materials to be used.

c) Proprietary systems shall be British Board of Agrément (BBA) certified and tested to satisfy the requirements of the Architectural Specification.

d) The works shall accommodate all architectural and functional features indicated on the Design Drawings, whilst maintaining the specified performance.

e) Dimensions indicated on the Design Drawings are nominal and indicative of the design intent. The Trade Contractor shall maintain these dimensions and clearly state them on the Working Drawings.

f) Determine the type, thickness and density of insulation and any integral or separate overlay to satisfy the requirements of the Architectural Specification.

g) The works shall be designed and installed as complete integrated systems, including all necessary support structure, bracketry, fixing rails and plates, angles, cleats, grouting, fixings and fastenings, rivets, clips, vapour control barriers, insulation, damp-proof membranes, breather and other membranes, firestops and cavity barriers, acoustic breaks, pressed metal components, closers, seals and sealants, gaskets, fillers, tapes, spacers, packers, shims, isolators, drainage channels, anti-rotation pins, glazing bridges and all other accessories and components necessary to complete the installation.

L10.214 Achieving Performance

a) Systems shall comply with all applicable performance criteria during the service life of the works, and shall also be sufficiently rigid to safely withstand any forces that may act on them during fabrication, transportation, storage, erection on Site and other applicable activities.

b) During the Detailed Design the Trade Contractor shall take into consideration these non-exhaustive architectural and functional requirements, when achieving the performance.

c) Work requiring mechanical fixing shall ensure that failure of any fixing shall not lead to progressive failure of others.

d) All components, couplings and fixings shall be capable of accommodating performance without permanent distortion, deformation or failure.

e) No elements from other trades shall be fixed to and/ or supported by the works, unless accurately specified, indicated on the Design Drawings and/ or agreed by the Architect.

f) The Detailed Design shall take into account the ambient temperature at the time of the respective operations of fabrication, assembly and erection, with appropriate allowances being made for any dimensional changes resulting therefrom.

g) The Detailed Design and construction of the works shall be such that all rigid or fixed joints shall remain rigid and accommodate all specified thermal, building structure or other movements and any applicable loads without compromising its watertightness. All movement joints shall also be finally designed and constructed to accommodate such loads or movements without compromising the system's watertightness.

h) Light factors and solar radiant heat factors:

i) Optical and thermal performance values for glass infill panels shall be confirmed by the Trade Contractor during the Detailed Design, which shall be completed in conjunction with other members of the design team as applicable. Values shall be provided, as follows, for light factors and solar radiant heat factors and confirmation of coatings, to achieve the performance and visual requirements defined by the Architectural Specification, to the acceptance of the Architect.

ii) Light factors:

- Light transmission factor.
- External light reflectance.
- Internal light reflectance.
- UV radiation transmittance.
- Colour rendering index.

iii) Solar radiant heat factors:

- Solar radiant heat transmittance.
- External solar radiant heat reflectance.
- Solar radiant heat absorptance/ external.
- Solar radiant heat absorptance/ internal.
- Solar factor (G-value).
- Shading coefficient.

iv) The requirement for low emissivity (Low E) coatings.

v) The requirement for high performance coatings.

i) Weather and watertightness:

i) Systems shall be based on pressure equalisation principles, unless accepted otherwise by the Architect.

ii) The Detailed Design of the works shall not be based on a single line of defence. The cavities between the lines of defence shall be ventilated and drained to the exterior.

iii) Allowance shall be made to control the flow of any water that may enter the system and for directing this water to the outside, such that no water remains internally.

iv) Systems shall be drained with precipitation draining to the outside in all instances. Water paths shall be indicated on the Working Drawings.

v) The works shall prevent infiltration due to ice dams/ water back-up.

vi) Rainwater ponding shall not be permitted on any element of the works.

vii) Wet applied seals for the purpose of preventing the ingress of water shall not be accepted with the exception of the structural silicone seals or wet seals used for sealing the works against adjacent interfacing systems.

viii) Weather seals shall be provided at all interfacing connections.

j) Allow for the fact that the works shall be erected in all extremes of weather conditions throughout the year and that the building may not be climatically controlled during construction. Damage to materials as a result of Site conditions shall be the Trade Contractor's responsibility.

L10.215 Fixings

a) Fixings shall be concealed unless accepted otherwise by the Architect.

b) Visible fixings, where permitted, shall have an appearance and finish to the acceptance of the Architect.

c) Where necessary, fixings/ fixing devices shall be capable of providing adequate adjustment to suit building movement, to accommodate tolerances and to prevent system/ installation failure.

L10.216 Fixing to Structure

a) Systems shall be mechanically fixed to the structure and shall include all necessary sub-constructions/ assemblies, including but not limited to, framing, fixing devices, brackets, cleats, angles, anchors, bolts, fixings, sockets and other components.

b) Works shall include all necessary preparation such as drilling, plugging, screwing, bolting, cutting, chasing, forming recesses/ mortices, casting-in/ grouting-in and making good.

c) Mechanical fixing devices shall be austenitic stainless steel of a suitable grade.

L10.217 Secondary Support

a) Provide a support system, as necessary, having due regard for any requirements in excess of that indicated in the Structural Engineer's documentation and also any requirements indicated on the Design Drawings. The support system shall include all necessary sub-constructions/ assemblies including, but not limited to, framing, brackets, cleats, angles and other components.

b) Where the Trade Contractor deems that the support system shall need to be visible in the finished works, inform the Architect at Tender return. Post Contract award the visual intent shall be finalised in conjunction with the Architect.

L10.218 Frames

a) To comply with the specified tolerances ensure that all corners are jointed and sufficiently flush, flat and true.

b) Frames shall be fully gasketed to form the air and moisture barrier. On-Site gasketing shall not be permitted.

c) Deliver and install the factory-glazed frames in one piece.

d) To maintain rigidity and performance all framing shall utilise the minimum cross section necessary.

e) A glazing chamber shall be included within the frame. The glazing chamber shall be separated by two seals, one outside the chamber and the other at the back. The glazing chamber shall be drained to the outside, and the system shall comprise the following:

i) An outer seal designed to prevent water ingress into glazing or other chamber, substantially inhibiting water penetration and preventing heavy wetting of the back seal. Where designs have full width gasket seals, these shall incorporate capillarity breaks preventing the ingress and entrapment of water between surfaces in continuous contact.

ii) A back seal shall act as an air seal, minimising air permeability up to specified limits. The seal shall prevent the ingress of this water to the inside face of the works if subjected to light wetting in localised patches.

iii) Openings in the framing shall comply with current glazing recommendations in size, spacing and location and shall be provided to the exterior of the frames in order to ventilate around the infill panels, creating a drainage system for any water or moisture. All draining shall be provided at the lowest level of the glazing rebates or framing system cavities to positively prevent any residue water from remaining within.

L10.219 Glass Infill Panels

a) Glass infill panels of each type may be required for both vertical and/ or inclined conditions, as indicated on the Design Drawings. The Detailed Design shall take into consideration such uses, to derive suitable solutions whilst maintaining the visual intent.

b) The selection of the glass type, thicknesses, any interlayers, coatings (including acoustic coatings), build-up, mode of breakage and containment of the glass panels shall be undertaken to meet the requirements of the Architectural Specification and paying full attention to safety requirements to minimise the risk to persons, both during construction and during the service life of the works. Unless accepted otherwise by the Architect, all inner panes shall be safety glass.

c) Where required, safety glass shall be used. Refer to Section Z25 of the Architectural Specification.

d) Under no circumstances shall monolithic toughened glass be used in overhead situations.

e) Visible glass edges shall be arrised and ground and polished.

f) Applied coatings (such as but not necessarily limited to low emissivity ((low E)), high performance, acoustic) shall maintain the appearance/ hue of the glass.

g) When used in like coloured glass, interlayers shall maintain the appearance/ hue of the glass.

h) All specified attributes/ criteria shall be nominal values.

i) The works shall be designed to ensure that the glazing does not crack or distort or is damaged in any way through differences of temperature on the surfaces of the glazing.

j) Applied finishes:

i) Where indicated on the Design Drawings, glass infill panels shall receive applied finishes, as specified.

ii) Where required, glass infill panels shall have safety manifestation to comply with the requirements of the Architectural Specification. Method, patterns and colours shall be to the acceptance of the Architect.

L10.220 Gaskets

a) All visible gaskets shall be coloured as described.

b) All visible room side glazing gaskets shall have factory-formed corners.

c) All other gaskets shall have overlapping joints with appropriate sealant in between.

d) Gaskets shall not leak or bleed causing any discolouration or staining.

L10.221 Seals/ Sealants

a) Seals/ sealants shall be colour co-ordinated with colours of interfacing components, to the acceptance of the Architect.

b) Seals/ sealants shall not leak or bleed causing any discolouration or staining.

L10.222 Services Integration

a) Systems shall accommodate services, as indicated in the Services Engineer's documentation and/ or as indicated on the Design Drawings.

b) Locations/ positioning of services shall be agreed with the Architect, where not indicated on the Design Drawings.

c) Services, such as wiring/ wireways and pipework, leading to and from user interfaces, shall be concealed within the finished works, unless indicated or specified otherwise.

d) All necessary seals, gaskets, grommets, support framing shall be provided where services penetrate or interface with the works.

L10.223 Pressed Metal Components/ Accessories

a) Systems shall incorporate all necessary pressed metal components/ accessories including flashings, copings, cappings, sills, reveals and returns.

b) Components shall be formed from fully welded and/ or sealed pressed aluminium sheets, in a temper suitable for the particular type of application and degree of forming to be used and sufficiently thick to provide a visually flat surface free from distortion and permanent deformation. The alloy shall also be selected to satisfy the requirements of the required finishing process.

c) Systems shall include purpose made prefabricated corner pieces for changes in direction as indicated on the Design Drawings. Cut corners at changes in direction shall not be acceptable.

d) Components shall be of finish, colour and texture to the acceptance of the Architect where not specified.

e) Systems shall include concealed support as required.

f) Insulation shall be included as required, including anti-drumming insulation to the underside.

g) Joints:

i) Joints shall include concealed continuous sealed gaskets with recessed/ folded interconnecting or lapped joints to provide continuation and a neat flush external appearance, unless indicated otherwise on the Design Drawings. Simple butt straps shall not be accepted.

ii) Locations shall be as indicated on the Detailed Design, or to the acceptance of the Architect.

L10.224 Maintenance

a) Maintenance shall be undertaken safely for operatives, building users and other people adjacent to the building during maintenance operations.

b) Systems shall permit ease of cleaning within the parameters stipulated by the Design.

c) Demountability:

i) Elements of the works shall be individually and independently removable, ensuring access for maintenance and/ or replacement of infill panels and other system components in the event of breakage/ damage.

ii) Disruption due to maintenance shall be minimised.

iii) Progressive dismantling shall be minimised.

iv) The removal of components/ assemblies shall not affect the performance or safety of adjacent or any other part of the works.

MATERIALS AND COMPONENTS

Metalwork and Finishes

L10.225 Metalwork

Refer to Section Z11 of the Architectural Specification.

L10.226 Finishes

a) Refer to Section Z30 of the Architectural Specification for general finishes to metalwork.

b) Refer to Section Z31 of the Architectural Specification for powder coatings.

Timber

L10.227 General

a) Refer to Section Z10 of the Architectural Specification.

b) Timber shall be in accordance with BS EN 14220 for external windows and BS EN 14221 for internal windows.

c) Where exposed to view finger jointing shall not be allowed.

d) On delivery the moisture content shall be 16% ±3.

L10.228 Preservative Treatment

Refer to Section Z12 of the Architectural Specification.

Glass

L10.229 General

Refer to Section Z25 of the Architectural Specification.

Fixings/ Adhesives

L10.230 General

a) Refer to Section Z20 of the Architectural Specification.

b) Fixings shall be inherently corrosion resistant or fully protected to prevent corrosion.

Sealants

L10.231 General

Refer to Section Z22 of the Architectural Specification.

Gaskets

L10.232 General

a) Refer to Section Z36 of the Architectural Specification.

b) Gaskets shall be made of either Ethylene Propylene Diene Monomer (EPDM), Ethylene Propylene material (EP) or of Silicone to suit the service conditions.

PERFORMANCE

L10.233 General

The works shall comply with the general performance requirements of Section A15 of the Architectural Specification in addition to the following specific performance requirements.

Structural

L10.234 General

a) Unless stated otherwise, systems shall be designed in accordance with the current relevant and applicable British Standards and/ or Eurocodes.

b) Refer to the Structural Engineer's documentation.

c) The works shall accommodate the most onerous combination of movements, deflections and loads while maintaining the overall performance and without sustaining system failure or any permanent deformation. When calculating design loads the worst combination shall be considered, taking account of the fact that the pressure coefficients at various locations may determine more than one design criterion.

d) Movements, deflections and loads shall be transmitted/ transferred safely to the points of support/ building structure in a statically determined manner.

e) Stresses shall be avoided. Any stresses shall be understood as a result of the Detailed Design and shall be accommodated safely.

f) The works shall accommodate movements, deflections and loads without levels of noise likely to be intrusive in and around the completed building.

L10.235 Dead Loads

The works shall accommodate the following:

a) The system/ component and final assembly dead load (self-weight gravity load), which shall be accommodated locally without causing deflections or movements that adversely affect any system/ component.

b) The dead loads imposed by/ derived from any permanent fixtures, elements or services attached to the works.

c) The dead loads imposed by/ derived from any adjacent elements that bear onto, are suspended from or are fixed to the system.

L10.236 Live Loads

The works shall accommodate the following:

a) All inertial loads resulting from movements and deflections of the building structure and system support structure.

b) Loads, due to the occupants/ users of the building, in accordance with BS 6180, BS EN 1991 and PD 6688.

c) Wind/ air pressure loads.

d) Loads from snow, ice and unintended water absorption, in accordance with BS EN 1991: Part 1-3.

e) Loads arising from the maintenance and cleaning operations:

   i) A static 500N load applied through a square of 100mm sides.

   ii) Loads imposed during replacement of system components and the components of interfacing systems.

   iii) Loads/ pressures associated with normal maintenance and access.

f) Accidental loads imposed by persons falling against or onto the works.

g) Loads arising from moving elements of the works, such as integrated opening elements.

h) Known impact loads, or transferred impact loads, that occur during its service life, without deterioration in performance and without sustaining non-repairable damage.

i) Horizontal and vertical loads of similar magnitude to those that are imposed upon adjacent or attached elements. Refer to the Design Drawings for information on such elements and/ or required load capacities.

j) Rooflights/ overhead/ horizontal/ inclined systems:

   i) Performance requirements shall be in accordance with BS 5516: Parts 1 and 2. as a minimum. Where performance criteria conflict with BS EN 1991: Part 1-1 the more onerous shall apply.

   ii) Overhead glazing/ panels in rooflights with maintenance access and unspecified general access shall, as a minimum, be designed to accommodate a concentrated load of 1.2kN acting over an area of 200mm x 200mm.

   iii) Refer to Section Z25 of the Architectural Specification.

L10.237 Wind/ Air Pressure Loads

The works shall accommodate the following:

a) Wind loads: Refer to Section A15 of the Architectural Specification.

b) Air pressure loads within the building shall also be calculated, taking into account the presence of openings in the building enclosure.

c) Systems shall be designed to eliminate vibration, noise and fatigue caused by wind action.

L10.238 Building Movements and Deflections

a) The works shall accommodate the following:
   i) Movements and deflections, including associated tolerances, of the building structure as stated in the Building Movement and Tolerances Report.
   ii) Movements and deflections, including associated tolerances, of adjacent building elements impacting on the works.
   iii) Movements and deflections, including associated tolerances, of the systems themselves specified herein.
   iv) Differential movements and deflections.
   v) Movements and deflections in permanent and temporary conditions.
   vi) Movements and deflections of any joint, whether designed to permit movement and deflection or not.
   vii) Cyclic movements and deflections over the service life of the works.

b) Movements and deflections shall include:
   i) Those under the application of all static and dynamic design loads; including dead, live, wind/ air pressure loads and impacts.
   ii) Settlement, shrinkage, creep, twisting and racking.
   iii) Changes in dimension and shape.
   iv) Effects of moisture:
      • Due to changes in the moisture content of system components used in the works, resulting from variations in the moisture content of the air.
      • Due to the expansion of absorbed or retained moisture caused by freezing.
   v) Thermal effects:
      • Due to climatic conditions.
      • Orientation of the works towards the sun. In particular for overhead and sloped glazing.
      • Changes in service temperatures and differential surface temperatures.

L10.239 Deflections

The maximum in-plane deflection, due to dead and live loads, shall not exceed 1/500 of the span or 3mm, whichever is the lesser, of any main framing member.

Environmental

L10.240 Thermal Performance Requirements

a) Detail the works to minimise thermal/ cold bridging in any area of the system.

b) The maximum thermal permitted transmittance (U-value) for the various areas of the works shall be in accordance with the Thermal Modelling Report.

L10.241 Light and Solar Radiant Heat Factors (Glass)

a) Light transmission and reflectance of the glazing shall be ***as specified OR in accordance with the Daylight Analysis Report.***

b) Solar radiant heat factors shall be compliant with the specified 'Thermal Performance Requirements'.

c) The Detailed Design shall take into consideration calculated solar performance under varying conditions of solar radiation and external/ internal air velocity.

L10.242 Air Permeability - Infiltration

a) The works shall control airflow through the system from the outside to the inside of the building. Permitted airflow shall be distributed and not concentrated at any one location.

b) The works including all interfaces shall achieve a maximum air infiltration rate of:
   i) 1.5 $m^3/hr/m^2$ for fixed lights.
   ii) 2.0 m^3/hr/per metre length for opening lights/ smoke vents.

L10.243 Air Permeability - Exfiltration

a) The works shall control airflow through the system from the inside to the outside of the building. Permitted airflow shall be distributed and not concentrated at any one location.

b) The works including all interfaces shall achieve a maximum air exfiltration rate in accordance with the Thermal Modelling Report at documented pressures.

L10.244 Condensation

a) Except under extreme conditions where the relative humidity is in excess of that stated in the Services Engineer's documentation, condensation shall not form, either on internal or external surfaces, or interstitially within the construction, such that it may lead to degradation of performance, damage or staining under the specified conditions.

b) Condensation shall be permitted in non-visible drained and ventilated rebates subject to condensation not having a deleterious effect on performance or durability.

c) The interstitial condensation risk of the works shall be determined in accordance with BS 5250 and other governing codes and standards.

L10.245 Capillarity

Water migration caused by capillarity shall be prevented to areas that are designed to remain dry.

L10.246 Weather and Water Penetration Resistance

a) The works shall be weatherproof and watertight, ensuring the prevention of water leakage onto the internal face of the works and any other part of the system that may be adversely affected.

b) The works, including flashings and junctions with adjacent parts of the building, shall be weatherproof and watertight under all conditions with full allowance made for deflections and other movements.

L10.247 Local Factors

a) A site visit shall be required in order that local requirements are understood. Take local microclimatic and atmospheric conditions into account and assess grades of materials as suitably durable for the location when selecting.

b) Make an assessment of microclimatic and atmospheric conditions, making due allowance for any factors likely to have an adverse effect on materials intended for the works. If adverse effects are suspected, more appropriate materials shall be substituted providing it does not contradict any items detailed within the Architectural Specification.

c) Obtain any additional meteorological and climate data considered necessary in order to fulfil contractual obligations.

Acoustic and Noise

L10.248 Acoustic

a) Performance criteria as identified in the Acoustic Report shall be achieved.

b) The works shall effectively insulate the internal areas of the building from levels of external noise.

c) Specified performance sound reduction value(s) shall be achieved.

L10.249 Noise

a) The works shall not creak, rattle, whistle or produce other sounds such that levels of noise are likely to be intrusive in and around the completed building.

b) The works shall provide a good standard of sound absorption to minimise internal reverberant sound levels, being capable of achieving a mean sound absorption co-efficient of 0.7-0.8.

c) The works shall accommodate movements, deflections and loads without levels of noise likely to be intrusive in and around the completed building.

d) Rain or hail striking against any surfaces shall not result in attention catching noise.

Fire

L10.250 General

a) Refer to the Fire Strategy Report.

b) All elements of the works shall be either non-combustible or not easily ignitable with low flame spread characteristics, and shall not produce excessive quantities of smoke or toxic gases.

L10.251 Surface Spread of Flame

All materials used internally and externally (excluding sealants and gaskets) shall have a Class 0 surface spread of flame classification when tested in accordance with BS 476: Parts 6 and 7, unless otherwise specified.

Durability

L10.252 General

As stated in the Architectural Specification, the performance criteria shall be satisfied for the full design life of the works, provided always that the maintenance has been carried out as specified.

L10.253 Abrasion Resistance

The works shall resist abrasion from agreed cleaning methods and maintenance systems without any noticeable change in surface appearance.

L10.254 Impact Load Resistance

The works shall accommodate the following:

a) Generally, surfaces shall be sufficiently hard to resist heavy impacts from hand-held objects without any noticeable change to the surface appearance.

b) Impact loads in accordance with CWCT Technical Note TN 75:

i) Exposure category B.

ii) Safety class: The Trade Contractor shall complete a risk assessment for each system and shall confirm the risk class, as defined in TN 75, for each location.

iii) Serviceability class: 1.

c) Soft body impact loads to glazed elements in accordance with BS EN 12600: Classification 1.

d) Rooflights/ overhead/ horizontal/ inclined systems: Impact loads in accordance with CWCT Technical Note TN 66: Class 1 (should necessary performance exceed this, the system shall be designed as a floor).

Security

L10.255 General

a) Refer to the Security Report.

b) The works shall comply with the recommendations of the 'Secured by Design' initiative as produced by the Association of Chief Police Officers. Refer to the Secured by Design Certification schedule.

c) The works shall accommodate manual attack in accordance with LPCB standard LPS 1175: Classification Level 3.

d) Burglar resistance to windows shall be in accordance with BS EN 1627: Resistance Class 6.

e) Security glazing shall resist impacts from hand-held objects in accordance with BS EN 356: Category of resistance PA8.

WORKMANSHIP

L10.256 General

a) Where applicable, the works shall be carried out in accordance with the manufacturer's recommendations.

b) Operatives shall be trained, experienced and appropriately skilled in the installation of the works and, where applicable, be recommended by the system/ product manufacturer.

c) Where preceding work is complete before fabrication, the Trade Contractor shall take Site measurements. If these measurements indicate that the dimensions indicated on the Working Drawings are unachievable, the Trade Contractor shall propose, to the Architect, remedial measures to rectify the situation and seek acceptance from the Architect before proceeding.

d) Works shall be formed true to shape/ detail, continuous (where applicable), accurate in size, free from distortions, marks, irregularities, flaws, steps, waves, rolling marks, imprints, scratches, defects or damage of any nature to configurations indicated on the Working Drawings.

e) Materials/ components that are damaged or have any other physical imperfections shall not be used in the works.

f) Damaged units shall not be repaired unless accepted by the Architect.

g) Materials/ components with prefinished surfaces shall not be altered unless accepted by the Architect.

Fabrication

L10.257 Tolerances for Manufacture

a) Assembly: The physical fitting together of any assembly of sub-elements shall be properly allowed for in the Detailed Design of the corresponding sub-elements.

b) The following tolerances shall apply to each individual component:

i) Length/Width: Maximum allowed deviation shall be the lesser of 1.5mm up to 3000mm and 3.0mm above 3000mm of design dimension.

ii) Thickness/ Depth (extrusion tolerances nominally): Maximum allowed deviation shall be ±0.5mm.

L10.258 Tolerances for Component Assembly

a) Assembly: The physical fitting together of any assembly of sub-elements shall be properly allowed for in the Detailed Design of the corresponding sub-elements.

b) Comply with the following tolerances during assembly of components:

i) Level of horizontal members: ±1mm from datum in 1500mm, non-cumulative.

ii) Plumb of vertical members: ±1mm to the vertical in any 1500mm, non-cumulative.

iii) Squareness: Any diagonal length across the panel shall not deviate by more than the lesser of ±3mm or ±0.075% of design dimension.

iv) Bow: The centre section of the element shall not bow by more than the lesser of 3mm or 0.075% of the length of the element measured from a straight line between the ends of the element.

v) Straightness: Any surface or edge shall not deviate by more than +1.5mm from a 2m straightedge placed against it in a direction parallel to the long axis of the element.

vi) Flatness: Any surface shall not deviate by more than +1.5mm from a 2m straightedge placed against it in any direction.

vii) Twist: No section of the element may be twisted by more than 1° from the section at either end of the element.

c) All finished metal surfaces shall be flat and free from undulations and irregularities:
   i) Twist: ±1.5mm - there shall be no warping of frame.
   ii) Line of panel: ±2mm overall difference between adjacent standards.

d) Permissible tolerances shall be considered in isolation and not compounded.

Inspection/ Preparation

L10.259 Inspection

a) Before commencing installation, the structure shall be surveyed.

b) Dimensions, line, level and fixing points shall be checked.

c) The Architect shall be informed immediately if the structure is unsuitable to receive the works.

d) If the structure/ substrate is unsuitable, remedial action to make the structure suitable shall be proposed.

L10.260 Suitability of Structure/ Substrate

a) All cutting, chasing, plugging, making good and other necessary procedures required to the substrate or to the adjacent works, that cannot/ should not be undertaken after the installation of the works, shall be completed.

b) Tolerances of the structure/ substrate shall be suitable to permit the required configuration and specified tolerances of the finished systems/ products.

Fabrication/ Installation

L10.261 General

a) Allowance for future moisture and temperature movement shall be made.

b) Where permitted by the manufacturer, materials/ components shall be cut neatly and accurately without damage. Cut edges shall be kept to a minimum.

c) Materials/ components from the same production batch shall be used in the same area to prevent banding, patchiness or other visual variations.

d) Interfacing works shall not be cut, drilled or otherwise altered to accommodate the system installation unless accepted by the Architect.

e) Systems shall be mounted so that they are all correctly and consistently orientated.

f) The works, when installed, shall not be subject to warping or twisting and shall be rigid, firm, free from vibration, knocking, rattles, squeaks and other noises.

L10.262 Fixing Requirements

a) Refer to Section Z20 of the Architectural Specification.

b) Fixings and fastenings shall be installed and positioned as recommended by the manufacturer. Where visible, positions shall be to the acceptance of the Architect.

c) The works shall be fixed securely to prevent pulling away, bowing or other movement during use and without causing stress or distortion. Include additional bracing and stiffening as required.

d) Isolating tape, plastic washers or other suitable means shall be provided to prevent bi-metallic corrosion between dissimilar metals, or between preservative treated timber and metal.

L10.263 Packings

a) Suitable tight packings shall be provided to take up tolerances and prevent distortion.

b) Packings shall be of non-compressible, rot-proof and non-corrosive materials/ components that maintain the performance of the systems/ products with which they interface.

c) Packings shall not intrude into zones that are to be filled with sealant or areas required for drainage. The performance of the works and interfacing systems shall be maintained.

d) Packers and shims shall not be visible in the finished works.

L10.264 Sealants

a) Refer to Section Z22 of the Architectural Specification.

b) Sealant shall be applied in a continuous bead.

L10.265 Insulation

a) Insulation shall be accurately installed to accommodate abutments and configurations.

b) There shall be no lipping at joints.

c) Insulation shall be fitted tightly to ensure continuity, no gaps shall be left.

L10.266 Pressed Metal Components

Joints in pressed metal components shall be installed in accordance with the recommendations/ guidelines set out in 'Profiled Sheet Metal Roofing and Cladding: A Guide to Good Practice' published by the National Federation of Roofing Contractors, and 'Profiled Metal Roofing Design Guide' published by the Metal Cladding and Roofing Manufacturers Association.

Protection and Completion

L10.267 Protection

Finished areas shall be adequately protected from damage until Practical Completion.

L10.268 Cleaning

a) At Practical Completion of the works, or when otherwise agreed with the Architect, all exposed areas/ surfaces of the works shall be cleaned.

b) Cleaning materials and methods shall be as recommended/ accepted by the system/ product manufacturer, where applicable.

c) Materials or methods that could alter the character of the exposed finishes shall not be used.

d) Adjacent surfaces shall be protected from damage due to cleaning operations.

L10.269 Completion

a) Defects shall be repaired without delay, to minimise damage and nuisance.

b) The works shall not be used for any purpose, except testing, until Practical Completion.

c) On Practical Completion, the works shall be checked for damage and defects. All damaged or defective materials/ components shall be replaced.

Tolerances

L10.270 General

Tolerances shall be measured against the relevant Base Reference Datum, Location Reference Point, Location Reference Plane; Location Reference Surface or Reference Element.

a) All elements shall be set out to their correct position as indicated on the Working Drawings, within ±2mm.

b) Generally, elements shall not deviate in size by more than ±1mm from the dimension as shown on the Working Drawings.

c) Vertical elements shall be plumb, within ±2mm or 0.1% of the height, whichever is the lesser.

d) Horizontal elements shall be level, within ±2mm or 0.1% of the length, whichever is the lesser.

e) The straightness of any flat plane or surface, including bow, an edge or lineal element shall not deviate by more than 2mm from a 3000mm straightedge and 1mm from a 1000mm straightedge. For flat planes and surfaces the tolerance shall be applied in any direction. For edges or lineal elements the straightedge shall be placed in any direction parallel to the long axis of the element.

f) The cross-section of any element shall not be twisted by more than 1° from the intended alignment.

g) Dimensional and locational tolerances at interfacing works shall as a maximum be ±2mm to the dimensions indicated on the relevant Working Drawings. Final tolerances shall be co-ordinated and agreed with performance being maintained.

h) Account shall be taken of the installation tolerance requirements such that repetitive elements are accurately located, relative to grid lines.

i) Deviations from lines, planes and verticality shall be limited to long wave formations of minimum wave length of 20m length with a rate of exchange not exceeding 1:1000 and a maximum amplitude of 3mm. Measured from an optical or laser reference line.

j) Sufficient analysis of the erection sequence shall be undertaken to ensure that the tolerances can be achieved.

k) Permissible tolerances shall be considered in isolation and not compounded.

l) Where an element/ component is subject to more than one applicable tolerance, the most onerous tolerance shall apply.

m) Make due allowance for building movements and deflections.

n) All tolerances stated shall be measured and monitored at a mean temperature.

o) Performance shall be maintained within tolerances.

End of Section

L13 LOUVRES

The particular requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the general requirements specified in the A and Z sections and the particular requirements of other applicable Architectural Specification sections.

L13.100 COMPLIANCE AND SCOPE

COMPLIANCE

L13.101 General

a) Refer to and comply with Section A15.100 of the Architectural Specification regarding the Trade Contractor's design responsibility for this element of the works.

b) Engage a specialist sub-contractor in accordance with clause A15.103, to complete the Detailed Design of this element of the works, maintaining the intent of the Design Drawings (A10.102 d) i)), where the Architect's role will be limited to checking compliance with quality, design and visual intent only.

c) Use the reference codes and accompanying descriptions listed on the System Reference Sheet (SRS) to identify materials, products, systems and components, when completing the Detailed Design.

SCOPE

Louvres

L13.102 Type EWS-701 Louvre/ Grille Panel

Aluminium single bank ventilation and rain defence louvres to locations indicated on the Design Drawings, comprising:

a) Size/ configuration as indicated on the Design Drawings.

b) Concealed thermally broken and separated aluminium perimeter framing and mullions.

c) Horizontal extruded aluminium louvre blades, mechanically secured to mullions using concealed methods.

d) Stainless steel or aluminium bird guard/ insect mesh to open areas.

e) Technical requirements for open louvres:

  i) Core velocity: Refer to the Services Engineer's documentation.

  ii) Free area: Refer to the Services Engineer's documentation, which states minimum requirements.

  iii) Air permeability (discharge and entry co-efficients):

    • The louvres shall be classified in accordance with BS EN 13030.

  iv) Weather and water penetration resistance:

    • The louvres shall be classified in accordance with BS EN 13030.

f) Rear blanking panels:

  i) Panels shall be formed from aluminium sheet, with suitable insulation as required. Insulation shall be encapsulated and protected by the aluminium sheet.

  ii) Where indicated in the Services Engineer's documentation and/ or on the Design Drawings, blanking panels shall be connected to ductwork. Methods of connection, where visible, shall be to the acceptance of the Architect.

  iii) Apertures shall be accurately cut to co-ordinate and align with services and ductwork requirements. Performance shall be maintained.

g) Visible aluminium shall be RAL coloured powder coat finished with matt appearance, to the acceptance of the Architect through sampling.

L13.103 Type EWS-705 Louvre Panel with Perforated Fascia (UKPN)

Bespoke ventilation and rain defence louvres including perforated fascia panels to locations indicated on the Design Drawings, comprising:

a) Size/ configuration as indicated on the Design Drawings.

b) Concealed thermally broken and separated aluminium perimeter framing and mullions.

c) Horizontal extruded aluminium louvre blades, mechanically secured to mullions using concealed methods.

d) Stainless steel or aluminium bird guard/ insect mesh to open areas.

e) Technical requirements for open louvres:

  i) Core velocity: Refer to the Services Engineer's documentation.

  ii) Free area: Refer to the Services Engineer's documentation, which states minimum requirements.

  iii) Air permeability (discharge and entry co-efficients):

- The louvres shall be classified in accordance with BS EN 13030.

iv) Weather and water penetration resistance:

- The louvres shall be classified in accordance with BS EN 13030.

f) Rear blanking panels:

i) Panels shall be formed from aluminium sheet, with suitable insulation as required. Insulation shall be encapsulated and protected by the aluminium sheet.

ii) Where indicated in the Services Engineer's documentation and/ or on the Design Drawings, blanking panels shall be connected to ductwork. Methods of connection, where visible, shall be to the acceptance of the Architect.

iii) Apertures shall be accurately cut to co-ordinate and align with services and ductwork requirements. Performance shall be maintained.

g) Perforated and folded aluminium fascia panels to louvre, refer to the Services Engineer's documentation for performance requirements.

h) Integrated doorset matching the finish and profile of louvre system including all components, accessories, locking mechanism and ironmongery to complete installation

i) Visible aluminium shall be RAL coloured powder coat finished with matt appearance, to the acceptance of the Architect through sampling.

L13.104 Type EWS-711 Louvre Panel with Perforated Fascia (Car Park)

Bespoke ventilation and rain defence louvres including perforated fascia panels to locations indicated on the Design Drawings, comprising:

a) Size/ configuration as indicated on the Design Drawings.

b) Concealed thermally broken and separated aluminium perimeter framing and mullions.

c) Horizontal extruded aluminium louvre blades, mechanically secured to mullions using concealed methods.

d) Stainless steel or aluminium bird guard/ insect mesh to open areas.

e) Technical requirements for open louvres:

i) Core velocity: Refer to the Services Engineer's documentation.

ii) Free area: Refer to the Services Engineer's documentation, which states minimum requirements.

iii) Air permeability (discharge and entry co-efficients):

- The louvres shall be classified in accordance with BS EN 13030.

iv) Weather and water penetration resistance:

- The louvres shall be classified in accordance with BS EN 13030.

f) Rear blanking panels:

i) Panels shall be formed from aluminium sheet, with suitable insulation as required. Insulation shall be encapsulated and protected by the aluminium sheet.

ii) Where indicated in the Services Engineer's documentation and/ or on the Design Drawings, blanking panels shall be connected to ductwork. Methods of connection, where visible, shall be to the acceptance of the Architect.

iii) Apertures shall be accurately cut to co-ordinate and align with services and ductwork requirements. Performance shall be maintained.

g) Perforated and folded aluminium fascia panels to louvre, refer to the Services Engineer's documentation for performance requirements.

h) Visible aluminium shall be RAL coloured powder coat finished with matt appearance, to the acceptance of the Architect through sampling.

L13.105 Type EWS-715 Frameless Louvre Panel (Courtyard)

Bespoke frameless louvre ventilation and rain defence panel to locations indicated on the Design Drawings, comprising:

a) Size/ configuration as indicated on the Design Drawings.

b) Aluminium perforated fascia panel.

c) Technical requirements for open louvres:

i) Core velocity: Refer to the Services Engineer's documentation.

ii) Free area: Refer to the Services Engineer's documentation, which states minimum requirements.

iii) Air permeability (discharge and entry co-efficients):

- The louvres shall be classified in accordance with BS EN 13030.

iv) Weather and water penetration resistance:

- The louvres shall be classified in accordance with BS EN 13030.

d) Visible aluminium shall be RAL coloured powder coat finished with matt appearance, to the acceptance of the Architect through sampling.

L13.106 Type EWS-721 External Wall Grilles

Bespoke aluminium grille/ louvre, configured and to dimensions indicated on the Design Drawings, comprising:

a) Material: Aluminium.

b) Finish: Powder coated, colour to the acceptance of the Architect through sampling, appearance to match brick dimensions/ setting out and to be only single brick course height.

c) Refer to the Services Engineer's documentation.

d) Built-in with no gaps at joints.

L13.200 QUALITY AND WORKMANSHIP

SUBMITTALS

L13.201 Tender Submittals

A design response shall be submitted with the Tender proposal, including the following:

a) Pre-contract samples, where specified.

b) A list of tests to be included.

c) Proposed QA/ QC programme.

d) A list of Working Drawings to be submitted.

e) A summary of any proposed deviations from the Architectural Specification and Design Drawings.

f) Outline technical specifications/ data sheets of proposed materials/ systems.

g) A list of proposed suppliers and sub-contractors.

L13.202 Post Contract Response

The post contract response shall include:

a) Samples where specified.

b) Test data to demonstrate compliance with the performance requirements,

c) Submittals associated with the QA/ QC process.

d) Working Drawings.

e) Detailed technical specifications reflecting materials/ systems being installed.

f) A list of suppliers and sub-contractors being used.

g) Provide method statements for removal and replacement of system components for acceptance by the Architect, as a preclude to the Maintenance Manual, refer to Section A33 of the Architectural Specification .

h) Thermal calculations shall be submitted for the various components and the overall thermal performance of the proposed works, to demonstrate compliance with the performance requirements.

i) Carry out a condensation risk assessment of the specified works and interfaces with the work of others and submit calculations to demonstrate that the risk of condensation, under specified conditions, has been eliminated.

j) Evidence shall be provided that the acoustic performance requirements given herein can be achieved.

k) Before work begins on Site the proposed method of dimensional setting-out and cross-checking with adjacent trades and elements, to satisfy the accuracy requirements, shall be submitted to the Architect.

l) After completion of on-Site testing, prepare and submit a report to the Architect, which shall include proposals for remedial measures, if any leaks/ defects or other failures occur.

m) Copies of the final testing certificates for earth bonding and lightning protection shall be incorporated in the Health and Safety File.

L13.203 Pre-contract Samples

The following pre-contract samples shall be provided:

a) 300mm x 200mm sample(s) of proposed louvre blade with specified finishes.

b) Proposed fixings visible in the finished works.

L13.204 Post Contract Samples

The following post contract samples shall be provided:

a) 600mm x 400mm framed assembly of each type including frame, louvre blades, blanking panels, seals/ gaskets and other necessary components.

b) Various extrusions/ flashings, a minimum of 300mm in length.

c) Accepted fixings visible in the finished works.

L13.205 Mock-ups

The following mock-ups shall be provided:

a) 1000mm x 1000mm mock-ups of each system type in specified finish.

L13.206 Prototypes

The following prototypes shall be provided:

a) Test certification that complies with all performance requirements and warranty providers' requirements, shall be submitted. if test certification is not submitted a prototype (including testing) will be required for the external cladding including all components and finishes.

L13.207 Quality Benchmarks

In locations to be agreed with the Architect, provide the following quality benchmarks:

a) First completed installation of each type of system.

TESTING

L13.208 General

a) Refer to Section A33 for the general requirements for testing.

b) Off-Site testing:

i) Data from previous independently certified tests may be provided by the Trade Contractor for the acceptance of the Architect to demonstrate that the proposed systems meet the performance requirements of the Architectural Specification.

ii) Prototypes shall be provided if suitable data or documentation is not provided to demonstrate compliance with the performance requirements of the Architectural Specification. Prototypes shall be subjected to independent tests in accordance with the testing required detailed herein.

iii) Independently certified test data, as applicable, shall include static and dynamic results, and Agrément certificates.

c) On-site testing: All on-Site testing specified herein shall be undertaken.

d) Test certificates shall not relieve the Trade Contractor of responsibilities to achieve the requirements of the Architectural Specification.

L13.209 Results and Certificates

a) Immediately they are available tests and inspection results shall be submitted.

b) Certificates relating to the materials used in the work shall be submitted as confirmation of tests carried out in accordance with the relevant British Standards, and/ or other national standards as appropriate.

c) Until the end of the defects liability period, records of all inspections and tests performed, material certification, inspection and test plans, drawings and any other documentation to substantiate conformity with the Architectural Specification, including those carried out by sub-contractors, shall be maintained.

d) Records shall be stored in such a way that they are identifiable to the component to which they refer and are retrievable.

e) The records shall be available for inspection by the Architect with copies of records being given to the Architect upon request and they shall be submitted to the Architect at the end of the defects liability period.

Off-Site Testing

L13.210 Blanked Areas of Louvre Systems

a) Air permeability tests:

i) Air infiltration: Testing shall be carried out in accordance with BS EN 1026 or other test method as representative of the particular service conditions, to the acceptance of the Architect, to a test pressure of 600Pa or 0.25 of the design wind pressure, whichever is the greater.

ii) In addition, an air exfiltration test shall be carried out to check the performance in relation to the whole building's air leakage test requirements.

b) Weatherproofing and watertightness tests:

i) Testing shall be carried out in accordance with BS EN 1027 or other test methods as representative of the particular service conditions, to the acceptance of the Architect.

ii) Resistance to water penetration when tested shall be in the test pressure class 600 Pa or 0.25 of the design wind pressure, whichever is the greater.

c) Wind resistance:

i) Testing shall be carried out in accordance with BS EN 12211 or other test methods as representative of the particular service conditions, to the acceptance of the Architect.

ii) Samples tested shall have been subjected to at least five cycles of positive pressure to satisfy maximum gust conditions and to meet the performance requirements as specified.

iii) The procedure shall then have been repeated with negative pressure.

iv) The results shall achieve the maximum deflection values as specified.

d) Acoustic: Testing to establish the sound reduction indices shall be carried out in accordance with BS EN ISO 10140 conforming to the requirements specified.

L13.211 Open Areas of Louvre Systems

a) Ventilation systems shall be tested in accordance with the requirements of BS EN 13030 and Heating Ventilation and Air Conditioning (HEVAC) requirements.

b) Testing requirements of wind driven natural ventilation systems shall be undertaken in accordance with BSRIA recommendations.

L13.212 Impact Testing

a) Impact testing shall be carried out in accordance with CWCT Technical Note TN 76, conforming to the category requirements specified.

b) A manual attack test shall be carried out in accordance with LPCB standard LPS 1175, conforming to the category requirements specified.

c) The façade prototype shall be tested with a prototype of the applicable maintenance access equipment, which is to technically and physically represent the proposals for the works. The testing shall be undertaken with loadings and movements representative of use and Site conditions to calculate/ establish impacts on the façade.

d) The extent of any damage determined through testing shall be recorded and, where possible, quantified. Samples shall also be submitted to the Architect.

On-Site Testing

L13.213 Thermal Performance Testing

a) Infra-red thermography testing in accordance with BS EN 13187 shall be carried out to ensure that there are no irregularities in the thermal properties of components constituting the external envelope using a suitable thermal imaging method as defined in CWCT Technical Note TN 45. The testing method shall be subject to acceptance by the Architect.

b) Any areas that are proven not to achieve the performance requirements shall be rectified.

L13.214 Air Permeability - Exfiltration

a) Refer to Section A33 for the 'Airtightness Fan Test' of the building envelope.

b) Air exfiltration rates shall be within the limits specified.

L13.215 Weatherproofing and Watertightness Testing

a) The weathertightness of the works shall be tested using the Site hose test carried out in accordance with the CWCT Standard for Systemised Building Envelopes.

b) If a different method is proposed, details of the testing system and a proposed method statement shall be submitted to the Architect for acceptance at least one month prior to the proposed testing on Site.

c) Prior to testing it shall be ensured that the works have been completed to a stage where the integrity of the system can be tested, that obvious defects have been made good and that the works have been cleared of all materials, debris and dust.

d) Testing shall be carried out when all works are complete including that of all associated trades and interfacing trades. This shall exclude works that, if completed, would inhibit the visual inspection of on-Site testing.

e) Performance under testing:

i) There shall be no leakage through the works at any time during the test or within 15 minutes of completion of the test.

ii) If any leaks/ defects occur, mark the location on the works and drain water completely. Prepare a report to be submitted to the Architect, together with proposals for remedial measures. Any part of the works that is adversely affected shall be replaced or repaired; the design intent shall be maintained.

iii) After making good any defects, retest locally to verify integrity of repair.

iv) At completion of the test there shall be no standing water in locations intended to remain dry. Certify the waterproof integrity of the works.

v) Invite the Architect to witness the tests.

L13.216 Acoustic Testing

Site sound insulation measurements may be undertaken by the Architect in accordance with BS EN ISO 140: Part 5 and BS EN ISO 16283: Part 1 to check compliance with the acoustic performance requirements.

L13.217 Testing of Fixings

As the work proceeds, structural fixings shall be proof load tested as required and witnessed by the Architect.

ARCHITECTURAL AND FUNCTIONAL REQUIREMENTS

L13.218 General

a) Ventilation and rain defence louvres generally shall be in accordance with the requirements of BS EN 13030.

b) The components of the entire system assembly/ assemblies shall be covered by a single source warranty.

c) Systems shall be designed and installed as complete integrated systems.

d) Systems shall include all necessary reinforcement, support structure, bracketry, fixing rails and plates, angles, cleats, cramps, grouting, fixings and fastenings, screws, bolts, nuts, washers, rivets, distance pieces, clips, vapour control membranes, insulation, damp-proof membranes, breather and other membranes, air barriers, firestops and cavity barriers, acoustic breaks, pressed metal components, closures, seals and sealants, gaskets, fillers, tapes, spacers, packers, shims, isolators, drainage channels, waterbars and all other accessories and components necessary to complete the works.

L13.219 Achieving Performance

a) Systems shall comply with all applicable performance criteria during the service life of the works and shall also be sufficiently rigid to safely withstand any forces that may act on them during fabrication, transportation, storage, erection on Site and other applicable activities.

b) During the Detailed Design the Trade Contractor shall take into consideration these non-exhaustive architectural and functional requirements, when achieving the performance.

c) Work requiring mechanical fixing shall ensure that failure of any fixing shall not lead to progressive failure of others.

d) All components, couplings and fixings shall be capable of accommodating performance without permanent distortion, deformation or failure.

e) No elements from other trades shall be fixed to and/ or supported by the works, unless accurately specified, indicated on the Design Drawings and/ or agreed by the Architect.

f) The Detailed Design shall take into account the ambient temperature at the time of the respective operations of fabrication, assembly and erection, with appropriate allowances being made for any dimensional changes resulting therefrom.

g) The Detailed Design and construction of the works shall be such that all rigid or fixed joints shall remain rigid and accommodate all specified thermal, building structure or other movements and any applicable loads without compromising its watertightness. All movement joints shall also be finally designed and constructed to accommodate such loads or movements without compromising the system's watertightness.

h) Movement and deflections:

   i) The requirement for any movement joints within the works shall be ascertained to achieve the performance criteria while maintaining the overall system performance.

   ii) Movement joints shall accommodate the maximum movement and range of movements that can be derived from the specified and determined design loads and movements. Under maximum movements the joints shall meet all the performance requirements of the Architectural Specification.

   iii) It shall be ensured that the works accommodate all movement of the joints in a manner that does not compromise the system’s integrity or appearance.

   iv) Movement joints shall appear as similar to the standard system joint as possible.

i) Allow for the fact that the works will be erected in all extremes of weather conditions throughout the year and that the building may not be climatically controlled during construction. Damage to materials as a result of Site conditions shall be the Trade Contractor’s responsibility.

j) Weather and watertightness:

   i) Allowance shall be made to control the flow of any water that may enter the system and for directing this water to the outside, such that no water remains internally.

   ii) Wet applied seals for the purpose of preventing the ingress of water shall not be accepted with the exception of wet seals used for sealing the works against adjacent interfacing systems.

   iii) Weather seals shall be provided at all interfacing connections.

   iv) Rainwater ponding shall not be permitted on any element of the works.

k) Vapour barriers shall be installed on the warm side of the thermal insulation to provide a continuous air and vapour tight seal at all interfacing joints, between opening elements and fixed elements, and intersections between the system and other interfacing systems/ building structure.

l) Allow for the fact that the works will be erected in all extremes of weather conditions throughout the year and that the building may not be climatically controlled during construction. Damage to materials as a result of Site conditions shall be the Trade Contractor’s responsibility.

m) Corrosion protection:

i) Protective measures shall be taken to avoid any corrosion or any deleterious effects caused by manufacturing, finishing, transportation, storage and installation of systems/ products/ materials/ components.

ii) Ensure full resistance to any corrosion for components that are secured or bolted to each other, paying particular attention to the surface damage caused by such bolting or securing.

iii) Ensure full resistance in repair of corrosion protection to cope with the Site cutting of components, especially at boundary and external conditions.

n) Components for earth bonding and lightning protection shall be concealed or inconspicuous in the finished works, and clearly indicated on the Working Drawings, for acceptance by the Architect. Methods shall not impair the performance or the visual characteristics of the interfacing works.

L13.220 Fixings

a) Fixings shall be concealed unless accepted otherwise by the Architect.

b) Visible fixings, where permitted, shall have an appearance and finish to the acceptance of the Architect.

c) Where necessary, fixings/ fixing devices shall be capable of providing adequate adjustment to suit building movement, accommodate tolerances and prevent system/ installation failure.

L13.221 Fixing to Structure

a) Systems shall be mechanically fixed to the structure and shall include all necessary sub-constructions/ assemblies including but not limited to, framing, fixing devices, brackets, cleats, angles, anchors, bolts, fixings, sockets and other components.

b) Works shall include all necessary preparation such as drilling, plugging, screwing, bolting, cutting, chasing, forming recesses/ mortices, casting-in/ grouting-in and making good.

c) Fixing shall be co-ordinated with the superstructure design.

d) Mechanical fixing devices shall be austenitic stainless steel of a suitable grade.

L13.222 Secondary Support

a) A structural steel cladding support system shall be provided, as necessary, having due regard for any requirements in excess of that indicated in the Structural Engineer's documentation and also any requirements indicated on the Design Drawings. The support structure shall include all necessary sub-constructions/ assemblies including, but not limited to, framing, brackets, cleats, angles and other components.

b) Where the Trade Contractor deems that the support system will need to be visible in the finished works, the Architect shall be informed at Tender return. Post contract award the visual intent shall be finalised in conjunction with the Architect.

L13.223 Gaskets

a) All visible gaskets shall be black, unless specified otherwise.

b) Gaskets shall not leak or bleed causing any discolouration or staining.

L13.224 Sealants

a) Sealants shall be colour co-ordinated with colours of interfacing components, to the acceptance of the Architect.

b) Sealant shall not leak or bleed causing any discolouration or staining.

L13.225 Services Integration

a) Systems shall accommodate services, as indicated in the Services Engineer's documentation and/ or as indicated on the Design Drawings.

b) Locations/ positioning of services shall be agreed with the Architect, where not indicated on the Design Drawings.

c) Services, such as wiring/ wireways, pipework, etc. leading to and from user interfaces shall be concealed within the finished works, unless indicated or specified otherwise.

d) Provide necessary seals, gaskets, grommets, support framing, etc. where services penetrate or interface with the works.

L13.226 Maintenance Access Equipment Components

a) Stainless steel restraint sockets, bracketry and other components, provided by or for the maintenance access equipment specialist, in accordance with the requirements of applicable standards, shall be integrated into the works.

b) The locations, type and mounting of components shall be co-ordinated with and advised by the maintenance access equipment specialist to the acceptance of the Architect.

L13.227 Pressed Metal Components/ Accessories

a) Systems shall incorporate all necessary pressed metal components/ accessories including flashings, copings, cappings, sills, reveals and returns.

b) Components shall be formed from fully welded and/ or sealed pressed aluminium sheets, in a temper suitable for the particular type of application and degree of forming to be used and sufficiently thick to provide a visually flat surface free from distortion and permanent deformation. The alloy shall also be selected to satisfy the requirements of the required finishing process.

c) Systems shall include purpose made prefabricated corner pieces for changes in direction as indicated on the Design Drawings. Cut corners at changes in direction shall not be acceptable.

d) Components shall be of finish, colour and texture to the acceptance of the Architect where not specified.

e) Systems shall include concealed support as required.

f) Insulation shall be included as required, including anti-drumming insulation to the underside.

g) Joints:

i) Joints shall include concealed continuous sealed gaskets with recessed/ folded interconnecting or lapped joints to provide continuation and a neat flush external appearance, unless indicated otherwise on the Design Drawings. Simple butt straps shall not be accepted.

ii) Locations shall be as indicated on the Design Drawings, or to the acceptance of the Architect.

L13.228 Maintenance

a) Maintenance shall be undertaken safely for operatives, building users and other people adjacent to the building during maintenance operations.

b) Systems shall permit ease of cleaning within the parameters stipulated by the Design.

c) Demountability:

i) Elements of the works shall be individually and independently removable, ensuring access for maintenance and/ or replacement of infill panels and other system components in the event of breakage/ damage.

ii) Disruption due to maintenance shall be minimised.

iii) Progressive dismantling shall be minimised.

iv) The removal of cladding panels/ components shall not affect the performance or safety of adjacent or any other part of the works.

MATERIALS AND COMPONENTS

Metalwork and Finishes

L13.229 Metalwork

Refer to Section Z11 of the Architectural Specification.

L13.230 Finishes

a) Refer to Section Z30 of the Architectural Specification for general finishes to metalwork.

b) Refer to Section Z31 of the Architectural Specification for powder coatings.

Fixings/ Adhesives

L13.231 General

a) Refer to Section Z20 of the Architectural Specification.

b) Fixings shall be inherently corrosion resistant or fully protected to prevent corrosion.

Sealants

L13.232 General

Refer to Section Z22 of the Architectural Specification.

Gaskets

L13.233 General

a) Refer to Section Z36 of the Architectural Specification.

b) Gaskets shall be made of either Ethylene Propylene Diene Monomer (EPDM), Ethylene Propylene material (EP) or of Silicone to suit the service conditions.

Membranes

L13.234 General

a) Membranes shall be inert, durable, rot-proof, vermin-proof, not degradable by moisture and resistant to specified extremes of movement and environmental temperatures.

b) Membranes shall be certified to an internationally recognised Agrément Certificate to the acceptance of the Architect.

L13.235 Damp-proof Membranes (DPM)

a) Membranes shall be water resistant/ impermeable, vapour permeable and airtight as necessary to suit the service conditions.

b) Unless detrimental to the performance of the system, DPM shall be manufactured from Ethylene Propylene Diene Monomer (EPDM) or acceptable equivalent.

c) Membranes shall be of limited combustibility and achieve Class 0 propagation and surface spread of flame, unless the Detailed Design of the system protects the membrane from the need for such requirements.

L13.236 Breather Membranes

a) Membranes shall be water resistant and water vapour permeable to suit the service conditions. Vapour resistance of the breather membrane shall not be greater than that of the substrate it is protecting.

b) Unless detrimental to the performance of the system, breather membranes shall be manufactured from non-woven, spunbonded high density polypropylene, or acceptable equivalent.

c) Membranes shall be of limited combustibility and achieve Class 0 propagation and surface spread of flame, unless the Detailed Design of the system protects the membrane from the need for such requirements.

L13.237 Vapour Control Layer/ Air Leakage Barrier

a) Layers shall be resistant to water vapour transfer and air, to suit the service conditions.

b) Layers shall be high performance reinforced membranes of metal or plastics, protected both sides by rigid facings/ linings.

c) Foil adhered to plasterboard shall not be accepted.

d) Include all necessary tapes, seals and accessories to provide a fully sealed system at joints, perimeter conditions and penetrations.

Insulation

L13.238 General

a) The insulation shall be inert, durable, rot-proof and vermin-proof and not be degradable by moisture, temperature or water vapour unless the Detailed Design of the system protects the insulation from the need for such requirements.

b) The insulation shall not bulge, sag, delaminate or detach during its installation or when in situ during the service life of the works.

c) Insulation shall be a minimum of Euroclass A2.

d) Expanded polystyrene or polyurethane core sandwich panels shall not be used in the works unless the Trade Contractor complies with all the recommendations of the LPC Design Guide for the Fire Protection of Buildings 2000 from the date of its first publication in December 1999 or any subsequent guidance which supersedes this guidance, or the Factory Mutual (FM) Approval standards, or the recommendations of independent fire consultants Arup Fire or Warrington Fire.

e) Insulation shall have zero Ozone Depleting Potential (ODP), be CFC and HFC free and have a Global Warming Potential (GWP) of less than five. Refer also to Section A33 of the Architectural Specification.

f) Insulation shall achieve an A or A+ rating as defined in the BRE Green Guide to Specification.

g) The selected insulation shall comply with all relevant British Standards and be British Board of Agrément (BBA) certified.

PERFORMANCE

L13.239 General

The works shall comply with the general performance requirements of Section A15 of the Architectural Specification in addition to the following specific performance requirements.

Structural

L13.240 General

a) Unless stated otherwise, systems shall be designed in accordance with the current relevant and applicable British Standards and/ or Eurocodes.

b) Refer to the Structural Engineer's documentation.

c) The works shall accommodate the most onerous combination of movements, deflections and loads while maintaining the overall performance and without sustaining system failure or any permanent deformation. When calculating design loads the worst combination shall be considered, taking account of the fact that the pressure coefficients at various locations may determine more than one design criterion.

d) Movements, deflections and loads shall be transmitted/ transferred safely to the points of support/ building structure.

e) Stresses shall be avoided. Any stresses shall be understood as a result of the Detailed Design and accommodated safely.

f) The works shall accommodate movements, deflections and loads without levels of noise likely to be intrusive in and around the completed building.

L13.241 Building Movements and Deflections

a) The works shall accommodate the following:
   i) Movements and deflections, including associated tolerances, of the building structure as stated in the Building Movement and Tolerances Report.
   ii) Movements and deflections, including associated tolerances, of adjacent building elements impacting on the works.
   iii) Movements and deflections, including associated tolerances, of the systems themselves specified herein.
   iv) Differential movements and deflections.
   v) Movements and deflections in permanent and temporary conditions.
   vi) Movements and deflections of any joint whether designed to permit movement and deflection or not.
   vii) Cyclic movements and deflections over the service life of the works.

b) Movements and deflections shall include:
   i) Those under the application of all static and dynamic design loads; including dead, live, wind/ air pressure loads and impacts.
   ii) Settlement, shrinkage, creep, twisting and racking.
   iii) Changes in dimension and shape.
   iv) Effects of moisture:
      • Due to changes in the moisture content of system components used in the works, resulting from variations in the moisture content of the air.
      • Due to the expansion of absorbed or retained moisture caused by freezing.
   v) Thermal effects:
      • Due to climatic conditions.
      • Orientation of the works towards the sun.
      • Changes in service temperatures and differential surface temperatures.

L13.242 Dead Loads

The works shall accommodate the following:

a) The system/ component and final assembly dead load (self-weight gravity load), which shall be accommodated locally without causing deflections or movements that adversely affect any system/ component.

b) The dead loads imposed by/ derived from any permanent fixtures, elements or services attached to the works.

c) The dead loads imposed by/ derived from any adjacent elements that bear onto, are suspended from or fixed to the system.

L13.243 Live Loads

The works shall accommodate the following:

a) All inertial loads resulting from movements and deflections of the building structure and system support structure.

b) Loads, due to the occupants/ users of the building, in accordance with BS 6180, BS EN 1991 and PD 6688.

c) Wind/ air pressure loads.

d) Loads from snow, ice and unintended water absorption, in accordance with BS EN 1991: Part 1-3.

e) Loads arising from the maintenance and cleaning operations:
   i) A static 500N load applied through a square of 100mm sides.
   ii) Loads imposed during replacement of system components and the components of interfacing systems.
   iii) Loads/ pressures associated with normal maintenance and access.

f) Accidental loads imposed by persons falling against or onto the works.

g) ***Loads arising from moving elements of the works, such as integrated opening elements/ doors.***

h) Known impact loads, or transferred impact loads, that occur during its service life, without deterioration in performance and without sustaining non-repairable damage.

i) Horizontal and vertical loads of similar magnitude to those that are imposed upon adjacent or attached elements. Refer to the Design Drawings for information on such elements and/ or required load capacities.

L13.244 Wind/ Air Pressure Loads

The works shall accommodate the following:

a) Wind loads: Refer to Section A15 of the Architectural Specification.

b) Air pressure loads within the building shall also be calculated, taking into account the presence of openings in the building enclosure.

c) Systems shall be designed to eliminate vibration, noise and fatigue caused by wind action.

L13.245 System Deflections

The works when carrying full design loads, and at both positive and negative applications of the peak test pressure, shall not exceed the following deflections, in association with clear span in a direction normal to the plane of that element:

a) Framing members shall not exceed 1/ 500 of the span or 3mm, whichever is the lesser.

b) Louvre blades shall not exceed L/ 200 of the span or 3mm, whichever is the lesser.

Environmental

L13.246 Thermal Performance Requirements

Louvres with blanking panels, and other works designed to provide thermal performance shall achieve the following:

a) Detail the works to minimise thermal/ cold bridging in any area of the system.

b) The maximum thermal permitted transmittance (U-value) for the various areas of the works shall be in accordance with Approved Document Part L of the Building Regulations.

L13.247 Air Permeability - Infiltration

a) Louvres and other works designed to provide airflow shall achieve the specified technical requirements.

b) Louvres with blanking panels and other works designed to resist air permeability shall achieve the following:

i) The works shall control airflow through the system from the outside to the inside of the building. Permitted airflow shall be distributed and not concentrated at any one location.

ii) The works including all interfaces shall achieve a maximum air infiltration rate of 1.5 $m^3/hr/m^2$.

L13.248 Air Permeability - Exfiltration

a) Louvres and other works designed to provide airflow shall achieve the specified technical requirements.

b) Louvres with blanking panels, and other works designed to resist air permeability shall achieve the following:

i) The works shall control airflow through the system from the inside to the outside of the building. Permitted airflow shall be distributed and not concentrated at any one location.

ii) The works including all interfaces shall achieve a maximum air exfiltration rate in accordance with Approved Document Part L of the Building Regulations.

L13.249 Condensation

Louvres with blanking panels and other works designed to avoid condensation shall achieve the following:

a) Except under extreme conditions where the relative humidity is in excess of that stated in the Services Engineer's documentation, condensation shall not form, either on internal or external surfaces, or interstitially within the construction, such that it may lead to degradation of performance, damage or staining under the specified conditions.

b) Condensation shall be permitted in non-visible drained and ventilated rebates subject to condensation not having a deleterious effect on performance or durability.

c) The interstitial condensation risk of the works shall be determined in accordance with BS 5250 and other governing codes and standards.

L13.250 Capillarity

Water migration caused by capillarity shall be prevented to areas that are designed to remain dry, such as to a 'conditioned space'.

L13.251 Weather and Water Penetration Resistance

a) Louvres and other works designed to resist weather and water penetration shall achieve the specified technical requirements.

b) Louvres with blanking panels and other works designed to be weather and watertight shall achieve the following:

i) The works shall be weatherproof and watertight, ensuring the prevention of water leakage onto the internal face of the works and any other part of the system that may be adversely affected.

ii) The works, including flashings and junctions with adjacent parts of the building, shall be weatherproof and watertight under all conditions with full allowance made for deflections and other movements.

L13.252 Local Factors

a) In order to become familiar with local requirements a site visit shall be required. Consideration shall be made of local microclimatic conditions and grades of materials assessed as suitably durable for the location shall be selected.

b) An assessment of microclimatic conditions shall be made. Allowance for any factors likely to have an adverse effect upon materials intended for the works shall be made. If adverse effects are predicted more appropriate materials shall be substituted.

c) Obtain any additional meteorological and climate data considered necessary in order to fulfil contractual obligations.

Acoustic and Noise

L13.253 Acoustic

a) Performance criteria as identified in the Acoustic Report shall be achieved.

b) Louvres with blanking panels, and other works designed to achieve an acoustic rating shall effectively insulate the internal areas of the building from levels of external noise:

i) Specified performance sound reduction value(s) shall be achieved.

ii) The measured noise exposure of each façade shall have been used in conjunction with the specified internal noise criteria to derive the façade sound insulation requirements of the works.

L13.254 Noise

a) The works shall not creak, rattle, whistle or produce other sounds such that levels of noise are likely to be intrusive in and around the completed building.

b) Wind/ air movement generated noise:

i) The necessary provisions are required to eliminate vibration, noise and fatigue caused by wind action and/ or vortex shedding of the façade elements.

ii) The works shall resist the generation and transmission of noise when exposed to wind. Wind generated airborne noise shall not exceed a target level of 35dB (A) at a distance of 1m from the façade, unless stated otherwise in the Acoustic Report .

iii) Wind generated noise shall not exceed a level that is 5dB below the building services noise limits for adjacent spaces, when measured at the nearest, normally occupied position, whether or not doors, where applicable, are open.

c) The works shall accommodate movements, deflections and loads without levels of noise likely to be intrusive in and around the completed building.

d) Rain or hail striking against any surfaces of the façade systems shall not result in attention catching noise.

Fire

L13.255 General

a) Refer to the Fire Strategy Report.

b) The works shall be non-combustible or not easily ignitable with low flame spread characteristics. The work shall not produce smoke or toxic gas in excessive quantities.

c) Surface spread of flame:

i) External areas shall meet unprotected limitations under requirement B4 ‘External Fire Spread’ of the Building Regulations.

ii) All materials used internally and externally shall have a Class 0 surface spread of flame classification (unless otherwise specified) when tested in accordance with BS 476: Parts 6 and 7.

d) Fire and smoke stopping:

i) All cavity barriers shall meet the requirements of Approved Document Part B of the Building Regulations.

ii) Fire and smoke stops shall be positively fixed in position in such a manner that they will not become dislodged in the event of a fire.

Security

L13.256 General

a) Refer to the Security Report.

b) The works shall comply with the recommendations of the ‘Secured by Design’ initiative as produced by the Association of Chief Police Officers. Refer to the Secured by Design Certification schedule.

c) The works shall accommodate manual attack in accordance with LPCB standard LPS 1175: Classification Level 3.

Durability

L13.257 General

The performance criteria shall be satisfied for the full service life of the works, as stated in Section A15 of the Architectural Specification, providing that the maintenance has been carried out as specified.

L13.258 Abrasion Resistance

The works shall resist abrasion from agreed cleaning methods and maintenance systems without any noticeable change in surface appearance.

L13.259 Impact Resistance

The works shall accommodate the following:

a) Without any noticeable change to the surface appearance, surfaces shall generally be sufficiently hard to resist heavy impacts from hand-held objects.

b) Impact loads in accordance with CWCT Technical Note TN 75:

i) Exposure category B.

ii) Safety class: The Trade Contractor shall complete a risk assessment for each system and shall confirm the risk class, as defined in TN 75, for each location.

iii) Serviceability class: 1.

Sustainability Requirements

L13.260 General

a) Refer to Section A33 of the Architectural Specification.

b) Refer to the Sustainability Report for the strategies that shall be adopted and a record of which Credits are targeted.

WORKMANSHIP

L13.261 General

a) Where applicable, the works shall be carried out in accordance with the manufacturer's recommendations.

b) Operatives shall be trained, experienced and appropriately skilled in the installation of the works and, where applicable, be recommended by the system/ product manufacturer.

c) Where preceding work is complete before fabrication, the Trade Contractor shall take Site measurements. If these measurements indicate that the dimensions indicated on the Working Drawings are unachievable, the Trade Contractor shall propose, to the Architect, remedial measures to rectify the situation and seek acceptance from the Architect before proceeding.

d) Works shall be formed true to shape/ detail, continuous (where applicable), accurate in size, free from distortions, marks, irregularities, flaws, steps, waves, rolling marks, imprints, scratches, defects or damage of any nature to configurations indicated on the Working Drawings. All works shall be true to detail with continuous profiles, free from marks, defects, flaws, steps, waves, or damage of any nature.

e) Materials/ components that are damaged or have any other physical imperfections shall not be used in the works.

f) Damaged units shall not be repaired unless accepted by the Architect.

g) Materials/ components with prefinished surfaces shall not be altered unless accepted by the Architect.

Inspection/ Preparation

L13.262 Inspection

a) Before commencing installation, the structure shall be surveyed.

b) Dimensions, line, level and fixing points shall be checked.

c) The Architect shall be informed immediately if the structure is unsuitable to receive the works.

d) If the structure/ substrate is unsuitable, remedial action to make the structure suitable shall be proposed.

L13.263 Suitability of Base/ Backing

a) All cutting, chasing, plugging, making good and other necessary procedures required to the substrate or to the adjacent works, that cannot/ should not be undertaken after the installation of the works, shall be completed.

b) Tolerances of the structure/ substrate shall be suitable to permit the required configuration and specified tolerances of the finished systems/ products.

Fabrication/ Installation

L13.264 General

a) Allowance for future moisture and temperature movement shall be made.

b) Where permitted by the manufacturer, materials/ components shall be cut neatly and accurately without damage. Cut edges shall be kept to a minimum.

c) Materials/ components intended to be installed in 'running lengths' shall be subject to the following:

i) Straight runs between angles or ends of runs shall be formed in single unjointed lengths wherever possible. Where running joints are unavoidable, obtain acceptance for location and method of jointing from the Architect.

ii) All joints at angles shall be mitred or to the acceptance of the Architect.

d) Materials/ components from the same production batch shall be used in the same area to prevent banding, patchiness or other visual variations.

e) Interfacing works shall not be cut, drilled or otherwise altered to accommodate the system installation unless accepted by the Architect.

f) Systems shall be mounted so that they are all correctly and consistently orientated.

g) The works, when installed, shall not be subject to warping or twisting and shall be rigid, firm, free from vibration, knocking, rattles, squeaks and other noises.

L13.265 Vapour Control Layers

a) Vapour control layers shall be fixed to ensure continuity of vapour control on the warm side of thermal insulation.

b) Lay as the work proceeds ensuring continuity.

c) Lap sides and ends of sheets and seal in accordance with the manufacturer's recommendations.

d) Seal with adhesive tape to pipes, ducts, structural members, etc. that pass through.

e) Carefully check for tears and punctures and seal them with adhesive tape before covering.

L13.266 Fixing Requirements

a) Refer to Section Z20 of the Architectural Specification.

b) Fixings and fastenings shall be installed and positioned as recommended by the manufacturer. Where visible, positions shall be to the acceptance of the Architect.

c) The works shall be fixed securely to prevent pulling away, bowing or other movement during use and without causing stress or distortion. Include additional bracing and stiffening as required.

d) Isolating tape, plastic washers or other suitable means shall be provided to prevent bi-metallic corrosion between dissimilar metals, or between preservative treated timber and metal.

L13.267 Packings

a) Suitable tight packings shall be provided to take up tolerances and prevent distortion.

b) Packings shall be of non-compressible, rot-proof and non-corrosive materials/ components that maintain the performance of the systems/ products with which they interface.

c) Packings shall not intrude into zones that are to be filled with sealant or areas required for drainage. The performance of the works and interfacing systems shall be maintained.

d) Packers and shims shall not be visible in the finished works.

L13.268 Sealants

a) Refer to Section Z22 of the Architectural Specification.

b) Apply in a continuous bead.

L13.269 Insulation

a) Accurately install to accommodate abutments and configurations.

b) There shall be no lipping at joints.

c) Fit tightly ensuring continuity, no gaps shall be left.

L13.270 Fire and Smoke Barriers

a) Material shall be cut to fit tightly, achieve correct compression and shall be securely fixed along all edges. All joints shall be wired or stapled together to provide a complete barrier to smoke and flame. Where proprietary systems are installed, they shall be in accordance with the manufacturer's recommendations.

b) A complete barrier shall be formed, there shall be no gaps.

L13.271 Pressed Metal Components

Joints in pressed metal components shall be installed in accordance with the recommendations/ guidelines set out in 'Profiled Sheet Metal Roofing and Cladding: A Guide to Good Practice' published by the National Federation of Roofing Contractors, and 'Profiled Metal Roofing Design Guide' published by the Metal Cladding and Roofing Manufacturers Association.

Protection and Completion

L13.272 Protection

Finished areas shall be adequately protected from damage until Practical Completion.

L13.273 Cleaning

a) At Practical Completion of the works, or when otherwise agreed with the Architect, all exposed areas/ surfaces of the works shall be cleaned.

b) Cleaning materials and methods shall be as recommended/ accepted by the system/ product manufacturer, where applicable.

c) Materials or methods that could alter the character of the exposed finishes shall not be used.

d) Adjacent surfaces shall be protected from damage due to cleaning operations.

L13.274 Completion

a) Defects shall be repaired without delay, to minimise damage and nuisance.

b) The works shall not be used for any purpose, except testing, until Practical Completion.

c) On Practical Completion, the works shall be checked for damage and defects. All damaged or defective materials/ components shall be replaced.

Tolerances

L13.275 General

Tolerances shall be measured against the relevant Base Reference Datum, Location Reference Point, Location Reference Plane; Location Reference Surface or Reference Element.

a) All elements shall be set out to their correct position as indicated on the Working Drawings, within ±2mm.

b) Generally elements shall not deviate in size by more than ±1mm from the dimension as shown on the Working Drawings.

c) Vertical elements shall be plumb, within ±2mm or 0.1% of the height, whichever is the lesser.

d) Horizontal elements shall be level, within ±2mm or 0.1% of the length, whichever is the lesser.

e) The straightness of any flat plane or surface, including bow, an edge or lineal element shall not deviate by more than 2mm from a 3000mm straightedge and 1mm from a 1000mm straightedge. For flat planes and surfaces the tolerance shall be applied in any direction. For edges or lineal elements the straightedge shall be placed in any direction parallel to the long axis of the element.

f) The maximum offset in plane or level between any two adjacent sections shall be ±2mm.

g) The average width of any panel to panel joint shall be within ±2mm or 10% of the nominal joint, whichever is the lesser. Any variation shall be equally distributed with no sudden changes or steps.

h) The maximum deviation between adjacent panel surfaces either side of an expressed joint shall be 1mm.

i) The cross-section of any element shall not be twisted by more than 1° from the intended alignment.

j) Dimensional and locational tolerances at interfacing works shall as a maximum be ±2mm to the dimensions indicated on the relevant Working Drawings. Final tolerances shall be co-ordinated and agreed with performance being maintained.

k) Account shall be taken of the installation tolerance requirements such that repetitive elements are accurately located, relative to grid lines.

l) Deviations from lines, planes and verticality shall be limited to long wave formations of minimum wave length of 20m length with a rate of exchange not exceeding 1:1000 and a maximum amplitude of 3mm. Measured from an optical or laser reference line.

m) Sufficient analysis of the erection sequence shall be undertaken to ensure that the tolerances can be achieved.

n) Permissible tolerances shall be considered in isolation and not compounded.

o) Where an element/ component is subject to more than one applicable tolerance, the most onerous tolerance shall apply.

p) Make due allowance for building movements and deflections.

q) All tolerances stated shall be measured and monitored at a mean temperature.

r) Performance shall be maintained within tolerances.

End of Section

M21 INSULATION WITH RENDERED FINISH

The particular requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the general requirements specified in the A and Z sections and the particular requirements of other applicable Architectural Specification sections.

M21.100 COMPLIANCE AND SCOPE

COMPLIANCE

M21.101 General

a) Refer to and comply with Section A15.100 of the Architectural Specification regarding the Trade Contractor's design responsibility for this element of the works.

b) Engage a specialist sub-contractor in accordance with clause A15.103, to complete the Detailed Design of this element of the works, maintaining the intent of the Design Drawings (A10.102 d) i)), where the Architect's role will be limited to checking compliance with quality, design and visual intent only.

c) Use the reference codes and accompanying descriptions listed on the System Reference Sheet (SRS) to identify materials, products, systems and components, when completing the Detailed Design.

SCOPE

Render

M21.102 Type EWS-403 Insulated Render Soffit Panel

Through coloured insulated render system to soffits as part of the rainscreen cladding.

a) Indicative manufacturer: Sto Limited.

b) Reference: StoTherm Classic system.

c) Dimensions/ configurations: As indicated on the Design Drawings.

d) Render

i) Adhesive coat and corrosion resistant mechanical fixing system as recommended by the system manufacturer to suit backing and performance requirements.

ii) Suitable core insulation board.

iii) Cement-free reinforcing coat.

iv) Reinforcing mesh.

v) Decorative render finish, colour white to the acceptance of the Architect.

vi) Soffit panels shall provide a monolithic in appearance final finish.

vii) Perimeter aluminium trim, finished to match the existing curtain walling.

e) Allowing for the fixing of recessed lighting, CCTV and conduit as indicated on the Design Drawings.

M21.200 QUALITY AND WORKMANSHIP

SUBMITTALS

M21.201 Tender Submittals

A design response shall be submitted with the Tender proposal, including the following:

a) Pre-contract samples, where specified.

b) A list of tests to be included.

c) Proposed QA/ QC programme.

d) A list of Working Drawings to be submitted.

e) A summary of any proposed deviations from the Architectural Specification and Design Drawings.

f) Outline technical specifications/ data sheets of proposed materials/ systems.

g) A list of proposed suppliers and sub-contractors.

M21.202 Pre-contract Samples

The following pre-contract samples shall be provided:

a) Insulation with rendered finish with colour and texture, as advised by the Architect.

b) Movement joints.

c) Sealants.

M21.203 Post Contract Samples

The following post contract samples shall be provided:

a) Insulation with rendered finish with colour and texture, as advised by the Architect.

b) Movement joints.

c) Sealants.

M21.204 Mock-ups

The following mock-ups shall be provided:

a) Not required.

M21.205 Prototypes

The following prototypes shall be provided:

a) Test certification that complies with all performance requirements and warranty providers requirements, shall be submitted. if test certification is not submitted a prototype (including testing) will be required for the external cladding including all components and finishes.

M21.206 Quality Benchmarks

In locations to be agreed with the Architect, provide the following quality benchmarks:

a) An area of rendering to be agreed, with the Architect.

TESTING

M21.207 Pull-out Test(s) on Fixing Pins and Adhesive(s)

a) Pull-out test(s) shall be carried out on Site, in order to prove the suitability of the structural background and to determine the size and number of fixings required and/ or adhesive type.

b) Advance notice of testing shall be given, to allow Architect the opportunity to be present.

ARCHITECTURAL AND FUNCTIONAL REQUIREMENTS

Not applicable.

MATERIALS AND COMPONENTS

M21.208 Manufacturers

Materials shall be specified by performance requirements and general description of product. The Architect may consider substitutions of products specified, provided that the procedures suggested for substitutions are followed. At his discretion, the Architect may reject any material, which in his opinion or requirement, will not produce the acceptable quality of work and/ or is specified herein.

M21.209 Adhesive

a) Minerallic microsilicate based adhesive that is mixed with clean water, as recommended in writing by the manufacturer. Or

b) Fibre reinforced, 100% acrylic based adhesive that is mixed with clean water and ordinary Portland cement additive(s), as recommended in writing by the manufacturer.

M21.210 Insulation for Render

a) Non-combustible insulation shall comply with the performance requirements. Insulation shall be suited to the purpose and shall achieve the required U-values as follows:
   i) Mineral wool products shall comply with BS EN 13162.
   ii) Expanded polystyrene (EPS) products shall comply with BS EN 13163.
   iii) Extruded polystyrene (XPS) products shall comply with BS EN 13164.
   iv) Rigid polyurethane foam (PUR) products shall comply with BS EN 13165.
   v) Phenolic foam (PF) products shall comply with BS EN 13166.
   vi) Cellular glass (CG) products shall comply with BS EN 13167.

b) Dimensional tolerances shall be as follows:
   i) Length or width: ± 1mm.
   ii) Squareness: Maximum 1mm over the entire length of the board.
   iii) Thickness: ± 0.5mm.
   iv) Deflection: Maximum 0.5mm.

c) Thickness shall be as indicated on the Design Drawings, minimum 20mm.

d) The insulation boards shall not exceed 1000mm x 500mm.

e) Insulation shall be inert, durable, rot-proof and vermin-proof and shall not be degradable by moisture, temperature or water vapour.

f) Insulation shall not bulge, sag, delaminate or detach during its installation or when in situ during the life of the works.

g) Insulation shall be Loss Prevention Certification Board (LPCB) certified to LPS 1181.

h) Insulation shall have zero Ozone Depleting Potential (ODP), be CFC and HFC free and have a Global Warming Potential (GWP) of less than five. Refer also to Section A33 of the Architectural Specification.

i) Insulation shall achieve an A or A+ rating as defined in the BRE Green Guide to Specification, which can be viewed at www.bre.co.uk/greenguide.

j) The selected insulation shall comply with all relevant British Standards and shall be British Board of Agrément (BBA) certified.

M21.211 Reinforcing Coat

Render shall be a ready mixed, non-cementitious base coat, 100% acrylic copolymer emulsion based, water resistant, vapour permeable, glass fibre reinforced, non-capillary action reinforcing coat. It may be used with or without accelerator to control the drying time, depending on weather conditions and strictly in accordance with the manufacturer's written recommendations.

M21.212 Reinforcement

a) Reinforcing fibre mesh with symmetrical interfaced glass fibre made from twisted multi-end strands, styrene butadiene coated to provide a high resistance to alkali attack and manufactured in order to prevent laminar movement and deformation.

b) Heavy duty, double standard, interwoven glass fibre mesh styrene butadiene coated, for application in high traffic, vandal prone and anticipated high impact areas.

M21.213 Vapour Retarders

Where required as recommended, the vapour retarder shall be of a type approved by the system manufacturer.

M21.214 Sealants

Sealant shall be of a type approved by the system manufacturer.

M21.215 Beads/ Trims

All necessary bell casts, stop beads, movement and expansion joint beads shall be provided and fixed as required to complete the installation.

Finishes

M21.216 Finish Requirements

a) The finish shall be a manufacturer's exterior, ready mixed, 100% acrylic resin containing quartz aggregates or silicone resin based wall coatings or acceptable equivalent.

b) The type, texture, colour and aggregate sizes shall be as indicated on the Design Drawings and/ or a sample acceptable to the Architect.

c) Finishes shall be formulated with dirt pickup resistance (DPR) and proven mildew resistance (PMR) cross linked acrylic technology or equivalent agreed for long term durability and low maintenance.

d) Colour selection: The lightness value of the exterior finish colour to be applied over mineral wool shall be 20% or greater or an acceptable equivalent. All synthetic resin finish renders/ plasters shall have maximum light fastness properties.

M21.217 Colour and Texture Uniformity

a) When samples of coatings have been accepted, type or proportion of constituent materials shall not be changed.

b) Supplies of materials shall be sufficient to give consistent and uniform colour and texture.

PERFORMANCE

M21.218 General

The works shall comply with the general performance requirements of Section A15 of the Architectural Specification, in addition to the following specific performance requirements.

Structural

M21.219 Integrity

The installation shall be:

a) Weathertight under all anticipated conditions.

b) Capable of resisting all dead loads and design live loads, including impact and wind loads, and shall accommodate all thermal movements without damage.

M21.220 Impact Loads

The finished wall(s) shall have the following impact resistance(s):

a) Up to 1.5m above ground level: 15Nm.

b) Between 1.5m and 6m above ground level: 10Nm.

c) Over 6m above ground level: 5Nm.

M21.221 Wind Loads

The works system shall be designed to withstand, without permanent deformation, the effects of wind loads in accordance with Section A15 of the Architectural Specification and in compliance with the recommendations of BS EN 1991: Part 1-4.

Environmental

M21.222 Vapour Permeability

The vapour permeability of the system shall be not less than that of the construction to which it is being applied.

M21.223 Thermal Performance

Thermal transmittance (U-value): The construction (assembly of work) shall provide an average U-value of ***0.28***W/m²K or better.

Fire

M21.224 Surface Spread of Flame

Fire rating: Class 0 surface spread of flame as defined in the Building Regulations.

WORKMANSHIP

M21.225 Generally

a) Installation work shall be carried out by the render system manufacturer or by a contractor approved by the render system manufacturer.

b) None of the proprietary insulated render products shall be altered with antifreeze, accelerators, rapid binders or any other additives.

M21.226 Job Conditions

Renders/ plasters described shall not be applied unless ambient and surface temperatures can remain above +5°C, both during application and the drying period. Prior to installation, the wall shall be free of residual moisture. The stored material shall be protected from frost and strong sunlight. Supplementary heat shall be provided if installation is carried out when temperatures are lower than +5°C.

M21.227 Adverse Weather

a) Frozen materials shall not be used and materials shall not be applied to frost bound surfaces.

b) Adhesive, mortar or render shall not be applied when the air temperature is at or below 5°C on a falling thermometer or below 3°C on a rising thermometer, or when the temperature of the air or wall surface is above 30°C and the surface is not protected.

c) The temperature of the work shall be maintained above freezing until the adhesive/ mortar/ render has hardened fully.

d) Newly rendered surfaces shall be protected against rain and snow by covering when precipitation occurs.

e) Coatings damaged by rain or frost shall be replaced.

M21.228 Condition of Backgrounds

Before pre-treatment or application of coatings, backgrounds shall be structurally sound, adequately true and level, dry, free from contamination by dirt, dust, efflorescence or other deleterious substances, and in a suitable condition to receive specified coatings.

M21.229 Preparation of Backgrounds

Efflorescence, dust and other loose material shall be removed by thorough dry brushing. All traces of paint, dirt and other substances incompatible with adhesive shall be removed by scrubbing with water containing detergent and rinsed off with plenty of clean water. Surfaces shall be allowed to dry before coatings are applied, unless specified otherwise.

M21.230 Render Thickness Gauges

In order to ensure the specified coating thickness, render thickness gauges shall be used.

M21.231 Union with Dissimilar Materials

The following measures shall be used when the proprietary insulated render system meets an adjoining material:

a) Insulation board shall be cut back 2-4mm from adjoining material.

b) In accordance with the manufacturer's written product data, a proprietary pre-compressed neoprene based expandable waterproofing tape shall be introduced to the edge of the insulation board.

M21.232 Drying Out

a) Primer coats and undercoats shall be allowed to dry out thoroughly before applying subsequent coats.

b) All necessary precautions shall be taken to prevent newly rendered surfaces from drying out too rapidly.

M21.233 Construction/ Movement Joints

Joints shall be formed accurately to detail and in locations indicated on the Design Drawings. If modifications to any joint location or design are necessary on Site, revisions shall be agreed with the Architect before proceeding.

M21.234 Supports for Services/ Fittings

a) Secure supports for soil and rainwater pipe brackets shall be provided in locations as indicated on the Design Drawings.

b) Type shall be as recommended by the system manufacturer.

M21.235 Sealant Joints

a) Location(s): Refer to the Design Drawings:
   i) At the abutting works.
   ii) At the door and window interfaces.

b) Sealant: Type shall be as recommended in writing by the manufacturer.

c) Form in accordance with the system manufacturer's written recommendations using any necessary joint filler, backing strips.

M21.236 Cleanliness

All existing work and approaches shall be protected carefully, using suitable boards and sheets. Any droppings from finished work shall be cleaned off immediately.

M21.237 Inspection of Completed Installation

As soon as possible after completion of the work and before removing scaffolding, an inspection to identify any defects shall be carried out with the Architect.

End of Section

P10.237 General 6

P10 SUNDRY INSULATION

The particular requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the general requirements specified in the A and Z sections and the particular requirements of other applicable Architectural Specification sections.

P10.100 COMPLIANCE AND SCOPE

COMPLIANCE

P10.101 General

a) Refer to and comply with Section A15.100 of the Architectural Specification regarding the Trade Contractor's design responsibility for this element of the works.

b) Complete the Detailed Design of this element of the works, maintaining the intent of the Design Drawings (A10.102 d) i)), where the Architect's role will be limited to checking compliance with quality, design and visual intent only.

c) Use the reference codes and accompanying descriptions listed on the System Reference Sheet (SRS) to identify materials, products, systems and components, when completing the Detailed Design.

SCOPE

Wall Insulation

P10.102 Type INS-122 Wall Insulation

Rigid polyisocyanurate foam cure (PIR) wall insulation to locations indicated on the Design Drawings, and complying with performance requirements, comprising:

a) Performance requirements:

i) Thickness: As indicated on the Detailed Drawings/ To achieve 0.1W/ m²K overall floor build-up U-value.

ii) Compressive strength: Not applicable.

iii) Fire rating: It must comply with BCA over 18m.

iv) Recycled content: A+ or A and BES 6001 or BS EN ISO 14001.

P10.103 Type INS-123 Wall Insulation

Rock mineral wool slab wall insulation to locations indicated on the Design Drawings, and complying with performance requirements, comprising:

a) Performance requirements:

i) Thickness: As indicated on the Design Drawings/ To achieve 0.1W/ m²K overall floor build-up U-value.

ii) Fire rating: It must comply with BCA over 18m.

iii) Compressive strength: 300KN/ m².

iv) Recycled content: A+ or A and BES 6001 or BS EN ISO 14001.

P10.200 QUALITY AND WORKMANSHIP

SUBMITTALS

P10.201 Tender Submittals

A design response shall be submitted with the Tender proposal, including the following:

a) Pre-contract samples, where specified.

b) A list of tests to be included.

c) Proposed QA/ QC programme.

d) A list of Working Drawings to be submitted.

e) A summary of any proposed deviations from the Architectural Specification and Design Drawings.

f) Outline technical specifications/ data sheets of proposed materials/ systems.

g) A list of proposed suppliers and sub-contractors.

P10.202 Pre-contract Samples

The following pre-contract samples shall be provided:

a) Not required.

P10.203 Post Contract Samples

The following post contract samples shall be provided:

a) 300mm x 200mm of each type of insulation sheet/ board material.

b) Associated fixings and accessories.

P10.204 Mock-ups

The following mock-ups shall be provided:

a) Not required.

P10.205 Prototypes

The following prototypes shall be provided:

a) Not required.

P10.206 Quality Benchmarks

In locations to be agreed with the Architect, provide the following quality benchmarks:

a) First of each type installed.

TESTING

P10.207 General

a) Provide Agrément certificates or other such certified data demonstrating that the systems have been suitably tested and meet the performance requirements of the Architectural Specification.

b) Testing data does not relieve the Trade Contractor of his responsibilities regarding the performance of the works, the technical requirements, durability or service life requirements, etc.

ARCHITECTURAL AND FUNCTIONAL REQUIREMENTS

P10.208 General

a) The works shall be installed within the fixing zones indicated on the Design Drawings.

b) The works shall accommodate all architectural and functional features indicated on the Design Drawings, while maintaining the performance requirements.

c) Include all necessary accessories recommended by the manufacturer to complete the works and maintain the intended performance requirements and service conditions.

d) Products and their associated accessories shall be installed in accordance with manufacturer's written instructions.

MATERIALS AND COMPONENTS

Metalwork and Finishes

P10.209 Metalwork

Refer to Section Z11.

P10.210 Finishes

Refer to Section Z30 for general finishes to metalwork.

Fixings

P10.211 General

a) Fixings shall be in accordance with the system manufacturer's recommendations, to suit the service conditions.

b) Where necessary, fixing components shall be capable of adequate three-dimensional adjustment to accommodate building structure and system fabrication/ installation tolerances.

c) Fixings shall be inherently corrosion resistant or fully protected to prevent corrosion.

d) Visible fixings shall be a type agreed with the Architect prior to installation.

Sealants

P10.212 General

a) Refer to Section Z22.

b) Sealant products shall be used in accordance with the system manufacturer's written recommendations, to suit the service conditions.

c) Sealant shall not leak or bleed causing any discolouration or staining.

Insulation

P10.213 Materials

a) Mineral fibre products shall comply with BS EN 13162.

b) Extruded polystyrene (XPS) products shall comply with BS EN 13164.

c) Rigid polyurethane foam (PUR) products shall comply with BS EN 13165.

d) Phenolic foam (PF) products shall comply with BS EN 13166.

e) Cellular glass (CG) products shall comply with BS EN 13167.

f) Rigid polyisocyanurate foam (PIR) products shall comply with BS 4841.

P10.214 Requirements

a) The insulation shall be inert, durable, rot-proof and vermin-proof and not be degradable by moisture, extreme temperatures or water vapour, unless the Design of the system protects the insulation from the need for such requirements.

b) The insulation shall not bulge, sag, delaminate or detach during its installation or when in situ during the life of the works.

c) Insulation shall be a minimum of Euroclass A2.

d) Insulation shall have zero Ozone Depleting Potential (ODP), be CFC and HFC free and have a Global Warming Potential (GWP) of less than five. Refer also to Section A33 of the Architectural Specification.

e) Insulation shall be selected to meet the recommendations of 'The Green Guide to Specification' and shall have a minimal environmental impact when assessed using BREEAM criteria.

f) The selected insulation shall comply with all relevant British Standards and be BBA certified.

g) Expanded polystyrene (EPS) shall not be permitted within the works.

PERFORMANCE

P10.215 General

The works shall comply with the general performance requirements of Section A15 of the Architectural Specification in addition to the following specific performance requirements.

Structural

P10.216 General

a) Refer to the Structural Engineer's documentation.

b) Unless stated otherwise, systems shall be designed in accordance with the current relevant and applicable British Standards and/ or Eurocodes.

c) Refer to the Building Movement and Tolerances Report for the anticipated movement of the building structure and relevant elements.

d) The works shall accommodate the most onerous combination of loads, movements and deflections while maintaining the overall performance and without sustaining any permanent deformation.

e) The works shall accommodate loads, movements and environmental effects without levels of noise likely to be intrusive in and around the completed building.

P10.217 Dead Loads

The works shall be capable of accommodating the following dead loads:

a) Self-weight gravity loads of the systems including any framing and supports.

b) Loads imposed by elements that bear onto; are suspended from; or are fixed to the systems, as indicated on the Design Drawings.

P10.218 Imposed Loads

The works shall be capable of accommodating the following imposed loads:

a) Loads arising from moving elements of the works, such as opening panels, doors and vents.

b) Loads resulting from movements of the building structure and cladding support structure.

c) Loads acting on the surface of the works arising from maintenance and cleaning operations:

   i) The works shall sustain safely, without reduction in performance and without permanent deformation to any component, a static 500N load applied through a square of 100mm sides.

   ii) Loads imposed during replacement of system components and components of interfacing systems.

   iii) Loads associated with normal maintenance and access.

d) Accidental loads imposed by persons falling against or onto the elements.

e) Horizontal line loads applied to the works, due to the occupants, in accordance with BS 6180 and BS EN 1991.

f) Loads imposed by interfacing elements/ works.

g) Known impact loads, or transferred impact loads.

P10.219 Air Pressure Loads

Calculated pressure loads shall include the effect of differential air pressures within the building.

P10.220 Movement

The works shall accommodate the following movements:

a) Due to the movement of joints, whether designed to permit movement or not.

b) Due to deflection under design loads.

c) Due to changes in dimension and shape of components arising from building movements, including settlement, creep, twisting and racking.

d) Thermal movement due to local climatic conditions and variations in service temperatures including during construction.

e) Moisture movement due to:

i) Shrinkage or expansion caused by variations in atmospheric moisture content.

ii) Drying shrinkage of building components.

P10.221 Deflections

The maximum allowable deflections of the works shall be L/ 200, or 10mm (whichever is the lesser).

Environmental

P10.222 Thermal Performance Requirements

a) The maximum thermal permitted transmittance (U-value) for the various areas of the works shall be in accordance with the Thermal Modelling Report.

b) The average U-value through the works shall comply with the above requirements and shall meet all Statutory requirements as well as Approved Document Part L of the Building Regulations.

Acoustic

P10.223 General

Refer to the Acoustic Report.

Fire and Smoke

P10.224 General

Fire and smoke performance requirements shall be as indicated in the Design Drawings, the Fire Strategy Report and Section A15.

P10.225 Reaction to Fire

Materials shall be either non-combustible or not easily ignitable with low flame spread characteristics and shall not produce excessive quantities of smoke or toxic gases under combustion, confirmed by testing in accordance with the appropriate parts of BS 476, unless otherwise stated.

P10.226 Fire Resistance

a) Where a floor or wall in the building is a fire-resisting separation, the junction between the works and the floor or wall shall maintain the integrity and insulation of the fire compartmentation, to prevent fire spread. Materials used to complete the junction shall accommodate movement between the works and other elements and their fire resisting performance shall not be affected by water from sprinkler discharge.

b) Cavity barriers and fire/ smoke stopping shall be provided within the works, including at the junction of the works with all other fire resisting elements of the building.

c) All fire/ smoke barriers/ stops shall be positively fixed in position, in accordance with the manufacturers' recommendations, in such a manner that they shall not become dislodged in the event of a fire. The fixing shall secure the barrier/ stop in position for a period at least equal to that required for the compartment wall or floor against which the works abut.

Durability

P10.227 General

a) The performance criteria shall be satisfied for the full service life of the works, as stated in the Architectural Specification, provided always that the maintenance has been carried out as specified.

b) Selected materials shall be durable and satisfy the requirements of the Architectural Specification for the service life of the works.

c) Exposure to sunlight during the lifetime of the works shall not reduce the performance or visual appearance of any element/ component. Take into consideration expected solar performance under varying conditions of solar radiation and air velocity.

d) The works shall perform throughout the service life without failure resulting from defects in design, materials or workmanship. Failure shall be defined as breakage, disengagement of components, deflection beyond stated values, reduction in performance or unacceptable change in appearance including breakage.

e) The works shall comply with Section 5 of Approved Document A of the Building Regulations, with regard to accidental damage/ robustness.

P10.228 Abrasion Resistance

The works shall resist abrasion from agreed cleaning methods and maintenance systems without any noticeable change in surface appearance.

WORKMANSHIP

P10.229 General

a) Where applicable, the works shall be carried out in accordance with the manufacturer's recommendations.

b) Operatives shall be trained, experienced and appropriately skilled in the installation of the works and, where applicable, be recommended by the system/ product manufacturer.

c) The system shall interface with pipes, ducts, structural members and other components that pass through it by mechanical means including seals, collars, sleeves, clips, welds, counter flashings and other such methods ensuring that the requirements of the Architectural Specification are maintained.

P10.230 Storage and Accuracy

a) Do not deliver materials/ components to Site until required or until there is suitable dry storage space, ensuring that the required moisture content can be maintained.

b) All materials/ components shall be stored on Site in accordance with the manufacturer's printed recommendations.

c) Adequate storage shall be provided for all materials/ components to maintain them free from damage and distortion, and in conditions suitable for their intended service conditions.

d) Finished materials/ components shall be carefully packed in stillages or crates such that they are suitably separated and protected to prevent scratching, scuffing, or other surface damage.

e) Do not remove protective package/ coverings until immediately before materials/ components are required for fixing.

P10.231 Preparation

a) Before commencing installation, survey the structure, checking dimensions, line, level and fixing points and report immediately to the Architect if the existing structure is unsuitable to receive the works.

b) If the structure/ substrate is unsuitable, propose remedial action to make the structure suitable.

c) All bases/ backgrounds shall be rigid, dry, sound, smooth, clean, free from dust, dirt, grease and other contaminants before systems/ products are installed.

d) Substrates shall be sound, with no loose material or significant cracks or gaps.

e) All cutting, chasing, plugging, making good and other necessary procedures required to the substrate or to the adjacent works, that cannot/ should not be undertaken after the installation of the works specified herein, shall be completed.

f) Tolerances of the structure/ substrate shall be suitable to permit the required configuration and specified tolerances of the finished systems/ products.

P10.232 Installation

a) Do not commence the works before the building is weathertight, wet trades have been completed and the building is dried out.

b) Allowance for future moisture and temperature movement shall be made.

c) The installation shall accommodate all specified tolerances and differences between actual Site dimensions and dimensions shown on the Design Drawings.

d) Inspect each material/ component of the works immediately before installation. The works shall be installed using materials/ components being properly sized, free from marks, defects, flaws, steps, waves, or damage of any nature.

e) Do not alter materials/ components with prefinished surfaces except where agreed with the Architect and except where cut finishes can be prepared and reinstated to their original finish quality.

f) Do not repair damaged units without acceptance. Such acceptance shall not be given where the units are badly damaged or where the proposed repair would impair appearance or performance.

g) Acceptance shall be obtained from the Architect and Structural Engineer before drilling or cutting parts of the structure, other than where indicated on the Working Drawings.

h) Do not cut, drill or otherwise alter the work of others to accommodate the system/ product installation without first seeking the acceptance of the Architect.

i) No materials/ components shall be installed until service outlets, duct covers and other fixtures around which the materials are to be cut have been fixed. The Architect shall be informed not less than 48 hours before commencing installation.

j) Make provision for foreseeable movements/ expansion/ contraction in accordance with the system/ product manufacturer's recommendations.

P10.233 Fixing Requirements

a) Refer to Section Z20.

b) Install and position fixings and fastenings as recommended by the manufacturer, and where required by the Architect to be visible to the Architect's acceptance.

P10.234 Insulation

a) Material shall be cut accurately to accommodate abutments and configurations.

b) Seal holes and remove all debris prior to installation.

c) Insulation shall fit tightly with closely butted joints, fittings and abutments. No gaps shall be left.

d) Insulation shall be kept dry and secure as the work proceeds.

P10.235 Breather Membranes/ Vapour Barriers

a) The moisture content of timber shall be a maximum of 20% prior to fixing.

b) A fully sealed membrane/ barrier shall be created, that is free from punctures, tears and sagging. All material shall be fixed carefully and neatly.

c) Sheets shall:

i) Use staples for fixing at maximum 250mm centres along all supports.

ii) Be lapped at supports and a minimum 150mm.

iii) Lap over and be fixed to reveals of openings.

d) Seal with adhesive tape to pipes, ducts, structural members, etc. that pass through.

e) Prior to covering, check membranes/ barriers for perforations or any other defects and if found, repair or replace to the satisfaction of the Architect.

P10.236 Accessories

Closure pieces, flashings, trims, gutters, fillers, spacers, tapes, sealants and fixings where not specified, shall be types recommended by and installed in accordance with the manufacturer's recommendations to suit the service conditions.

Tolerances

P10.237 General

a) All elements shall be set out to their correct position as indicated on the Design Drawings and/ or Working Drawings, within ±2mm or 0.1% of the length, whichever is the lesser

b) Vertical elements shall be plumb, within ±2mm or 0.1% of the height, whichever is the lesser.

c) Horizontal elements shall be level, within ±2mm or 0.1% of the length, whichever is the lesser.

d) The maximum variation in gap from a straightedge applied to a flat vertical plane shall be 2mm for a 3000mm straightedge and 1mm for a 1000mm straightedge.

e) The maximum variation in gap from a straightedge applied to a flat horizontal plane shall be 2mm for a 3000mm straightedge and 1mm for a 1000mm straightedge.

f) The maximum variation in gap from a straightedge applied to a flat inclined plane shall be 2mm for a 3000mm straightedge and 1mm for a 1000mm straightedge. Drainage requirements of inclined planes shall be maintained.

g) The maximum offset in plane, level or section between any two adjacent sections shall be ±1mm.

h) The average width of any panel to panel joint shall be within ±1mm of the nominal joint. Any variation shall be equally distributed with no sudden changes or steps.

i) The maximum deviation between adjacent tile/ panel surfaces either side of an expressed joint shall be 1mm.

j) The bow of any flat surface shall not exceed more than ±2mm from a 2000mm straightedge placed against it in any direction.

k) The straightness of any surface of an edge shall not deviate by more than ±2mm from a 2000mm straightedge placed against it in any direction parallel to the long axis of the element.

l) The centre section of any lineal element shall not bow by more than the lesser of ±2mm or 0.075% of the length of the element measured from a straight line between the ends of the element.

m) The cross-section of any element shall not be twisted by more than 1° from the intended alignment

n) Dimensional and location tolerances of cut-outs for interfacing works shall be ±1mm the dimensions indicated on the Design Drawings. The Trade Contractor shall verify, with the appropriate supplier/ trade contractor, that such dimensions and locations are correct. Any deviation shall be agreed with the Architect

o) Account shall be taken of the installation tolerance requirements such that repetitive elements are accurately located, relative to gridlines.

p) Permissible tolerances shall be considered in isolation and not compounded. The most onerous tolerance shall apply.

End of Section

P12 FIRE STOPPING

The particular requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the general requirements specified in the A and Z sections and the particular requirements of other applicable Architectural Specification sections.

P12.100 COMPLIANCE AND SCOPE

COMPLIANCE

P12.101 General

a) Refer to and comply with Section A15.100 of the Architectural Specification regarding the Trade Contractor's design responsibility for this element of the works.

b) Complete the Detailed Design of this element of the works, maintaining the intent of the Design Drawings (A10.102 d) i)), where the Architect's role will be limited to checking compliance with quality, design and visual intent only.

c) Use the reference codes and accompanying descriptions listed on the System Reference Sheet (SRS) to identify materials, products, systems and components, when completing the Detailed Design.

SCOPE

Fire/ Smoke Stopping

P12.102 General

General fire/ smoke stopping, as required to suit the service conditions, comprising:

a) Provision of fire/ smoke stopping systems and products to interfaces, services and other penetrations to maintain fire compartmentation as indicated in the Fire Strategy Report.

b) Fire/ smoke stopping, where not included within other systems, shall be as required to maintain the fire performance of the building as indicated on the Design Drawings.

c) Systems types:

i) Fire stop sealant.

ii) Fire stop pipe sleeves/ penetrations as appropriate to suit the service conditions and to meet the requirements of the Fire Strategy Report.

iii) Fire stopping to floors of service risers as appropriate to suit the service conditions.

iv) Cavity barriers.

v) Intumescent seals.

vi) Proprietary fire barriers/ stops.

vii) Mineral wool reinforcement quilt.

viii) Fire resistant plasterboard to BS EN 520, classification Type F.

ix) Proprietary trowel applied compounds.

x) Proprietary trays.

xi) Proprietary preformed compressible fillers.

xii) Fire stopping to cable trays containing data/ similar power completed using removable fire stop cushions/ bricks to allow future cable installations to be completed.

xiii) Others as required to suit the service conditions.

P12.200 QUALITY AND WORKMANSHIP

SUBMITTALS

P12.201 Tender Submittals

A design response shall be submitted with the Tender proposal, including the following:

a) Pre-contract samples, where specified.

b) A list of tests to be included.

c) Proposed QA/ QC programme.

d) A list of Working Drawings to be submitted.

e) A summary of any proposed deviations from the Architectural Specification and Design Drawings.

f) Outline technical specifications/ data sheets of proposed materials/ systems.

g) A list of proposed suppliers and sub-contractors.

P12.202 Pre-Contract Samples

The following pre-contract samples shall be provided:

a) Not required.

P12.203 Post Contract Samples

The following post contract samples shall be provided:

a) 300mm x 200mm of each type of sheet/ board material.

b) Associated fixings and accessories.

P12.204 Mock-ups

The following mock-ups shall be provided:

a) Not required.

P12.205 Prototypes

The following prototypes shall be provided:

a) Not required.

P12.206 Quality Benchmarks

In locations to be agreed with the Architect, provide the following quality benchmarks:

a) The first of each type installed.

TESTING

P12.207 General

a) Provide independently certified test data and Agrément certificates that demonstrate that the proposed systems meet the performance requirements of the Architectural Specification.

b) Include for all on-Site testing specified herein, which shall be carried out by an independent testing body accredited by the United Kingdom Accreditation Service (UKAS).

P12.208 Inspection/ Testing Fire Sealing

a) Seals shall be examined for proper installation, adhesion and curing as appropriate for the respective seal materials.

b) Requirements:

i) 10% of penetration seals shall be tested, but no fewer than one of each type.

ii) The installed thickness of the fire stop material shall be measured.

iii) The penetration seals shall be re-examined immediately prior to concealment by other construction, in order to ensure that no damage has occurred since the initial inspection.

ARCHITECTURAL AND FUNCTIONAL REQUIREMENTS

P12.209 General

a) The works generally shall be designed and constructed in accordance with the recommendations of the Passive Fire Protection Federation (PFPF).

b) Systems that include proprietary products shall be designed and installed in accordance with the manufacturer's recommendations to suit the service conditions.

c) The works shall be covered by a single source warranty.

d) The works shall accommodate all architectural and functional features indicated on the Design Drawings, while maintaining the performance requirements.

e) Systems shall, where possible, be provided with a permanently fixed label/ tag that identifies:

i) The material supplier.

ii) The date of installation.

iii) The Trade Contractor's details.

f) Fire/ smoke stopping systems shall include all other components/ accessories necessary to complete the works as supplied/ recommended by the manufacturer to suit the service conditions.

MATERIALS AND COMPONENTS

Metalwork and Finishes

P12.210 Metalwork

Refer to Section Z11 of the Architectural Specification.

P12.211 Finishes

Refer to Section Z30 of the Architectural Specification for general finishes to metalwork.

Fixings

P12.212 General

a) Fixings shall be in accordance with the system manufacturer's recommendations, to suit the service conditions.

b) Where necessary, fixing components shall be capable of adequate three-dimensional adjustment to accommodate building structure and system fabrication/ installation tolerances.

c) Fixings shall be inherently corrosion resistant or fully protected to prevent corrosion.

d) Visible fixings shall be a type agreed with the Architect prior to installation.

Sealants

P12.213 General

a) Refer to Section Z22 of the Architectural Specification.

b) Sealant products shall be used in accordance with the system manufacturer's written recommendations, to suit the service conditions.

c) Sealant shall not leak or bleed causing any discolouration or staining.

PERFORMANCE

P12.214 General

The works shall comply with the general performance requirements of Section A15 of the Architectural Specification in addition to the following specific performance requirements.

Structural

P12.215 General

a) Refer to the Structural Engineer's documentation.

b) Unless stated otherwise, systems shall be designed in accordance with the current relevant and applicable British Standards and/ or Eurocodes.

c) Refer to the Building Movement and Tolerances Report for the anticipated movement of the building structure and relevant elements.

d) The works shall accommodate the most onerous combination of loads, movements and deflections while maintaining the overall performance and without sustaining any permanent deformation.

e) The works shall accommodate loads, movements and environmental effects without levels of noise likely to be intrusive in and around the completed building.

P12.216 Dead Loads

The works shall be capable of accommodating the following dead loads:

a) Self-weight gravity loads of the systems including any framing and supports.

b) Loads imposed by elements that bear onto; are suspended from; or are fixed to the systems, as indicated on the Design Drawings.

P12.217 Imposed Loads

The works shall be capable of accommodating the following imposed loads:

a) Loads arising from moving elements of the works, such as opening panels, doors and vents.

b) Loads resulting from movements of the building structure and cladding support structure.

c) Loads acting on the surface of the works arising from maintenance and cleaning operations:

   i) The works shall sustain safely, without reduction in performance and without permanent deformation to any component, a static 500N load applied through a square of 100mm sides.

   ii) Loads imposed during replacement of system components and components of interfacing systems.

   iii) Loads associated with normal maintenance and access.

d) Accidental loads imposed by persons falling against or onto the elements.

e) Horizontal line loads applied to the works due to the occupants/ users of the building, in accordance with BS 6180, BS EN 1991 and PD 6688.

f) Loads imposed by interfacing elements/ works.

g) Known impact loads, or transferred impact loads.

P12.218 Air Pressure Loads

Calculated pressure loads shall include the effect of differential air pressures within the building.

P12.219 Movement

The works shall accommodate the following movements:

a) Due to the movement of joints, whether designed to permit movement or not.

b) Due to deflection under design loads.

c) Due to changes in dimension and shape of components arising from building movements, including settlement, creep, twisting and racking.

d) Thermal movement due to local climatic conditions and variations in service temperatures including during construction.

e) Moisture movement due to:

   i) Shrinkage or expansion caused by variations in atmospheric moisture content.

   ii) Drying shrinkage of building components.

P12.220 Deflections

The maximum allowable deflections of the works shall be L/ 200, or 10mm (whichever is the lesser).

Fire and Smoke

P12.221 General

Fire and smoke performance requirements shall be as indicated in the Design Drawings, the Fire Strategy Report and Section A15 of the Architectural Specification.

P12.222 Reaction to Fire

Unless otherwise stated, materials shall be either non-combustible or not easily ignitable with low flame spread characteristics and they shall not produce excessive quantities of smoke or toxic gases under combustion, confirmed by testing in accordance with the appropriate parts of BS 476.

P12.223 Fire Resistance

a) Where a floor or wall in the building is a fire-resisting separation, the junction between the works and the floor or wall shall maintain the integrity and insulation of the fire compartmentation, to prevent fire spread. Materials used to complete the junction shall accommodate movement between the works and other elements and their fire resisting performance shall not be affected by water from sprinkler discharge.

b) Cavity barriers and fire/ smoke stopping shall be provided within the works, including at the junction of the works with all other fire resisting elements of the building.

c) All fire/ smoke barriers/ stops shall be positively fixed in position, in accordance with the manufacturers' recommendations, in such a manner that they shall not become dislodged in the event of a fire. The fixing shall secure the barrier/ stop in position for a period at least equal to that required for the compartment wall or floor against which the works abut.

Durability

P12.224 General

a) The performance criteria shall be satisfied for the full service life of the works, as stated in the Architectural Specification, provided always that the maintenance has been carried out as specified.

b) Selected materials shall be durable and satisfy the requirements of the Architectural Specification for the service life of the works.

c) Exposure to sunlight during the lifetime of the works shall not reduce the performance or visual appearance of any element/ component. Take into consideration expected solar performance under varying conditions of solar radiation and air velocity.

d) The works shall perform throughout the service life without failure resulting from defects in design, materials or workmanship. Failure shall be defined as breakage, disengagement of components, deflection beyond stated values, reduction in performance or unacceptable change in appearance including breakage.

e) The works shall comply with Section 5 of Approved Document A of the Building Regulations, with regard to accidental damage/ robustness.

P12.225 Abrasion Resistance

The works shall resist abrasion from agreed cleaning methods and maintenance systems without any noticeable change in surface appearance.

WORKMANSHIP

P12.226 General

a) Workmanship shall generally comply with the requirements of BS 8000: Part 0 and BS 8000: Part 8.

b) Where applicable, the works shall be carried out in accordance with the manufacturer's recommendations.

c) Make due allowance for the sequencing of the whole works and all interfaces.

d) Operatives shall be trained, experienced and appropriately skilled in the installation of the works and, where applicable, be recommended by the system/ product manufacturer.

P12.227 Storage and Accuracy

a) Do not deliver materials/ components to Site until required or until there is suitable dry storage space, ensuring that the required moisture content can be maintained.

b) All materials/ components shall be stored on Site in accordance with the manufacturer's printed recommendations.

c) Adequate storage shall be provided for all materials/ components to maintain them free from damage and distortion, and in conditions suitable for their intended service conditions.

d) Finished materials/ components shall be carefully packed in stillages or crates such that they are suitably separated and protected to prevent scratching, scuffing, or other surface damage.

e) Do not remove protective package/ coverings until immediately before materials/ components are required for fixing.

P12.228 Preparation

a) Before commencing installation, survey the structure, checking dimensions, line, level and fixing points and report immediately to the Architect if the existing structure is unsuitable to receive the works.

b) If the structure/ substrate is unsuitable, propose remedial action to make the structure suitable.

c) All bases/ backgrounds shall be rigid, dry, sound, smooth, clean, free from dust, dirt, grease and other contaminants before systems/ products are installed.

d) Substrates shall be sound, with no loose material or significant cracks or gaps.

e) All cutting, chasing, plugging, making good and other necessary procedures required to the substrate or to the adjacent works, that cannot/ should not be undertaken after the installation of the works specified herein, shall be completed.

f) Tolerances of the structure/ substrate shall be suitable to permit the required configuration and specified tolerances of the finished systems/ products.

P12.229 Installation

a) Do not commence the works before the building is weathertight, wet trades have been completed and the building is dried out.

b) Allowance for future moisture and temperature movement shall be made.

c) The installation shall accommodate all specified tolerances and differences between actual Site dimensions and dimensions shown on the Design Drawings.

d) Inspect each material/ component of the works immediately before installation. The works shall be installed using materials/ components being properly sized, free from marks, defects, flaws, steps, waves, or damage of any nature.

e) Do not alter materials/ components with prefinished surfaces except where agreed with the Architect and except where cut finishes can be prepared and reinstated to their original finish quality.

f) Do not repair damaged units without acceptance. Such acceptance shall not be given where the units are badly damaged or where the proposed repair would impair appearance or performance.

g) Acceptance shall be obtained from the Architect and Structural Engineer before drilling or cutting parts of the structure, other than where indicated on the Working Drawings.

h) Do not cut, drill or otherwise alter the work of others to accommodate the system/ product installation without first seeking the acceptance of the Architect.

i) No materials/ components shall be installed until service outlets, duct covers and other fixtures around which the materials are to be cut have been fixed. The Architect shall be informed not less than 48 hours before commencing installation.

j) Make provision for foreseeable movements/ expansion/ contraction in accordance with the system/ product manufacturer's recommendations.

P12.230 Fixing Requirements

a) Refer to Section Z20 of the Architectural Specification.

b) Install and position fixings and fastenings as recommended by the manufacturer, and where required by the Architect to be visible to the Architect's acceptance.

P12.231 Fire Stopping

a) Installation of fire stopping shall be scheduled after completion of work involving penetration items, but prior to covering, concealing or eliminating the access openings.

b) Fire stop system materials shall be installed in accordance with the manufacturer’s recommendations and the Working Drawings. Device frames shall be securely attached to the supporting construction. Component parts shall be assembled to ensure proper contact and sealing of all gaps and openings around penetrating items.

c) The design requirements pertaining to the separation of cables not in conduit shall be complied with. Required separation of penetrating items from the edges of openings and from each other shall be maintained.

d) Fire stop material shall be installed in a manner and to the depth required to achieve a rating of no less than the fire resistance of the element that is being penetrated.

e) Fire stop material shall be installed with sufficient pressure to maintain uniform density and texture, and to ensure proper filling and sealing of openings to effect a smoke seal.

f) Unless otherwise specified, exposed surfaces shall be tooled or trowelled to give a smooth finish, flush with surrounding surfaces.

g) Surfaces and conditions of openings shall be inspected to confirm that they have no defects that could interfere with the installation of the fire stopping materials.

h) When installed, fire stopping materials shall not shrink or slump.

i) The fire protection material shall not become damp or wet prior to, during, or after installation in a way that may be detrimental to its performance. Any such material shall not be incorporated in the works (that has been affected by water or dampness).

j) Where any imperfections of fit occur between building elements that are required to have fire resistance and/ or resist the passage of smoke, these shall be sealed completely. Unless otherwise specified, gaps shall be packed tightly with mineral fibre.

P12.232 Cavity Barrier

a) Along all edges, material shall be cut to fit tightly and shall be fixed securely. In order to provide a complete barrier to smoke and flame, all joints shall be wired or stapled together.

b) Sleeved fibre small cavity barriers:

i) At no more than 150mm centres, barriers shall be fixed securely with staples. Vertical barriers shall be fixed by both flanges, horizontal barriers by the upper flange only.

ii) Barriers shall be closely butted at joints and intersections and they shall be compressed along their full length to give a complete seal.

c) Wired fibre small cavity barriers:

i) Barriers shall be fixed securely with staples and if necessary folded, to ensure a tight fit. Barriers shall be closely butted at joints and intersections, leaving no gaps.

P12.233 Intumescent Sealants

a) Intumescent sealants shall be applied in accordance with the manufacturer's requirements and criteria specified herein.

b) Where services pass through partitions and fire resistant elements of the structure, sealant shall be applied all around them.

c) Work shall be carried out in accordance with the manufacturer's recommendations.

d) Pipe sleeves shall:

i) Be installed where required.

ii) Extend for the full thickness of the fire resisting element.

iii) Be accurately positioned to give a minimum clearance around the service of 20mm or the diameter of the service, whichever is the least.

iv) Be bedded solid.

e) The space between sleeve and service shall be filled with a proprietary product suitable for the purpose. The space shall be filled completely, leaving no gaps, and shall be finished neatly to the acceptance of the Architect.

f) Certified proof of suitability of their materials for the particular installation shall be provided by the manufacturers.

P12.234 Insulation

a) Accurately cut boards to accommodate abutments and configurations.

b) Lay evenly, with no lipping at joints.

c) Material shall fit tightly with closely butted joints fittings and abutments, no gaps shall be left

d) Keep dry and secure as the work proceeds, ensuring continuity and leaving no gaps.

P12.235 Fire and Smoke Barriers

a) Material shall be cut to fit tightly, achieve correct compression and be securely fixed along all edges. All joints shall be wired or stapled together to provide a complete barrier to smoke and flame. Where proprietary systems/ products are installed, they shall be strictly in accordance with the manufacturer's printed recommendations.

b) The works shall be erected in alignment and in relation to established lines and grades as indicated on the Design Drawings

c) Sealants shall not compromise the integrity of the works.

Tolerances

P12.236 General

a) Service pipes and cable trays shall be sealed all round where they pass through floors with an accepted material made for the purpose and tested.

b) Material shall fit tightly with closely butted joints fittings and abutments, no gaps shall be left.

c) The works shall be erected in alignment and in relation to established lines and grades as indicated on the Design Drawings.

d) The maximum variation in height of any part of the works from given datum shall be ±2mm.

e) The maximum offset in plane, level or section between any two adjacent sections shall be ±1mm.

f) The maximum variation in plan over a distance of 1800mm shall not exceed ±2mm.

g) Cut-outs for interfacing works shall comply with the dimensions indicated on the Design Drawings ±1mm.

h) Analysis of the erection sequence and overall method statement shall be produced to satisfy the Architect that the installation tolerances stated shall be met.

End of Section

P21 IRONMONGERY

The particular requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the general requirements specified in the A and Z sections and the particular requirements of other applicable Architectural Specification sections.

P21.100 COMPLIANCE AND SCOPE

COMPLIANCE

P21.101 General

a) Refer to and comply with Section A15.100 of the Architectural Specification regarding the Trade Contractor's design responsibility for this element of the works.

b) Complete the Detailed Design of this element of the works, maintaining the intent of the Design Drawings (A10.102 d) i)), where the Architect's role will be limited to checking compliance with quality, design and visual intent only.

c) Use the reference codes and accompanying descriptions listed on the System Reference Sheet (SRS) to identify materials, products, systems and components, when completing the Detailed Design.

SCOPE

Ironmongery

P21.102 General

The Trade Contractor shall be responsible for the selection of ironmongery, which shall meet the requirements of the Architectural Specification and shall be as indicated on the Design Drawings. Provide an Ironmongery Schedule listing proposed ironmongery and their associated doors/ frames for review and acceptance by the Architect.

P21.103 General

Ironmongery generally shall be as indicated in the Ironmongery Schedule.

P21.200 QUALITY AND WORKMANSHIP

SUBMITTALS

P21.201 Tender Submittals

A design response shall be submitted with the Tender proposal, including the following:

a) Pre-contract samples, where specified.

b) A list of tests to be included.

c) Proposed QA/ QC programme.

d) A list of Working Drawings to be submitted.

e) A summary of any proposed deviations from the Architectural Specification and Design Drawings.

f) Outline technical specifications/ data sheets of proposed materials/ systems.

g) A list of proposed suppliers and sub-contractors.

P21.202 Pre-contract Samples

The following pre-contract samples shall be provided:

a) Not required.

P21.203 Post Contract Samples

The following post contract samples shall be provided:

a) 3 No. samples of each type of ironmongery in the specified finish.

b) A complete sample board of standard items. The exact extent to be agreed.

P21.204 Mock-ups

The following mock-ups shall be provided:

a) Not required.

P21.205 Prototypes

The following prototypes shall be provided:

a) Not required.

P21.206 Quality Benchmarks

In locations to be agreed with the Architect, provide the following quality benchmarks:

a) First item of ironmongery installed of each type.

TESTING

P21.207 General

a) Provide manufacturer's test data.

b) The responsibilities of the Trade Contractor shall not be relinquished through the provision of test data with respect to guarantees provided for the ironmongery.

ARCHITECTURAL AND FUNCTIONAL REQUIREMENTS

P21.208 General

a) The works generally shall be designed, constructed and installed in accordance with the recommendations of the Guild of Architectural Ironmongers (GAI).

b) System build-ups indicated on the Design Drawings are only indicative of the design intent.

c) Proprietary ironmongery systems shall be designed, manufactured and installed in accordance with the manufacturer's recommendations to suit the service conditions.

d) The Trade Contractor shall determine the required ironmongery types and all necessary components to suit the service conditions.

e) The works shall accommodate all architectural and functional features indicated on the Design Drawings, while maintaining the performance requirements.

f) Ironmongery shall be compatible with and shall not compromise compliance with the performance requirements for any item to which it is fixed.

g) Refer to the Door Schedule and the Work Sections of the Architectural Specification detailing the doors/ frames to which ironmongery is fitted for specific component requirements. A detailed Ironmongery Schedule shall be produced by the supplier.

h) Ironmongery shall be generally of one internationally recognised, fully co-ordinated ironmongery suite, in continuing production, of consistent design and finish, with a ready supply of extras and spares.

i) Ironmongery shall reflect the use(s) and quality of the Project, facilitate building use and maintenance, prevent unauthorised access or egress, allow and direct escape from, protect against and inhibit spread of fire, smoke and other hazards, protect doors and surfaces and create desired aesthetic effects.

j) The ironmongery supplier shall be a registered full member of the Guild of Architectural Ironmongers, or approved international registered equivalent, and shall have in employment, on a permanent basis, a diploma holder of the Guild of Architectural Ironmongers (Dip GAI) who shall be available as a consultant for the duration of the works and to work specifically with the Architect as required.

k) Ironmongery systems shall include fixings, framing, bracketry, support framing and all other components/ accessories necessary to complete the works as supplied/ recommended by the manufacturer to suit the service conditions.

l) All handles from the manufacturer's range shall be installed according to their specific method statement to ensure a tight fit.

P21.209 Suiteing of Locks

a) Unless otherwise stated, cylinders and lever mechanism locks shall be under a master key suited plan.

b) Master key and suiteing proposals shall be agreed in writing with the Trade Contractor and manufacturer prior to order placement.

MATERIALS AND COMPONENTS

P21.210 CE Marking

a) In accordance with Annex ZA of the relevant BS EN, all items of ironmongery shall be CE marked.

b) Only non-visible areas of items shall have the CE marking once installed.

c) Relevant legislation:

i) Construction Products Regulations (CPR) 2013.

ii) Building Regulations Approved Document 7 2013.

P21.211 Metalwork

a) Refer to Section Z11 of the Architectural Specification.

b) Stainless steel for internal and external ironmongery shall be a minimum of grade 1.4401.

P21.212 Hinges

a) Single axis hinges shall comply with BS EN 1935 and shall be labelled in accordance with the standard confirming the following characteristics of the hinge, which shall be determined by the Trade Contractor for each door/ frame:

i) Category of use.

ii) Durability.

iii) Door leaf weight.

iv) Suitability for use on fire resistant and/ or smoke control doors.

v) Safety.

vi) Corrosion resistance.

vii) Security.

viii) Hinge grade.

b) Double axis hinges shall be labelled to show their particular characteristics. The label shall include those categories used to classify single axis hinges.

c) External hinges shall be stainless steel and Grade 13-14 in accordance with BS EN 1935.

d) For hinges that shall be used with fire doors, intumescent card shall be used between the hinge and the frame, meeting the requirements of BS EN 1634: Parts 1 and 3.

e) A minimum of three hinges per leaf shall be provided for 'heavy duty' category doors and heavier (by weight) fire doors, selected and positioned in accordance with the manufacturer's recommendations for the weight and usage frequency of the door.

f) A minimum of four hinges per leaf shall be provided for oversized (height and/ or width) doors, selected and positioned in accordance with the manufacturer's recommendations for the weight of the door.

g) Hinges shall be of the strength class to suit the opening element weight, duty, number of hinges and other factors recommended in BS EN 1935.

h) The relevant corrosion protection shall be applied to the hinges as stated in BS EN 1670:

i) Grade 0: No defined corrosion resistance.

ii) Grade 1: Mild resistance.

iii) Grade 2: Moderate resistance.

iv) Grade 3: High resistance.

v) Grade 4: Very high resistance.

i) Free-moving floor pivot hinges shall be heavy-duty, fully adjustable and housed in pivot boxes, the visible face of which shall match those of floor spring units. Throughout the works both types shall be from a single suite of units, from one manufacturer. Unless otherwise stated, floor pivots shall have the following features:

i) Fully reversible, non-handed and suitable for double action timber or metal doors, using compatible fittings, with concealed fixing top plates to match other ironmongery and with no visible manufacturer's markings.

ii) Opening/ closing through 90° in either direction.

iii) Special reinforced galvanised main boxes allowing vertical, longitudinal and transverse adjustment after installation, with waterproof seal.

j) Fixings shall be proposed by the Trade Contractor. Fixings for fire rated doors shall be included within the fire test certificate.

P21.213 Door Holding/ Closing Devices

a) Mechanically operated door closing devices for swing doors shall comply with BS EN 1154.

b) Electrically powered door closing devices for swing doors shall comply with both BS EN 1154 and BS EN 1155.

c) Refer also to BS EN 1158 for manually or electronically operated door closing devices, which incorporate door co-ordinating devices.

d) Door closers shall be from a single manufacturer's suite of matching closers, which shall offer a range of optional functions, including, but not limited to, mechanical and/ or electromagnetic stand open and delayed closing.

e) Closing speed shall be adjustable from 2 to 30 seconds.

f) All floor springs on fire rated doors shall incorporate delayed closing and the door, when opened to 90° or beyond, shall stand open for an adjustable period of up to not less than 60 seconds before closing. All floor springs to non-fire rated doors shall have a mechanical stand open at 90° in either direction.

g) Closers shall have the following features unless stated otherwise:

i) Hydraulic control from 180°.

ii) Be thermo-constant.

iii) Separate adjustable closing speed.

iv) Separate adjustable latching speed.

v) Separate sweep and latch valve.

vi) Self-adjusting backcheck.

vii) Fully adjustable delayed closing function.

h) Functions such as spring strength and delayed action functions shall, by means of an Allen key or acceptable equivalent, be fully adjustable.

i) Uncontrolled jamb closer devices shall comply with prEN 15887.

j) Closing devices which include hold open functionality shall also comply with BS EN 1155.

P21.214 Overhead Door Closers

a) Selection of door closers shall be governed by the recommendations in BS EN 1154.

b) Closers shall be fully reversible, non-handed and suitable for single or double action wood or metal doors, using compatible fittings, with concealed fixing top plates to match other ironmongery and with no visible manufacturer's markings.

c) Closing speed shall be adjustable from 2 to 30 seconds.

d) Overhead closers shall:

i) Be matched to the sizes and weights of the doors.

ii) Override latches and/ or door seals when fitted.

iii) Hold unlatched doors shut under normal working conditions.

e) Overhead closers for fire rated doors shall:

i) Be types included in successful tests to BS 476: Part 22 at date of installation of door assemblies similar to those for which the closers are proposed and shall comply with BS EN 1634: Parts 1 and 3. Submit evidence of testing by an approved laboratory.

ii) Be fixed in accordance with the manufacturer's recommendations.

iii) Have arms formed from materials with a melting point above 1000°C.

P21.215 Floor Spring Closing Devices

a) Floor springs shall be heavy-duty, fully adjustable, hydraulic check types. All floor springs throughout the works shall be from a single suite of matching units, from one manufacturer, offering a complete range of optional functions, such as mechanical stand open and delayed closing. Unless otherwise stated, floor springs shall have the following features:

i) Comply with BS EN 1154.

ii) Fully reversible, non-handed and suitable for single or double action wood or metal doors, using compatible fittings, with concealed fixing top plates to match other ironmongery and with no visible manufacturer's markings.

iii) Closing speed adjustable from 2 to 30 seconds.

iv) All floor springs on fire rated doors shall incorporate delayed closing and the door, when opened to 90° or beyond, shall stand open for an adjustable period up to not less than 60 seconds before closing. All floor springs to non-fire rated doors shall have a mechanical stand open at 90° in either direction.

v) Opening/ closing through 90° in either direction, with check control from any angle between 85° and closed.

vi) Overload protection, to prevent damage from forced closing.

vii) Special reinforced galvanised main boxes allowing vertical, longitudinal and transverse adjustment after installation, with waterproof seal.

P21.216 Door Selectors

a) Door co-ordinating devices shall comply with BS EN 1634: Parts 1 and 3, BS 476: Part 22 and BS EN 1158 with additional requirements for devices on fire resisting doors.

b) Suitable selectors shall be provided if both leaves of a pair of rebated edge doors have closers or rebated latchbolts.

c) The selectors shall not obstruct other ironmongery or affect the fire ratings of the doors.

d) On doors opening outwards, spring type, under-frame fixing selectors shall be used. If doors open inwards, rebate or face fixing types shall be used.

P21.217 Locks, Cylinders and Keys

a) Mechanically operated locks and latches shall comply with BS EN 12209 and BS 3621.

b) Electromechanically operated locks and latches shall comply with BS EN 14846.

c) Electro-magnetic locks shall be slim profile with nominal 250kg holding force magnetic locks, including all concealed wireways and containments within the door frame, subject to the recommendations of the frame manufacturer.

d) Multipoint locking assemblies shall comply with PAS 8621, PAS 10621 and PAS 3621, where applicable.

e) The lock recess to fire doors shall be lined with intumescent card to comply with the door manufacturer's certification in accordance with BS EN 1634: Parts 1 and 3.

f) Cylinders shall conform to BS EN 1303.

g) Where cylinders are fitted with an internal thumb-turn handle, this shall be with an 'easi-grip' pattern.

h) Unless otherwise specified, keyed locks for doors/ doorsets shall be of the pin tumbler, cylinder type such as 'Europrofile', with a minimum of 6 pins. Double cross cut or side-pin cylinders shall be removable when the door is open but shall not be removable when the door is closed.

i) Padlocks shall comply with BS EN 12320.

P21.218 Lever Handles

a) Lever handles shall comply with BS EN 1906, BS EN 1634: Parts 1 and 3, BS 8300 and Approved Document Part M of the Building Regulations.

b) Unsprung lever handles shall be used in conjunction with heavy sprung locks. Sprung lever handles shall be used only in conjunction with unsprung or lightly sprung locks.

c) Lever handles shall:

i) Be round in section, safety shape in form and a minimum diameter of 19mm.

ii) Have double security fixings that incorporate captive screw thread fixings onto the roses or back plates.

iii) Have positive self-tapping countersunk screw fixings onto the spindle.

iv) Have Roses or back plates fitted back-to-back with countersunk head, back-to-back through fixings.

v) Rotate freely on a ball race type bearing contained in a minimum 25mm diameter cup welded to the rose or back plate to give minimal wear and friction. Using the drill provided, countersink the ball bearing cup into the door face to ensure stabilised seating for the handle into the door.

d) Bore and countersink roses with star drilling to accept back-to-back fittings that are countersunk. Roses and back plates shall be to a thickness of no less than 3mm and thread screw shall be captured onto the appropriate lever handle. It shall not be acceptable for Nylon washers, 'circle' or star washer fixings.

P21.219 Pull Handles

Pull handles shall be the through bolted type and shall conform to BS 8424. Bolt heads shall be concealed by a push plate on the reverse face of the door.

P21.220 Hardware for Sliding/ Folding Doors

Hardware for sliding doors and folding doors shall comply with BS EN 1527, BS EN 1634: Parts 1 and 3 and BS 476: Part 22.

P21.221 Door Bolts

a) Bolts shall comply with BS EN 1634: Parts 1 and 3 and BS 476: Part 22, BS EN 12051 and bolts to comply with the recommendations of BS 8300.

b) Bolts shall be provided at the top and bottom of one leaf of the locking double doors. Top bolts shall have suitable plates or keeps and bottom bolts shall have easyclean sockets. Unless otherwise required, top bolts shall be 300mm long and bottom bolts 225mm long.

c) Bolts generally shall be of a high quality flush type, with dovetail returns to resist door damage. They shall have projecting slides where escape may be required and lever action in other locations.

d) Bolts to plant room and duct doors shall be of a good quality satin anodised aluminium surface type. Where doors open outward, top bolts shall be necked types, to allow proper fixings.

e) Indicator bolts to WC cubicles shall be of a mortice type, unless door and frame details are unsuitable, when a surface type shall be permitted. They shall have red/ white or red/ green outside indicator and coin operated emergency releases.

P21.222 Doorstops

a) Suitable stops shall be provided where required to protect doors, hardware or surfaces. They shall have robust holders and rubber inserts, which can be replaced easily using simple tools without removing the unit. Doorstops shall be finished to match door ironmongery.

b) Select doorstop types to suit service conditions, operation requirements and the preference of the Architect that doorstops shall be floor mounted. Types for each location shall be submitted to the Architect for acceptance.

i) Liaise with the appropriate works contractor noting particular requirements where skirting mounted doorstops are installed to drywall or other hollow construction.

ii) Floor-mounted doorstops shall be installed with expansion shield type fixing devices.

iii) Concealed fixing, overhead limit stays shall be installed and the stays shall be finished to match the ironmongery. On non-fire rated doors limit stays shall be fitted with stand open facility, if required.

P21.223 Emergency and Panic Exit Devices

a) BS EN 179 shall be complied with where emergency exit devices are operated by a lever handle or push pad.

b) Emergency exit devices generally shall be of mortice types (with concealed latches or vertical bolts) suitable for the size of door leaf and shall operate when they are pushed or touched at any point on their effective surface. They shall have catches, which automatically hold bolts in the withdrawn position on operation, release them when fully closed and shall incorporate security anti-thrust devices.

c) Emergency exit devices that are electronically controlled shall comply with prEN 13637.

d) Panic devices on single and paired doors generally shall have vertical bolts and horizontal activating bars that operate when they are pushed at any point on their effective length.

e) BS EN 1125 shall be complied with for horizontal bar panic exit devices.

f) prEN 13633 shall be complied with for electronically controlled panic exit devices.

g) Emergency and panic exit devices shall comply with the operational and testing requirements of the Door & Hardware Federation (DHF) best practice guides and shall be finished identically to other ironmongery. Enamelled steel panic devices shall only be accepted in locations agreed with the Architect.

P21.224 Door Plates

a) Push and kick plates shall be 1.5mm thick and sharp corners of plates shall be slightly rounded to be made safe.

b) Plates shall be fixed with suitable countersunk screws nominally located 5mm from the edges, with one screw at each corner and screws at equal centres. Check sizes of all kick, mid-rail and half-height plates on Site before ordering.

P21.225 Sundries

a) Hat and coat hooks shall have at least two fixings and to the acceptance of the Architect. Heavy-duty hooks shall be used in areas that are vulnerable to abuse and shall be capable of withstanding an applied load of 100N without deformation. For precise locations refer to Design Drawings.

b) Flush and drawer pulls shall be from accepted, suitably sized units and from a range that is the same as the door hardware.

PERFORMANCE

P21.226 General

a) The works shall comply with the general performance requirements of Section A15 of the Architectural Specification in addition to the following specific performance requirements.

b) Ironmongery shall be capable of meeting the minimum performance criteria stated in BS EN 12209, BS EN 1906 and other standards stated in this Work Section.

c) Ironmongery shall maintain the operational, fire and acoustic performance requirements of the doors/ frames to which it is fitted. Refer to the Design Drawings, Door Schedule and the Work Sections of the Architectural Specification covering the doors/ frames to which ironmongery is fitted.

P21.227 Strength of Ironmongery

a) Ironmongery shall maintain the duty category, as defined in BS EN 1192 or an equivalent international standard, of the doors/ frames to which it is fitted.

b) Provide evidence to demonstrate that ironmongery has been tested to meet the minimum acceptable criteria given in BS EN 1192 for the following, giving consideration to the doors/ frames to which it is fitted:

i) Slamming shut impact.

ii) Slamming open impact.

iii) Heavy body impact.

iv) Hard body impact.

v) Torsion.

vi) Downward deformation.

vii) Closure against obstruction.

viii) Resistance to jarring and vibration.

ix) Abusive forces on door handles.

Acoustic

P21.228 General

Ironmongery shall be supplied and installed such that it maintains the acoustic performance of the system into which it is fitted, and of any interfacing systems. Refer also to the requirements of the Acoustic Report and the Door Schedule.

Fire

P21.229 General

a) Ironmongery shall be supplied and installed such that it maintains the fire performance of the system into which it is fitted, and of any interfacing systems. Refer also to the requirements of the Fire Strategy Report and the Door Schedule.

b) All elements of the works shall be either non-combustible or not easily ignitable with low flame spread characteristics, and shall not produce measurable quantities of smoke or toxic gases.

c) Ensure that the maximum opening pressures required to open fire rated or non-fire rated doors on disabled access routes are in accordance with the requirements of BS 8300.

d) Comply with the document 'Code of Practice: Hardware for Fire and Escape Doors' produced jointly by the DHF and GAI, but if other standards are specified herein, or are required by the Building Control Officer and/ or the Fire Brigade respectively, the higher standard shall apply. Fire or smoke control doors shall have closers as specified.

e) Ironmongery to fire rated doors shall be of accepted types and independently certified for specified fire rating under BS 476: Part 22 or BS EN 1634. Test reports submitted shall be for doors of similar construction to those used in the works. Where specified, doors of special construction, or with special facings, shall have specific test reports submitted for acceptance.

Disabled Access Requirements

P21.230 General

Where required, ironmongery shall comply with the requirements of Approved Document Part M of the Building Regulations and BS 8300.

P21.231 Opening Pressures

The maximum opening pressures required to open fire rated or non-fire rated doors on disabled access routes shall be in accordance with the requirements of BS 8300.

Durability

P21.232 General

The performance criteria shall be satisfied for the full service life of the works, as stated in the Architectural Specification, provided always that the maintenance has been carried out as specified.

P21.233 Impact and Abrasion Resistance

The works shall resist abrasion from agreed cleaning methods and maintenance systems without any noticeable change in surface appearance. Generally, surfaces shall be sufficiently hard to resist all reasonable impacts from hand-held objects.

WORKMANSHIP

Installation

P21.234 General

The correct installation of all items of the ironmongery is essential to achieve the performance levels specified and required. Door hardware locations from finished floor level to centre-line of hardware shall be as follows, unless noted otherwise:

a) Lever handles/knobs: 1000mm.

b) Push plate/pull handle: 1070mm.

c) Cylinder pull: 1200mm.

d) Kickplate (to top of plate): 600mm.

P21.235 Fixings

a) Door ironmongery items shall be supplied with stainless steel screws, the length and type of which shall be as recommended in writing by the manufacturer and suitable for fixing to wood or metal as appropriate to suit the door leaf and frame.

b) Fit lever handles positively to roses by screw thread fixing and by countersunk screws to the spindle.

c) Fit roses or back plates back to back with countersunk head, back to back through fixings. All other visible fixings shall have countersunk heads.

d) Fixing templates shall be supplied for morticed items and door closing devices. Clear fixing instructions shall also be provided for all items.

P21.236 Installation

a) Install ironmongery in accordance with the manufacturer’s recommendations.

b) Ironmongery shall not be fixed until background finishes are complete. Ironmongery previously fixed shall be removed before any finishing process takes place.

c) Co-ordinate the ironmongery works with other trades. Form holes, mortices and chases, reinforce and prepare hollow constructions to receive ironmongery and provide wiring, conduits and accessories for electrical items.

d) Lead holes to receive woodscrews, etc. shall be drilled. If, during installation, fixings are burred or otherwise damaged, these shall be replaced. Where woodscrews are to be fixed to masonry, plastic plugs shall be provided.

e) Check the ironmongery on installation for correct operation, maintain each item in accordance with the manufacturer’s instructions and protect it against damage by other trades.

f) Submit to the door manufacturer copies of the accepted hardware templates or samples. The door manufacturer shall be responsible for:

i) Ensuring that sections and details are suitable for the hardware proposed.

ii) Advising the hardware supplier of the door sizes where the thickness is greater than 54mm or less than 38mm.

iii) Advising the hardware supplier of types of fixing devices to be provided for each item.

g) All timber/ metal doors shall be morticed in the factory to receive hardware, ensuring the correct preparation and avoiding the potential for negation of fire ratings. It shall not be accepted for morticing to take place on Site.

h) Mortice and reinforce adequately door stiles and rails such that they are able to receive hinges, strikes, locusts, closers, floor bolts and any other item as listed on the Ironmongery Schedule.

P21.237 Completion

Adjust, clean and lubricate all ironmongery upon completion and in accordance with the manufacturer's recommendations.

P21.238 Cleaning

a) Dirt or blemishes on exposed surfaces shall be cleaned.

b) Wash and rinse in accordance with the manufacturer’s recommendations.

c) Adjacent surfaces shall be protected from potential damage cause by cleaning operations.

d) Cleaning materials, products or processes that could alter the character of the exposed finish shall not be used.

P21.239 Key Handover

a) All keys shall be labelled and accounted for at Practical Completion.

b) Create and provide the Architect with an itemised schedule. Duplicate the schedule and retain a copy as a receipt.

c) The cylinder/ key supplier shall issue the master keys directly to the Architect.

End of Section

Z10 JOINERY

The general requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the particular requirements of applicable Architectural Specification section, and the general requirements specified in the A and other applicable Z sections.

Z10.100 PRODUCTS, SYSTEMS AND MATERIALS

Z10.101 General

a) All timber shall be sourced in compliance with the sustainability criteria stipulated in Section A33 of the Architectural Specification.

b) Timber shall be merchantable, properly seasoned, straight and free from any defects or combination of defects, natural or otherwise, making it unsuitable for its function in the works, and sorted and selected at the time of fabrication for suitability for purpose. No damaged, decayed or rotten materials shall be used.

c) Materials shall be relatively knot free, free from distortion, cracks or other blemishes, insect attack (including pinholes) unless stated otherwise in the specified standards.

d) All timber shall be subjected to controlled drying to ensure that the moisture content, if not otherwise specified, is suitable for the service conditions. When fixed it shall remain stable and free from expansion, contraction or other movements detracting from the required performance or appearance.

e) Timber shall be marked with all information as required within the specified standards. Markings shall be concealed from building user view.

f) Materials shall either have zero formaldehyde release or conform to class E1 in accordance with BS EN 13986.

Z10.102 Joinery Timber/ Wood

a) Timber generally shall be in accordance with BS 1186 and BS EN 942.

b) Timber for doors and windows shall be in accordance with BS EN 14220 and BS EN 14221.

c) Timber for concealed joinery shall be milled from suitable species and with stock sorted to provide appropriate classes sawn in the most appropriate ways to suit the service conditions.

d) Softwood for concealed joinery shall have no knots wider than half the width of the section.

e) Maintain the dimensions as indicated on the Design Drawings and/ or Working Drawings within the tolerances as agreed with the Architect for, but not limited to, the following:

   i) Timber sub-frames.

   ii) Material thicknesses.

   iii) Mullion dimensions.

   iv) Transoms.

f) Materials and components shall be durable, complying with the minimum standards as detailed in the Architectural Specification and the relevant British Standards.

g) Unless agreed otherwise with the Architect, the total quantity of each material or component shall be obtained from the same supplier or manufacturer.

h) Support systems shall be of adequate strength and thickness to meet the structural requirements and to eliminate any risk of distortion in the finished surfaces.

i) Provide protection on the finished elements until handover to avoid any blemishes.

j) Where specified, prior to receiving a finished coating system, paint and seal any timber and woodwork that is exposed. This shall be done in accordance with the relevant British Standard.

k) In all conditions protect and seal any concealed framework for units. Cut edges shall be treated ensuring that the level of protection is maintained.

Z10.103 Veneers

a) Timber of a suitable grade shall be selected so that a high quality finished surface is achieved.

b) The batching of finished veneer shall provide consistent colour, texture and quality on individual and adjacent surfaces.

c) Surface matching shall provide a symmetrical balanced pattern of grain and figuring across completed panels.

Z10.104 Structural Timber

a) Structural timberwork shall be in accordance with BS EN 1995: Part 1-1.

b) Timber shall be strength graded, as specified, under supervision by companies that are currently registered under a third party quality assurance scheme operated by any of the certification bodies approved by the UK Timber Grading Committee and bear the appropriate markings.

c) Timber shall be strength graded at a moisture content appropriate to the service conditions.

d) Structural timber members, which are cut from larger graded sections shall be regraded for acceptance and then appropriately marked according to the new grade.

Z10.105 Strength Graded Timber

a) Softwood shall be strength graded either visually in accordance with BS 4978 or by machine in accordance with BS EN 14081 with further visual inspection.

b) Hardwood shall be strength graded in accordance with BS 5756, or other national equivalent.

c) Strength class(es) shall be in accordance with BS EN 338.

d) Where exposed, species and corresponding strength class(es) shall be in accordance with BS EN 1912. Timber shall also be selected to comply with the specified visual requirements for exposed joinery.

Z10.200 QUALITY AND WORKMANSHIP

Fabrication

Z10.201 Generally

a) Joinery components shall be fabricated in accordance with BS 1186: Part 2.

b) Sections shall be formed out of the solid timber when not specified otherwise. Timber shall be carefully machined to accurate lengths and profiles, free from twist and bowing. After machining, surfaces shall be smooth and free from tearing, woolliness, chip bruising and other machining defects.

c) Joinery shall be assembled with tight, close fitting joints to produce rigid components free from distortion.

d) Countersink screw heads not less than 2mm below visible timber surfaces. All screws shall have clearance holes. Pilot holes shall exist for screws of 8 gauge or more and all screws into hardwood.

e) The dimensions indicated on the Design Drawings of timber sub-frames, material thicknesses, the dimensions of mullions and transoms shall be maintained within the specified tolerances.

f) For each material or component the total quantity shall be obtained from the same supplier or manufacturer, unless otherwise agreed with the Architect.

g) All support systems shall be of adequate thickness and strength, not only to meet the structural requirements, but also to eliminate any risk of distortion in the finished surfaces.

h) All exposed timber and woodwork shall be painted or sealed prior to receiving the finished coating system where specified, all in accordance with the relevant British Standards.

i) Concealed framework/ carcassing for units shall be protected and sealed in all conditions.

j) Any cut edges shall be treated to ensure that the level of protection is maintained.

k) Remedial work shall not be undertaken on visible or semi-concealed faces to timber of Class J2, J5 or CSH and 1 without acceptance by the Architect.

l) Unsound, dead and loose knots shall not be present on any visible or semi-concealed face.

Z10.202 Veneer Faced Panels

a) The selection of substrate and method of veneer application shall be suitable for the service conditions.

b) Veneers shall be bonded to substrates in presses whenever possible.

c) Core material and veneers shall be conditioned before bonding.

d) Unless specified otherwise, a balancing veneer with the same moisture and temperature movement characteristics as the facing veneer shall be applied to the reverse side of flat boards.

e) Veneers shall be set out so that features and pattern are aligned and in regular, uniform symmetry unless specified otherwise.

f) Veneers shall be applied with edges tight butted and with no gaps or other open defects and no lipping.

g) Precautions shall be taken to prevent 'telegraphing' or other defects appearing in the finished surface.

h) The veneer surface shall be sanded to a fine, smooth finish free from sanding marks.

i) Finished components shall be free from bow, twist, scratches, chipping, pimpling, depressions, glue spill and staining.

j) Moisture content shall be maintained at appropriate levels in relation to the core material to suit the service conditions.

k) Adhesives shall be in accordance with BS EN 204, type to match durability class of core material.

l) The Trade Contractor shall nominate the specialist fabricator whose responsibility it shall be to accrue, assess and quantify the entire project veneer requirement so that sufficient stock of selected batches are reserved for the whole project.

m) The final detailing shall be co-ordinated so that the finished surface accommodates the following:

i) The batching of finished veneer to give consistent colour, texture and quality on individual and visual adjacent surfaces.

ii) Matching of surface to give a symmetrical balanced pattern of grain and figure, with consistency and direction for areas as indicated on the Design Drawings.

Z10.203 Laminated Plastics Veneers

a) Sheets shall be applied in accordance with 'Recommendations for the fabrication of decorative laminated sheets' published jointly by the British Plastics Federation (BPF) and the British Laminate Fabricators Association (BLFA) Ltd.

b) Sheets shall be conditioned before bonding. Unless specified otherwise, a balancing veneer of similar construction to the decorative veneer and from the same manufacturer shall be applied to the reverse side of flat boards.

c) Sheets shall be bonded in presses whenever possible.

d) Components that are finished shall be free from bow, twist, scratches, chipping, cracks, pimpling, depressions, glue spill, staining, defects in colour and pattern.

e) In the works that is finished, exposed to view joints shall be tight butted and true with no lipping. All external angle edges shall be chamfered.

Workmanship

Z10.204 Cross-sectional Dimensions

Unless stated otherwise, cross-sectional dimensions on the Design Drawings, for timber, are nominal sizes. Reduction to finished sizes shall comply with BS EN 1313: Part 1 for softwoods and BS EN 1313: Part 2 for hardwoods. Unless the Architect has given prior acceptance it shall not be permitted to deviate from the sizes stated.

Z10.205 Preservative Treated Timber

a) Prior to treatment carry out as much cutting and machining as possible.

b) Sawn, ploughed, planed or any other timber that has otherwise been extensively processed in any way shall be retreated.

c) Two flood coats of a solution, as recommended by the main treatment solution manufacturer, shall be applied to treat any surfaces exposed by minor cutting and drilling.

Z10.206 Moisture Content

Within the range specified for the component, maintain the moisture content of timber and wood based sheets during manufacture and storage.

Z10.207 Finishing and Protecting

a) All joinery shall be sanded giving a smooth, flat surface that is then suitable to receive finishes as specified. Unless specified otherwise, arrises shall be eased.

b) Prior to assembly, the specified primer or sealer shall be used to seal all end grains for external components and allow to dry.

c) Completed joinery shall be protected from damage, dirt, moisture and other deleterious substances.

End of Section

Z11 METALWORK

The general requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the particular requirements of applicable Architectural Specification section, and the general requirements specified in the A and other applicable Z sections.

Z11.100 PRODUCTS, SYSTEMS AND MATERIALS

Z11.101 Metal Components

a) The Detailed Design of sections, material thicknesses and the dimensions indicated on the Design Drawings shall be maintained within specified tolerances.

b) Metal components shall be fabricated using only appropriate grades, strengths and thicknesses. The size of profile and gauge of material shall be sufficient to ensure rigidity required in the final installation.

c) Cut joints/ junctions shall be clean and true without waves or deviations from the vertical and horizontal planes.

d) The materials and components shall be durable and they shall be to the minimum standards indicated in the Architectural Specification and the British Standards.

e) Unless otherwise agreed with the Architect, all materials or components shall be obtained from the same supplier or manufacturer.

f) Throughout the design life of the works, all steel that is inaccessible shall be protected against corrosion.

g) In order to meet the structural requirements and to eliminate the risk of distortion in finished surfaces, all support systems shall be of adequate thickness and strength.

h) In order to avoid any blemishes on the finished elements, protection shall be provided until handover.

i) To prevent bimetallic corrosion between dissimilar metals and to isolate aluminium components from cementitious surfaces, adequate measures shall be taken. Accordingly, attention is drawn to British Standard PD 6484 'Commentary on corrosion at bimetallic contacts and its alleviation'.

Z11.102 Finishes and Corrosion Protection

a) Preparation of surfaces to receive finishes and coatings shall be in accordance with the finishes and/ or coating manufacturer's recommendations.

b) All exposed metalwork shall be finished in accordance with the relevant British Standards.

c) Unless otherwise specified, items formed from aluminium in internal conditions shall be mill finished.

d) Unless otherwise specified, concealed items formed from mild steel shall be hot dip galvanised steel in accordance with BS EN ISO 1461.

e) Inaccessible metalwork shall be properly protected against corrosion for the design life of the works.

f) Metal components shall be protected against the effects of corrosion during and after fabrication until application of finishes.

g) Protective coatings and finishes on joints shall be to the same standard as the main assemblies.

h) Cut edges shall be treated to ensure that the level of protection is maintained.

Z11.103 Aluminium

a) Unless otherwise specified, all extruded aluminium alloy members shall be fabricated from the appropriate grade of aluminium alloy complying with BS EN 754: Parts 3-5 and BS EN 755: Parts 1-9.

b) Aluminium sheeting shall be a minimum of 3mm thick and shall meet the requirements of BS EN 485, BS EN 515 and BS EN 573: Parts 1-3, unless specified otherwise.

c) The extruded precision profiles in alloys EN AW-6060 and EN AW-6063 shall be in accordance with BS EN 12020: Parts 1 and 2.

d) In order to ensure that all structural and finishing requirements of the Architectural Specification are met, only appropriate grades, strengths and thicknesses of aluminium shall be used. The aluminium extrusion wall thicknesses shall be sufficient to ensure their rigidity in the lengths required in the final installation.

e) In accordance with the requirements of BS EN 515, BS EN 573: Part 3 and BS EN 755: Parts 1-9, aluminium fixing brackets and cleats shall be manufactured from the appropriate grade of alloy. If visible, they shall be finished to match the metal panels and framing members.

f) Structural aluminium shall comply with BS EN 1999.

g) During construction and prior to handover, all exposed aluminium shall be protected with low tack adhesive film.

h) Where aluminium is to be anodised:

i) Aluminium sheeting and flat panels shall be manufactured using alloy grade J57S, or acceptable equivalent.

ii) Aluminium extrusions shall be manufactured using alloy grade AW-6063, or acceptable equivalent.

i) Aluminium panels shall be manufactured such that the grain on each runs in the same direction.

j) The 'Die Drawings' shall:

i) Be issued to the Architect for review.

ii) Be considered as Working Drawings.

iii) Indicate polished surfaces and shape.

k) Aluminium extrusions that contain score lines resulting from poorly polished surfaces shall not be acceptable.

l) Bowing, dimpling, oil canning, sagging, pillowing, rippling, warp, abrupt transitions or other visible deformation or irregularity of aluminium shall be prevented.

Z11.104 Mild Steel

a) Unless stated otherwise, all mild steelwork shall comply with BS EN 1993.

b) Bright steel shall be in accordance with BS EN 10277.

c) Long and flat products:

i) Hot rolled structural steels (excluding structural hollow sections and tubes) in accordance with BS EN 10025: Parts 1 and 2.

ii) Fine grain steels including special steels in accordance with BS EN 10025: Parts 3 and 4.

iii) Steels with improved atmospheric corrosion resistance in accordance with BS EN 10025: Part 5.

d) Plate, sheet and strip:

i) High yield strength steel plates and wide flats in accordance with BS EN 10025: Part 6.

ii) Hot rolled products:

- High yield strength steel flat products for cold forming in accordance with BS EN 10149.
- Carbon steel sheet and strip for cold forming in accordance with BS EN 10111.
- Narrow strip steel products for forming and general engineering purposes in accordance with the relevant Parts of BS 1449 and BS EN 10130.

iii) Cold rolled products:

- Steel sections in accordance with BS EN 10162.
- High yield strength micro-alloyed steel flat products for cold forming in accordance with BS EN 10268.
- Carbon steel flat products for cold forming in accordance with BS EN 10130 and BS EN 10131.
- Uncoated carbon steel narrow strip for cold forming in accordance with BS EN 10139 and BS EN ISO 10140.
- Narrow strip for general engineering purposes in accordance with BS EN 10132: Parts 1-3.
- Carbon steel flat products for vitreous enamelling in accordance with BS EN 10209.

iv) Coated flat products:

- Hot dip zinc coated carbon steel sheet and strip for cold forming in accordance with BS EN 10143.
- Hot dip zinc coated structural steel sheet and strip in accordance with BS EN 10143.
- Hot dip coated sheet and strip in accordance with BS EN 10346.
- Organic coated flat products in accordance with BS EN 10169.

e) Structural hollow sections (SHS):

i) Hot finished non-alloy and fine grain steels in accordance with BS EN 10210: Parts 1 and 2.

ii) Cold formed welded non-alloy and fine grain steels in accordance with BS EN 10219: Part 2.

iii) Hot finished weather resistant steels in accordance with BS 7668.

f) Tubes:

i) Seamless circular tubes in accordance with BS EN 10297: Part 1.

ii) Seamless cold drawn tubes in accordance with BS EN 10305: Part 1.

iii) Welded and cold sized square and rectangular tubes in accordance with BS EN 10305: Part 5.

iv) Welded circular tubes in accordance with BS EN 10296: Part 1.

v) Welded cold drawn tubes in accordance with BS EN 10305: Part 2.

vi) Welded cold sized tubes in accordance with BS EN 10305: Part 3.

g) Equal flange tees in accordance with BS EN 10055.

h) Equal and unequal angles in accordance with BS EN 10056: Parts 1 and 2.

i) General wire and wire products in accordance with BS EN 10218: Part 2.

j) Carbon steel wire for general engineering purposes in accordance with BS 1052.

k) Open steel die forgings for general engineering purposes shall be in accordance with BS EN 10250: Part 2 for non-alloy quality and special steels and BS EN 10250: Part 3 for alloy special steels.

l) Steelwork fabrication shall be in accordance with the requirements of the Architectural Specification.

m) The fit of permanent connections in frames and other structural elements that are assembled before delivery to Site shall be checked for accuracy.

n) Distortion shall be reduced to a minimum and local distortion rendered negligible in the final fabrication, owing to welding procedures. If required, corrections shall be carried out using a method that is acceptable to the Architect.

o) Only welds indicated on the Working Drawings, even for temporary attachments or repairs, shall be acceptable unless otherwise agreed by the Architect. The welding and removal of the connection shall be in accordance with BS EN 1011: Parts 1 and 2, if welded temporary connections are agreed.

p) Vent holes in hollow sections shall be sealed such that the ingress of moisture shall be prevented. The proposed method of achieving this requirement shall be submitted for the Architect's acceptance.

q) External visible lines and depressions caused by the internal welding of hollow section steelwork shall not be visible.

Z11.105 Stainless Steel

a) Stainless steel shall be austenitic and non-magnetic, in accordance with BS EN 10088, unless otherwise specified.

i) Sheet, strip and plate shall be in accordance with BS EN 10088: Part 2.

ii) Bars, rods, wire and sections shall be in accordance with BS EN 10088: Part 3.

iii) Welded circular tube shall be in accordance with BS EN 10296: Part 2.

iv) Seamless circular tube shall be in accordance with BS EN 10297: Part 2.

b) Specific stainless steel grade designations shall be either as specified in the relevant sections of the Architectural Specification or, where not identified specifically, they shall be selected to meet the performance criteria specified for the particular element or components. The following grades shall be considered to be the minimum acceptable (higher performing grades shall be used as necessary):

i) Grade 1.4401 for works that are external (including within the thermal/ vapour zone) and internally where visible in the finished works, unless otherwise specified.

ii) Grade 1.4301 for works that are internal and not visible in the finished works.

c) Finishes:

i) Internal conditions: Stainless steel shall have a brushed finish (240 grit finish), which shall be achieved without the use of aluminium oxide abrasives, unless specified otherwise.

ii) External conditions: Stainless steel shall have a brushed 2K finish (the surface roughness shall be <0.5 microns Ra) in accordance with BS EN 10088: Part 2. The finish shall be achieved without the use of aluminium oxide abrasives, unless specified otherwise.

d) Stainless steel fasteners, bolts, screws, nuts and other fixings shall be in accordance with BS EN ISO 3506: Parts 1 and 2. The property class of fastenings shall be selected to meet the specified performance requirements.

e) As appropriate, stainless steel shall meet the minimum dimensional tolerances specified in BS EN 10095, BS EN 10029, BS EN 10048, BS EN 10051 and BS EN ISO 9445: Parts 1 and 2.

f) Welds to visible areas of stainless steel shall be ground smooth to achieve a seamless surface, unless otherwise specified. Remove heat tints using light abrasives, pickling paste, wire brushing or similar to achieve continuity with the specified finish. If necessary, areas difficult to access shall be finished manually.

g) Welds shall comply with BS EN 1011: Part 3 and the definitions in BS 499: Part 1 and Part 1 Supplement. Any distortion that occurs because of thermal movement shall be minimised using jigs or other methods as appropriate during welding. Welding methods and consumables shall be selected as most appropriate to the type, thickness, shape and location of joints, in order to meet the performance levels required and to have mechanical properties at least equal to the original base metal. Consumables shall also have equal or superior corrosion resistance to the base metal that is being welded. All welding recommendations that are required to meet other relevant standards as specified shall also apply. Electrodes for manual metal arc welding shall comply with BS EN ISO 3581.

h) Stress corrosion or cracking shall not occur. All necessary precautions during the fabrication and installation of stainless steel elements/ materials shall be undertaken, avoiding the simultaneous presence of any of the following:

i) Tensile stresses.

ii) Residual stresses after welding or cold working.

iii) Aggressive local environmental conditions.

iv) Metal temperatures that, in conjunction with the above, may induce stress corrosion cracking.

i) Stainless steel castings:

i) Shall be in accordance with BS EN 10283 and BS 3146: Part 2.

ii) Shall be of austenitic stainless steel. The casting alloy shall be determined by the Trade Contractor, in order to meet the requirements of the Architectural Specification, but shall be equal or superior to grade 1.4408 with respect to corrosion resistance.

iii) Shall be manufactured using the lost wax process or such other process, which is proposed by the Trade Contractor and accepted by the Architect.

iv) In the finished castings, exposed feeder ports and die lines shall not be acceptable.

v) Samples of the casting surface finish shall be submitted for review and acceptance by the Architect. When accepted, samples shall be the standard required for all subsequent castings used in the works.

vi) Prior to any subsequent finishing process, the surface roughness of the casting surface shall be SCRATA A2 or better.

vii) Make allowance for two post production finishing processes to be utilised. The Architect shall agree the processes and shall include blast finishes (including bead blasting) and electropolishing or acid pickling.

j) Open steel die forgings for general engineering purposes shall be in accordance with BS EN 10250: Part 4.

k) Stainless steel wire, cold-forged fasteners and other similar components shall be in accordance with BS EN 10263: Part 5.

l) The stainless steel for wall ties and all other components associated with masonry construction shall be in accordance with BS EN 845: Part 1.

m) Where possible, stainless steel shall be protected by appropriate adhesive film, which shall be in accordance with the film manufacturer's written recommendations.

n) Stainless steel shall be cleaned thoroughly if it has not been protected by adhesive film, prior to presentation to the Architect for acceptance.

o) Take all precautions necessary to prevent the onset of ferritic contamination of stainless steel elements. Ferritic contamination can occur due to a number of factors, however elements become particularly vulnerable immediately following the removal of surface protective adhesive media. Follow BSSA recommendations to ensure adhesive residue is completely removed allowing the material to acquire its characteristic resistivity before being contaminated by ferrous elements.

Z11.106 Terne Coated Stainless Steel

a) Terne coated stainless steel shall be in accordance with the requirements of BS EN 502 and BS EN 508: Part 3.

b) Stainless steel shall be either continuously hot dip coated with a lead-tin alloy or continuously coated with tin by electrodeposition to comply with the requirements of the Architectural Specification, and provide a consistent uniform finish as accepted by the Architect through sampling.

Z11.107 Weathering Steel

a) Steel shall be high strength, low alloy, atmospheric corrosion resistant steel in accordance with ASTM A242/ ASTM A242M, ASTM A588/ ASTM A588M, ASTM A606/ A606M and BS EN 10025: Parts 1-6.

b) A consistent, uniform finish to all components including all perforations, welds and fixings shall be provided by protective oxide.

c) Blast-cleaning or pickling shall be carried out on steel surfaces, in order to remove mill scale. Contamination from grease, oil or shop marking shall be avoided.

d) Welding shall be carried out using techniques compatible with the corrosion resistant steel, as recommended in writing by the manufacturer. Welding shall be finished by power grinding or blast cleaning, in order to remove welding slag and spatter. Weld points shall weather at the same rate as other materials.

e) Consistent corrosion rates and appearance for the design life of the building shall be ensured by the Detailed Design.

Z11.108 Copper

a) Copper shall be in accordance with BS EN 1172 and BS EN 1652.

b) Where applicable, copper shall comply with CP 143: Part 12 and current good practice as described in the current publications of the Copper Development Association and as recommended by the system manufacturer, unless specified otherwise.

c) Where it is specified as pre-patinated, copper shall have consistency in appearance and composition of naturally aged copper and shall achieve the visual requirements of the Architect as produced through sampling.

d) Copper shall be free of inclusions, laminations and pinholes.

Z11.109 Bronze

a) Bronze (alloy of copper and tin) shall be in accordance with BS EN 1172 and BS EN 1652.

b) Where applicable, bronze shall comply with CP 143: Part 12 and current good practice as described in the current publications of the Copper Development Association and as recommended by the system manufacturer, unless specified otherwise.

c) Bronze shall be free of inclusions, laminations and pinholes.

Z11.110 Brass

a) Brass (alloy of copper and zinc) shall be in accordance with BS EN 1172 and BS EN 1652.

b) Where applicable, brass shall comply with CP 143: Part 12 and current good practice as described in the current publications of the Copper Development Association and as recommended by the system manufacturer, unless specified otherwise.

c) Brass shall be free of inclusions, laminations and pinholes.

Z11.111 Zinc

a) Zinc and zinc alloys shall be in accordance with BS EN 988 and BS EN 501, where applicable.

b) Where applicable, zinc shall comply generally with CP 143: Part 5 and current good practice as described in the current publications of the Zinc Information Centre (ZINC) and as recommended by the system manufacturer, unless specified otherwise.

c) Zinc shall be free of inclusions, laminations and pinholes.

Z11.200 QUALITY AND WORKMANSHIP

Workmanship

Z11.201 Fabrication

a) Components shall be fabricated carefully and accurately, in order to ensure compliance with the Design and the Architectural Specification.

b) There shall be no contact between dissimilar metals in components that are to be fixed where moisture may be present or may occur.

c) Finished components shall be rigid and shall be free of distortion, rolling marks, cracks, scratches, imprints, burrs and sharp arrises. Moving parts shall move freely and without binding.

d) Corner junctions of identical sections shall be mitred, unless specified otherwise.

Z11.202 Cold Formed Work

Brake presses or cold rolling shall be used to produce accurate profiles with straight arrises.

Z11.203 Adhesive Bonding

a) Surfaces of metals to receive adhesives shall be prepared by degreasing and abrading, either mechanically or chemically.

b) Adhesives shall be used in accordance with the manufacturer’s written recommendations.

c) Bond shall be formed under pressure.

Z11.204 Thermal Cutting of Stainless Steel

Material that is liable to corrode shall be ground off after cutting.

Z11.205 Welding/ Brazing Generally

a) Surfaces to be joined shall be cleaned thoroughly.

b) An accurate fit shall be ensured, using clamps and jigs where practicable. Tack welds shall only be used for temporary attachment.

c) Joints with parent and filler metal shall be fully bonded throughout with no inclusions, holes, porosity or cracks.

d) Ensure that weld spatter does not fall onto surfaces of materials that are self-finished and visible in the completed work.

e) All traces of flux residue, slag and weld spatter shall be removed.

f) Metal arc welding shall be in accordance with BS EN 1011: Parts 1 and 2, or other methods subject to the Architect's review.

Z11.206 Site or Shop Welding

a) Site or shop welding, where required, shall be carried out using the process of manual inert gas tungsten-arc welding, with a procedure that complies with BS EN ISO 15614: Part 1 and by welders tested in accordance with BS EN ISO 9606.

b) Welds shall be continuous and shall be of a material and technique suitable for the sections that are assembled.

c) The weld finish shall be smooth, all flux residue shall be removed and there shall be no surface defects (i.e. undercut, porosity, deep ridges).

Z11.207 Brazing

Brazing shall comply with BS EN 14324.

Z11.208 Finishing Welded/ Brazed Joints

a) Visible butt joints in the completed work shall be smooth and flush with adjacent surfaces.

b) Visible fillet joints in the completed work shall be executed neatly. Where specified, they shall be ground smooth.

Z11.209 Coating Application

a) Unless otherwise specified, after fabrication is complete and all fixing holes have been drilled, coatings shall be applied.

b) Prior to coating application, all paint, grease, flux, rust, burrs and sharp arrises shall be removed.

c) All defects that would appear after application of the coating shall be made good and finish surfaces shall be smooth.

End of Section

Z12 PRESERVATIVE/ FIRE RETARDANT TREATMENT FOR TIMBER 1

Z12 PRESERVATIVE/ FIRE RETARDANT TREATMENT FOR TIMBER

The general requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the particular requirements of applicable Architectural Specification section, and the general requirements specified in the A and other applicable Z sections.

Z12.100 PRODUCTS, SYSTEMS AND MATERIALS

Type(s) of Preservative/ Fire Retardant Treatment

Z12.101 Organic Solvent Preservative Treatment

a) At the time of treatment the timber moisture content shall be as specified for the component at the time of delivery.

b) Post treatment: Timber shall be surface dry before use.

c) Application: Double vacuum/ low pressure.

Z12.102 Water Based Microemulsion Preservative Treatment

a) Based on copper and organic biocides.

b) At the time of treatment the timber moisture content shall not be more than 28%.

c) Post treatment: Timber shall be allowed to dry for a minimum of 14 days before use and until dry.

d) Application: Double vacuum/ pressure treated.

Z12.103 Boron Compound Preservative Treatment

a) Based on boron compounds.

b) At the time of treatment the timber moisture content shall not be more than 28%.

c) Post treatment: Timber shall be allowed to dry for a minimum of 14 days before use and until dry.

d) Application: High pressure impregnation.

Z12.104 Fire Retardant Treatment

a) At the time of treatment the timber moisture content shall be as specified for the component at the time of fixing.

b) Post treatment: Timber shall be dried slowly at temperatures not exceeding 65°C, minimising degradation and distortion.

c) Application: Vacuum/ hydraulic and low pressure.

Z12.105 Leach Resistant Fire Retardant Treatment

a) At the time of treatment the timber moisture content shall be as specified for the component at the time of fixing or:

i) For timbers maximum 50mm thick: 22%.

ii) For thicker timbers: 25%.

b) Application: Vacuum/ hydraulic and low pressure.

Z12.200 QUALITY AND WORKMANSHIP

Z12.201 Wood Preservative Treatments Generally

Wood preservative products shall:

a) Conform to the efficacy requirements of BS EN 599: Part 1 and BS 8417.

b) Be treated in accordance with the penetration and retention guidance given in BS EN 351: Part 1 to give a desired service life in the selected hazard class (defined in BS EN 335).

c) Be compatible with all applied finishes.

Z12.202 Generally

a) By a processor licensed by the treatment solution manufacturer for the specified treatment, carry out the application after cutting and machining but prior to assembly,

b) A certificate of assurance shall be provided showing treatment has been carried out as specified for each batch of timber.

Z12.203 Wood Protection Association (WPA) Commodity Specifications

a) WPA Commodity Specifications are as defined in the latest edition of the WPA Manual: Industrial Wood Preservation Specification and Practice.

b) Select the solution strengths and treatment cycles to achieve the service life (if specified) and to suit timber treatability.

End of Section

Z20 FIXINGS/ ADHESIVES

The general requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the particular requirements of applicable Architectural Specification section, and the general requirements specified in the A and other applicable Z sections.

Z20.100 PRODUCTS, SYSTEMS AND MATERIALS

Fixings

Z20.101 Fixings - General

a) All fixings shall be of sufficient strength, appropriate to their location and provided at adequate positions so as to ensure the performance of the elements being attached. The fixings shall be suitable and used solely for the purposes intended by the manufacturer, in order to meet the requirements of the Architectural Specification.

b) Unless otherwise specified, the following requirements shall be observed:

i) Durability - fixings shall be selected in order that adequate protection is provided against any corrosion likely to occur in their position of use, for the service life specified.

ii) Rigidity - fixings that are suited to the likely stresses, movements and vibrations shall be used.

iii) Appearance - fixings shall not be visible, unless otherwise specified; where fixings are visible, they shall match or suit the items being fixed or they shall comply with the Design Drawings.

iv) Unless otherwise specified, removable items that require accessibility or removal shall be fixed with hidden screws and/ or bolts.

c) Fixings that are suitable for their intended purpose and are adequate to comply with the requirements of the Architectural Specification shall be used.

d) Bolts, screws, nuts, anchors and other fixings shall be of adequate strength for their designed purpose and, unless specified otherwise, they shall be manufactured of the most appropriate grade of austenitic stainless steel or other materials as specified. Structural steel fixings shall comply with grades where specified.

e) All necessary and appropriate fasteners, fixings, bearings and brackets necessary for the safe and proper installation plus associated flashings and closures shall be supplied.

f) With respect to strength and type, fixings shall conform to all statutory requirements.

g) To prevent bimetallic corrosion between dissimilar metals and to isolate aluminium components from cementitious surfaces, adequate measures shall be taken. Accordingly, attention is drawn to British Standard PD 6484 'Commentary on corrosion at bimetallic contacts and its alleviation'.

h) With the exception of capping pieces fixed to vertical mullions, fixings within aluminium framing components shall not be generally visible.

i) Using round-headed Allen bolts into a proprietary system, visible fixings shall be restricted to the assembly of non-visible elements to support steelwork.

j) In order to avoid exposure to the external environment, steel sub-frame assemblies shall be galvanised and effectively weatherproofed.

k) Cast-in channel fixings in concrete and fixings directly made to structural steelwork shall be provided.

l) Fixings shall be tested by an independent Testing Authority acceptable to the Architect, in accordance with BS 5080: Parts 1 and 2.

Z20.102 Fasteners

a) Steel:

i) Bolts, screws and nuts shall be in accordance with BS 4190, BS EN ISO 4016 and BS EN ISO 4034.

ii) Mechanical properties of fasteners shall be in accordance with BS EN 20898: Part 7 and BS EN ISO 898: Parts 1, 2 and 5.

b) Mechanical properties of corrosion-resistant stainless steel fasteners (bolts, screws, studs and nuts) shall be in accordance with BS EN ISO 3506.

c) Aluminium rivets, bolts and screws shall be in accordance with BS 1473.

Z20.103 Powder Actuated Fixing Systems

a) Powder actuated fixing systems shall not be used without the acceptance of the Architect.

b) Tools shall be in accordance with BS 4078: Part 2 and they shall be Kitemark certified.

c) The tool manufacturer shall recommend types of fasteners, accessories and consumables.

Z20.104 Screw Fixings

Washers and screw cups, where specified, shall be of the same material as the screw.

Z20.105 Packings Generally

a) Suitable, tight packings at fixing points to take up tolerances and to prevent distortion shall be provided.

b) Non-compressible, rot-proof, non-corrodible materials positioned adjacent to fixing points shall be used.

Z20.106 Types of Nail

Nails shall be in accordance with BS 1202.

Z20.107 Masonry Nails

Masonry nails shall not be used without the Architect's acceptance.

Z20.108 Plugs Generally

Proprietary type plugs shall be selected to suit the background, the loads to be supported and the conditions expected in use.

Adhesives

Z20.109 General

a) Hot-setting phenolic and aminoplastic based adhesives shall be in accordance with BS 1203.

b) Thermosetting wood adhesives shall be in accordance with BS EN 12765.

c) Polyvinyl acetate thermoplastic adhesive shall be in accordance with BS EN 204.

d) Animal glues shall be in accordance with BS EN ISO 9665.

e) Adhesives shall be compatible with finished surfaces, preservative/ fire retardant treatments and shall maintain the performance requirements of the elements to be bonded.

Z20.110 Non-loadbearing Applications

a) Durability class/ strength requirements of adhesives used in non-loadbearing uses of wood and derived timber products shall be in accordance with BS EN 205.

b) Adhesives used in non-loadbearing applications shall be tested in accordance with BS EN 205.

Z20.111 Loadbearing Applications

a) Glued joints shall be in accordance with BS EN 1995: Part 1-1.

b) Durability class/ strength requirements of adhesives used in loadbearing uses of wood and derived timber products shall be in accordance with BS EN 301.

c) Adhesives used in loadbearing applications shall be tested in accordance with BS EN 302.

Z20.200 QUALITY AND WORKMANSHIP

Application

Z20.201 Adhesives

a) Surfaces that shall receive adhesive shall be sound, unfrozen and free from dust, grease and any other contamination that is likely to affect bond. Where necessary, surfaces shall be cleaned using methods and materials recommended by the adhesive manufacturer.

b) Surfaces shall suit the gap-filling and bonding characteristics of the adhesive and they shall be sufficiently smooth and even. Surfaces shall be prepared as necessary.

c) Both the manufacturers' and statutory requirements for storage and safe usage of adhesives shall be observed by the operatives.

d) Adhesives shall not be used in either unsuitable environmental conditions or beyond the manufacturer's recommended maximum shelf life or open-pot time periods.

e) Using recommended spreaders/ applicators to ensure correct coverage, adhesives shall be applied. Surfaces shall be brought together within the recommended time period and pressure applied evenly over the full area of contact surfaces, in order to ensure full bonding.

f) Using methods and materials recommended by the adhesive manufacturer and without damage to affected surfaces, surplus adhesive shall be removed.

Z20.202 Fixings

a) All necessary preparation work such as drilling, plugging, screwing, bolting, cutting for anchor bolts or sockets to be cast-in and for making good, including grouting-in of anchor bolts and fixings where necessary shall be carried out.

b) The fixing method shall not damage anything being fixed or anything receiving fixings.

c) Unless accepted by the Architect, welding shall not be permitted.

d) Fasteners shall be installed with a co-ordinated purpose design tooling system, which incorporates a mechanical depth locator, in order to ensure consistent depth setting and facilitate perpendicular installation. The fastener manufacturer shall be able to provide on-Site instruction in the use of the fastener installation tooling system.

e) All fixings and attachments shall be secured against vibrating loose.

f) Fixings shall comply with Section 2 of Approved Document Part A of the Building Regulations and any subsequent amendments thereto.

g) QA/ QC procedures for inspection of fixings shall be submitted to the Architect including, but not be limited to, checking each fixing for correct torques, depth of mortices and alignment.

h) No lock-up stresses shall be generated.

Z20.203 Powder Actuated Fixing

a) Tools shall be used to comply with BS 4078: Part 1. The Trade Contractor shall ensure that operatives are trained and certified as competent.

b) Operatives shall take full precautions to prevent injury to themselves and to others.

c) When no longer required, all unspent cartridges shall be removed from the Site.

d) Zinc rich primer shall be applied to heads of fasteners used externally, in external walls or in other locations subject to dampness.

e) Top hat section plastic washers shall be used to isolate cartridge-fired nails from stainless steel components fixed externally, in external walls or in other locations subject to dampness.

Z20.204 Screw Fixings

a) Screws shall have clearance holes. Screws of 8 gauge or more and all screws into hardwood shall have pilot holes of approximately half the diameter of the shank.

b) Pre-cut the thread with a matching steel wood screw, before using brass, aluminium or other soft metal wood screws.

c) Screws shall not be hammered unless specifically designed to be hammered.

d) Unless specified otherwise, screw heads shall be countersunk no less than 2mm below timber surfaces that are visible in the completed work.

Z20.205 Packings Generally

Packings shall not intrude into zones that are to be filled with sealant.

Z20.206 Nail Fixing

a) Unless specified otherwise, use no fewer than two nails in joints and opposed skew nailing.

b) Nails shall be driven in fully without splitting or crushing the material that is being fixed.

c) Nail heads shall be punched below surfaces that are visible in the completed work.

Z20.207 Plugs Generally

Plugs shall be located accurately in correctly sized holes, in accordance with the manufacturer’s recommendations.

End of Section

Z21 MORTARS

The general requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the particular requirements of applicable Architectural Specification section, and the general requirements specified in the A and other applicable Z sections.

Z21.100 PRODUCTS, SYSTEMS AND MATERIALS

Materials

Z21.101 Mortar - General

a) Site-mixed masonry mortar mix proportions shall comply with NA to BS EN 1996: Part 1-1.

b) Proprietary factory formed masonry mortar shall comply with BS EN 998: Part 2.

c) The characteristics, product data and testing criteria of pre-mixed mortar (if used) shall be submitted to the Architect for review.

Z21.102 Materials

a) Sand (for mortar):

i) Shall be from one source and graded 0/2 (FP or MP) to comply with BS EN 13139, unless specified otherwise.

ii) Where the proportion of sand in a mortar mix is specified as a range (i.e. 1:1:5-6), the fines content shall be:

- Lower proportion of sand: Category 3, to comply with BS EN 13139.
- Higher proportion of sand: Category 2, to comply with BS EN 13139.

iii) No marine sand shall be used with sulphate resisting or with super sulphated cement.

b) Portland cement shall comply with BS EN 197: Part 1. Unless otherwise specified, the cement shall be Ordinary Portland Cement and shall be delivered in the manufacturer's original sealed bags or in suitable bulk containers.

c) Lime shall comply with BS EN 459: Part 1 and shall be hydrated lime Type (i), (ii) or (iii).

d) Mortar plasticiser shall be to the acceptance of the Architect and shall be used in accordance with the manufacturer’s recommendations. Also, mortar mixes shall be altered in accordance with the manufacturer's recommendations. Suitability of the mixture for use in any particular mortar shall be demonstrated to the Architect for acceptance.

e) Unless accepted by the Architect, admixtures shall not be used in mortar. Calcium chloride, or any admixtures containing calcium chloride, shall not be used. If specified, admixtures shall comply with BS EN 934: Part 3.

f) Pigments for coloured mortar shall comply with BS EN 12878.

Testing

Z21.103 Mortar Testing

a) Tests:

i) Mortar testing shall be carried out in compliance with BS 4551 and BS EN 1015, or to equivalent standards acceptable to the Architect.

ii) Testing shall be carried out by a United Kingdom Accreditation Service (UKAS) accredited laboratory.

iii) Specimens used for preliminary testing of the mortar shall be prepared six weeks or more before any walling construction commences.

iv) Prior to commencement of preliminary testing, all material sources shall be identified to the Architect for acceptance.

v) At the point of mixing or use, samples shall be taken.

vi) If the mortar does not comply with the Architectural Specification, additional tests and sampling shall be carried out.

vii) Mix proportions shall be adjusted and tested, subject to the test results.

viii) The consistency of fresh mixed mortar shall be in accordance with BS EN 1015: Part 4, unless otherwise accepted by the Architect.

ix) Tests for cement content shall be carried out by the BREMORTEST method described in BRE Information Paper 8/89, or other equivalent accepted by the Architect and as instructed by the Architect.

b) Testing Apparatus: On Site, ensure that the following apparatus is maintained in good repair:

i) Maximum and minimum thermometers.

ii) Soil thermometers (where required for measuring the mortar and ground temperatures).

iii) Apparatus for taking test samples and for carrying out tests to comply with BS EN 1015 and BS 4551.

c) Testing Frequency: Test samples shall be prepared for each type of mortar and for each type of brick/ block walling or for every storey of the building, whichever is most frequent. However, the minimum frequency of testing shall be no less than that specified.

d) Failure of mortar: Brick/ block walling containing mortar not complying with the requirements of the Architectural Specification shall be demolished, all debris carted away and the walling rebuilt.

Z21.200 QUALITY AND WORKMANSHIP

Transportation, Handling and Storage of Materials

Z21.201 Storage of Materials

a) Cements and lime shall be stored off ground, under cover, away from damp and in such a manner as to enable them to be used in order of delivery.

b) Sand shall be stored separately, according to type, on clean, hard, dry standings and protected from contamination.

c) If used, pre-mixed mortar shall be stored in accordance with the manufacturer's recommendations.

Workmanship

Z21.202 General

a) At all times, mixing plant, tools and banker boards shall be kept clean.

b) Using clean gauge boxes, materials shall be measured accurately by volume. Proportions of mixes shall be for dry sand, making allowance for bulking if it is damp.

c) Ingredients shall be mixed thoroughly to a consistency suitable for the work and shall be free from lumps.

d) Mortar containing air-entraining admixtures shall be mixed by machine, but shall not be overmixed.

e) Any retarded mortar shall be used within the time recommended by the manufacturer.

f) The required amount of water shall be determined, in order to achieve a workable mix.

End of Section

Z22 SEALANTS

The general requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the particular requirements of applicable Architectural Specification section, and the general requirements specified in the A and other applicable Z sections.

Z22.100 PRODUCTS, SYSTEMS AND MATERIALS

Materials

Z22.101 Types and Method

a) Sealant shall be suitable for the purpose intended, used in accordance with the manufacturer's instructions.

b) Sealant shall not be a potential health hazard. Full up-to-date records of all current published research and legislation in this respect shall be maintained. Information from the sealant manufacturer shall be obtained, regarding storage, handling, use and disposal of sealants.

c) Wet applied sealants shall be used only in the locations indicated on the Design Drawings or the Working Drawings or as and where agreed with the Architect, provided that all requirements of the Architectural Specification are met.

d) Sealant shall be the most appropriate type and grade suitable for the intended application.

e) Silicone sealants are designed to prevent the ingress of water penetration and shall not be used to bridge gaps generated by poor material tolerances and building workmanship.

f) Written confirmation from the sealant manufacturer shall be obtained and it shall be submitted to the Architect for consideration regarding the suitability of the sealant for the intended application.

g) Prior to ordering, proposals and reference samples of the type and colour of the sealant shall be submitted to the Architect.

h) The period during which the sealant shall not change in appearance or colour shall be agreed with the Architect. During this time, discolouration of sealant shall not be acceptable.

i) Where there are any sealants and primers, their chemical composition shall be compatible with the joint substrate and with adjacent surface treatments or building components that may come into contact with them.

j) The appropriate hardness, compressibility or consistency of sealants shall be determined in consultation with the manufacturer, considering the joint movement and exposure for the size of joint. On request, information shall be supplied, concerning theoretical joint movement related to the anticipated temperatures at which sealants shall be installed and cured.

k) To the satisfaction of the Architect, demonstrate that the sealant joints are able to accommodate and be compatible with any movements to which they may be subjected.

l) Sealant shall have the lowest modulus of elasticity, consistent with the degree of exposure to wear, abrasion and vandalism. Any sealant exposed to traffic shall have strength and modulus sufficiently high to resist damage from traffic, including indentation.

m) Any sealants that are likely to stain, discolour or bleed into adjacent building materials shall not be used. Independent testing evidence to this effect shall be provided.

n) Where there are special requirements regarding sealant location, the following shall be complied with:

   i) The sealant shall comply with BS EN 14188: Part 1 for hot applied sealants and BS EN 14188: Part 2 and BS 5212 for cold applied sealants, where it is to be used in trafficked surfaces and/ or shall be fuel resistant.

   ii) Independent UK performance certification for the proposed sealant shall be provided, to show that the sealant meets the required fire resistance requirements, where it is required to achieve a period of fire resistance.

   iii) Evidence of compliance with UK water quality standards shall be provided, where sealant shall be in contact with drinking water.

   iv) Resistance to all permanently wet service environments.

o) The provision of current independent test certificates shall verify sealant performance.

p) Manufacturers' product descriptions shall confirm compliance with performance standards, including the BS EN ISO 11600 coding. This shall be confirmed on the package labels, in the technical data sheets and on any certificates demonstrating performance capability.

q) Sealants that comply with the Architectural Specification shall be manufactured as part of an independently assessed BS EN ISO 9000 series quality system. Each pack shall have a batch number and date of manufacture.

r) As recommended by the manufacturer, an on-Site test procedure shall be used as a means of assessing the extent of sealant cure and/ or adhesion to joint surfaces.

Z22.102 Testing

Compliance with the testing requirements in BS 3712: Parts 1-4 shall be demonstrated.

Z22.200 QUALITY AND WORKMANSHIP

Workmanship

Z22.201 Preparation

a) Joints shall be cleaned out immediately before installing joint sealers, in order to comply with the joint sealer manufacturer's recommendations and the following requirements:

i) All foreign material from joint substrates that could interfere with adhesion of the joint sealer shall be removed. This shall include dust, paint (except for permanent protective coatings tested and accepted for sealant adhesion and compatibility), oil and grease.

ii) All joints shall be blown with clean, dry, oil-free, compressed air ensuring removal of any loose matter to obtain a clean contamination-free substrate.

iii) In all cases a clean bonding surface shall be obtained. Following preparation, place into the base of the joint a bond breaker or foam backing to form the correct section for the joint sealant bonding to the base of the joint.

iv) Metal and other non-porous surfaces shall be cleaned with chemical cleaners (or other means recommended by the sealant manufacturer), which are not harmful to substrates or which leave any residue that may interfere with the adhesion of joint sealers.

b) Sealants shall be mixed in accordance with the manufacturer’s written recommendations. Materials shall be used within the time limits stipulated by the manufacturer.

c) Joint substrates shall be primed where indicated or where recommended by the joint sealer manufacturer; a proper bond shall be achieved, based on pre-construction tests or prior experience. Primer shall be applied in accordance with the manufacturer’s written recommendations. Primers shall be confined to contact surfaces of joint sealer, spillage or migration onto adjoining surfaces shall not be permitted.

d) Masking tape shall be used where required, to prevent contact of sealant with adjoining surfaces, which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Tape shall be removed immediately after tooling, without disturbing the sealant.

Z22.202 Application

a) Surfaces shall be prepared carefully to receive sealant, using correct degreasing solvents, primers and bonding agents as necessary.

b) Environmental conditions: Do not dry or raise temperatures of joints by heating.

c) Where sealants are applied, either on or off Site, they shall comply with BS 6213, BS 6093, BS 8000: Part 0, BS 8000: Part 16 and BS EN ISO 11600 as required.

d) Application of sealants shall be in accordance with the supplier's/ manufacturer's written preparatory and application procedures and the British Adhesives and Sealants Association (BASA) publication 'Industry Guide to the Professional Application of Construction Sealants on Site', or an acceptable equivalent.

e) All excess sealant shall be removed and all joints shall be neat and clean. Only liquids that are approved by the sealant manufacturer shall be used to tool freshly applied sealants.

f) Sealant shall be applied evenly, with no bubbles in joints.

g) Sealant shall be protected adequately during the curing process, in order to avoid contamination or damage from other activities or conditions on Site.

h) When placed in the joint, joint fillers shall provide a gap consistent with the required depth of sealant. The cross section of sealant in the joint shall be 2:1 (width to depth), unless otherwise accepted. Joint fillers shall be as follows:

i) Compatible with the sealant used and with surrounding construction elements.

ii) Formed of closed cell foam.

iii) Not adhering to cured sealant, otherwise bond breaker tape shall be used.

i) Applicators shall operate in accordance with an approved BS EN ISO 9001 scheme.

j) Only materials that meet the requirements of the Architectural Specification, and that are stored in appropriate conditions, shall be used for installation.

End of Section

Z25 GLASS AND COATINGS

The general requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the particular requirements of applicable Architectural Specification section, and the general requirements specified in the A and other applicable Z sections.

Z25.100 PRODUCTS, SYSTEMS AND MATERIALS

Types of Glass

Z25.101 Glazing Generally

a) The selection of the glass type, thickness any interlayers, coatings, build-up, mode of breakage and containment of the glass panels shall be undertaken to meet the performance requirements of the Architectural Specification and to minimise the risk to persons both during construction and during the service life of the works. The risk of failure and the consequences of failure shall be documented and prepared by the Trade Contractor for review.

b) Generally, glass manufacture shall comply with BS EN 572 for float (annealed) glass, BS EN 1096 for coated glass, BS EN 1863 for heat strengthened glass, BS EN ISO 12543 for laminated glass, BS EN 12150 for toughened glass and BS EN 14179: Part 1 for heat soak tested toughened glass. As a minimum, dimensional requirements of the respective glass types shall be as cited in the British Standards, unless specified otherwise.

c) Visual Quality:

  i) As minimum, visual quality shall be in accordance with the ‘Guideline to Assess the Visual Quality of Glass in Buildings’ 2009, prepared by the ‘Institute of the Glazing Trade for Glazing Technology and Window Manufacture, Hadamar’, unless specified otherwise.

  ii) Inspections shall be carried out at a minimum distance of 1000mm measured, from the surface of the glass, at viewing angles which correspond to the normal usage of the room.

  iii) Visual quality shall be to the acceptance of the Architect through sampling, with a standard benchmark set.

d) Glass types shall all be cut to accurate sizes and they shall have clean cut, arrised edges. If detrimental to the visual and performance criteria of the glass, damage such as shark teeth, serration hackle, sharp flare, flake chips, rough chips, feathered edges, shells or other imperfections, shall not be acceptable. Glass that is delivered to Site shall be of the required size. On Site, no cutting or nipping of glass shall be permitted. Variations in manufacture and performance of the glass shall not affect the colour or appearance. The appearance and colour of all glass of the same type shall be visually consistent, giving fair consideration to the manufacturing tolerances and the agreed range of samples or agreed observations of previous installations of the same glass type.

e) Glazing shall be carried out in accordance with the manufacturer’s recommendations and all glass shall be of the type specified in the relevant BS EN series range.

f) Glass panes within frames shall be installed to give the necessary edge cover and clearance, in order to ensure a permanent and safe installation.

g) A warranty from the glass manufacturer shall be provided, which states that the glazing systems comply with the manufacturer's requirements and indicates the life expectancy of the glass, interlayers, spacers and any other components.

h) Distortion shall be kept to a minimum and no local defects (such as tong marks) producing irregular reflections shall be permitted. All glass shall be manufactured and processed to comply with quality control procedures (in accordance with BS EN ISO 9000), which shall be maintained independently.

i) Glazing stresses:

  i) Glass, glazing combination, forming techniques (for non-planar glass) or glazing methods shall not develop stresses that may lead to the damage of glass, coatings, interlayer glazing materials, components and/ or framing systems:

  ii) A thermal stress analysis shall be carried out and due allowance made for any required thermally treated or edge working of annealed glass.

  iii) Shading stresses that may occur from adjacent components, including solar shading devices, shall be taken into account.

j) The method of glazing adopted shall take account of the glass manufacturing tolerances, thus minimising the resultant effects of distortion.

k) Glass shall be easily replaceable. A method statement shall be provided, which shows the method of removing damaged glass and any associated metal framework and of installing new components.

l) Glass with a colour rendering index (Ra) shall be provided as specified, both for the transmittance and the reflected spectrum and detailed reflected and transmitted spectrum data for the purpose of identifying/ anticipating the possible problems with colour reflection shall also be provided. This shall be demonstrated by the provision of full size samples of each glass type, which shall be viewed under representative lighting conditions and accepted prior to the manufacture of material.

m) All glass shall be provided by a single supplier unless agreed otherwise by the Architect and certification establishing the origin of the glass shall be provided.

n) The glass shall not contain impurities that would detract in any way from the glazing system performance.

o) Exposed glass edges shall be ground and arrised.

p) Glass shall be free of bubbles, smoke vanes, air holes, scratches or any other visible defects, unless described as acceptable elsewhere in the Architectural Specification.

q) High reflective mirror glass shall not be acceptable unless described as acceptable elsewhere in the Architectural Specification.

r) The least stringent criteria for viewing shall be used, in accordance with the relevant standards, where combinations of glass types are used in a unit.

s) Prior to placing an order for any glazing materials, the required confirmation and/ or calculations shall be obtained in writing from the glass manufacturer, on all aspects of the glazing systems for review, as but not limited to the following:

i) Glazing rebate ventilation and draining provisions.

ii) Thickness of individual glass panes and of insulating glass units, owing to consideration of the wind loadings specified.

iii) Snow and access loads for horizontal/ inclined glazing conditions, taking into consideration the specified wind loadings.

iv) Determination as to whether or not heat strengthening or toughening of glass shall be required.

v) Where applicable, parameters necessary for the formation of non-planar glass units to suit the service conditions.

vi) Thickness and number of the interlayers (laminated glass).

vii) Thermal and shading performance of the insulating glass units.

viii) Thermal safety of the insulating glass units.

ix) Hardness, location, shape and dimensions of the setting blocks and glazing gaskets.

x) Depth and width of the glazing rebates.

xi) Expansion, tolerances, glass bite and clearance to meet all the specified performance requirements.

Z25.102 Safety Glass

a) Safety glass categories for use in critical locations shall be selected as defined and recommended in BS 6262, BS EN ISO 12543: Parts 1-6 and BS EN 1279 and as required to comply with the Building Regulations, Local Authority requirements and other relevant health and safety requirements.

b) All safety glass shall be Kitemarked, or shall be to another internationally recognised standard. Glass shall be marked and labelled in accordance with the relevant standards and shall meet the requirements of Approved Document Part K of the Building Regulations for safety glass. Marking shall be in a consistent position on the glass as agreed with the Architect.

c) Annealed float glass used as safety glass shall be in accordance with BS 6262 and BS 6206 and BS EN 12600, including any labelling requirements.

d) Safety glass shall be tested in accordance with BS 6206 and BS EN 12600.

e) Manifestation shall be provided where it is necessary to meet the requirements of BS 6262, the Building Regulations and any other health and safety requirements. The manifestation type shall be agreed with the Architect and samples provided for acceptance.

f) Manifestation:

i) Location: As required in accordance with Approved Document Part K of the Building Regulations.

ii) Application:

- Factory applied: Screen printed ceramic fritting.
- Factory or Site applied: Acid etched/ vinyl adhesive backed film/ sand blasting.

iii) Colour: As specified in the particular requirements.

iv) Setting out: Set out carefully to scan across panels, giving a consistent pattern and spacing across the length of the façade.

Z25.103 Annealed Glass

a) All sheet glass shall be manufactured using the float process, unless otherwise specified and accepted in advance by the Architect with their prior written agreement.

b) Clear, undistorted vision and reflection shall be provided using untinted glass sheets.

c) The tolerances on thickness shall be as indicated in BS 952: Part 1.

d) The tolerances on cut sizes for different thicknesses of material shall be as indicated in BS EN 572: Part 2.

Z25.104 Laminated Glass

a) Expertise and experience for the selection of glass shall be utilised in order to comply with the performance requirements of the Architectural Specification.

b) Laminated glass shall comply with BS 952, BS EN 572 and BS EN ISO 12543: Parts 1-6.

c) Laminated glass shall comprise a number of sheets of flat glass with suitable interlayers interleaving between each layer. The layers shall be clear, translucent or coloured, depending on the glazing design intentions. The glass shall be annealed, heat strengthened or heat soak toughened, as required to meet the performance requirements of the Architectural Specification.

d) Where the laminated glass includes sheets of glass that may be distorted because of the manufacturing process, the distortion shall:

i) Be within parameters, as specified for the particular glass type.

ii) Be accurately aligned and orientated in the same direction.

e) Prior to ordering materials, final selection of glass type and thickness of each layer, together with type, opacity, density and location of interlayer and coatings shall be accepted by the Architect.

f) Glass shall meet the colour and quality standards set by the control samples.

g) Laminated glass edges shall be sealed with materials that are compatible with the interlayer. Delamination of the laminated glass shall not be acceptable.

h) In order to provide even distribution of vertical load to the setting blocks, the bottom supported edges of laminated glass panes shall be cut flush over the width of the pane.

Z25.105 Toughened Glass

a) Minimal use of toughened glass shall occur and shall be justified by risk assessment including calculations.

b) All toughened glass shall be heat soak tested in accordance with BS EN 14179: Part 1 and particular attention shall be paid to the temperature and duration of treatment. It shall be demonstrated that the surface temperature of all glass was maintained for 2 hours at 290°C ±10°C.

c) The glass shall be in accordance with BS EN 12150 and the following requirements in the horizontal toughening process:

i) Maximum overall bow: 0.002mm/ mm measured along the glass edge.

ii) Maximum local bow: The maximum deviation for flatness from peak to trough shall not exceed 0.3mm/ 300mm or 0.15mm at the edge.

iii) Rollerwave:

- Glass shall be sized to allow the consistent and horizontally aligned orientation of ripples throughout the works.
- The maximum deviation for flatness from peak to trough shall not exceed 0.08mm relative to a length of 300mm.
- Proposals to control the extent of rollerwave, if any, shall be stated in the Tender submission.
- Prior to commencing production of the glass, full size samples of all specified heat treated glass to signify the range of rollerwave throughout the works shall be provided.

iv) Edge dip: Maximum 0.25mm.

d) Exposed edge working shall be flat ground with small ground arris and shall have a frosted appearance. Small shells and/ or chips that exceed a maximum diameter of 2mm shall be ground out prior to toughening.

e) The surface compressive stress shall be demonstrated by non-destructive testing, controlled at the works at greater than 69N/mm² and suitable for the service conditions.

f) Glass shall be cut to accurate sizes and it shall be delivered to the Site in the required sizes. No on-Site cutting or nipping shall be permitted. Glass shall be marked clearly to indicate its intended final position and orientation.

g) Glass heat treatment requirements shall meet wind, impact, thermal or other loads anticipated in the works. The toughened glass manufacturer shall be aware of its intended use in the works. Any drilling and notching shall be carried out with the agreement of the manufacturer of the toughened glass and prior to the toughening being carried out. All toughened glass shall be tempered on a roller heath furnace eliminating tong marks and shall conform with BS 6206 and BS EN 12600 (Class A /Class 1C1).

h) The toughening process shall not produce iridescence, distortion, roll marks or ripples in the glass, which are not acceptable to the Architect. Such anticipated imperfections shall be demonstrated by the provision of full size samples to signify the range of rollerwave, prior to commencement of glass production. The Architect shall examine the samples provided and shall advise what is acceptable and what is not acceptable. As a minimum standard, all glass produced for the works shall comply with the acceptable samples.

i) Prior to commencement of manufacture, the Architect shall be advised of the glass supplier and the premises where fabrication and processing are to be carried out.

j) Prior to the installation of toughened glass, all documentary evidence shall be in place and shall demonstrate that the glass has been heat soaked for the prescribed periods. As a minimum, such evidence shall also include the following:

   i) Supply source and evidence of batching.

   ii) Dates and records of toughening/ heat soaking of glass.

   iii) Before dispatch to the Site, records of heat soaking shall be kept for each batch for QA/ QC inspection purposes.

   iv) Temperature diagrams for each processed batch.

   v) Production line information for each heat soaked batch shall be retained by the Trade Contractor for a minimum period of seven years.

   vi) Certification that glass meets the performance requirements of the Architectural Specification.

   vii) Records that include details of all units that failed during the heat soak test.

k) During fabrication and/ or processing, the Architect shall be given the opportunity to visit the glass manufacturer's premises.

l) The toughening process shall create no stresses in the glass that are visible within the limits specified.

m) The toughening process shall not affect the coating appearance.

n) Cooling jet marks shall not be visible on the finished surface of the toughened glass.

o) Discolouration or distortion caused by the toughening process shall not be acceptable outside of the rollerwave, distortion and glass bow specified.

p) At the time of manufacture, all reasonable measures shall be taken to control the toughening process, in order to control the occurrence of anisotropy. If it does not fall within the range of agreed samples and benchmarks, glass shall be rejected.

Z25.106 Heat Strengthened Glass

a) All heat strengthened glass, unless otherwise specified, shall be in accordance with the requirements of BS EN 1863, and the following requirements in the horizontal heat strengthening process:

   i) Maximum overall bow: 0.003mm/ mm measured along the glass edge.

   ii) Maximum local bow: The maximum deviation for flatness from peak to trough shall not exceed 0.3mm/ 300mm or 0.15mm at the edge.

   iii) Rollerwave:

   - Glass shall be sized to allow the consistent and horizontally aligned orientation of ripples throughout the works.
   - The maximum deviation for flatness from peak to trough shall not exceed 0.08mm relative to a length of 300mm.
   - Proposals to control the extent of rollerwave, if any, shall be stated in the Tender submission.
   - Prior to commencing production of the glass, full size samples of all specified heat treated glass to signify the range of rollerwave throughout the works shall be provided.

   iv) Edge dip: Maximum 0.25mm.

b) When subject to a fracture test in accordance with BS 6206 and BS EN 12600, the fracture characteristics shall be similar to annealed glass and therefore, heat strengthened glass shall not be considered to be a 'safety' glass. Heat strengthened glass shall be laminated if it is proposed for use in a situation that requires safety glazing material.

c) At the time of manufacture, all reasonable measures shall be taken to control the toughening process, in order to control the occurrence of anisotropy. If it does not fall within the range of agreed samples and benchmarks, glass shall be rejected.

Z25.107 Wired Glass

a) As defined in BS 952: Part 1 and BS EN 572: Part 1, wired glass shall comprise 'polished wired glass'.

b) Glass shall be annealed.

c) Glass shall be of the thickness specified and with 1.3mm ‘Georgian’ wire embedded into the glass thickness, unless otherwise specified.

d) The tolerances on wired glass thickness shall be the minimum specified in BS 952: Part 1 and the length, breadth and squareness as specified in BS EN 572: Part 3 for polished glass and BS EN 572: Part 6 for patterned glass.

Z25.108 Fire Resistant Glass

a) Fire resistant glass shall provide the fire ratings specified and shall be tested to BS 476: Parts 20 and 22.

b) Fire resistant glass shall also be classified as safety glass in accordance with BS 6206 and BS EN 12600, minimum category Class B/ Class 2B2.

c) Fire resistant glass shall incorporate fire rated beading and fixing methods to match the fire rating specified. It shall also be tested or certified or assessed as being equal to the relevant parts of BS 476.

d) Unless specified otherwise, wired glass shall not be used. Glass shall be clear, with fire resistant properties as specified above.

e) Technical/ product information on all fire resistant glass shall be submitted for review by the Architect. The glass shall not necessarily meet the visual quality requirements described in the Architectural Specification. Details of the visual quality and dimensional limits of any proposed fire resistant glass shall be submitted for review by the Architect.

f) Where insulation is specified in addition to stability/ integrity, this shall be in accordance with Approved Document Part B of the Building Regulations, tested to the relevant parts of BS 476.

Z25.109 Curved Glass (Tolerances)

a) Maximum variation in curved form shall be ±4mm from the theoretical form.

b) Maximum variation in adjacent glass edges when installed shall be 1mm/ 1000mm.

c) Maximum difference between curved adjacent glass edges when installed shall be 3mm.

d) As indicated on the Design Drawings, all curved glass panels shall be curved consistently for the full arc length radius with no straight returns.

e) Maximum allowed deviation of the length and width of sheets shall be ±4mm for dimensions up to and including 2000mm and ±4.5mm for dimensions greater than 2000mm.

f) Maximum allowed deviation of the diagonal dimension of any sheet shall be ±7mm for dimensions greater than 2000mm.

g) Maximum allowed deviation of the top and bottom edges, i.e. the curved edges, measured on the face of the glass and perpendicularly to the curvature shall be ±3mm.

Coatings and Tinting

Z25.110 Glass Coatings - General

a) Submit detailed proposals in respect of coatings to the Architect.

b) Surface coatings: Surface modified glass shall require a highly uniform, low reflective and durable quality. In order to avoid damage, such coatings shall be consistent in colour, durable and sufficiently hard on exposed surfaces.

c) Visual quality testing of coated glass for dimensional requirements and visual defects shall comply with BS EN 1096: Part 1.

d) Enamelled/ ceramic frit coatings:

i) Individual applications of ceramic coating forming the required pattern shall be distinct without blurring, smearing or phasing.

ii) Tolerances for positioning and sizes of prints shall comply with optical quality determined viewing from a distance of 3000mm using daylight without direct sunlight or direct spotlight, perpendicularly to the glass, for not more than 20 seconds.

iii) Shall be applied smoothly and consistently over the whole, or part, of each glazed area as indicated on the Design Drawings. A screen printing application method shall be used, unless otherwise agreed.

iv) Shall be fused into the surface of the glass, thus providing a permanent layer (with the exception of the exposed internal surface).

v) Coatings shall colour match and shall have similar sheen, chromaticity and luminosity, to give a non-discernible colour difference when viewed by eye and illuminated by a standard light source. All ceramic fritting shall be opaque and to a colour agreed with the Architect.

vi) Extent: The frit pattern shall extend to the glass edges, unless specified otherwise. There shall be no clear border.

e) Coatings/surface modified glass requirements:

i) A highly uniform, low reflection and durable quality shall be required of any surface modified glass. In order to avoid damage, such coatings shall be neutral in colour, durable and sufficiently hard on exposed surfaces. For the purposes of the Architectural Specification, neutral shall be defined as a colour that has no unacceptable hue quantified by the range of samples and is capable of refracting light without chromatic aberration when viewed from any direction.

ii) High performance and low E glass shall be produced from a single source on a single process.

iii) Unless agreed otherwise by the Architect, glass coatings shall be provided by a single manufacturer/ supplier.

f) Coatings/ Treatments/ Interlayers shall not crack, disintegrate or corrode in any way under the extremes of conditions described in the Architectural Specification.

g) Prior to commencement of the glass coating, the Architect shall be advised of the name of the supplier and applicator, together with the location of the premises where this work shall be carried out.

Z25.111 High Performance Glass Coatings

a) As relevant, coated glass shall comply with BS EN 1096.

b) Coated panes of glass shall be examined for defects, to comply with BS EN 1096: Part 1. They shall be viewed from a distance of 3000mm from the outside face of the glazing, for both the main area and the edge area of the glass panes.

c) The acceptance criteria of coated glass defects for uniformity, stain, spots/ pinholes, clusters and scratches shall comply with BS EN 1096: Part 1.

d) Soft coatings applied to glass panes shall be protected up until the time of installation with the double glazed unit. All handling of glass shall be carried out using protective cotton or surgical gloves, so as not to cause damage to the surface of the coating with fingerprints. After protection is removed from the coated glass panes, the panes must be installed into the double glazed units and sealed by the coating manufacturer during the recommended time, in order to avoid any atmospheric deformation of the surface.

e) For review by the Architect, samples shall be provided of any coated glass types of minimum size 1200mm x 1200mm.

Z25.112 Glass Body Tints

a) Evidence from the glass manufacturer shall be provided, showing that the correct body tint has been incorporated at the appropriate stage into the materials used by the glass manufacturer, where this has been specified on the Design Drawings.

b) Evidence that the correct surface modified tinting has been applied by the glass manufacturer shall be provided, where this has been specified on the Design Drawings.

Insulating Glass Units

Z25.113 Insulating Glass Units - Generally

a) Insulating glass units shall be hermetically sealed units in accordance with BS EN 1279, unless otherwise specified.

b) Precautions shall be taken to minimise the effects of pillowing distortion.

c) Where the insulating glass units include multiple layers of glass that may be distorted because of the manufacturing process, the distortion shall:

i) Be within parameters, as specified for the particular glass type.

ii) Be orientated in the same direction and accurately aligned within the same insulating glass unit and with adjacent insulating glass units.

d) Optical interference and associated spectral colours due to superposition of two or more light waves at a single point shall be kept to an absolute minimum. Glass shall be rejected if it does not fall within the range of accepted samples.

e) Spacers shall be of adequate rigidity for their purpose, continuous, with bent corners and shall have welded joints sealed to ensure the integrity of the seal and to provide a consistent moisture seal around the entire perimeter of the unit. Spacers shall accommodate the seal and contain desiccant, allowing both to operate at maximum efficiency.

f) Spacers shall separate the glass panes and the units shall have a mechanically applied primary seal between glass and spacer. This shall provide a continuous vapour-proof barrier to a minimum width of 2mm and a secondary seal to the perimeter of the units.

g) Materials used in primary and secondary seals shall be mutually compatible. This shall be demonstrated by the supplier by accelerated testing, or by the submission of acceptable previous test results.

h) Spacers shall be coloured as specified in the Architectural Specification or to the acceptance of the Architect.

i) No drainage of water along edge seals shall be permitted.

j) Insulating glass units shall be assembled in controlled temperature and humidity conditions. If necessary, during manufacture and transportation, breather tubes shall be used. Thereafter, these shall be removed and the units sealed prior to installation.

k) The manufacturer shall confirm the maximum compression allowable on the edge of the units, with regard to mechanically restrained glazing systems.

l) The maximum concavity and convexity that will occur under the ambient climatic conditions and barometer pressure differentials anticipated by the requirements of the Architectural Specification shall be stated. The insulating glass units shall be flat (with a maximum deviation of 1/ 1000 at the centre of the glass pane when measured diagonally) when finally installed.

m) In order to provide even distribution of load to the setting blocks, the bottom supported edges of laminated glass panes within vertical insulating glass units shall be ground flush over the width of the pane.

n) Load transfer/ spacer blocks/ setting blocks shall not be visible in the finished works.

o) The load transfer/ spacer blocks under insulating glass units shall be positioned to support fully, both internal and external panes, so that neither pane is cantilevered on an edge seal.

p) Insulating glass units shall have a test certificate/ report from an independent authority, complying with BS EN 1279: Part 2.

q) Visual inspection of the glass edges, edge seals and spacers shall be unhindered, prior to glazing.

r) Soft coatings at unit perimeter:

i) No discolouration to the coating shall occur due to the primary seal.

ii) Coloured lines shall not be acceptable to the Architect.

iii) Corrosion/ contamination/ oxidisation shall not be acceptable to the Architect.

Structural Silicone Glazing

Z25.114 Type and Method

a) General:

i) Responsibility for the structural silicone glazing shall be based on the Design Drawings and the requirements of the Architectural Specification.

ii) Final selection of materials, testing, fabrication, transportation and installation of the structural silicone glazing shall be carried out in accordance with BS EN ISO 11600 and/ or other standards described in the Architectural Specification and prior to manufacture, samples shall be submitted for review by the Architect.

iii) Structural silicone glazing shall be carried out such that it shall not compromise the integrity of the double glazed unit edge seals and the specified warranties.

iv) Application shall only be carried out in an appropriate working environment. The environment shall be strictly controlled in accordance with the manufacturer's written instructions to maintain temperature, humidity, dust-free and dirt-free conditions in the working environment.

b) Materials:

i) Structural silicone adhesive shall be provided and it shall be obtained from a single source manufacturer and applied in accordance with the manufacturer's written recommendations.

ii) In marine or similar environments, the structural silicone shall be resistant to damage from algae or attack by birds.

c) Installation/ Fabrication:

i) Structural silicone glazing application shall not be carried out on Site, unless agreed otherwise with the Architect.

ii) Documentation covering the sealant manufacturer's requirements for the particular substrate of the construction including joint sizes, limitations and requirements for mixing, cleaning, surface preparation, priming and application shall be provided.

iii) Evidence that the sealant has been selected shall be provided, taking into account the sealant manufacturer's recommendations regarding use and compatibility with the contact surfaces.

iv) Taking into consideration the design wind pressures and panel sizes, joint design shall be in accordance with the sealant manufacturer's written recommendations for glue-line and bite to glue-line ratio.

v) Details of the tensometer and any other testing equipment as required shall be provided.

vi) Glazing procedures shall include frame assembly, cleaning, priming (if necessary), gunning, tooling and frame handling after glazing and curing. Sealants shall not be applied when the temperature is below 4°C and units shall not be moved until the silicone has achieved a level of cure recommended by the silicone supplier.

vii) Adopt silicone batching logging procedures to record all batches used, including batch manufacture date and arrival date of each batch at the fabrication works. The location of each structural silicone glazed panel shall be individually located on As-built Drawings of the building, recording date and batch of structural silicone, with details of tests carried out to ensure that the highest quality of silicone is being used.

viii) The structural silicone glazing shall be recorded at the time of assembly and shall include identification marks of every panel by a unique number, readable from the inside of the building for the life of the building. Provide glazing records with information on each panel including silicone type, batch, date of application, glazier's name and temperature and humidity measured inside the factory on the day of assembly.

ix) Recommend a periodical maintenance regime for agreement with the Architect. This shall be incorporated in the O&M manuals. Acceptance criteria shall be consistent with the requirements of the testing criteria, which as a minimum shall be:

- A standard 'peel test' on any broken panels that require replacement.
- A close visual inspection, carried out externally from the cleaning apparatus, including application of hand pressure to verify continued adhesion. This exercise shall be carried out for 1% of the cladding, at a yearly frequency for the first 3 years, then at a frequency of 5 years. The panels shall be selected randomly around the elevations at varying heights.
- Tests shall be carried out by the sealant supplier or other qualified body.

Rooflights/ Horizontal and Inclined Glazing

Z25.115 Type and Method

a) Horizontal glazing shall be designed to meet the requirements of ACR(M) 001, CWCT Technical Note No. 66, 'Health and Safety in Roof Work' guidance book (G)33, Appendix 4 and the HSE and CDM Regulations and shall be manufactured by a company registered to BS EN ISO 9001 or carrying European Technical Approval (ETA).

b) Without any reduction in performance, glazing for rooflights or horizontal and inclined situations shall accommodate the following live loads:

i) Defined loads resulting from specified movements of the main structural frame during building use.

ii) Point loads imposed on the glass framing members of 695N inwardly acting, based on BS 5516: Parts 1 and 2. The glass infill panels shall not carry maintenance loads.

iii) Wind loads, in accordance with BS EN 1991: Part 1-4 and BS 5516: Parts 1 and 2.

iv) Loads imposed by snow, in accordance with BS EN 1991: Part 1-3 and BS 5516: Parts 1 and 2.

v) Minimum working pressures on infill panels for hand cleaning operations, in accordance with BS 5516: Parts 1 and 2.

vi) The impact load of two persons falling on it during maintenance, cleaning and inspection operations in accordance with the Architectural Specification. The glazing system shall maintain its structural integrity and the glass and edge covering shall have adequate thickness so that units do not 'pop out' of the frame under such impact. If the outer layer of glass breaks, then the inner sheet glass shall remain in place and shall support the operatives.

vii) Large body impact tests by an accredited test organisation with certification produced to demonstrate compliance with an energy level of 1200J, when tested in accordance with BS EN 1873.

c) When calculating glazing and structure loads, the worst combination shall be considered, taking into account the fact that the pressure coefficients at various locations may determine more than one design criterion.

End of Section

Z30 METALWORK FINISHES

The general requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the particular requirements of applicable Architectural Specification section, and the general requirements specified in the A and other applicable Z sections.

Z30.100 GENERAL

Z30.101 Quality and Appearance

a) Metalwork surfaces shall be finished to a quality level acceptable to the Architect, being stable, fade resistant and not affected by ultraviolet light.

b) All surfaces shall be sufficiently durable, be of uniform texture and colour as well as resilient to environmental and pollution effects. Surface scratches, blemishes and burns are not acceptable.

c) Where agreed in advance with the Architect, minor scratches, blemishes and marks may be repaired providing the manufacturer's recommended process is adhered to and the correct products are used to provide an identical match in terms of finish quality, match, colour, texture and gloss. All such repairs shall be carried out to the satisfaction of the Architect. When instructed, engage an independent specialist consultant to inspect the work and carry out tests as required in order provide a detailed report for review.

d) Samples shall be provided and agreed in advance to represent the proposed finish quality and appearance, without irregularities or distortions, for acceptance by the Architect.

e) Non-visible fixings and other components shall be treated to ensure that there is no discontinuity in surface appearance of the final installation.

f) Upon request, provide relevant data and samples to demonstrate compliance with the Architectural Specification.

Z30.102 Steel Surface Preparation

Remove all rust, scale and surface contamination to achieve Sa 2.5 quality of BS EN ISO 8501: Part 1. Acid pickling is not acceptable where the presence of paint, oil, grease, welding slag and other materials renders it ineffective. For welds, locally blast-clean to Sa 2.5 quality of BS EN ISO 8501: Part 1.

Z30.200 TYPES OF FINISH

Z30.201 Liquid Organic Coating

Aluminium alloy component finishes shall comply with BS 4842.

Z30.202 Surface Plating

a) Cadmium/ zinc plating to steelwork shall comply with BS EN ISO 2081 and BS EN ISO 2082.

b) Chromium plating shall comply with BS EN ISO 1456.

Z30.203 Galvanising

a) Galvanising of metalwork shall be carried out in accordance with BS EN ISO 1461.

b) Coating thicknesses shall be applied in accordance with BS EN ISO 1461 and BS EN ISO 14713.

c) In areas where galvanising is visible, provide a smooth finish, which is continuous, consistent and free from staining.

d) The weight of applied galvanised coating shall be consistent to maintain a uniform and consistent appearance.

e) Blast cleaning shall be Sa 2.5 where the applied thickness is greater than 86 microns, and carried out in accordance with BS EN ISO 8504: Parts 1 and 2 and BS EN ISO 8503.

f) Remove all surface contaminants including grease, varnish and oil prior to grinding edges and prior to commencement of galvanising.

g) Remove oil and/ or silicone based or other anti-weld spatter, weld spatter, grind welds as necessary. Complete preparation by filling pits and any other surface imperfections to ensure an acceptable galvanising application.

h) Steelwork to be galvanised, shall be of a suitable quality and condition prior to commencement of galvanising so that it can be acid pickled in dilute hydrochloric acid, passivated and hot dip galvanised in accordance with BS EN ISO 1461.

i) The final galvanised finish shall be smooth and uniform and double dipping shall only be used when agreed in advance with the Architect.

j) Galvanised surfaces shall not be treated, repaired or "touched up" without prior agreement with the Architect. If post treatment repair or "touch up" is required it shall be carried out in accordance with BS EN ISO 1461.

k) Repair or "touching up" of finished galvanised elements shall not be permissible if it is located more than 10mm from an acceptable surface finish. Galvafroid or paint applied finishes will not be accepted by the Architect.

l) Follow the recommendations of the Zinc Information Centre in respect of galvanising and zinc metal-spraying applications.

m) The galvanising methodology is to be agreed with the Architect prior to commencement. Drips will not be acceptable in surfaces visible in the works.

n) Locate breathing holes carefully such that they are not visible in the works and agree precise locations with the Architect in advance.

o) Distortion shall be controlled and minimised such that the final product is visually acceptable to the Architect.

Z30.204 Over Painting

a) Painting to galvanised surfaces shall be carried out in accordance with the manufacturer's recommendations in compliance with BS EN ISO 1461 and BS EN ISO 12944: Parts 1-8.

b) Sprayed finishes shall comply with BS EN ISO 2063 using a minimum coating thickness in accordance with Table 1 of BS EN ISO 17834.

End of Section

Z31 POWDER COATINGS

The general requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the particular requirements of applicable Architectural Specification section, and the general requirements specified in the A and other applicable Z sections.

Z31.100 STANDARD DURABILITY POWDER COATINGS

Z31.101 General

a) Unless stated otherwise in the Architectural Specification section, the polyester powder coating for the works shall be in accordance with the following standards:
   i) Qualicoat Class 1.
   ii) BS EN 12206: Part 1 (aluminium substrates).
   iii) BS EN 13438 (galvanised steel substrates).
   iv) GSB International Quality Regulations - aluminium and steel.
   v) British Board of Agrément (BBA).

b) Only materials, sourced from a reputable supplier and which are fit for purpose shall be used.

c) The final visual appearance of all powder coated elements and components shall be consistent and identical.

d) Extrusion alloys shall be grade EN AW-6063, EN AW-6060 or acceptable equivalent, and comply with BS EN 754: Parts 3-5 and BS EN 755: Parts 1-9.

e) Powder coating to sheet material shall be grade 1200/3103, and shall comply with BS EN 485, BS EN 515 and BS EN 573: Parts 1-3.

f) Base aluminium shall be suitable to receive the powder coating application.

g) Aluminium sheet shall be of a suitable temper and thickness to facilitate the stoving process without damage or reduction in performance and visual intent.

h) Comply with the relevant sections of the COSHH Regulations 2002, the Environmental Protection Act 1990 Part 1, the Management of Health and Safety at Work Regulations 1999 and the Construction (Design and Management) Regulations 2015.

Z31.102 Materials

a) Colour shall be as specified or selected by the Architect from the BS/ RAL range.

b) Colour shall remain consistent regardless of batch, as stated in BS 950: Part 1.

c) In order to achieve consistency of colour only use one batch per colour, spray apply, use regulated and automated equipment and use the minimum number of batches.

d) Provide a range of colour, including metallic, and finish quality samples prior to production for selection by the Architect. Samples shall demonstrate the range of anticipated finish and colour consistency acceptable to the Architect.

e) Local dry film thickness, applied to adjacent panels, shall not vary (maximum and minimum) by more than 20% unless otherwise agreed by the Architect following receipt of samples for review.

f) All coatings shall be consistent in terms of colour, quality and finish within the limits agreed in advance through samples provided and accepted.

g) Use only low tack protective tape applied in accordance with good practice and manufacturer's recommendations for a maximum period of six months. If longer periods are required, remove and re-apply new tape.

Z31.103 Workmanship

a) All coatings shall have a current BBA Approval Certificate or acceptable equivalent.

b) Application of coatings shall be carried out as recommended by the Qualicoat scheme, BS EN 12206 and/ or BS EN 13438.

c) All coating work shall be carried out at a single plant/ location using a single batch where possible. If multiple batching is required, notify the Architect and take measures necessary to comply with the Architectural Specification in terms of quality and consistency of colour and finish.

d) Keep the surfaces clean and as new until Practical Completion so as to maintain the warranty. This includes sufficient regimes in environments stipulated as Hostile (C4 and C5 as determined by BS EN ISO 12944), which can reduce cleaning periods from every twelve months to every three months for standard polyesters, depending on specific locality from the pollutant.

e) Damage rectification shall be carried out if it is repaired immediately and to the Architect's satisfaction. Repairs shall be carried out at the point of manufacture under strictly controlled conditions and not on Site unless specifically agreed in advance with the Architect and colour retention, gloss retention and adhesion are guaranteed without detriment to the warranty.

f) In environments classified as Hostile (C4 and C5) environments, cut edges, drilled holes and mitres shall be sealed to avoid coating failure.

g) Agree in advance with the Architect any proposed pre-anodising.

Z31.104 Testing

Carry out tests or provide certified evidence of previous tests to satisfy the Architect that the following requirements have been achieved in relation to the works in accordance with the specified standards, quality and performance requirements:

a) Artificial weathering.

b) Natural Weathering, including chalking and colour/ gloss fastness shall be based on a one year Florida Testing regime.

c) Visual inspection, from a distance of not more than 1000mm to determine any failure as a result of exterior exposure.

d) Impact resistance.

e) Cupping, scratching, adhesion, flexibility, salt spray, humidity and film thickness in accordance with the Qualicoat scheme and BS EN 12206.

f) Permeability.

g) Mortar resistance.

h) Film thickness:

i) The minimum average film thickness at any point shall be 50 microns for aluminium and 60 microns for galvanised steel.

ii) In hazardous environments, the minimum thickness shall be increased to 60-70 microns.

iii) Certain colours may require an increase in the minimum film thickness to 80 microns to achieve the required colour intensity.

iv) Seeding and double coating is not acceptable.

v) Ensure that the minimum film thicknesses are applied to non-significant, non-visible surfaces and secondary faces.

i) Gloss levels shall be maintained at 30% ±5% for matt finishes, 70% ±5% for satin finishes and 85% ±5% for gloss finishes when measured using a 60° gloss meter.

j) Coatings shall achieve Class 1 rating when tested in accordance with BS 476: Part 7.

k) Coatings shall achieve a Class 0 rating as defined under the Building Regulations.

l) Carry out tests on finished elements (extrusions and panels) which are a minimum size of 150mm x 75mm consisting of a flat coated/ significant surface, as defined in BS EN ISO 2064, using instrumental measurements.

m) Comply with the testing requirements of BS EN ISO 2064 and BS EN 13438.

n) Provide detailed reports confirming where and when tests were carried out, which coating system was tested (i.e, name of product, supplier, the precise colour reference, product code and precise batch reference) and confirmation that all tests were passed, or details of failures and extent of failure.

o) Should the Architect deem it necessary the Trade Contractor shall appoint an independent testing authority to prove compliance with the Architectural Specification. Such a test shall comprise a minimum of three independent inspections, sampling procedures and plans as set out in BS 6001: Part 1 for general inspection level 2. An Acceptable Quality Level of 1% for each colour and finish to be installed shall be the minimum acceptable.

p) Independent Site inspections shall be carried out if the Architect is not satisfied with the test reports provided by the Trade Contractor to confirm Architectural Specification compliance or otherwise. Such inspections shall comply with the requirements of BS 6001: Part 2, LQ (Limited Quality) (Pa = 10%) + 5% with each individual fabrication element being considered as an individual component for assessment purposes. For units that are finished in fewer than three production runs, inspections shall comply with the requirements of BS 6001: Part 2 to the same LQ.

q) Where elements delivered to Site are damaged or test reports have not been provided, the Trade Contractor shall carry out an independent investigation of all finishes to all relevant elements. This investigation shall be carried out within the guidelines of BS 6001: Part 2, LQ (Limited Quality) (Pa = 10%) + 5%. For the purpose of this inspection, each section in the window curtain wall or other fabrication shall be taken as an individual component in assessing the overall batch number to allow the acceptance inspection laboratory to certify that the works comply with the Architectural Specification. For units that are finished in fewer than three production runs, acceptance inspections shall also be made using BS 6001: Part 2 to the same LQ.

r) Practical Completion will not be confirmed if any test report has not been received by the Architect.

Z31.200 SUPER DURABLE POWDER COATINGS

Z31.201 General

a) Unless stated otherwise in the Architectural Specification section, the polyester powder coating for the works shall be advanced super durable polyester coated in accordance with the following standards:
   i) Qualicoat Class 2.
   ii) BS EN 12206: Part 1 (aluminium substrates).
   iii) BS EN 13438 (galvanised steel substrates).
   iv) GSB International Quality Regulations - aluminium and steel.
   v) British Board of Agrément (BBA).

b) Only materials sourced from a reputable supplier and which are fit for purpose shall be used.

c) The final visual appearance of all powder coated elements and components shall be consistent and identical.

d) Extrusion alloys shall be grade EN AW-6063, EN AW-6060 or acceptable equivalent, and comply with BS EN 754: Parts 3-5 and BS EN 755: Parts 1-9.

e) Powder coating to sheet material shall be grade 1200/3103, and comply with BS EN 485, BS EN 515 and BS EN 573: Parts 1-3.

f) Base aluminium shall be suitable to receive the powder coating application.

g) Aluminium sheet shall be of a suitable temper and thickness to facilitate the stoving process without damage or reduction in performance and visual intent.

h) Comply with the relevant sections of the COSHH Regulations 2002, the Environmental Protection Act 1990 Part 1, the Management of Health and Safety at Work Regulations 1999 and the Construction (Design and Management) Regulations 2015.

Z31.202 Materials

a) Colour shall be as specified or selected by the Architect from the BS/ RAL range.

b) Colour shall remain consistent regardless of batch, as stated in BS 950: Part 1.

c) In order to achieve consistency of colour only use one batch per colour, spray apply, use regulated and automated equipment and use the minimum number of batches.

d) Provide a range of colour, including metallic, and finish quality samples prior to production for selection by the Architect. Samples shall demonstrate the range of anticipated finish and colour consistency acceptable to the Architect.

e) Local dry film thickness, applied to adjacent panels, shall not vary (maximum and minimum) by more than 20% unless otherwise agreed by the Architect following receipt of samples for review.

f) All coatings shall be consistent in terms of colour, quality and finish within the limits agreed in advance through samples provided and accepted.

g) Use only low tack protective tape applied in accordance with good practice and manufacturer's recommendations for a maximum period of six months. If longer periods are required, remove and re-apply new tape.

Z31.203 Workmanship

a) All coatings shall have a current BBA Approval Certificate or acceptable equivalent.

b) Application of coatings shall be carried out as recommended by the Qualicoat scheme, BS EN 12206 and/ or BS EN 13438.

c) All coating work shall be carried out at a single plant/ location using a single batch where possible. If multiple batching is required, notify the Architect and take measures necessary to comply with the Architectural Specification in terms of quality and consistency of colour and finish.

d) Keep the surfaces clean and as new until Practical Completion so as to maintain the warranty. This includes sufficient regimes in environments stipulated as Hostile (C4 and C5 as determined by BS EN ISO 12944), which can reduce cleaning periods from every eighteen months in non-aggressive environments, (i.e. C1-C3 as determined by BS EN ISO 12944, only) to every three months for standard polyesters, depending on specific locality from the pollutant.

e) Damage rectification shall be carried out if it is repaired immediately and to the Architect's satisfaction. Repairs shall be carried out at the point of manufacture under strictly controlled conditions and not on Site unless specifically agreed in advance with the Architect and colour retention, gloss retention and adhesion are guaranteed without detriment to the warranty.

f) Agree in advance with the Architect any proposed pre-anodising.

g) Where pre-anodising is proposed as a method to promote strong adhesion, this shall be specifically notified to the Architect as part of the proposals/ submittals process.

Z31.204 Testing

Carry out tests or provide certified evidence of previous tests to satisfy the Architect that the following requirements have been achieved in relation to the works in accordance with the specified standards, quality and performance requirements:

a) Artificial weathering.

b) Natural Weathering, including chalking and colour/ gloss fastness shall be based on a one year Florida Testing regime.

c) Visual inspection, from a distance of not more than 1000mm to determine any failure as a result of exterior exposure.

d) Impact resistance.

e) Cupping, scratching, adhesion, flexibility, salt spray, humidity and film thickness in accordance with the Qualicoat scheme and BS EN 12206.

f) Permeability.

g) Mortar resistance.

h) Film thickness:

  i) The minimum average film thickness at any point shall be 50 microns for aluminium and 60 microns for galvanised steel.

  ii) Where hazardous environments are involved, the minimum shall be increased to 60-70 microns.

  iii) Certain colours may require an increase in the minimum film thickness to 80 microns to achieve the required colour intensity.

  iv) Seeding and double coating is not acceptable.

  v) Ensure that the minimum film thicknesses are applied to non-significant, non-visible surfaces and secondary faces.

i) Gloss levels shall be maintained at 30% ±5% for matt finishes, 70% ±5% for satin finishes and 85% ±5% for gloss finishes when measured using a 60° gloss meter.

j) Coatings shall achieve a Class 1 rating when tested in accordance with BS 476: Part 7.

k) Coatings shall achieve a Class 0 rating as defined under the Building Regulations.

l) Carry out tests on finished elements (extrusions and panels), which are a minimum size of 150mm x 75mm consisting of a flat coated/ significant surface, as defined in BS EN ISO 2064, on which to conduct instrumental measurements.

m) Comply with the testing requirements of BS EN ISO 2064 and BS EN 13438.

n) Provide detailed reports confirming where and when tests were carried out, which coating system was tested (i.e, name of product, supplier, the precise colour reference, product code and precise batch reference) and confirmation that all tests were passed, or details of failures and extent of failure.

o) Independent Site inspections shall be carried out if the Architect is not satisfied with the test reports provided by the Trade Contractor to confirm Architectural Specification compliance or otherwise. Such inspections shall comply with the requirements of BS 6001: Part 2, LQ (Limited Quality) (Pa = 10%) + 5% with each individual fabrication element being considered as an individual component for assessment purposes. For units that are finished in fewer than three production runs, inspections shall comply with the requirements of BS 6001: Part 2 to the same LQ.

p) Where elements delivered to site are damaged or test reports have not been provided, the Trade Contractor shall carry out an independent investigation of all finishes to all relevant elements. This investigation shall be carried out within the guidelines of BS 6001: Part 2, LQ (Limited Quality) (Pa = 10%) + 5%. For the purpose of this inspection, each section in the window curtain wall or other fabrication shall be taken as an individual component in assessing the overall batch number to allow the acceptance inspection laboratory to certify that the works comply with the Architectural Specification. For units that are finished in fewer than three production runs, acceptance inspections shall also be made using BS 6001: Part 2 to the same LQ.

q) Practical Completion will not be confirmed if any test report has not been received by the Architect.

End of Section

Z36 GASKETS

The general requirements specified within this Architectural Specification section shall be read in conjunction with the Contract Conditions, Preliminaries, the particular requirements of applicable Architectural Specification section, and the general requirements specified in the A and other applicable Z sections.

Z36.100 PRODUCTS, SYSTEMS AND MATERIALS

Z36.101 Materials

a) The maximum movements applicable shall be accommodated by the gaskets.

b) Butt joint and heat seal gasket to gasket joints. Other materials used to bond gaskets shall not be acceptable.

c) The gasket system shall comprise extruded and moulded elements, which shall appear and perform as a single element.

d) All gaskets shall be designed and selected in order to:

  i) Comply with BS 4255.

  ii) Be the most appropriate to the design of the extrusion.

  iii) Ensure that the requirements of glass retention and weatherproofing are maintained by dry solid materials and/ or structural silicone.

  iv) Ensure that there is no permanent distortion over the period of the working life of the works.

e) Gaskets shall:

  i) Be compatible with all substrate, sealants and all other materials used in the works.

  ii) Not come into contact with materials that have stain characteristics.

  iii) Be fabricated to the most appropriate grade and hardness.

  iv) Perform and appear as a single continuous material.

  v) Be black in colour unless specified otherwise.

  vi) Not shrink or warp.

  vii) Not deteriorate between the times for replacement periods as stated by the Trade Contractor.

f) Written confirmation shall be received from the gasket manufacturer confirming that:

  i) The gasket material and designs are suitable for their specific use in any part of the works.

  ii) The gasket material is compatible with:

    - All other materials and sealants used within the installation.
    - All interfaces with other materials/ components.

g) Gasket corners in frames shall be preformed and factory vulcanised in ladders.

h) There shall be no reduction in the performance of sound insulation through the choice of seals and gaskets.

i) The full range of dimensional tolerances and movements associated with the design, fabrication and installation of the works shall be considered and accommodated by the gaskets and seals to be used to ensure that the required airtightness is achieved. They shall be:

  i) Formed from materials that are capable of maintaining their elastic qualities and dimensions.

  ii) Sufficiently resistant to attack of a physical or chemical nature to maintain the full acoustic performance of the works.

End of Section