ARCHITECTURAL SPECIFICATION

The Horniman CUE Roof Replacement Project

Document Number: LAB-687-SPE-0001

30 May 2023

Document History

Revision:	Date:	Prepared By:	Checked By:	Authorised By:	Reason For Revision:
00	30-05-2023	M Paris	M Paris	A Brown	Issue for Client Review

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Spec Work Sections		Specification Design Responsibility	Item Code & Simple Description	Description	Samples / Mock Up / Requirements
Preliminaries					
A	General Requirements	N/A	N/A	General Requirement section is applicable to all specification works sections.	Defines General Requirements of contractor submissions, samples, mock-ups and benchmarks
Demolition/ Alteration/Renovation					
C90	Alterations – spot items	**Descriptive (D)** Detail Design Completed by Contractor.	ALT-01 Removal of existing roof systems, inspection and remediation of existing timber deck.	Removal of existing roof systems, flashings and trims. Inspection, reporting and remediation of existing timber deck to receive new roof membrane RFS-01.	N/A
			ALT-02 Removal, repair and reinstatements of roof timber perimeter profiles.	Careful cutting back and removal of timber roof edge profiles and surface water drainage spouts. Fabrication and installation of new roof timber edge profiles and surface water drainage spouts.	Provide fabrication and assembly drawings for Client Representative acceptance prior to commencing system construction. Provide timber type and finish samples. Provide Mock up as described in specification. Provide Benchmark as described in specification.
			ALT-03 Removal, repair and reinstatements of timber balcony assembly.	Careful cutting back and removal of existing timber balcony construction and wall lining profiles. Form new foundations and install new balcony supports, floor construction, decking and timber wall and guarding systems.	Provide fabrication and assembly drawings for Client Representative acceptance prior to commencing system construction. Provide timber type and finish samples.
Cladding/ Covering					
H71	Lead sheet fully supported roof coverings and flashings.	**Descriptive (D)** Detail Design Completed by Contractor.	RFS-03 New horizontal lead flashing, coping and formed outlets supported.	New horizontal lead flashing, coping and formed outlets supported on timber grounds to roof edge perimeters and upstands.	Provide Benchmark as described in specification.
Waterproofing					
J41	Reinforced bitumen membrane roof coverings	**Descriptive (D)** Detail Design Completed by Contractor.	RFS-01 Reinforced bitumen membrane roof system	New reinforced bitumen membrane roof system applied to existing timber roof deck. To receive flashing, copings and green roof over.	Provide roof systems Warranty in acknowledgment of Q37 Green Roof installation over.
Furniture/ Equipment					
N25	Permanent Access and Safety Equipment	**Descriptive (D)** Detail Design Completed by Contractor.	ASE-01 Roof Edge Protection Guarding	Provide new metal custom roof edge protection guarding system with posts fixed to vertical timber fascia and wall linings.	
			ASE-02 Custom Metal Ladder Retention and Storage Systems	Provide new custom metal wall mounted eye plates and cable stays fixed to existing wall to provide safe restraint to existing temporary ladder when access to roof is required. Provide custom wall/soffit mounted brackets located at high level with cable stays to provide secure storage for high level ladder that is required to be used when accessing high level roof.	
			ASE-03 Existing Horizontal Cable Safety Line Inspection, Report and Remedial Works.	Inspect existing Fall Arrest Cable system in all location and report on conditions and suitability for future use following roof renewal work. Renew and/or provide new fall arrest cable systems as required following inspection to provide certified systems.	
Paving/ Planting/ Fencing/ Site furniture					
Q37	Green roofs	**Descriptive (D)** Detail Design Completed by Contractor.	RFS-02 New Biodiverse Green Roof System.	Extensive green roof system, protection fleece, drainage board, filter fleece, biodiverse substrate of varying depths and seed bed applied with Riverstone borders. Optigreen net soil retention system to 25° roof pitch. To be installed over RFS-01 Reinforced Bitumen Membrane and to coordinate will all requirements of roof membrane system to maintain overall roof system integrity.	Provide roof system and install in agreement with all Warranty requirements for J41 Reinforced bitumen membrane roof system
Building fabric reference specification					
Z10	Purpose made joinery				
Z11	Purpose made metalwork				
Z20	Fixings and adhesives				
Z22	Sealants				

A GENERAL REQUIREMENTS

A - 1. FORMAT DEFINITIONS AND USE OF THE SPECIFICATION

A - 1.1. SPECIFICATION FORMAT

a) The *Specification* comprises Sections A to Z and follows the Uniclass (Common Arrangement) classification system.

b) Sections A and Z provide general requirements applicable to individual trade Works Sections A to Z. Sections E to Z detail particular requirements specific to individual trades or elements of the works and shall be read in conjunction with Section A and other related sections of the *Specification*.

c) The Work Sections listed herein form part of the *Specification* with design responsibility and specification type indicated for each as follows:

i) Prescriptive (P): The Section is a detailed materials and workmanship *Specification* reflecting the Employer's design solution. The *Contractor* may be required to provide some fabrication details but design responsibility remains with the Employer.

ii) Descriptive (D): The Section, when read with the *Design Drawings*, indicates the visual intent with which the *Contractor* must comply when undertaking the *Detailed Design*. The *Contractor* retains full responsibility for completing the *Detailed Design* and execution of the works and for meeting the specified performance criteria.

d) The Work Sections of the *Specification* shall not impose a lesser standard of material or workmanship than defined in Sections A and Z.

e) The *Specification* shall be read in conjunction with the Conditions of Contract, Preliminaries, *Design Drawings*, Instructions to Tenderers, supplemental information and other relevant documents.

f) Performance criteria where specified shall be considered as minimum standards with which the *Contractor*'s proposals shall comply.

g) Sections A to Z shall constitute a single document.

h) Unless stated otherwise, all requirements of this document (and any related document) refer to work to be provided by, and obligations of, the *Contractor* and therefore all clauses are addressed to, and refer to, the *Contractor*.

A - 1.2. SPECIFICATION CODING EXPLANATION

The Specification clauses are numbered consecutively on the left of the page following introduction heading to each Section.

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The *Specification* include a 'T Sheet' which is a directory of references for elements and systems. This directory shall be used to correlate the *Design Drawings* with the *Specification*. The T Sheet provides a link between the *Specification* and the *Design Drawings*

A - 1.2.2. WORK SECTION CATEGORIES

A - General Requirements

C90 Alterations – spot items

H71 Lead sheet fully supported roof coverings / flashings

J41 Reinforced bitumen membrane roof coverings

N25 Permanent access and safety equipment

Q37 Green Roofs (Intensive)

J41 Reinforced Bitumen Membrane Roof Coverings

Z10 Purpose made joinery

Z11 Purpose made metalwork

Z20 Fixings and adhesives

Z22 Sealants

A - 1.3. SUPPLEMENTAL INFORMATION

a) Read also in conjunction with the Structural / Civil Documentation

b) ~~Read also in conjunction with the Services Engineer's Documentation~~.

A - 1.4. DEFINITIONS

The following definitions apply to the *Specification*:

a) "Works Information": as defined by the identified and defined terms clause in the Annexure 1 Conditions of Contract.

b) "*Specification*": This document, comprising Sections A - Z inclusive.

c) "*Contractor*'s Proposals": Drawings, detailed technical specifications, method statements, risk assessment, calculations and any other relevant information prepared by the *Contractor* , maintaining the design and visual intent, functional, performance criteria and technical requirements as stated in the Works Information.

d) "*Contractor*'s Statement": Part of the *Contractor*'s Proposals, which explains the *Contractor*'s proposals for the execution of the Performance Specified works including any information which is required to be included.

e) "*Design*":

i) Prescriptive (P): The design solution prepared by the Employer, represented by the Works Information . This may be supplemented by fabrication details, prepared by or on behalf of the *Contractor*.

ii) Descriptive (D): The design intent prepared by the Employer represented by the Works Information.

f) "Detailed Design": That prepared by the Contractor .

g) "Design Drawings":

i) Prescriptive (P): Drawings issued by the Employer at the Contract Award and the Project Manager during the course of the Contract.

ii) Descriptive (D): Drawings issued by the Employer at Contract Award and the Project Manager during the course of the Contract, representing the Employer's design intent, showing the visual and design intent, scope, layout, principal dimensions, arrangement of services and structure, function, visual and aesthetic requirements.

h) "Working Drawings":

i) Drawings for the design submissions, for the Project Managers review and acceptance, as set out in the Central Section Project, Works Information Volume 2B Part 7.

j) Drawings representing the Detailed Design, prepared by the Contractor(OR his specialist sub-contractor)based upon the Design Drawings, showing plans, elevations, sections and full size details of fabrication, assembly, installation and fixings of the works, submitted to the Project Manager for acceptance prior to manufacture, showing all necessary information to fabricate, manufacture and install/ construct all elements of the works.

k) "*As-built Drawings*": Drawings produced by the *Contractor*, where required, which show the works as finally constructed as represented by the *Working Drawings* unless otherwise agreed.

l) "Contract Drawings": The drawings listed in the Contract

m) "Evaluation": Reviews carried out by the Project Manager and Contractor.

n) "Inspection": Inspection carried out by the *Project Manager* of systems, products, materials, components, equipment and installation of the works. Such inspection shall be limited to an inspection of the visual appearance only. The *Detailed Design*; selection of systems, products and materials, and construction of components and equipment shall remain the sole responsibility of the *Contractor* for works specified descriptively.

o) "A(a)ccepted, A(a)cceptance or A(a)cceptable": Systems, products, materials, components, equipment and installations accepted by the *Project Manager* after evaluation and with due regard to responsibilities as defined in the Contract Documents and stated in the *Specification*.

p) "acceptable equivalent": Systems and products proposed by the *Contractor* as alternatives, equal to or an enhancement of those specified in every respect. Subject to acceptance by the *Project Manager* following evaluation and with due regard to responsibilities as defined in the Contract Documents and stated in the *Specification*.

q) "*Contractor*'s Supplemental Information": Documentation produced by the *Contractor*, demonstrating that the *Detailed Design* complies with the Contract Documents.

r) "Inspecting Body": Competent independent body or association, which verifies compliance with the Specification.

s) "Testing Body": Competent accredited independent testing body or association, which provides appropriate testing equipment, testing environment and independent testing results which will be used to verify conformance with the Specification. The Testing Authority shall be subject to acceptance by the Project Manager.

t) "works": The scope of work covered by the Specification.

u) "Detailed Design Programme": Submitted by the Contractor, prior to Contract award, showing the Detailed Design drawing submission dates, sample submissions, prototyping and testing activities prior to manufacturec

v) Section 'A' refers to Section 'A' of this specification.

A - 2. DESCRIPTION OF THE PROJECT

A - 2.1. PROJECT DESCRIPTION

For detailed information and drawings refer to the:

Architecture. Civil, Structural ~~and Services Engineering~~ works.

This is an Architectural Specification that should also be read in conjunction with Civil/ Structural ~~and MEP~~ Works Information.

a) Project Description:.

A - 2.2. SCOPE OF WORK

The Horniman CUE Roof Replacement Project

A - 3. DETAILS OF CONTRACTORS RESPONSIBILITIES

A - 3.1. DESCRIPTIVE ELEMENTSOF THE WORKS D

A - 3.1.1. GENERAL REQUIREMENTS

a) Take responsibility for the *Contractor* Design works as identified herein, and comply with the requirements of the Contract and *Specification*.

b) Design and general performance requirements shall be as stated herein. Specific performance requirements are provided in each Work Section (A to Z) of the Specification.

c) Undertake the *Detailed Design*, supply, install and warrant the works to comply with the design intent indicated on the *Design Drawings* and criteria stated in the *Specification*.

d) Where no material, product or supplier is indicated in the *Specification*, propose suitable materials and systems which comply with the design intent and performance criteria stated in the Works Information and remain fully responsible for the *Detailed Design* of the works.

e) Where a particular material, product or supplier is indicated in the *Specification*, such material, product or supplier shall be deemed indicative representing the Employer's design intent only. The *Contractor* may complete the installation using that product, or equivalent confirmed as acceptable by the *Project Manager* , but shall remain fully responsible for the *Detailed Design* and performance of the works.

f) Interfaces:

i) Co-ordinate with the work of others including all interfacing as required.

ii) Performance shall be maintained at all interface conditions.

iii) Complete the *Detailed Design* of all interfaces with adjoining trades prior to commencement of manufacture.

A - 3.1.2. CONTRACTOR's RESPONSIBILITIES

a) Read in conjunction with the Central Section Project Works Information Volume 2B Part 7.

b) The *Contractor*'s proposals shall include drawings, calculations, methods, technical specifications and risk assessment detailing the proposed materials and systems in order that a technical appraisal can be made by the *Project Manager* prior to acceptance.

c) The design and visual character of the project is important and shall be maintained. Hence, there shall be no variation in the final surface finish of similar materials, which shall remain visually consistent, including colour and texture, regardless of orientation or natural grain within agreed tolerances and agreed samples.

d) Where proprietary products are to be installed, be responsible for providing any modification, additional bracing, reinforcing and suitable fixings, to ensure that the products meet the requirements of the Works Information for the circumstances and situation in which they shall be expected to perform. Be responsible for conveying any concerns that the manufacturers may have expressed regarding the suitability of products for the purpose intended.

e) Be responsible for ensuring that items specified are installed correctly such that the performance requirements specified are fully satisfied for the service life required. All fixings and other aspects not fully detailed or specified shall be regarded as the *Contractor*'s responsibility.

f) Be responsible for the final selection of products and associated components, which shall be used solely for the purpose intended by the manufacturer; which shall satisfy the requirements of the Works Information.

g) Be responsible for the carrying out of all testing as specified and as necessary to demonstrate compliance.

h) Provide warranties as required.

i) Submit relevant documents to local and national building regulation and legislation approval authorities as required to comply with the requirements of the Works Information.

j) Comply with the requirements of Planning Approval.

k) Submit relevant documents for submission to the Planning Authority as required by Works Information.

l) Set out the works and accurately co-ordinate all related works.

m) Provide details, calculations and any other relevant information to the *Project Manager* for submission to and approval by the local and national building regulation and legislation approval authorities. Make any adjustments required by the local authorities, following submissions, to the satisfaction of the *Project Manager*. Ensure that the *Detailed Design* and installations are in accordance with all local and national building regulation and legislation approval authorities.

n) In addition to submissions to the local and national building regulation and legislation approval authorities, be responsible for submitting structural, deflection and other calculations and technical information, where required (as requested in the *Specification*) for review by the *Project Manager*. Such submissions shall demonstrate compliance with the *Specification*.

A - 3.1.3. CONTRACTORS PROPOSALS

Contractor's Proposals

a) The *Contractor*'s Proposals will be reviewed during the Evaluation by the *Project Manager*. Attend evaluation meetings as required and make adjustments and alterations to the *Contractor*'s Proposals to agree the major design principles to the satisfaction of the *Project Manager* prior to the possible Contract award.

b) Provide the *Project Manager* with access to the design office and personnel during the Design Evaluation.

c) The *Contractor*'s Proposals as a minimum shall include:

i) Full details of systems, materials and suppliers.

ii) Pre contract proposals

iii) Details of any 'Specialist' involvement.

iv) Details of *Working Drawings* programme.

v) Samples of proposed materials as required by the relevant work sections.

vi) Full details of systems, materials and suppliers where different from those specified.

vii) Comprehensive technical specifications of the *Contractor*'s Proposals.

viii) Relevant supplementary information.

ix) Drawings as required by the *Specification* or as deemed necessary to explain the *Contractor*'s Proposals.

x) Technical statements confirming performance compliance.

xi) Details of guarantees and warranties including details of predicted service lives for primary and secondary components.

xii) Summary of deviations from the *Design Drawings* and *Specification*.

xiii) Commissioning information as relevant.

xiv) Method statements and safety risk assessments.

A - 3.1.4. THE DETAILED DESIGN

a) Comply with all relevant Codes of Practice, Standards, Fire Regulations, Building Regulations (refer to clause series JA.6200) and local Building Codes, Safety Regulations and any other regulations applicable to the installation, together with all relevant Statutory Rules, Regulations, Bye-laws and other enforceable instruments applicable to both the design and execution of the works.

b) Submit to the *Project Manager* one distributed transmitted electronic copy and two paper A3 reduction copies of all design/ production information. *Detailed Design* work shall be clearly legible when reduced to A3 paper size.

c) The *Working Drawings* shall finalise all manufacturing, interface and installation details.

d) Ensure that any necessary amendments are made in a timely manner, unless and until the Project Manager confirms that resubmission is not required, submit copies of amended drawings, etc., and ensure incorporation of necessary amendments.

e) Select suitable materials, sizes, thicknesses, types and locations of fixings and sealants, all in accordance with specified standards and ensure that they are used for the purpose intended by the manufacturer.

f) Any necessary support structure shall incorporate all movements and tolerances to which it is subjected.

g) Include descriptions of relevant structural performance principles of the works, including how and where loads are transmitted to the primary structure and the accommodation of tolerances.

h) Show details of all fixing requirements to interfacing elements of the works, which shall be accepted with the Project Manager prior to commencement of the installation.

i) Co-ordinate all interfaces.

j) The Project Manager's review of Working Drawings shall relate to visual performance and functional matters only.

k) Be responsible for providing method statements and safety risk assessments for review.

A - 3.1.5. SUPPLY OF SUPPLEMENTAL INFORMATION

a) Provide supplemental information in respect of design, materials, systems, methods, installation and procedures to the Project Manager.

b) Supplemental information shall comply fully with the design intent, functional and performance requirements of the Works Information.

c) Provide such supplemental information as necessary to demonstrate compliance with the requirements of A.7 of the Specification.

A - 3.1.6. SYSTEMS, PRODUCTS AND MATERIALS PREFERENCES

a) Where the *Specification* identifies preferred systems, products and materials, these shall be confirmed as being suitable for their specified and intended purpose with the Tender return. If no such specific confirmation is received, then the submission of the Tender return itself shall constitute such a confirmation. If the preferred systems, products and materials are considered unsuitable, advise at the time of ender.

b) Acceptance of alternative proposals by the *Project Manager* shall not relieve the *Contractor* from responsibility to provide suitable systems, materials, components and assemblies, which shall be used as intended by the manufacturer and in compliance with the Contract Documents.

c) If, with the Tender return, the Contractor submits no such alternative proposal to any of the preferences indicated in the proposed in the Specification and on the Design Drawings shall be deemed to be acceptable and be warranted by the Contractor

A - 3.1.7. DETAILED_DESIGN, MANUFACTURING AND INSTALLATION TOLERANCES

a) The *Specification* together with the corresponding *Design Drawings* indicate the dimensional tolerances (hereafter referred to as "tolerances") to which the *Contractor* shall work (where relevant) for the *Detailed Design*, manufacture, sub-assembly, setting out and installation of the works.

b) The *Working Drawings* shall clearly demonstrate how manufacturing and construction tolerances are to be accommodated.

c) Take account of various specified tolerances and their effect on the works. Allow for integration of following work. Inform the Project Manager of any apparent tolerance omissions, inconsistencies or incompatibilities, and their resolution.

d) Maintain the tolerances as defined and demonstrate, upon request by the *Project Manager*, the means by which specified tolerances shall be assured and, where appropriate, which specialist equipment and/ or methods shall be used.

e) All dimensions shall be checked on Site, confirming all dimensions critical to the works. Site measurements shall be undertaken in sufficient time to enable corrective action to be taken to the works, or if agreed by the Project Manager the work of others, to ensure an accurate fit within agreed or implied tolerances.

f) Confirm common reference points and agree with the *Project Manager*. Carry out dimensional checks prior to the commencement of manufacture as necessary.

g) Ensure that any dimensions are compatible and consistent with other relevant design dimensions and accumulated tolerances and movements. State and/ or show, on the *Working Drawings*, the provisions made which are intended to accommodate the accumulated tolerances of adjoining or adjacent trades.

h) Inform the *Project Manager* of any work that does not meet the specified tolerances.

i) The works shall be free from deformation outside of specified tolerances and shall not be subject to warping, twisting and/ or perishing but remain stable, firm, free from vibrations, knocking, rattles and/ or whistles, squeaks or other such noises, taking into account known or specified conditions.

j) Details shall be provided for acceptance by the *Project Manager* of the *Contractor*'s proposed methods for achieving and constantly monitoring the fabrication and erection tolerances during all stages of the works. Detailed records of the constant control and tolerance achieved shall be submitted to the *Project Manager*.

k) In the event of there being any discrepancy in the values of existing datum reference points, datum levels, buildings, foundations or other features to which the works are related, determine and report such a discrepancy to the *Project Manager* and obtain written instructions before proceeding.

l) The permissible tolerances stated in the *Specification* shall be progressively checked up to handover. Where two or more different tolerances can be derived by calculation and/ or from the *Design Drawings* for the same dimension, the least tolerance shall apply which shall be confirmed by the *Contractor* to the *Project Manager*. Tolerances shall not be cumulative.

m) Method statements and safety risk assessments.

A - 3.1.8. SUBSTITUTION AT THE TIME OF TENDER

a) Should the *Contractor*, after consideration of all the criteria which in his specialist knowledge are relevant to the design and construction of the works, wish to make proposals for changes in any details, dimensions or materials indicated in the *Design Drawings* or referred to in the *Specification*, then such proposals shall be provided as separate alternative options and returned with the Tender. In no way shall any proposal fail to meet the minimum performance requirements herein specified.

b) A request for a substitution shall be deemed to be a warranty by the *Contractor* to the client that such substitutions meet the requirements of the *Specification* and as such must be confirmed in writing as equal by the *Contractor* and accepted in writing by the *Project Manager*. Admissibility of any request for substitution after Tender shall be at the sole discretion of the *Project Manager* and may be rejected without reason given.

c) In the case that any substitution alters the specified requirements, submit sufficient information on substituted materials to all evaluation by the Project Manager on any deviations from the Specification.

A - 3.2. PERSCRIPTIVE ELEMENTS OF THE WORKS P

A - 3.2.1. General Requirements

a) Supply, deliver, install and warrant the works in strict compliance with the materials and workmanship requirements of the Works Information.

b) The Contractor shall prepare drawings, schedules and all other necessary information detailing components and systems etc., required by the Works.

A - 4. SUBMITTALS

A - 4.1. PROCEDURE

a) No portion of the works shall commence without acceptance of the required submittals by the *Project Manager*.

b) A schedule of submittals shall be provided for agreement with the *Project Manager*. The schedule shall indicate the dates on which the *Project Manager* shall receive the required submittals. The schedule shall be correlated with the master programme and include the period for the review and reply time. Critical decision dates shall be indicated for selection of finishes and colours. The schedule of submittals shall be revised and resubmitted as necessary.

c) Provide submittals in accordance with the following:

i) Addressing of Submittals: Submittals shall be delivered to the premises identified by the *Project Manager*.

ii) Identification of Submittals: Each submittal shall be individually identified on a self-adhered printed label with the project name, respective Specification reference, supplier's/ manufacturer's name and product reference as appropriate. Each submittal shall be accompanied by a transmittal form containing similar information; together with the purpose for which the submittal is being made. Space shall be provided on the label on each item submitted for acceptance by the *Project Manager*.

iii) Numbering of Submittals: Submittals shall be numbered consecutively and that numbering system shall be retained throughout all revisions and resubmittals.

iv) Completeness of Submittals: All relevant information shall be included within each submittal to define completely and explain each separate system of work. Submittals may be combined from various sections as necessary and furnished at one time as a single submission.

v) Variations and Substitutions: Submittals that differ from the requirements of the *Design Drawings* and the *Specification* shall be so identified.

d) Submission and Return of *Working Drawings*/ Documents:

i) Allow for a sufficient period (a minimum of 10 (ten) working days) between the first submission of a drawing/ document and receipt of comments. Allow for resubmissions of each item to achieve an 'A' or 'B' status.

ii) Provide a list of *Working Drawings* proposed.

iii) Information specifically requested for each element of the works shall be provided. Additional information may be required by the *Project Manager* on inspection of the *Contractor*'s submittals to allow for accurate comments to be made.

A - 4.2. TENDER SUBMITTALS

a) Provide submittals as required by the Specification.

A - 4.3. TENDER RESPONSE

a) The Contractor to make response in accordance with the requirements of the Specification.

A - 4.4. POST CONTRACT SUBMITTALS

a) The Contractor to make submittals as required by the Specification

A - 4.5. POST CONTRACT RESPONSE

a) The Contractor to make a response in accordance with the requirements of the Specification.

A - 4.6. SAMPLES GENERALLY

a) Samples shall include various products, natural materials, fabricated items, equipment, devices, appliances or components thereof, as may be required to satisfy the visual appearance and technical requirements of the *Design*.

b) Samples shall be reviewed for their visual characteristics only and where moving or operating elements are involved, the *Project Manager* shall be given the opportunity to review working samples.

c) Ranges of samples shall be provided where a considerable range of colour, graining, texture, smoothness and other characteristics may be anticipated in the works.

d) Where custom colours are specified, samples shall be submitted illustrating precise colours, textures, patterns and finishes for review by the *Project Manager*.

e) Where the sample sizes stated in the Works Sections are not representative to allow the *Project Manager* to appraise the visual characteristic of the material/ component provide samples of a suitable size.

A - 4.7. PRE-CONTRACT SAMPLES

a) Not required.

A - 4.8. POST CONTRACT SAMPLES

a) Samples provided during the *Detailed Design* shall be checked against Employer's samples where applicable, and the *Specification* to ensure that quality and type have been maintained.

b) At the appropriate time provide the *Project Manager* with samples indicated in Work Sections, which shall be kept as a record of materials to be incorporated in the works and used as references for controlling consistency throughout the works.

c) Post contract award samples shall comprise materials in their final form.

d) Samples shall include relevant trade literature and technical specifications.

A - 4.9. MOCK-UPS

a) During the *Working Drawings* preparation phase (in due time to permit adjustments to the design) and where described in the Works Information, the *Contractor* shall provide full size mock-ups (unless otherwise agreed with the *Project Manager*) for inspection by the *Project Manager* and or Supervisor.

b) Mock-ups shall be erected either on or off Site, not necessarily using actual materials to be incorporated in the works but representing the design solutions.

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

A - 4.10. PROTOTYPES

a) Prior to manufacture of elements of the works, construct off Site (or on Site if specifically requested by the *Project Manager*) full scale three-dimensional sections where described in the Works Information utilising final specified materials but not necessarily final production techniques.

b) Where necessary, the prototypes shall be tested fully to ensure that the systems meet the requirements of the *Specification* by application of the maximum applied loads, climatic conditions and structural movements, and/ or be used as a Quality Assurance/ Quality Control "Hold Point". Manufacture of materials/ products for inclusion in the works shall not commence until the *Project Manager*'s and or Supervisor's acceptance of the prototypes.

c) *Working Drawings* for the prototypes shall be submitted in accordance with the requirements of the *Specification*.

d) Any modifications required to the prototypes shall be recorded to show their final construction.

e) Programme tests to enable any necessary adjustments without delay to the works programme.

A - 4.11. BENCHMARKS

a) Upon commencement of installation, erect complete sections of elements of the works for the acceptance of the Supervisor. These shall be used as a quality benchmark for the remainder of the works until Practical Completion.

b) Installations shall not commence in other areas of that particular trade until the Supervisor has examined and accepted the quality benchmark. Carry out immediately any alterations or adjustments required to achieve the quality of installation required by the Works Information.

c) Upon receipt of the acceptance, fully protect the quality benchmark. It shall be used, from time to time, by the Supervisor to check and monitor quality of materials and workmanship incorporated in the remaining areas of the works, or where specifically stated for the purpose of further testing. Remove and replace all protection when requested by the *Project Manager* and or Supervisor for such purposes.

A - 4.12. WORKING_DRAWINGS

a) Following Contract award, the required number of *Working Drawings*, and where specifically requested, relevant structural, thermal and acoustic calculations and other data, shall be submitted to the *Project Manager* for review.

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

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

ii) Layouts, locations and 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.

c) Submit *Working Drawings* and do not commence fabrication of components until formally returned by the *Project Manager* with either 'A' or 'B' endorsed on each of the *Working Drawings*. Ensure that space is left clear on each of the *Working Drawings* for endorsing by the *Project Manager*. The following drawing codes shall be used when returning the *Working Drawings* to the *Contractor*:

i) Drawing endorsed 'A' - Fabrication, manufacture or construction may proceed in accordance with the drawings submitted.

ii) Drawing endorsed 'B' - Fabrication, manufacture or construction may proceed in accordance with the drawings submitted subject to the *Contractor* taking necessary action based on the *Project Manager*'s comments and all annotations added to the returned drawings. Unless indicated to the contrary on such drawings, the work shall comply with the Contract Documents. To achieve 'A' status, the required number of copies of amended drawings shall be sent to the *Project Manager*.

iii) Drawings endorsed 'C' - No work shall be fabricated, manufactured or constructed. Submit new drawings to the *Project Manager* for review until re-submission is not required.

d) The *Project Manager*'s final comment on the *Working Drawings* ('A') shall be conditional upon receipt of all documentation, certification, acceptances in respect of anchorages, fire stop assemblies, samples, mock-ups and test reports as defined in the *Specification*.

e) When preparing the *Working Drawings* consult the current Architectural, Structural and Services *Design Drawings*, adjusting the *Working Drawings* to allow for any changes to Site tolerances and/ or discrepancies where applicable.

f) If, before commencing or during the preparation of the *Working Drawings* the design intent of the *Design Drawings* and/ or *Specification* may be affected, or where other elements of the works may be affected, notify the *Project Manager* immediately.

g) Where applicable, the *Working Drawings* may utilise the manufacturer's standard details provided that they comply with the design intent.

h) The *Project Manager* shall have the right at all reasonable times to visit the *Contractor*'s (or his specialist sub-contractors) design office to check on progress.

i) The *Working Drawings* shall be annotated in English and titled in the manner determined for the Contract, with the title block fully indicating the part of the works to which they apply.

j) Maintain on Site a full set of *Design Drawings*, *Working Drawings* and technical specifications.

k) Upon completion of the design, manufacture and installation phases, provide the *Project Manager* of *As-built Drawings*.

l) No *Working Drawings* shall be accepted if produced to a reduced size.

m) The *Working Drawings* shall be fully co-ordinated with interfacing trades.

A - 4.13. ASBUILT_DRAWINGS AND MANUALS

a) The Contractor provides as-built information as required by Central Section Project Works Information Volume 2B Part13.

A - 4.14. OTHER SUBMITTALS

a) Product Data: Provide technical information detailing the characteristics of each system, system component or material incorporated in the works. This shall include material schedules and manufacturer's literature.

b) Certifications: Provide independently certified reports verifying compliance of each element or component with the requirements of the Works Information.

c) QA/ QC Programme: Provide a programme to satisfy the requirements of Section A of the Specification, the Contract conditions or any other documents referred to in the Contract Documentation.

d) Pre-construction Testing Reports:

   i) Provide technical reports recording test results systems, components and materials as required by the Works Information, the *Project Manager* and or Supervisor prior to commencement of installation.

   ii) These reports shall state compliance with the technical requirements of the Works Information and include, where appropriate, test certificates.

e) Maintenance/ Operation Manuals: Manuals prepared by the *Contractor* for the Client/ building user's maintenance and operation of the various building systems and/ or components thereof.

f) Supplementary Product Literature: manufacturer's catalogue information, product specifications, standard illustrations, diagrams and standard details. The supplementary product literature shall describe physical characteristics such as size, weight, finish, material analysis, electrical requirements and other information such as load tables, test results, assessments and industry quality standards.

g) Manufacturer's/ Supplier's Recommendations: Manufacturer's/ supplier's recommendations shall be contained within a formal printed document in accordance with the QA/ QC procedures.

h) Technical Calculations: These shall consist of technical engineering calculations which document technical performance of various systems, system components and/ or materials, as required by the Works Information.

i) Guarantees and warranties: Provide certified copies of all relevant guarantees and warranties available for installed materials and products.

j) Prepare and submit method statements and risk assessments for review.

k) The Contractor shall provide a post construction sustainability evaluation report to demonstrate performance against the sustainability requirements defined within the Sustainability Report, format to be agreed.

l) All submittals provided shall be written in the English language.

A - 4.15. REVIEW OF SUBMITTALS

a) The *Project Manager* shall review submittals for general and practical conformance with the requirements of the Works Information. Submittals which meet these requirements shall be stamped or marked in accordance with the procedure described. Submittals which are incomplete or erroneous, or which are not required, will be returned and a new submittal made as necessary.

b) Submittals which provide supplementary information to substantiate the technical performance of building systems, components and materials including, supplementary product literature, certifications, statements of manufacturer's review and pre-construction testing and inspection reports, will be stamped 'Record Document' by the *Contractor* before submission.

c) Resubmittals shall be made under the procedure for initial submittals; identifying changes made since previous submittals.

A - 5. PERFORMANCE REQUIREMENTS AND DATA

A - 5.1. GENERAL

A - 5.1.1. PERFORMANCE REQUIREMENTS

a) The works shall comply with the following performance criteria and that detailed in the Particular works sections. Refer also to the *Structural Engineer's Works Information* and *Services Engineer's Works Information* for specific performance requirements where applicable.

b) The performance criteria included in the *Specification* sets minimum standards with which the *Detailed Design* shall comply.

c) Minimum Requirements: Where there is in existence a relevant British Standard, BS code of practice, draft BS, German DIN Standard, ISO Standard, European Standard or British Board of Agrément Certificate applicable to the design, execution or performance of the works or any part thereof, then the recommendations and requirements of such documents shall be considered a minimum standard for the work described and must be complied with. Should two standards conflict notify the Project Manager of the option preferred for use.

d) The works shall comply with the latest edition of the Building Regulations unless this conflicts with the Employers Standards Baseline.

A - 5.2. DESIGN AND SERVICE LIFE

A - 5.2.1. DESIGN LIFE OF BUILDING

The design life of the works shall be in accordance with BS ISO 15686: Part 1.

A - 5.2.2. SERVICE LIFE OF COMPONENTS

a) Primary components are all components with a predicted service life not less than the design life of the element being specified without the need for maintenance, other than regular cleaning.

b) Secondary components:
   i) Secondary components are all components that may require replacement during the design life of the building, assuming regular cleaning and maintenance has been carried out in accordance with information to be provided by the *Contractor* and his relevant suppliers.
   ii) Secondary components shall be capable of easy replacement without compromising the structural or weatherproof integrity of the element being specified.
   iii) Secondary components shall be capable of replacement without progressive dismantling of adjacent elements.

c) Confirm the predicted service life (i.e. the service life predicted from recorded performance or accelerated tests) and maintenance requirements of the components of the building as defined in BS 7543 and BS ISO 15686 for the review by the *Project Manager* and provide detailed information at Tender Stage.

d) Materials shall be used solely for the purpose intended by the manufacturer and which satisfy the requirements of the *Specification*.

e) Premature deterioration shall not be acceptable.

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

g) The works shall be suitable for their intended purpose and perform satisfactorily for their full design life. Elements shall be designed, manufactured, cured and tested in compliance with all relevant glazing, metal, steel and London Underground standards.

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

i) Exposure to sunlight during the lifetime of the works shall not reduce the performance or visual appearance of any element/ component. Expected solar performance under varying conditions of solar radiation and external/ internal air velocity shall be taken into consideration.

j) 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.

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

l) Metal sheets shall not suffer bowing, dimpling, oil canning, sagging, pillowing, rippling, warp, abrupt transitions and other visual deformation or irregularity.

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

n) Non structural elements are to have a minimum design life of 30 years with a first maintenance life of 15 years.

o) Adequate measures shall be taken to prevent bimetallic corrosion between dissimilar metals, attention is drawn to publication British Standards Institute Practice Document PD6484 "Commentary on corrosion at bimetallic contacts and its alleviation.

A - 5.3. STRUCTURAL

A - 5.3.1. GENERAL

This is an Architectural Specification, refer to the Structural Engineering Works Information for particular requirements

A - 5.3.2. DEAD LOADS

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

   i) The component and final assembly dead load which shall be accommodated locally without causing deflections or movements which adversely affect any component,and

   ii) Refer to Structural Engineering Works Information.

b) When calculating loads the worst combination shall be considered.

A - 5.3.3. LIVE LOADS

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

   i) All loads resulting from movements of the building structure and support structure, and

   ii) Refer to Structural Engineering Works Information.

b) When calculating loads the worst combination shall be considered.

A - 5.3.4. DEFLECTIONS

a) Refer to Structural Engineering Works Information.

   i) The Works shall be capable of accommodating all air pressures whether naturally or mechanically induced.

b) The works shall not deflect under loading in any way that is detrimental to the appearance or performance of the works. Deflections shall not be detrimental to the appearance or performance of any adjacent material, system or product.

c) All components, couplings and fixings shall be capable of accommodating deflections without permanent distortion, deformation or failure.

d) The works shall accommodate differential structural movements arising from any loads imposed by adjacent structures, road or rail.

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

A - 5.3.5. WIND LOADS

a) The works shall withstand without permanent deformation, the effects of wind loads where appropriate (e.g. external conditions or internal areas subject to external wind pressure).

b) Design Wind Pressures: Precise wind load values shall be determined in accordance with the geographical location of the Site, the topographical conditions and the type of building in accordance with BS EN 1991: Part 1-4.

c) When assessing the wind pressure allowances, account shall be taken of the shape of the building and its location in relation to the layout of the adjacent structures.

d) Particular attention is to be paid to areas subject to increased pressures, i.e. eaves, canopies and external corners. Special care shall also be taken to identify and design for any situation not clearly defined in BS EN 1991: Part 1-4 where it is believed that the geometry of the building shall cause increased pressure due to vortex or eddy conditions. Maximum gust wind presssure shall be calculated in accordance with BS EN 1991: Part 1-4. For buffeting pressures induced by train movements refer to the Engineers Design information.

A - 5.3.6. PRECEDING WORK

a) Check all preceding work, including line, level and fixing points and report immediately to the *Project Manager* if any is considered to be unsuitable and propose remedial action.

b) Prior to manufacture of components, where possible, inspect the Site and check measurements of the preceding works while completing the *Working Drawings* and co-ordinate all Site dimensions.

c) The *Working Drawings* shall include full details of all interface conditions, demonstrating full compatibility with adjoining items of work and that the *Detailed Design* takes into account all such conditions.

A - 5.3.7. VIBRATION

Ensure that the works withstand all vibration caused by traffic, aircraft, equipment effects or any other shocks, slamming, strains, stresses and movement imposed, thus avoiding deterioration or fracture of any element, both during construction and after installation.

A - 5.4. ENVIRONMENTAL CONDITIONS

A - 5.4.1. GENERAL

This is an Architectural Specification refer to Mechanical Engineering Works Information for particular services requirements.

A - 5.4.2. CLIMATICDATA

Refer to the Mechanical Engineering Works Information.

A - 5.5. ENVIRONMENTAL REQUIREMENTS

A - 5.5.1. General

Refer to the *Services Engineer's Works Information* for particular requirements.

A - 5.5.2. Generally

a) Ensure that the works conform to all aspects of the *Specification*, taking into account all local environmental conditions prevailing at Site.

b) Refer to the Work Sections for specific performance data.

c) Obtain any additional meteorological and climate data considered necessary in order to fulfil contractual obligations.

d) 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 *Contractor*'s responsibility.

e) All works shall be fully capable of resisting the prevailing atmospheric conditions.

f) All material grades, manufacturing methods and standards and corrosion protection, shall be selected so that they are fully suited to the internal and external environmental conditions as set out below (to meet the relevant British Standards and all other relevant standards) and as contained in the relevant parts of the *Services Engineer's Works Information*. Refer to *Services Engineer's Works Information* for relevant data.

A - 5.5.3. Solar Performance

Exposure to sunlight during the service life of the works shall not reduce the performance or visual appearance of any element/ component.

A - 5.5.4. 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.

A - 5.6. ACOUSTIC PERFORMANCE

A - 5.6.1. GENERAL

a) The Works shall achieve sound reduction values stated in the Acoustic Report and the Mechanical Engineering Works Information.

b) Evidence shall be provided to confirm that the acoustic requirements have been achieved.

A - 5.7. SECURITY

A - 5.7.1. GENERAL

Refer to the Works Information and Employer's Security Advisors for specific requirements to be implemented in the Works.

A - 5.8. FIRE AND SMOKE

A - 5.8.1. GENERAL

a) Refer to the Works Information Fire Strategy Report

b) Unless otherwise stated in the Works Information, the Works shall be in accordance with the Building Regulations in conjunction with BS7974 where applicable.

c) Where the Statutory Authorities and/ or Local/ National Fire Regulations require specific fire resistance to elements of structure which form a junction with adjacent components, ensure that the junction is fire stopped to the same degree as the elements.

d) Supply test certificates to demonstrate that all materials met the above requirements.

A - 5.9. COROSION PROTECTION

A - 5.9.1. GENERAL

a) Ensure that protective measures are taken to avoid any corrosion or any deleterious effects caused by manufacturing, finishing, transportation, storage and installation of materials.

b) 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.

c) Ensure full resistance in repair of corrosion protection to cope with the Site cutting of components, especially at boundary and external conditions.

d) The minimum requirements for the corrosion protection system for secondary structural steelwork for other areas shall conform to BS 5493, BS EN ISO 12944: Parts 1-8 and BS EN ISO 14713: primary structural steelwork refer to the *Structural Engineer's Works Information*.

e) The environmental category under BS EN ISO 12944: Part 2 shall be:

i) External corrosion: Category C3-

ii) Internal corrosion: Category C3-

f) Allow for protection against all corrosion arising 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) Particular care shall be taken with delivery and storage on Site, particularly if storage is prolonged. On no account shall materials or components be stored or used beyond the manufacturer's expiry date.

A - 5.9.2. GALVANISING CORROSION PROTECTION

The interval to first maintenance shall be no less than 'Very long (equal to or greater than 20 years)' as defined in BS EN ISO 14713: Parts 1,2 & 3. Refer also to the requirements for design and service life.

A - 5.9.3. ELECTROLYTIC PROTECTION

At all locations where different metals are assembled together, ensure that electrolytic corrosion does not occur and that the necessary protection is provided where needed, in both temporary and permanent conditions.

A - 5.10. EARTH BONDING LIGHTNING PROTECTION

A - 5.10.1. GENERAL

a) Refer to the Services Engineer's documentation

A - 6. QUALITY CONTROL

A - 6.1. GENERAL QUALITY ASSURANCE QUALITY CONTROL TESTING

Refer to the Project Works Information

A - 6.1.1. MEANS OF AUDITING

a) Refer to the Project Works Information

A - 6.1.2. QUALITY CONTROL METHODS

a) Refer to the Project Works Information

Testing

A - 6.1.3. TESTING AND INSPECTION

a) Where required, engage an accredited UKAS or similar independent testing specialist, as agreed with the *Project Manager*, to verify that the requirements of the Contract have been satisfied. Read in conjunction with the Central Section Project Works Information Volume 2 Part 14 & 15.

b) Allow for testing on samples and materials incorporated in the works as necessary.

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

d) Approach to testing:

i) Off-Site testing:

- The *Contractor* may provide data from previous independently certified tests and Agrément certificates to demonstrate that the proposed systems meet the performance requirements of the *Specification*. The information shall be to the entire satisfaction of the *Project Manager*. Where applicable, tests shall include static and dynamic results.

- All tests shall comply with the rules and standards laid down by the appropriate testing authorities, unless it can be demonstrated that the final design solution has been previously tested and certified to the acceptance of the *Project Manager*. In any event, the performance of the installed works shall remain the *Contractor*'s responsibility.
- 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 *Specification*.

ii) On-Site testing: The *Contractor* shall include for all on-Site testing specified herein.

e) Include and supply detailed proposals of tests that demonstrate compliance with the requirements of the *Specification* and the *Design Drawings*.

f) The following minimum provisions shall be made available to the *Project Manager* at all times:

i) Suitably qualified personnel using appropriate validated equipment.

ii) All necessary access and facilities for inspection and testing in fabrication shops and on Site.

iii) Regularly calibrated equipment for the purposes of load measuring.

g) Maintain the following:

i) Tests and inspection results during all stages of manufacture, assembly and installation of components.

ii) Certificates relating to the materials used in the work, as confirmation of tests carried out in accordance with the relevant standards and codes.

iii) Records of all inspections and tests performed to substantiate conformity with the *Specification*, including those carried out by sub-contractors and sub-suppliers.

h) Should any test reveal defective material and/ or workmanship, immediately carry out any remedial work and/ or re-testing, including that of a special nature, under instruction from the *Project Manager*.

i) Indicate on the Contract Programme the exact timing of all testing, procedural trials and trial assemblies, in order to allow the *Project Manager* the opportunity of attending.

j) If the *Project Manager* is of the opinion that the works do not conform to the requirements of this document, or to the details indicated on the *Working Drawings*, then the *Project Manager* shall give instructions for special tests to be carried out to establish the case.

A - 6.1.4. AIRTIGHTNESS FAN TEST

a) Not Required

A - 6.1.5. RESULTS AND CERTIFICATES

a) Refer to Works Information requirements.

A - 6.2. STATUTORY REGULATIONS

A - 6.2.1. STANDARDS

a) BSEN Standards shall be the governing standards for the works.

b) Only where expressly stated in the *Specification* shall other standards be applicable to the works.

c) All reference to British and other standards, regulations and requirements of statutory bodies shall mean the latest published editions at the Contract date. Where such standards, regulations and requirements are amended the Contract date and affect the *Contractor*'s responsibilities during the course of the works, immediately inform the *Project Manager*.

A - 6.2.2. BUILDING 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.

A - 6.2.3. SUBMISSIONS TO AUTHORITIES

a) When required by the Statutory Authorities, submit to them any component part of the works for appraisal, testing, stamping or certifying.

b) After such component part has been satisfactorily approved, tested, stamped or certified, return the marked component or documentary evidence of its approval, as appropriate, to Site for reference purposes.

c) If the Statutory Authority rejects components, replace the component part(s) with those that are acceptable.

d) Obtain any approvals required from the Statutory Authorities.

A - 6.3. SAFETY / PROTECTION

Safety

A - 6.3.1. HEALTH AND SAFETY REGULATIONS

a) Comply with the latest Health and Safety Regulations, ensuring that full consideration is given to the health and safety of operatives when completing the *Detailed Design*, manufacturing, installing or operating and maintaining the works.

b) The *Working Drawings* shall only incorporate methods of manufacture, installation, maintenance and use that are safe and comply with all Health and Safety regulatory requirements.

c) Provide safety risk assessments.

Protection

A - 6.3.2. DAMAGE ANTICIPATION

Other than damage through terrorist attack or similar activity, anticipate the possible sources of damage to the works and take active and positive protective measures to maintain them in pristine condition until Completion of the whole of the Works.

A - 6.3.3. PROTECTIVE DEVICES

a) Provide necessary protective devices to protect all goods and materials incorporated into the works, at all stages through to Completion of the whole of the Works against damage arising from weather conditions, construction, other contractors, warping, distortion, abrasion and other conditions which could have an adverse effect on any goods and/ or materials used in the works.

A - 6.3.4. PROTECTIVE MEASURES

Provide full details of the protective measures proposed for implementation at each of the following stages:

a) Manufacture and packaging of goods and materials at off-Site locations.

b) Shipment to Site and unloading.

c) Storage on Site and movement to point of installation or construction.

d) Installation/ construction.

e) Completion to handover.

A - 6.3.5. PACKING AND CRATING

a) Where components are delivered to the Site in packages or crates, then each package or crate shall be labelled on the outside giving the reference and quantity of the contents so that deliveries can be accepted at the Site without the necessity of breaking open any package.

b) Carefully remove all protection from the works immediately before Completion and leave the works clean and ready for use.

A - 6.3.6. PROTECTION OF GLAZED ELEMENTS

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

b) 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.

c) All glass panes, sealants and gaskets shall be stored on Site in accordance with their manufacturer's written recommendations.

A - 6.3.7. PEST INFESTATIONS

a) The *Detailed Design*, manufacture and installation of the works shall protect against and not contain or provide harbourage for infestation by pests.

b) Carry out the recommendations and take account of Digest 415 produced by the Building Research Establishment.

A - 6.4. MAINTENANCE TRAINING AND REPLACEMENT MATERIALS

A - 6.4.1. GENERAL

a) Replaceable materials/ components shall be maximised.

b) Materials shall be capable of simple maintenance/ repair and integration with other maintenance systems.

A - 6.4.2. MAINTENANCE MANUAL

a) Content:

i) The Maintenance Manual shall incorporate all maintenance systems and give details of the safe operation and required maintenance of all items, components and systems comprising the works.

ii) This information shall be supplied for the *Project Manager*'s review in the following format:

- Specially written information shall be on A4 size pages with typed text using double spacing and in a format agreed prior to submission.
- Drawn information shall generally be on A1 size sheets.
- Standard published information shall be carefully selected and edited to include only those items installed. Where editing is not appropriate, the relevant items shall be typed out and included.

b) Component Information: The following information shall be supplied for every item, component and/ or system:

i) Certified manufacturing certificate.

ii) Full description giving any special features. A full breakdown of the parts and the catalogue number of the constituent parts.

iii) The guarantee period of any element or material where in excess of the warranty required by the Contract Documents.

c) Maintenance Procedures: The Maintenance Manual shall include fully comprehensive details in respect of:

i) Safe cleaning procedures for all elements of the works.

ii) Safe replacement procedures.

iii) Regular cyclical maintenance procedures (avoiding damage).

iv) Safe repair procedures in the event of damage.

v) Washing methods, including the frequency and method of washing required to maintain performance and appearance. Details shall be provided in respect of the maximum time during which performance of components can be maintained, together with the frequency and method of washing required to achieve this.

A - 6.4.3. TRAINING OF USER'S PERSONNEL

a) Read in conjunction with the Central Section Project Works Information Volume 2A.

A - 6.4.4. SPARES

a) Where required by the Contract, provide spares upon completion of the works.

b) All spares shall be of identical quality to those installed in the works.

c) In addition, supply a list of recommended spares, together with unit prices for specialist elements of the works.

d) All spares provided as part of the works shall be handed over in crates, boxes or cabinets, each individually marked with the words "Replacement Parts for . " and the component or equipment name and reference number stencilled on. Such materials shall be identified within the Contract Documents.

A - 6.4.5. PROJECT COMPLETION RECORDS

a) Provide necessary Maintenance Manual information for inclusion in the Health and Safety File.

b) In addition, agree with the Project Manager suitable cross-referencing in the Maintenance Manual so that it is fully co-ordinated with the Health and Safety File and other contractors' O&M manuals.

A - 6.5. GENERAL MATERIALS AND WORKMANSHIP REQUIREMENTS

Materials

A - 6.5.1. STANDARD OF MATERIALS AND QUALITY

a) Materials shall be new, unless otherwise specified, carefully selected and of the best merchantable quality.

b) All materials shall be acceptable to the *Project Manager*.

c) Preference shall be given to materials/ products that comply with the European Union (EU) Construction Products Directive (CPD) and are physically labelled with CE marking.

d) Materials shall comply with all the recommendations of the LPC Design Guide for the Fire Protection of Buildings.

e) Foamed insulation used in the works shall be manufactured using HFC- CFC- and HCFC-free processes, i.e. zero ODP and a global warming potential of less than 5.

f) Insulated foam core sandwich panels shall not be used in the works unless the *Contractor* complies with all the recommendations of:

i) 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 edition, or

ii) Factory Mutual (FM) Approval standards, or

iii) Independent fire consultants such as Arup Fire or Warrington Fire.

iv) BS 476: Parts 6 and 7.

g) Insulation materials shall be either non-combustible or not easily ignitable (to a minimum of Euroclass A2 and other applicable international standards), and shall not produce measurable quantities of smoke or toxic gases.

A - 6.5.2. HEALTH HAZARDS

All proposed materials shall not in any way be a potential health hazard. Maintain a full, up-to-date knowledge of all current published research and legislation in this respect. The *Contractor* shall also accept the exclusions contained in the Contract documents.

Workmanship

A - 6.5.3. SKILLED PERSONNEL

Execute the work using persons skilled in the processes to be adopted. Where requested, provide such documentation necessary to demonstrate an individual's ability to carry out the work to which he has been assigned.

A - 6.5.4. SUITABILITY OF STRUCTURE

Before commencing any part or element of the works, survey the structure, checking line, level and fixing points and report immediately to the *Project Manager* if the structure is considered to be unsuitable. If the structure is unsuitable, propose remedial action.

A - 6.5.5. SETTING OUT

a) Establish a physical Base Reference Datum on Site from which all primary plan positioned grids and principal levels are subsequently set out. This Base Reference Datum point shall be strategically placed such that it can be referred to as necessary for the duration of the works. It shall be physically robust and located in ground that is not prone to movement or vibration during the works so that it is spatially fixed for the duration of the works. The Base Reference Datum shall be located to within ±2mm accuracy of the design dimension to the designated reference point.

b) Suitably qualified personnel shall carry out all primary setting out. It shall be done using instruments and methods appropriate for achieving the necessary precision and accuracy.

c) Prior to commencing the installation, submit to the *Project Manager* the proposed method of setting out, how grid lines shall be marked on Site and how their positions shall be checked and maintained for the duration of the works.

d) The plan position of any designated mark (measured to its centre) defining a Primary Positional Grid Line shall be located to within ±2mm of its design dimension from the Base Reference Datum.

A - 6.5.6. PROJECT TOLERANCES DEFINITIONS

a) Tolerance: The defined maximum allowable dimensional deviation from a prescribed or agreed value or position.

b) Base Reference Datum: The physical marker established on Site to define the base reference plan and level position to which all other Site setting out is referenced.

c) Dimension: Any prescribed dimension, or any dimension which can be determined from a set of prescribed dimensions, for any element or part thereof as defined by the designer responsible for that element.

d) Primary Positional Grid Line: Any setting-out grid line used to define the spatial layout of the project and to which the local setting out of elements may be referenced.

e) Location Reference Point: A specified point that is used to define the position of certain other points and/ or elements.

f) Location Reference Plane: A specified plane that is used to define the position of certain other planes and/ or elements. The reference plane shall typically be defined by a specified set of reference points.

g) Location Reference Surface: A specified surface that is used to define the position of another surface and/ or surfaces. The reference surface may be defined mathematically (e.g. as part of a cylinder or as part of a sphere) where it is spatially fixed in relation to specified reference points.

h) Reference Element: A specified element that is used to define the position of other elements. Typically a specific point on the reference element shall be defined to any other element to which it refers.

A - 6.5.7. COMPATIBILITY

Ensure that all materials and processes employed in the works are compatible with each other and meet the current requirements of the relevant British Standards, Codes of Practice and the Employers Standard Baseline.

A - 6.5.8. MANUFACTURER'S RECOMMENDATIONS

a) The method of building or installing the works shall be in accordance with manufacturer's written instructions/ recommendations, with copies of all such documentation being supplied to the *Project Manager* prior to commencement of the works.

b) All materials and associated components shall be stored in a clean dry area, in accordance with the manufacturer's recommendations.

A - 6.5.9. SUPPLIERS

Be responsible for all materials, components and equipment supplied or manufactured by sub-contractors or suppliers, until the end of the warranty period defined in the Contract.

A - 6.5.10. CUTTING

a) All methods, principles, details, etc. for Site cutting of components shall be submitted as part of the *Contractor*'s method statement to the *Project Manager* for review. No manufacture shall commence until it can be demonstrated that all proposed techniques have been reviewed by the *Project Manager*.

b) Cutting of metal products shall be straight and free from burrs and all joints shall be flush, without gaps or imperfections. If base metal is exposed, the surface shall be protected to the same level of protection as stated in the *Specification*.

c) All edges, unless specifically required otherwise by the *Specification*, shall be lightly arrised and smooth, free from sharp surfaces, snags or points.

A - 6.5.11. DETERIORATION

a) All materials shall be treated/ selected to prevent any damage from all possible combinations of atmospheric deterioration, corrosion, wet rot, dry rot, fungi, mould and all other deleterious effects including atmospheric pollution and pH factor of the adjacent elements.

b) Ensure that no chemical or electrolytic action takes place where dissimilar metals and/ or materials are used together.

c) No materials shall discolour, crack or otherwise be damaged by the worst possible combination of environmental conditions identified herein.

d) With materials subject to surface treatment, special attention shall be given to the substrate to ensure that the preparation is compatible with the surface treatment.

e) Ensure that all superficial dust and friable materials are removed and that adequate protection is provided during the process of the surface treatment and finishes to prevent contamination by dust and other debris.

f) Materials used in the manufacture of the works shall not be liable to infestation attack by micro-organisms, fungi, insects or other vermin, nor provide harbourage for same.

A - 6.5.12. LINE AND LEVEL

All components shall be installed such that they are plumb or horizontal and shall line up with adjacent components, in all directions, taking account of the allowable tolerances as defined in the *Project Common Tolerance and Movement Document*.

A - 6.5.13. METHOD STATEMENTS

Provide detailed method statements describing the sequence and methods to be employed in carrying out the works identifying proposed solutions and processes with regard to workmanship, fabrication, fixing, securing, storing and handling, setting out, site assembly and protection.

A - 6.6. PERFORMANCE REQUIREMENTS

A - 6.6.1. DURABILITY

a) Refer to A - 5.2 series clauses.

b) Materials, systems and components shall be:

i) Durable and have a high life expectancy preventing the need for frequent replacement.

ii) Robust providing protection against potential malicious or physical abuse. The external wall construction, to areas subject to vehicle movement, shall incorporate additional measures to protect the façade from damage from vehicle movements to the acceptance of the *Project Manager*.

iii) Reusable at the end of the building's useful life where possible.

A - 6.7. PRODUCTS AND MATERIALS

A - 6.7.1. DELETERIOUS MATERIALS

The following materials shall not be used in the works unless it can be demonstrated, to the satisfaction of the *Project Manager*, that they are safe during manufacture, installation and use and that their suitability is ensured:

a) Asbestos or asbestos-containing products, as defined in the United Kingdom's The Control of Asbestos Regulations 2006, or any statutory modification or re-enactment thereof.

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

e) Pitch polymer DPC.

f) Materials which generally comprise mineral fibres, either man-made or naturally occurring, which have a diameter of 3 microns or less and a length of 200 microns or less, or which contain any fibres not sealed, encapsulated, or otherwise stabilised to ensure that fibre migration is prevented. Products that may contain these fibres include insulation, fire protection and air filters. For all mineral fibre insulation products, test evidence must be available and produced confirming that the materials fulfil the requirements of European Directive 97/ 69/ EC and the Approved Supply List of current HSE CHIP Regulations and consequently are not classified as a possible human carcinogen.

g) Chlorofluorocarbons or hydrochlorofluorocarbons or any goods and/ or materials containing the same (e.g. materials in which CFCs, HCFCs or HFAs have been used as blowing agents)

h) High alumina cement in structural elements.

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

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

k) 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.

l) Polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs) or any goods and/ or materials containing the same.

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

n) Lindane - wood treatment/ insecticidal spray.

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

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

q) Tributyltin (TBT).

r) Medium density fibreboard (MDF) which is neither zero formaldehyde nor conforms to class E1 according to BS EN 13986.

s) If wishing to use any of the materials that are listed above, prepare detailed observations for the *Project Manager* based upon the guidelines contained within the document 'Good Practice in the Selection of Construction Materials' prepared by Ove Arup & Partners.

t) The supplier must demonstrate that the materials will not be hazardous in the event of a fire. In particular, the supplier must confirm that:

   i) Any powder coatings contain no materials that might be toxic in the event of a fire (e.g. Epoxy Resin coating), and

   ii) Any laminated glass will not produce toxic or irritant fumes in the event of fire.

A - 6.7.2. SUSTAINABLE SOURCES OF TIMBER

a) All timber and wood based products for both temporary and permanent uses within the works shall be procured only from Legally Sourced Timber and from Certified Sustainable Sources.

b) Legally Sourced Timber means timber sourced in accordance with the definition of Legally Sourced Timber in BREEAM Credit Mat 5 - Responsible Sourcing of Materials, AND which is not listed on Appendix I of the Convention on the International Trade in Endangered Species (CITES); or if a timber species is listed in Appendix II or III of CITES, that the timber is the subject of a valid, legal import permit or certificate issued in accordance with CITES Article VI. Information about CITES can be found at http://www.cites.org/ . Authentication documentation for any hardwood timber should be carefully checked.

c) Certified Sustainable Sources means timber that carries the Forest Stewardship Council's (FSC) Trademark or has a certified FSC Chain of Custody certificate or that fits the definition of a Tier 1 Legal and Responsibly Sourced product in BREEAM Credit Mat 5 - Responsible Sourcing of Materials (i.e. CSA, SFI with CoC, PEFC, or Reused Timber).

d) Tropical hardwoods in timber or timber-based products (including but not limited to veneers, lippings and manufactured board) shall be avoided. Where use of tropical hardwoods cannot be avoided, all tropical hardwoods must be sustainably sourced (FSC or accepted equivalent as per sub-clause d)) AND must not be listed on any of the CITES appendices for endangered or threatened species (Appendix I, II, or III).

e) Tropical hardwoods or timber-based products from unsustainable or unknown origin are prohibited from use in the works.

f) All timber and timber-based products shall carry the Forest Stewardship Council's (FSC) Trademark or other label from an equivalent internationally recognised, globally applicable, independent certification system for good forest management, acceptable to the BRE.

g) All plywood used in the works shall preferentially be from softwood or temperate hardwoods from sustainable sources. Where use of tropical hardwoods cannot be avoided, all tropical hardwoods must be sustainably sourced (FSC or accepted equivalent as per sub-clause d)) AND must not be listed on any of the CITES appendices for endangered or threatened species (Appendix I, II, or III).

h) Provide information to the *Project Manager* in respect of timber products proposed for use in the works for review and acceptance by the *Project Manager*. No timber products shall be procured prior to acceptance of the proposed timber products by the *Project Manager*. The information shall be presented to the *Project Manager* in tabular form under the following headings:

   i) Country of Origin.

   ii) Trade Name.

   iii) Botanical Name.

   iv) Wood Product Volume Category A (m^3).

   v) Wood Product Volume Category B (m^3).

   vi) Wood Product Volume Category R (m^3).

   vii) Total Volume (m^3), where timber is:

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

i) Proof of the source of supply and all chain of custody certificates, including full shipping documents to confirm the chain of custody from the concession/ plantation to the supplier's premises, shall be supplied for retention by the *Project Manager*.

A - 6.7.3. CEMENT SUBSTITUTES

a) Not required

A - 6.7.4. END OF LIFE DISASSEMBLY FOR REUSE OR RECYCLING

a) Not required.

End of Section

C90. ALTERATIONS/SPOT ITEMS

To be read in conjunction with Section A and other related sections of the Specification,

Preliminaries and Contract Conditions.

C90 - 1. SCOPE AND SUBMITTALS

C90 - 1.1. SPECIFICATION TYPE

C90 - 1.1.1. DESCRIPTIVE WORKS

a) Undertake the *Detailed Design*, supply, install and warrant the works complying with the visual intent indicated on the *Design Drawings* and criteria stated in the *Specification*.

b) Where no material, product or supplier is indicated in the *Specification*, the Contractor shall propose suitable materials and systems prior comply with the visual intent and performance criteria stated in the Works Information and remain fully responsible for the *Detailed Design* of the works.

c) Where a particular material, product or supplier is indicated in the *Specification*, such material, product or supplier shall be deemed indicative representing the Employer's design intent only. The *Contractor* may complete the installation using that product, or such other confirmed as acceptable by the Project Manager, but shall remain fully responsible for the *Detailed Design* and performance of the works.

C90 - 1.1.2. Scope of Works

This work section provides particular requirements with respect to the following:

a) Safe methods of removal and alteration.

b) Protection of retained works.

c) Alterations

i) Careful removal of existing green roof system, roof membrane, roof fixtures, repair and remedial works to existing timber deck.

ii) Careful removal of timber perimeter roof profiles and rainwater outlet spouts and reinstatement of new plywood timber perimeter profiles.

iii) Careful cut back and removal of timber balcony deck and wall lining construction and reinstatement of new timber supports fixed to new support posts, new timber decking and new timber wall linings.

iv) Installation of new metal roof edge protection guardrail.

v) Installation of metal permanent anchors, hanging brackets and systems for ladder storage and access to roof levels.

vi) Inspection and testing of existing mansafe cable stay systems.

vii) Renew and reinstate lightning protection tape.

d) Completion of the works as described herein.

e) Observance of Health and Safety requirements. Refer also to the Trade Contract documentation.

f) Method statements.

C90 - 1.1.3. Adjacent Occupation

a) At all times take suitable measures to ensure that owners and occupiers of any property adjacent to the works are not unduly or unreasonably inconvenienced by the work. This shall include problems which may be associated with noise, dust, vibration, smell, access and other disturbance which might have a detrimental effect on the local community, owners and occupiers.

b) In the event of complaints arising from any of the aforementioned, then take immediate steps to eliminate the cause of the problem and rectify any damage done and indemnify the Project Manager from and against all claims arising out of such cause.

c) Be totally satisfied before Tendering that the general or specific processes intended for use during the Contract shall not result in problems for adjoining owners/ occupiers and their property. No claim shall be entertained if the Contractor is forced to alter his method of working as a result of complaints to the aforementioned.

C90 - 1.1.4. Survey Benchmarks

Not applicable

C90 - 1.1.5. Clearance

Not applicable

C90 - 1.1.6. Schedule of Conditions

a) Agree a Schedule of Conditions of the existing adjacent areas with the Project Manager.

b) Upon completion of the Contractor's work a joint inspection with the Project Manager shall be made of adjacent areas to agree and record their condition, including record photographs which shall be taken at the Contractor’s expense and submitted for retention by the Project Manager.

c) Any damages so occasioned shall be rectified at the Contractor's expense.

C90 - 1.2. DESCRIPTION OF WORKS

C90 - 1.2.1. Stripping out

Any stripping out to roof membrane, flashing, fixtures and fittings shall be carried out such that damage to adjacent roof, floor and wall systems shall be prevented.

C90 - 1.2.2. Features to be Retained

Note the extent of the works as indicated in the design drawings and specification to ensure that permanent retained structures are maintained and/ or restored throughout the works.

C90 - 1.2.3. ALTERATION: ALT-01 Removal of existing roof systems, inspection and remediation of existing timber deck.

Note the extent of the alterations required, as indicated in the Works Information drawings:

a) Careful removal of existing green roof system inclusive of all green roof components.

b) Careful removal of existing roof membrane and all associated trims, flashing, copings and fixtures.

c) Allow to temporary provisions to maintain integrity of roof lightning protection tapes.

d) Make proposals for temporary weather protection to exposed roof deck to maintain adequate weather protection in temporary condition.

e) Inspect and report on roof deck condition in consultation with RFS-01 Roof membrane installers.

f) Agree scope for repair and remedial works to existing timber deck as required to provide substrate suitable to receive RFS-01 roof membrane.

g) System to coordinate with all requirements for adjoining new systems including:

i) RFS-01 Roof Membrane.

ii) RFS-02 Green Roof.

iii) ALT-02 Removal, repair and reinstatement of roof timber perimeter profiles.

iv) Structural engineer requirements associated with integrity of existing timber deck/roof constructions.

C90 - 1.2.4. ALTERATION: ALT-02 Removal, repair and reinstatements of roof timber perimeter profiles.

Note the extent of the alterations required, as indicated in the Works Information drawings:

a) Carefully remove existing timber fascia, projecting rafters and drainage spout formwork to roof perimeter as described in design drawings.

b) Undertake timber repairs to existing retained timber at roof perimetres. The extent of timber repairs is to be assessed and agreed with the architect and contract administrator following removal fascia timber.

c) Allow to temporary provisions to maintain integrity of roof lightning protection tapes.

d) Make proposals for temporary weather protection to exposed roof edge areas to maintain adequate weather protection in temporary condition.

e) Timber repair scope assumed to include:

i) Smaller areas of decayed timber, of less than 50mm in diameter may be repaired using two-pack epoxy subject to location.

ii) Areas of timber decay which are too large for patch repair and where wider replacement of the timber is necessary should be identified.

iii) In these instances, spliced repairs should be made by cutting out rotten wood and splicing or scarfing-in timber inserts which are shaped to obtain the maximum strength and to match the existing profiles.

f) Install new plywood roof fascia assemblies as described in design drawings. Plywood type suitable for location, exposure, use and visual appearance requirement:

i) Appearance Class: to BS EN 635.

ii) Exposure type; Exterior Use – fully exposed (Service Class 3).

iii) Risk Type: Use Class 3: Exposed to weather subject to frequent wetting.

iv) Birch Finish to exposed face. Provide sample for acceptance of Client Representative.

v) Assume Marine Grade Ply or similar.

vi) Refer to C90 Clause 1.2.6 for further requirements for timber type and finish.

g) New fascia, edge/verge and drainage spout assemblies to be constructed using discrete mechanical and glue fixings and to be formed and installed in sections.

h) Fascia assemblies to be securely fixed to existing timber and to new steel angle.

i) Form Ventilation slot with robust stainless steel vermin control mesh backing.

j) New plywood to receive weather sealant.

k) New plywood fascia and drainage assemblies to coordinate with requirement for the application of lead coping and flashings as Specification H71 RFS-03 Custom Formed Metal Copings, Flashings and Outlets.

l) Supply shop drawings describing proposed timber assemblies and arrangements.

m) Supply sample of proposed timber types and applied finish.

n) Provide Mock-Up of typical fascia and rainwater outlet spout arrangement for Client Representative acceptance.

o) Provide Quality Benchmark installation of 3 linear meter of typical fascia and rainwater outlet spout arrangement for Client Representative acceptance.

p) System to coordinate with all requirements for adjoining new systems including:

i) RFS-01 Roof Membrane.

ii) RFS-02 Green Roof.

iii) RFS-03 Custom Formed Metal Copings, Flashings and Outlets.

iv) ALT-01 Existing Roof removal and deck remediation

v) ALT-03 Removal, repair and reinstatement of timber balcony.
vi) ALT-04 New metal guardings.
vii) ALT-05 Metal Ladder Restraint systems.
viii) Structural engineer requirements associated with systems fixings and steel angles and profiles.
ix) Structural engineer requirements associated with maintaining integrity of existing timber deck/roof constructions.

C90 - 1.2.5. ALTERATION: ALT-03 Removal, repair and reinstatements of timber balcony assembly.

Note the extent of the alterations required, as indicated in the Works Information drawings:

a) Inspect and report on timber balcony condition and agree locations for cutting and removal of timber with client representative. The design drawings describe current intent for removal and replacement of timber elements.
b) Undertake timber repairs to existing retained timber at roof perimeters. The extent of timber repairs is to be assessed and agreed with the Client Representatives. Timber repair methodology assumed to include methods described in ALT-02.
c) Carefully cut back and remove existing timber balcony members as described in design drawings including:
  i) Cut back of timber floor beams to location to be agreed with Client Representative and Structural Engineer.
  ii) Carefully remove timber decking and timber supports.
  iii) Carefully removed timber balcony wall lining members.
d) Make proposals for temporary weather protection to interfaces with walls fronting interior spaces and roof areas. Maintain adequate weather protection in temporary condition at all times.
e) Provide new support foundations in line with Structural Engineers proposals.
f) Provide new timber columns with metal plate fixing arrangement fixed to new timber beams. Timber to match existing timber type and finish. Timber provided to suit Structural Engineers requirements.
g) Provide new timber decking and timber secondary supports to form new balcony floor.
  i) Contractor to make proposal for timber decking type to match existing building appearance.
h) Provide new timber uprights spanning between floor and roof edge including timber guarding assembly with vertical balustrades, timber high level louvres and timber top and bottom rails.

i) Timber to be British Douglas Fir, BS 4978 Visual, Strength Grade CS 18 SS; where visible above deck level. Contractor to propose all architectural timber of appropriate specification to suit exposure type, use and appearance requirements. Make submission and supply sample for Client Representative acceptance.

i) Refer to C90 Clause 1.2.6 for further requirements for timber type and finish.

j) Supply shop drawings describing proposed timber assemblies and arrangements.

k) Supply sample of proposed timber types and applied finish.

l) System to coordinate with all requirements for adjoining new systems including:

i) RFS-03 Custom Formed Metal Copings, Flashings and Outlets.

ii) ALT-02 Removal, repair and reinstatements of roof timber perimeter profiles.

iii) Structural Engineering Design and Specification.

iv) Structural engineer requirements associated with maintaining integrity of existing timber deck/roof constructions.

C90 - 1.2.6. ALTERATION: ALT-02 / 03 Timber Type General Requirements.

This clause describes the general requirement for external timbers:

a) Visible Structural Timbers including Rafters:

i) Species: 'Douglas Fir ' softwood timber.

ii) Planed all round. Square edges

iii) Surface blemishes/Knots to max 25% of the width of each face. Dropped knots not acceptable.

iv) Structural graded to structural engineers specification generally BS EN 338 class C16, but stamps should not visible on the finished building.

v) Finish: Smooth. Planed PAR.

vi) Surface treatment: matt, transparent weather sealer to suit location. Clear sealer to be used in external areas to protect the boards from moisture and mould growth.

vii) Moisture content to suit structural use and location.

b) Hidden Structural Timbers such as above cantilevers:

i) Species: softwood timber.

ii) Finish: Sawn

iii) Structural graded to structural engineers specification generally BS EN 338 class C16.

iv) Moisture content to suit structural use and location.

c) Boards:

i) Birch Ply Grade BB. Boards Free from decay and insect attack (including pinholes) and free from knots and splits on face to be exposed.
ii) Refer to Design Drawings for exposure faces.
iii) Grade: EN314-2 Class 3 Exterior Grade
iv) Finish: Smooth
v) Surface treatment: matt, transparent weather sealer to suit location. Clear sealer to be used in external areas to protect the boards from moisture and mould growth.
vi) Thickness size: Generally Nominal 24mm. Refer to Design Drawings.
vii) Joints coordinated to not be visible from below.
viii) Pattern Direction: To be propose by installer to Client Representative acceptance.
ix) Moisture content to suit location.

d) Fixing:
i) Fixed securely to each support with flat, true surfaces free from undulations, splits, hammer marks, scratches and protruding fastenings.
ii) Movement of timber: Allowed for when positioning boards and fastenings to prevent cupping, springing, opening of joints or other defects.
iii) Heading joints (where permitted): End matched, butted and, where applicable, positioned centrally over.

C90 - 1.2.7. Temporary Supports

Maintain temporary support structures until the completion of permanent supporting structures.

C90 - 1.2.8. Quality Benchmarks

Provide quality benchmarks in accordance with General Requirements clause A-4. A suitable area identified for each process proposed for the demolition of elements abutting elements which are to be retained in the final works:

C90 - 1.2.9. Licences/Approvals

Obtain all necessary licences and approvals for street closures, scaffolding or hoarding and also provide all hoardings, fencing, lighting, barricades, platforms, props, handrails, etc., as required by the Statutory Authorities or the Project Manager.

C90 - 1.2.10. Health and Safety

Carry out all work in accordance with:

a) The Health and Safety at Work Act 1974, etc.
b) All relevant current British Standards and Codes of Practice.
c) All relevant Building Regulations and Statutory requirements.
d) Health and Safety Executive (HSE) Directives and other requirements.

e) Construction Design and Management (CDM) Regulations and Approved Code of Practice (ACOP).

f) The Contract Documents.

C90 - 1.2.11. COSHH Assessment and Safety Method Statement

a) Prior to the start of demolitions/excavation and filling work, undertake an assessment in accordance with the Control of Substances Hazardous to Health Regulations (COSHH) 1988 which takes due account of the waste and contaminated materials (solid, liquid and gaseous) likely to be encountered. Details of Site investigation findings, including chemical data, have been issued with the Contract Documents.

b) Following the COSHH assessment produce a written Safety Method Statement which describes in detail the manner in which the workforce (including any sub-contractors), other Site personnel and the general public in the surrounding neighbourhood shall be protected during the course of the works.

c) No demolitions/ excavation or filling work shall be carried out until the Method Statement has been formally accepted in writing by the Project Manager.

d) Any airborne emissions of dust shall be minimised by judicious water spraying combined with careful handling of waste materials, e.g. during loading into lorries.

C90 - 1.3. PERFORMANCE REQUIREMENTS

C90 - 1.3.1. GENERAL:

Comply with the general performance requirements of Section A of the Specification and the following specific performance requirements.

C90 - 1.3.2. STANDARDS

The Contractor developing the design is to comply with the current versions of the prevailing BS EN and industry best practice standards.

Structural Performance

C90 - 1.3.3. 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.

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.

C90 - 1.3.4. MOVEMENT;

a) The works shall be capable of accommodating the following movements without any permanent deformation or reduction in the specified performance:
   i) Due to deflection under design loads.
   ii) Due to the effects of repeated wind loading.
   iii) Due to changes in dimension and shape of components arising from building movements, including settlement, creep, twisting and racking.
   iv) Due to moisture movement.

C90 - 1.3.5. LIVE/ IMPOSED LOADS:

The works (green roof system, perimeter stone, insulation and all aspects of the waterproofing system) shall be capable of accommodating the following live loads without any reduction in performance for the design life specified. Be responsible for selecting materials to suit the following loading conditions:

a) All loads resulting from movements of the building structure and support structure of the works.
b) Vertically applied loads acting on the surface of the works arising from maintenance and cleaning operations.
c) Roof loads (including snow and snow drift loads) to be calculated in accordance with BS 6399: Part 3 for a roof with access for cleaning and maintenance.
d) Impact loads, or transferred impact loads, that occur during their service life, without deterioration in performance and without sustaining non-repairable damage.
e) The loads created by rainwater.
f) Loads imposed by water testing (including within gutters).

C90 - 1.3.6. ATTACHMENT/ WIND LOADS:

a) Design/ Select the method(s) of attachment of the roofing system to withstand, without permanent deformation, the positive and negative effects of wind loads on the roofing.
b) Design wind pressures: Refer to Section A-5.
c) Ensure that the method(s) of attachment makes sufficient provision for relative movement of materials and effects of vapour pressure; do not perforate the covering and do not reduce the performance of the vapour control layer below that required.
d) Flotation of the insulation shall be prevented.

C90 - 1.3.7. THERMAL MOVEMENT:

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

b) The annual surface temperature ranges for the materials used in the works shall be confirmed by the *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.

Environmental Performance

C90 - 1.3.8. MOISTURE MOVEMENT:

The works shall withstand the following movements without permanent deformation or any reduction in the specified performance:

a) Due to changes in the moisture content of their components, resulting from variations in the moisture content of the air, either inside or outside the building.

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

C90 - 1.3.9. THERMAL PERFORMANCE REQUIREMENTS:

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

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

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

d) U-value calculations shall be based on wet roof conditions.

C90 - 1.3.10. SOLAR PERFORMANCE:

a) Exposure to sunlight during the lifetime of the works shall not reduce the performance nor adversely affect the visual appearance of any element/ component. Take into consideration expected solar performance under varying conditions of solar radiation and external/ internal air velocity.

b) Submit independently certified test data in respect of solar and visible light performance confirming compliance with the *Specification*.

c) All insulation shall be adequately protected from ultraviolet light degradation.

C90 - 1.4. SUBMITTALS

C90 - 1.4.1. Site Survey

Before commencing any demolition work or the manufacture of any elements, examine all available information, carry out a condition survey of the Site and adjacent areas and submit a method statement and a survey report to the Project Manager, covering all relevant matters listed below and in the relevant Health and Safety Executive Guidance Notes. Refer also to the Structural

Engineer's and Site information supplied in the Health and Safety File.

a) The form, condition and demolition methods of the structure(s).

b) The form, location and removal methods of any toxic or hazardous materials.

c) The type and location of adjoining or surrounding premises that may be adversely affected by noise, vibration, dust or removal of structure.

d) The identification and location of services above and below ground.

C90 - 2. MATERIALS/PRODUCTS

C90 - 2.1. GENERAL

C90 - 2.1.1. Precise details of materials may be developed in consultation with the Project Manger to take account of specific conditions found on site.

C90 - 2.2. TIMBER

C90 - 2.2.1. General:

a) Ensure that timber is 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.

b) Identify existing timber species and provide any replacement items/ elements to match in accordance with BS 7359.

c) Provide timber for joinery specified as 'clear finished' to comply with BS EN 942: Class CSH.

d) Treat all timber in accordance with BS 5268, after machining and before assembly. Brush apply the manufacturer's recommended preservative to all cut and machined surfaces before assembly.

e) The works shall be in accordance with Section Z10 of the Specification.

C90 - 2.2.2. Plywood:

a) Shall satisfy the requirements of the relevant standards.

b) Thickness to suit the design and performance requirements.

c) Dimensional tolerances shall be in accordance with British Standards and shall satisfy any additional requirements of the Specification.

C90 - 2.2.3. Timber Boards:

a) Timber Board should comply with BS 8201 BS EN 942, BS EN Iso 14021, BS EN 1313 and shall satisfy any additional requirements of the Specification .

C90 - 2.3. FIXINGS

C90 - 2.3.1. Refer to Section Z20 of the Specification for general requirements.

C90 - 2.3.2. All structural fixings shall be stainless steel grade 1.4401 of a size recommended by the manufacturer to achieve the performance criteria of the Specification.

C90 - 2.3.3. All structural fixings shall be capable of physical inspection in accordance with BS 6037 and Health and Safety Directives.

C90 - 2.4. ADHESIVES

C90 - 2.4.1. General:

a) Refer to Section Z20.

b) Determine suitable adhesives to achieve the requirements of the Specification.

c) Adhesives for timber shall be to BS EN 204 or to the manufacturer's specification, as applicable.

d) Adhesives shall be compatible with the proposed finishes and any preservative/ fire retardant treatments.

C90 - 2.5. SEALANTS

C90 - 2.5.1. General:

a) Refer to Section Z22.

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 or staining.

C90 - 3. FABRICATION AND WORKMANSHIP

C90 - 3.1. WORKMANSHIP

C90 - 3.1.1. Generally

a) Ensure that Site staff responsible for supervision and control of the works are experienced in the assessment of the risks involved and in the methods of demolition to be used.

b) Take account of the Site limitations and restrictions as to access and the use of equipment and plant necessary to complete the works.

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

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

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

C90 - 3.1.2. Control of Dust

Control dust caused by the works to avoid inconvenience to the public in general and to occupants of adjacent buildings.

C90 - 3.1.3. Health Hazards

Take adequate precautions to protect Site operatives and the general public from health hazards associated with dangerous fumes and dust arising during the course of the works.

C90 - 3.1.4. Unknown Hazards

Record any unknown voids, tanks, chemicals, etc. discovered during the works, and agree with the Project Manager methods for safe removal, filling, etc.

C90 - 3.1.5. Adjoining Occupied Property

When creating openings in structure(s) against adjoining property:

a) Leave adequate temporary support and protection at each stage and arrange for inspection by the Project Manager and maintain and alter temporary supports and protection as necessary as work progresses.

b) Cause a minimum of damage to adjoining property and leave no unnecessary or unstable projections.

c) Do not disturb support to foundations of adjoining property.

d) Report to the Project Manager any defects exposed or becoming apparent in adjoining property.

e) Promptly repair and make good any damage caused to existing structure(s), insulation or finishes to adjoining property by demolition work and maintain safety, integrity, stability, weather protection thermal properties and security, all to the satisfaction of the Project Manager.

C90 - 3.1.6. Creating Openings in Existing Structure(s)

a) Create openings to BS 6187 and in consultation with the Structural Engineer including any special cutting requirements, to the Project Manager's acceptance.

b) Leave partly demolished structure(s) in a stable condition, with adequate temporary support at each stage to prevent risk of uncontrolled collapse prior to the installation of lintels and precast surrounds.

c) Prevent debris from overloading scaffolding platforms.

d) Prevent access of unauthorised persons to partly demolished structure(s).

e) Leave all structures safe outside working hours.

C90 - 3.1.7. Preparation of Solid Backgrounds

a) Complete all cutting, chasing, plugging and making good required in the adjacent structure.

b) Remove all loose material by brushing thoroughly on the base and adjacent wall structure.

c) Ensure that noggings, bearers, etc. required to provide fixing points for linings running parallel with, but offset from main structural supports, or to support fixtures, fittings and services, are accurately positioned and securely fixed. After fixing panels/linings mark positions of noggings and bearers, for following trades.

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

C90 - 3.1.8. Tolerances

Ensure that all tolerances in manufacture and installation of components are appropriate for the intended application such that the works when completed match as closely as possible to the details and appearance of the existing retained elements.

C90 - 3.1.9. STORAGE general:

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

b) Adequate storage shall be provided for all components to maintain them dry, 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.

C90 - 3.1.10. PREPARATION general:

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

b) All loose material shall be removed.

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

C90 - 3.1.11. INSTALLATION general:

a) The works shall be installed true to detail 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) The works shall be installed square, regular, true to line, level and plane with a satisfactory fit at all junctions, to the stated tolerances.

d) Acceptance shall be obtained from the Project Manager before drilling or cutting parts of the structure, other than where indicated on the Working Drawings.

e) Do not cut, drill or otherwise alter the work of others to accommodate the system installation without first seeking the acceptance of the Project Manager.

f) Do not alter prefinished surfaces except where shown on the Working Drawings or otherwise agreed with the Project Manager.

g) 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.

h) Where applicable, 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 system manufacturer/ supplier.

j) Where applicable, isolating tape, plastic washers or other suitable means shall be used to prevent bi-metallic corrosion between dissimilar metals.

C90 - 3.1.12. TOLERANCES

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 Contractor shall verify, with the appropriate supplier/ trade contractor, that such dimensions and locations are correct. Any deviation shall be agreed with the Project Manager.

o) Account shall be taken of the installation tolerance requirements such that repetitive elements are accurately located, relative to gridlines.

p) Tolerances shall not be cumulative. The most onerous tolerance shall apply.

C90 - 3.1.13. Fixing Linings/ Repairs to Timber

a) Set out components accurately, true to line and level, free from undulations, with lines and joints aligned, straight and parallel unless specified otherwise.

b) Fix components securely to prevent pulling away, bowing, or other movement during use.

c) Make adequate allowance for future moisture and temperature movement of panels/support structure.

d) Ensure that methods of fixing and fastenings are, where appropriate, as recommended by the manufacturer or in the case of reused materials suitable for the application of the material and generally in accordance with the methods adopted for retained adjacent elements.

e) Note that trims are to be in unjointed lengths between angles or ends of runs. Where running joints are unavoidable, obtain approval of location and method of jointing. Angle shall match those of adjacent relevant.

C90 - 3.1.14. FIXINGS:

a) Refer to Section Z20.

b) All fixings shall be installed in accordance with the manufacturer's recommended procedures.

C90 - 3.1.15. ADHESIVES:

a) Refer to Section Z20.

C90 - 3.1.16. SEALANTS

a) Refer to Section Z22.

b) Sealants shall not compromise the integrity of the works.

c) Apply as a continuous bead unless specified or recommended otherwise by the manufacturer.

C90 - 3.1.17. FLASHINGS/TRIMS:

Joints in flashings/ trims shall be installed to fully accommodate thermal movement. Proprietary expansion joints shall be installed on flat sheets wherever practicable. Joints generally shall be in accordance with the system manufacturer's recommendations.

C90 - 3.1.18. Workmanship Generally

a) Produce joinery in accordance with good quality joinery practice as follows:

i) Undertake as much fabrication as possible in humidity controlled workshops equipped with modern machinery manned by skilled joiners.

ii) Restrict site work to fixings and other operations that cannot be undertaken as last stated.

b) Produce joints by traditional or modern machine-shop practices that comply with the following:

i) Use joints designed to tighten under stress and to not form a weak link in the assembly.

ii) Wherever possible, use joints that are not wholly dependent upon adhesive.

iii) Provide for movement in joints where necessary otherwise glue all joints.

iv) Design joints to conceal the end grain of natural wood or the edge of laminated or particleboards.

v) Make joints capable of being assembled dry as a push fit with all joint surfaces in full contact and only fine joint lines visible.

vi) Ensure that joint widths match adjacent areas.

C90 - 3.1.19. Finished Appearance

a) Ensure that, in so far as is reasonably practicable, all new works match the appearance, form, colour and texture of adjacent retained elements except where explicitly stated in the Works Information drawings and/or specification.

b) Provide joinery for clear finishing to match existing elements, which is finely finished to remove cutter or sanding marks, raised grain, stains or other blemishes.

c) Provide angles and edges slightly rounded with exposed edges and vulnerable edges pencil rounded.

d) Ensure that moving and closing parts fit accurately and easily. Visible gaps between fixed and moving parts shall be a consistent width not exceeding 1mm.

e) Ensure that trims are properly mitred or scribed as necessary. Pin and stop for decoration. Fix clear finished work with brass or sherardised pins and stop with matching stopper or otherwise conceal.

C90 - 3.1.20. Clear Finishes to Timber

Fill nail holes with stopping coloured to match timber. Scrape, sand and fill wood surfaces to give a smooth, closed surface free from sanding marks.

C90 - 3.1.21. Completion

a) Installed works shall be left clean.

b) All work necessary to provide a weathertight finish shall be satisfactorily completed.

c) Defects shall be repaired without delay, to minimise damage and nuisance.

d) A representative of the system manufacturer shall inspect the works and notify the Contractor of any defects. All defects shall be corrected

e) Clear away all debris and leave the Site in a tidy condition on completion.

C90 - 3.1.22. Materials Arising

Ownership: Components and materials arising from the works shall become the property of the Contractor, unless otherwise stipulated. Remove from Site as work proceeds.

C90 - 3.2. TEMPORARY SUPPORTS

C90 - 3.2.1. Generally

Before starting work:

a) Examine all available information.

b) Carry out a survey of the structure, Site and surrounding area.

c) Submit a survey report and method statements to the Project Manager covering any relevant matters raised in the design brief and in relevant Health and Safety Executive Guidance Notes.

d) Design temporary supports and submit method statements and Detailed Design proposals for acceptance by the Project Manager and Structural Engineer.

e) Ensure that all statutory notices have been given and licences obtained including Party Wall Agreements and Awards.

C90 - 3.2.2. Commencement Condition Survey

a) Before starting work, survey the existing state of structure(s) to be kept in place to locate and record the magnitude and extent of all cracks, spalling, flaking and other irregularities of the fabric.

b) Agree the commencement conditions survey record with the Project Manager.

C90 - 3.3. NOISE

C90 - 3.3.1. General

a) Comply generally with BS 5228.

b) Noise levels shall be restricted at reasonable times, as acceptable to the Project Manager.

c) Fit all compressors, percussion tools and vehicles with effective silencers of a type recommended in writing by the manufacturers of the compressors, tools or vehicles.

d) Do not use or permit employees to use radios or other audio equipment in ways or at times that may cause a nuisance.

C90 - 3.4. FIRE

C90 - 3.4.1. General

Take all necessary precautions to prevent personal injury, death and damage to the works or other property from fire.

C90 - 3.5. BURNING ON SITE

C90 - 3.5.1. General

Burning on Site of materials arising from the work shall not be permitted.

C90 - 3.6. RUBBISH

C90 - 3.6.1. General

a) Remove rubbish, debris and surplus material and spoil regularly; keep the Site and works clean and tidy.

b) Remove all rubbish, dirt and residues from voids and cavities before filling or closing in.

c) Ensure that unwanted, non-hazardous material and rubbish is disposed of at a tip approved by the Waste Regulation Authority.

d) Remove all surplus hazardous materials and their containers regularly for disposal off Site in a safe and competent manner as approved by the Waste Regulation Authority and in accordance with relevant regulations.

e) Retain waste transfer documentation on Site.

C90 - 3.7. ELECTROMAGNETIC INTERFERENCE

C90 - 3.7.1. General

Take all necessary precautions to avoid excessive electromagnetic disturbance of apparatus outside the Site.

C90 - 3.8. NUISANCE

C90 - 3.8.1. General

Take all necessary precautions to prevent nuisance from smoke, dust, rubbish, vermin and other causes.

C90 - 3.9. PROTECTION

C90 - 3.9.1. General

Protect the following:

a) Existing Services:

i) Notify all Service Authorities and/or adjacent owners of the proposed works not less than one week before commencing Site operations.

ii) Before starting work check positions of existing services.

iii) Observe Service Authority's recommendations for work adjacent to existing services. Do not interfere with their operation without the consent of the Service Authorities or other owners.

iv) If any damage to services results from the works, notify the Project Manager and appropriate Service Authority without delay. Make arrangements for making good without delay; to be to the satisfaction of the Service Authority or other owner as appropriate.

v) Replace marker tapes or protective covers disturbed by Site operations, to the Service Authority's recommendations.

vi) Locations of Services: Locate and mark the positions of services affected by the work. Arrange with the appropriate authorities for the location and marking of the positions of mains services.

vii) Disconnection of Services: Before starting demolition, arrange with the appropriate authorities for the disconnection of services and removal of fittings and equipment.

viii) Disconnection of Drains: Locate and disconnect all disused drain connections. Seal within the Site.

ix) Drains in Use: Protect drains, manholes, gullies, vent pipes and fittings still in use and ensure that they are kept free of debris at all times. Make good any damage arising from demolition work and leave clean and in working order at completion.

x) Bypass Connections: Provide as necessary to maintain continuity of services to occupied areas of the same and adjoining properties. Give a minimum 72 hours' notice to occupiers if shutdown is necessary during changeover.

C90 - 3.9.2. Dangerous Openings: Not applicable.

C90 - 3.9.3. Asbestos Based Materials

Report immediately to the Project Manager any suspected asbestos based materials discovered during demolition work. Avoid disturbing such materials. Agree with the Project Manager methods for safe removal.

End of Section

H71. LEAD SHEET FULLY SUPPORTED ROOF AND WALL COVERINGS / FLASHINGS

H71- 1. FORMAT SYSTEMS PERFORMANCE AND MATERIALS

H71- 1.1. SPECIFICATION TYPE

H71- 1.1.1. DESCRIPTIVE WORKS:

a) Undertake the *Detailed Design*, supply, install and warrant the works complying with the visual intent indicated on the *Design Drawings* and criteria stated in the *Specification*.

b) Where no material, product or supplier is indicated in the *Specification*, the Contractor shall propose suitable materials and systems which comply with the visual intent and performance criteria stated in the Works Information and remain fully responsible for the *Detailed Design* of the works.

c) Where a particular material, product or supplier is indicated in the *Specification*, such material, product or supplier shall be deemed indicative representing the Employer's design intent only. The *Contractor* may complete the installation using that product, or equivalent confirmed as acceptable by the Project Manager, but shall remain fully responsible for the *Detailed Design* and performance of the works.

H71- 1.2. SYSTEM DESCRIPTIONS

Architectural and Functional Requirements

H71- 1.2.1. SCOPE:

This section of the Specification, when read in conjunction with the Design Drawings, provides particular requirements for the following:

a) Lead sheet flashing to roofs.

b) Lead sheet copings to roof perimeters.

c) Flashings and dressed work at roof outlets.

H71- 1.2.2. LEAD SHEET FLASHING TO ROOFS

a) Type RFS-03: New horizontal lead flashing, coping and formed outlets supported on timber grounds.

H71- 1.2.3. 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 works shall include movement joints as required, which shall be installed in accordance with the manufacturer's recommendations. Exposed elements shall be accepted by the *Project Manager* through sampling.

c) The works shall include all primers, bonding compounds, adhesives, fixings, sealants, ventilators, fillets and all other components necessary to complete the installation and meet performance requirements.

d) The works shall include all junctions and interfaces at perimeters to the external cladding, rooflights, chimney upstands, services penetrations and other interfacing works.

e) When installing the lead sheet using mechanical fasteners, adhesive or tape, the recommendations of the manufacturer shall be followed.

f) The lead works shall coordinate with perimeter of the roof membrane which shall be sealed with mechanical fastenings at all roof edges, changes of plane, kerbs and upstands.

g) Underlayers, where required, shall be formed from materials proposed by the *Contractor* and accepted by the *Project Manager*.

h) Corrosion protection from ply substrate shall be installed. Generally install building paper to BS 1521 Class A1 between lead and ply substrate.

H71- 1.2.4. GENERAL METAL COMPONENTS/ ACCESSORIES:

a) Systems shall incorporate and coordinate with all necessary metal accessories including flashings, collars, copings, cappings, outlets, to all penetrations, upstands and perimeter conditions as required.

b) Components shall be formed from fully welded and/ or sealed lead sheets, which shall be sufficiently thick to provide a visually flat surface and to eliminate excessive distortion and permanent deformation.

c) Provide concealed support as required.

d) Joints:

e) Joints shall be of profiles accepted by the Project Manager and shall maintain the performance requirements of the Specification.

f) Locations shall be as indicated on the Design Drawings, or to the acceptance of the Project Manager.

g) Where required, joints shall be assembled centrally over bracketry.

h) All products shall be in accordance with the manufacturer's current technical data sheet.

i) It shall be demonstrated to the Architect that, where materials overlap or are used in conjunction with other waterproofing products they are compatible.

H71- 1.2.5. LEAD SHEET:

a) It shall be ensured that the lead sheet is colour marked for thickness and weight and of the type and code specified, and is:
   i) Milled, to BS EN 12588,
   ii) or Machine cast, to BS EN 12588 in respect of general quality, chemical composition and tolerance on thickness, or
   iii) Sand cast from lead complying with BS EN 12588 and free from bitumen, solder, other impurities, inclusions, laminations, cracks, air, pinholes and blowholes. Thickness(es) as BS EN 12588 but with a tolerance of 10%.

H71- 1.2.6. TIMBER USED FOR LEADWORK:

a) Plywood.
   i) Plywood shall comply with BS EN 314: Part 2, BS EN 635: Parts 1-3, BS EN 636 and DD ENV 1099, or another equal and approved National Standard, WBP bonding minimum class 2 or class 3 to bond quality to BS EN 314, of thickness shown on the Contract Drawings.

b) Timber for Use with Leadwork.
   i) Timber shall be planed, free from wane, pitch pockets, decay and insect attack except pinhole borers
   ii) The moisture content shall be not more than 22% at the time of covering.
   iii) Timber shall be preservative treated to the British Wood Preserving and Damp-proofing Association Commodity Specification C8.

LEAD SYSTEMS

H71- 1.2.7. TYPE: RFS-03: CUSTOM FORMED LEAD COPINGS, FLASHINGS AND OUTLETS

Location: Applied to existing timber roof deck perimeter construction including upstands, copings and spout outlets.

a) Provide all associated roof lead flashings, soakers, aprons, gutters, linings and other features, to the profiles and locations specified.

b) Lead for this work shall be of the minimum thickness as recommended by BS 5534 and by the Lead Development Association as follows:

i) Type of Lead: Rolled to BS EN 12588.

ii) Lead thickness: 2.24mm (Code 5)

iii) Joints: Propose jointing appropriate to location and assembly. Assume Welted Seams generally. Joint spacing to be evenly set out across the assemblies. Types, locations and set outs to be agreed with architect and project manager.

iv) Corrosion protection from ply substrate: Install building paper to BS 1521 Class A1 between lead and ply substrate.

c) Metal components shall be in accordance with Section Z11.

d) Joints in flashings and trims shall be installed to fully accommodate thermal movement. Flashing joints generally shall comply with the Cladding Manufacturer's recommendations, and recommendations contained within the - "Profiled Sheet Metal Roof and Cladding, A Guide to Good Practice" or as otherwise stated.

e) Flashings shall match the visible lead coping and lead lined rainwater outlet spout systems, in colour and texture.

f) Flashings shall include all necessary anti-drumming measures.

g) Externally exposed flashing and copings shall have continuation and inter-connecting joints fully complying with the sealant manufacturer's recommendations for movement joints. Simple butt straps will not be accepted.

h) Electrical continuity shall be achieved between conductive parts. Provisions shall be made for lightning protection integration requirements.

i) Abutments: Weathertight junctions with flashings shall be correctly located and neatly dressed down. Fixings to Structure: Fixings shall confirm to all statutory requirements in respect of strength and type. They shall be fully protected to prevent corrosion and contact between dissimilar materials shall be avoided or detailed to prevent galvanic corrosion. Only suitable materials shall be used.

j) Generally: Lead sheet shall be fixed to timber substrates with:
   i) Copper clout nails to BS 1202: Part 2, with annular ring, helical ring or serrated shank, length not less than 20mm, shank diameter not less than 3.35mm and head diameter not less than 8mm, or
   ii) Stainless steel (austenitic) clout nails with annular ring, helical ring or serrated shank, length not less than 19mm, shank diameter not less than 2.65mm and head diameter not less than 8mm.

k) Clips. Generally:
   i) The clips shall generally be 50mm wide and continuous length to suit detail.
   ii) The lead clips shall be cut from sheets of the same code as the sheet being secured.
   iii) The copper clips shall be cut from sheet to BS EN 1652 and BS EN 1654, temper grade 1/4H, and dipped in solder if exposed to view. The thickness shall be in accordance with the recommendations of BS 6915 and The Lead Sheet Manual.
   iv) The stainless steel clips shall be cut from sheet to BS EN 10095, BS EN 10029, BS EN 10048, BS EN 10051, BS EN 10258 and BS EN 10259 grade 1.4301, and terne coated if exposed to view. The thickness shall be in accordance with the recommendations of BS 6915 and The Lead Sheet Manual.
   v) Each clip shall be fixed with two fastenings not more than 50mm from the edge of the lead sheet. Clips welted around the edges of the sheets shall be turned over 25mm.

l) Continuous Clips. Generally:
   i) The clips shall be of a width to suit detail.
   ii) The lead continuous clips shall be cut from code 6 sheet.
   iii) The copper continuous clips shall be cut from sheet to BS EN 1652 and BS EN 1654. The thickness shall be in accordance with the recommendations of BS 6915 and The Lead Sheet Manual.

iv) Stainless steel continuous clips shall be cut from 2mm thick sheet to BS EN 10095, BS EN 10029, BS EN 10048, BS EN 10051, BS EN 10258 and BS EN 10259 grade 1.4301 (304).

v) The clips shall be fixed at centres in accordance with the recommendations of BS 6915 and The Lead Sheet Manual. Welt the edge of the lead sheet around a continuous clip and dress down.

m) Finishes: Allow for application of patination oil to all lead finishes. Specific locations and extents to be agreed with Client Representative prior to application.

n) Quality Benchmark: Provide Quality Benchmark installation of 3 linear meter of typical fascia and rainwater outlet spout arrangement for Client Representative acceptance.

H71- 1.3. PERFORMANCE REQUIREMENTS

H71- 1.3.1. GENERAL:

Comply with the general performance requirements of Section A of the Specification and the following specific performance requirements.

H71- 1.3.2. STANDARDS

The Contractor developing the design is to comply with the current versions of the prevailing BS EN and industry best practice standards.

Structural Performance

H71- 1.3.3. 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.

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.

H71- 1.3.4. MOVEMENT;

a) The works shall be capable of accommodating the following movements without any permanent deformation or reduction in the specified performance:

i) Due to deflection under design loads.

ii) Due to the effects of repeated wind loading.

iii) Due to changes in dimension and shape of components arising from building movements, including settlement, creep, twisting and racking.

iv) Due to moisture movement.

H71- 1.3.5. LIVE/ IMPOSED LOADS:

The works (green roof system, perimeter stone, insulation and all aspects of the waterproofing system) shall be capable of accommodating the following live loads without any reduction in performance for the design life specified. Be responsible for selecting materials to suit the following loading conditions:

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

b) Vertically applied loads acting on the surface of the works arising from maintenance and cleaning operations.

c) Roof loads (including snow and snow drift loads) to be calculated in accordance with BS 6399: Part 3 for a roof with access for cleaning and maintenance.

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

e) The loads created by rainwater.

f) Loads imposed by water testing (including within gutters).

H71- 1.3.6. ATTACHMENT/ WIND LOADS:

a) Design/ Select the method(s) of attachment of the roofing system to withstand, without permanent deformation, the positive and negative effects of wind loads on the roofing.

b) Design wind pressures: Refer to Section A-5.

c) Ensure that the method(s) of attachment makes sufficient provision for relative movement of materials and effects of vapour pressure; do not perforate the covering and do not reduce the performance of the vapour control layer below that required.

d) Flotation of the insulation shall be prevented.

H71- 1.3.7. THERMAL MOVEMENT:

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

b) The annual surface temperature ranges for the materials used in the works shall be confirmed by the *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.

Environmental Performance

H71- 1.3.8. MOISTURE MOVEMENT:

The works shall withstand the following movements without permanent deformation or any reduction in the specified performance:

a) Due to changes in the moisture content of their components, resulting from variations in the moisture content of the air, either inside or outside the building.

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

H71- 1.3.9. THERMAL PERFORMANCE REQUIREMENTS:

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

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

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

d) U-value calculations shall be based on wet roof conditions.

H71- 1.3.10. SOLAR PERFORMANCE:

a) Exposure to sunlight during the lifetime of the works shall not reduce the performance nor adversely affect the visual appearance of any element/ component. Take into consideration expected solar performance under varying conditions of solar radiation and external/ internal air velocity.

b) Submit independently certified test data in respect of solar and visible light performance confirming compliance with the *Specification*.

c) All insulation shall be adequately protected from ultraviolet light degradation.

H71- 1.3.11. AIR PERMEABILITY : INFILTRATION

a) No requirement.

H71- 1.3.12. AIR PERMEABILITY : EXFILTRATION

a) No requirement.

H71- 1.3.13. CONDENSATION:

a) Except under extreme conditions where the relative humidity is in excessive, 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) Determine the interstitial condensation risk of the works in accordance with BS 5250 and other specified governing codes and standards, where applicable. Provide a condensation risk assessment with the Tender return based upon the specified conditions.

c) Install, as necessary, a vapour control barrier and associated protection to provide a continuous line of protection. At interfaces between the works by other trades the interfaces shall not result in material breakdown or other failure of seals at these locations.

H71- 1.3.14. WEATHER AND WATER PENETRATION RESISTANCE:

a) Provide a secure, free draining and completely waterproof system to comply with the requirements of BS EN 1928.

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) Leakage of water shall be defined as the sign of water, in any quantity, on the inside face of the construction.

d) Prevent infiltration in case of ice dams/ water back-up.

e) Unless otherwise agreed, all roof finishes shall be installed such that no track migration of water is possible beneath the principal waterproofing membrane.

f) All waterproof membranes shall form continuous waterproofing barriers either fully bonded or mechanically fixed to their substrates as specified.

H71- 1.3.15. DRAINAGE;

a) The works shall be laid to sufficient falls to ensure effective disposal of water to outlets provided, as recommended in BS 6229.

b) The works shall effectively discharge all precipitation to outlets provided for this purpose, without adversely affecting their performance or appearance, and shall ensure the timely disposal of surface water under all weather conditions.

i) Include for all drainage outlets and provide flow rate calculations to demonstrate that the design rate of rainfall is accommodated to BS EN 12056: Part 3 and BS 8490 as applicable. Refer also to the *Services Engineer's documentation*

c) Gutters: Not required.

d) Ensure that all roof outlets are suitable/ compatible for the roofing membrane(s) used.

Acoustic

H71- 1.3.16. GENERAL;

a) No requirements.

Fire and Smoke

H71- 1.3.17. GENERAL:

Fire and smoke performance requirements shall be as indicated in the *Design Drawings* and Section A.

H71- 1.3.18. 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.

H71- 1.3.19. 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.

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

H71- 1.3.20. GENERAL:

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

b) Selected materials shall be durable and satisfy the requirements of the *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 external/ internal air velocity.

d) The works shall perform throughout the service life without failure resulting from defects in design, materials or workmanship.

e) Metal sheets shall not suffer bowing, dimpling, oil canning, sagging, pillowing, rippling, warp, abrupt transitions and other visual deformation or irregularity.

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

H71- 1.4. MATERIALS

Lead

H71- 1.4.1. LEAD:

a) See section 1.2 System Descriptions.

b) The works shall be in accordance with Section Z11 of the Specification.

H71- 1.4.2. TIMBER:

a) See section 1.2 System Descriptions.

b) Ensure that timber is 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.

c) Identify existing timber species and provide any replacement items/ elements to match in accordance with BS 7359.

d) Provide timber for joinery specified as 'clear finished' to comply with BS EN 942: Class CSH.

e) Treat all timber in accordance with BS 5268, after machining and before assembly. Brush apply the manufacturer's recommended preservative to all cut and machined surfaces before assembly.

f) The works shall be in accordance with Section Z10 of the Specification.

H71- 1.4.3. SHEET MEMBRANES:

Polyvinylchloride (PVC).

Flexible Polyolefin (FPO).

a) High performance sheet membranes shall include fleece backing to prevent ghosting of joints in underlying system components or substrates.

b) Where required by the particular system, the membrane shall be suitable for exposure to UV light/ solar properties.

c) Joints shall be lapped and hot-air or solvent welded, unless confirmed otherwise by the system manufacturer.

d) Colour shall be as described.

Insulation

H71- 1.4.4. MATERIAL:

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.

Sealants

H71- 1.4.5. GENERAL:

a) Refer to Section Z22.

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 or staining.

Fixings/ Adhesives

H71- 1.4.6. GENERAL:

Refer to Section Z20.

Metalwork

H71- 1.4.7. General

Refer to Section Z11.

a) Refer to Section Z30 for general finishes to metalwork.

b) Refer to Section Z31 for powder coatings.

c) Refer to Section Z33 for anodising.

H71- 2. SUBMITTALS AND TESTING

H71- 2.1. SUBMITTALS

Tender Submittals

H71- 2.1.1. TENDER RESPONSE:

Not required

H71- 2.1.2. PRE-CONTRACT SAMPLES:

Not required

H71- 2.1.3. POST CONTRACT AWARD SAMPLES:

Not Required

H71- 2.1.4. MOCK-UPS:

Not Required

H71- 2.1.5. QUALITY BENCHMARK REQUIREMENTS:

Quality benchmarks, in location(s) to be agreed with the *Project Manager*, in accordance with Section A shall be provided as follows:

a) First 2m length of each coping, flashing and rainwater outlet type incorporating accessories as listed in Section 1.2 where possible.

H71- 2.2. TESTING

H71- 2.2.1. GENERAL:

a) Refer to Section A clause series A-6 for the general requirements for testing and the approach to off-Site and on-Site testing.

b) Provide independently certified tests and Agrément certificates that demonstrate that the proposed systems meet the performance requirements of the *Specification*.

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

d) 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).

On-Site Testing

H71- 2.2.2. AIR PERMEABILITY : EXFILTRATION

a) Not required.

H71- 2.2.3. WATERPROOFING AND WATERTIGHTNESS;

a) Coordinate with requirements for waterproofing and watertightness test undertaken to verify performance of the complete room membrane system with all interface flashings and trims. Refer to Specification J41. Reinforced Bitumen Membrane

H71- 2.2.4. THERMAL PERFORMANCE TESTING:

a) Not required.

H71- 3. FABRICATION AND WORKMANSHIP

H71- 3.1. FRABRICATION

H71- 3.1.1. GENERAL:

H71- 3.1.2. TOLERANCES FOR MANUFACTURE

a) The design tolerances shall be rigidly adhered to.

b) The provisions intended to accommodate the construction tolerances and surrounding elements shall be stated and shown on the *Working Drawings*. Any further information required in formulating the design shall be obtained from the *Project Manager*.

H71- 3.2. WORKMANSHIP

Standards

H71- 3.2.1. GENERAL:

a) The installation shall be carried out by fully trained, competent and certified tradesmen.

b) Comply with BS 6229, BS EN 1928 and BS 8000.

c) Comply with the manufacturer's recommendations at all times unless specifically adjusted according to the *Specification*.

d) Any ancillary products or accessories, where not specified, shall be types recommended for the purpose.

e) When installing the roofing covering using mechanical fasteners, adhesive or tape, the recommendations of the manufacturer shall be followed:

i) Allow solvents to evaporate naturally from the adhesive.

f) The perimeter of the roofing covering membrane shall be sealed with mechanical fastenings at all roof edges, changes of plane, kerbs and upstands.

g) Lay out membrane panels in a fashion so that splices are installed to shed water.

h) Lay out membrane panels to ensure uniformity of coverage and that all joints are correctly formed.

H71- 3.2.2. LEAD - GENERALLY:

a) The lead shall be cut, jointed and dressed neatly and accurately, to provide fully waterproof coverings/flashings, free from ripples, kinks, buckling and cracks.

b) The installation shall comply with BS 6915 and current good practice as described in the latest editions of 'The Lead Sheet Manual' published by the Lead Sheet Association, unless specified or agreed otherwise.

c) No scribers or other sharp instruments shall be used to mark out lead.

d) Solder shall only be used if specified.

e) Finished leadwork shall be fully supported, adequately fixed to resist wind uplift and also be able to accommodate thermal movement without distortion or stress.

H71- 3.2.3. FIXING TO STRUCTURE:

a) Survey the structure, checking line, level, and fixing points before commencement and report immediately to the *Project Manager* if the structure is unsuitable to receive the works.

b) The works shall include the detailing of all interfacing connections to the structure.

H71- 3.2.4. IN SITE LEAD WELDING

a) In situ lead welding shall not be permitted unless a 'hot work permit' form is submitted for acceptance by the Architect, showing compliance with its requirements.

Preparation

H71- 3.2.5. INSPECTION;

All surfaces, substrates and structures to receive the works shall be examined and verified as acceptable and proper for the application and to verify the following:

a) Structural adequacy of deck.

b) Adequate falls.

c) Structural movement joints.

d) The installation of the system/ assembly shall not proceed until all defects have been corrected.

H71- 3.2.6. SUITABILITY OF BASE:

a) 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.

b) The base shall have even falls with no areas subject to ponding.

c) All preliminary work including formation of upstands, kerbs, box gutters, sumps, grooves, chases, pipe sleeves and expansion joints and fixing of battens, fillets, flashings, copings, roof outlets, ventilators and anchoring plugs/ strips shall be complete and satisfactory.

d) The substrate shall be thoroughly swept prior to application of the roof membrane.

e) The substrate shall be blown clean using an air compressor to remove any remaining loose debris.

H71- 3.2.7. TEMPORARY DRAINAGE:

Temporary drainage at the low points of the roof shall be installed for the period of the works. This shall ensure dry working to allow the works to proceed without undue interruption.

H71- 3.2.8. SETTING OUT:

Accurately set out the works, particularly in relation to interfaces with other adjacent or related works.

Workmanship

H71- 3.2.9. 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.

H71- 3.2.10. FLASHINGS/TRIMS:

Joints in flashings/ trims shall be installed to fully accommodate thermal movement. Proprietary expansion joints shall be installed on flat sheets wherever practicable. Joints generally shall be in accordance with the system manufacturer's recommendations and/ or the recommendations contained within the latest edition of 'Profiled Sheet Metal Roofing and Cladding, A Guide to Good Practice' published by the National Federation of Roofing Contractors (NFRC) whichever the more onerous, or as otherwise stated. REFER also to Section H71 Lead Sheet Coverings / Flashings.

H71- 3.2.11. FIXINGS:

a) Use mechanical fasteners, adhesive or tape as recommended by the manufacturer.

b) Head Fixing Lead Sheet

i) Where not specified otherwise, the top edge of lead sheets shall be secured with two rows of fixings, 25mm and 50mm from the top edge of the sheet, at 75mm centres in each row, evenly spaced and staggered.

ii) b) Sheets less than 500mm deep shall be secured with one row of fixings, 25mm from the top edge of the sheet and evenly spaced at 50mm centres.

H71- 3.2.12. FORMING OF DETAILS

a) Details may be formed by bossing or lead welding except where bossing is specifically required.

i) Lead welded seams shall be neatly and consistently formed. Undercutting or otherwise reducing the thickness of the sheet at the seams shall not be permitted. Filler strips shall be of the same composition as the sheets being joined. Butt joints shall be formed to a thickness one third more than the sheets being joined. Lap joints shall be formed with 25mm laps and two loadings to the edge of the overlap.

ii) b) Bossing shall be carried out with thinning, cutting or otherwise splitting the lead sheet.

H71- 3.2.13. WEDGE FIXING INTO JOINTS/CHASES

a) The joint/chase shall be carefully raked out to a depth of not less than.

b) Lead shall be dressed into the joint/chase and fixed with lead wedges at not more than 450mm centres, at every change of direction and with at least two for each piece of lead.

c) The joint/chase shall be prepared and sealant applied as specified.

i) Sealant: One part polysulphide to BS 5215.

H71- 3.2.14. STRUCTURAL MOVEMENT JOINTS:

a) Provide back-to-back supported upstands fixed either side of gaps coinciding with structural movement joints. The gap width shall match the structural movement requirements and be protected by cover flashings fixed to one side only.

b) Details shall be in accordance with the manufacturer's recommendations.

H71- 3.2.15. ABUTMENTS:

Weathertight junctions with interfacing elements shall be correctly located and neatly dressed down.

H71- 3.2.16. VERGE TERMINATION:

a) Refer to the Design Drawings.

b) Interface with adjoining systems as required, as indicated on the Design Drawings, and provide a fully sealed interface.

H71- 3.2.17. EAVES TERMINATION:

a) Refer to the Design Drawings.

b) Interface with adjoining systems and eaves gutter, as indicated on the Design Drawings and provide a fully sealed interface.

Adverse Weather

H71- 3.2.18. WORKING IN ADVERSE CONDITIONS:

a) If unavoidable wetting of the construction does occur, take prompt action to minimise and make good any damage.

b) The membrane must not be laid in wet or damp conditions or at temperatures below 5°C.

c) Provide temporary covers and drainage as required to keep unfinished areas of the roof dry.

d) Suspend work in severe or continuously wet weather unless an effective temporary roof is provided over the working areas.

Workmanship Tolerances

H71- 3.2.19. GENERAL:

Tolerances shall be measured against the relevant Base Reference Datum; Location Reference Point; Location Reference Plane; Location Reference Surface or Reference Element as defined in Section A.

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 *Contractor* shall verify, with the appropriate supplier/ trade contractor, that such dimensions and locations are correct. Any deviation shall be agreed with the *Project Manager*.

o) Account shall be taken of the installation tolerance requirements such that repetitive elements are accurately located, relative to gridlines.

p) Tolerances shall not be cumulative. The most onerous tolerance shall apply.

H71- 3.2.20. FINISHES:

a) General.

i) As soon as practicable, a smear coating of patination oil shall be applied evenly in one direction and in dry conditions to all surfaces of exposed leadwork described herein and shown on the Contract Drawings.

H71- 4. SYSTEMS INTEGRATION AND HANDOVER

H71- 4.1. SYSTEMS INTEGRATION

H71- 4.1.1. GENERAL:

a) Integrate with J41 Reinforced Bitumen Membrane and Q37 Green Roof systems.

b) Integrate fixings of lightning protection tape.

c) Integrate with interface and fixing requirements associated with new roof access and man safe systems.

H71- 4.2. HANDOVER

H71- 4.2.1. GENERAL:

a) As the Contract Requirements.

End of Section

J41. REINFORCED BITUMEN MEMBRANE ROOF COVERINGS

J41- 1. FORMAT SYSTEMS PERFORMANCE AND MATERIALS

J41- 1.1. SPECIFICATION TYPE

J41- 1.1.1. DESCRIPTIVE WORKS:

a) Undertake the *Detailed Design*, supply, install and warrant the works complying with the visual intent indicated on the *Design Drawings* and criteria stated in the *Specification*.

b) Where no material, product or supplier is indicated in the *Specification*, the Contractor shall propose suitable materials and systems which comply with the visual intent and performance criteria stated in the Works Information and remain fully responsible for the *Detailed Design* of the works.

c) Where a particular material, product or supplier is indicated in the *Specification*, such material, product or supplier shall be deemed indicative representing the Employer's design intent only. The *Contractor* may complete the installation using that product, or equivalent confirmed as acceptable by the Project Manager, but shall remain fully responsible for the *Detailed Design* and performance of the works.

J41- 1.2. SYSTEM DESCRIPTIONS

Architectural and Functional Requirements

J41- 1.2.1. SCOPE:

This section of the Specification, when read in conjunction with the Design Drawings, provides particular requirements for the following:

J41- 1.2.2. REINFORCED BITUMEN MEMBRANE ROOF COVERINGS

a) Type RFS-01: New roof membrane and system applied to existing timber roof deck construction.

J41- 1.2.3. GENERAL

a) The works shall meet the recommendations of:
   i) BS EN13707 and BS 8747
   ii) BS 6229
   iii) BS 8217
   iv) BRE Digest 312, 324 and 419
   v) Ruberoid Blue Book.

b) The components of the system shall be covered by a single source warranty. Therefore, guarantees shall be obtained on the basis of a "back to back" type agreement provided jointly by the membrane manufacturer and the *Contractor* for the complete roofing system(s). The warranty shall cover the entire roof assembly and shall be obtained for the full warranty period with an insurance company backing based upon a single whole term premium paid at the inception of the policy with no requirement for periodic renewal premiums.

c) Proprietary systems shall be British Board of Agrément (BBA) certified and tested to satisfy the requirements of the *Specification*.

d) The works shall include movement joints as required, which shall be installed in accordance with the manufacturer's recommendations. Exposed elements shall be accepted by the *Project Manager* through sampling.

e) The works shall include all primers, bonding compounds, adhesives, fixings, sealants, ventilators, fillets and all other components necessary to complete the installation and meet performance requirements.

f) The works shall include all junctions and interfaces at perimeters to the external cladding, rooflights, chimney upstands, services penetrations and other interfacing works.

g) When installing the waterproof membrane using mechanical fasteners, adhesive or tape, the recommendations of the manufacturer shall be followed.

h) The perimeter of the membrane shall be sealed with mechanical fastenings at all roof edges, changes of plane, kerbs and upstands.

i) Underlayers, where required, shall be formed from materials proposed by the *Contractor* and accepted by the *Project Manager*.

J41- 1.2.4. METAL COMPONENTS/ ACCESSORIES:

a) Systems shall incorporate and coordinate with all necessary metal accessories including flashings, collars, copings, cappings, outlets, to all penetrations, upstands and perimeter conditions as required.

b) System shall coordinate with all requirements associated with new lead flashings, copings and formed outlets as described in specification H71 RFS-03.

c) Components shall be formed from fully welded and/ or sealed lead sheets, which shall be sufficiently thick to provide a visually flat surface and to eliminate excessive distortion and permanent deformation.

d) Provide concealed support as required.

e) Joints:

f) Joints shall be of profiles accepted by the Project Manager and shall maintain the performance requirements of the Specification.

g) Locations shall be as indicated on the Design Drawings, or to the acceptance of the Project Manager.

h) Where required, joints shall be assembled centrally over bracketry.

i) All products shall be in accordance with the manufacturer's current technical data sheet.

j) It shall be demonstrated to the Architect that, where materials overlap or are used in conjunction with other waterproofing products they are compatible.

COLD ROOF SYSTEMS

J41- 1.2.5. TYPE: RF-01 RFS-01: REINFORCED BITUMEN ROOF SYSTEM

Location: Applied to existing timber roof deck construction.

a) Axter CityFlor Roof Membrane

i) Axter Limited

ii) West Road, Ransomes EuroPark, Ipswich Suffolk IP3 9SX

Tel: 01473 724056. website: www.axter.co.uk

b) Axter CityFlor Roof Membranes

i) SBS modified bitumen membranes composed of:

- Hyranger Spot ADH — a self-adhesive underlay membrane with a 120 g·m–2 polyester reinforcement, a macroperforated film and a sand finish on the upper face, and a silicone release film on the lower face.
- Force membrane - Force 4000 Trafic — a torch-on, root-resistant cap sheet with a 250 g·m–2 polyester reinforcement, a mineral finish on the upper face and a thermofusible film on the lower face.
- Axter PMMA liquid applied system to interfaces.
- General Axter systems required for complete install to suit substrates, interfaces and overlay requirements.

ii) To include all secondary fixing bars, clips, brackets, framing and fixings required to complete the system for install of membrane system onto existing timber roof deck at pitches of circa 8° and 25°.

iii) Coordinate with all requirements of adjoining RFS-02 Green Roof System specification Q37 including Optigreen roof retention net fixings.

iv) Coordinate with all requirements of adjoining RFS-03 Lead sheet flashings and linings specification H71.

v) Warrant new roofing membrane with specified Green Roof provided over. Provide separate price for providing the following Warranty levels:

- PLATINUM. Insurance backed system guarantee (IBG).
- GOLDSHIELD. Insured system guarantee.
- SILVERSHIELD. Insured system guarantee.
- BRONZESHIELD. Insured system guarantee.

vi) Warranty type to be instructed by Client Representative at contract award.

J41- 1.3. PERFORMANCE REQUIREMENTS

J41- 1.3.1. GENERAL:

Comply with the general performance requirements of Section A of the Specification and the following specific performance requirements.

J41- 1.3.2. STANDARDS

The Contractor developing the design is to comply with the current versions of the prevailing BS EN and industry best practice standards.

Structural Performance

J41- 1.3.3. 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.

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.

J41- 1.3.4. MOVEMENT;

a) The works shall be capable of accommodating the following movements without any permanent deformation or reduction in the specified performance:

i) Due to deflection under design loads.

ii) Due to the effects of repeated wind loading.

iii) Due to changes in dimension and shape of components arising from building movements, including settlement, creep, twisting and racking.

iv) Due to moisture movement.

J41- 1.3.5. LIVE/ IMPOSED LOADS:

The works (green roof system, perimeter stone, insulation and all aspects of the waterproofing system) shall be capable of accommodating the following live loads without any reduction in performance for the design life specified. Be responsible for selecting materials to suit the following loading conditions:

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

b) Vertically applied loads acting on the surface of the works arising from maintenance and cleaning operations.

c) Roof loads (including snow and snow drift loads) to be calculated in accordance with BS 6399: Part 3 for a roof with access for cleaning and maintenance.

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

e) The loads created by rainwater.

f) Loads imposed by water testing (including within gutters).

J41- 1.3.6. ATTACHMENT/ WIND LOADS:

a) Design/ Select the method(s) of attachment of the roofing system to withstand, without permanent deformation, the positive and negative effects of wind loads on the roofing.

b) Design wind pressures: Refer to Section A-5.

c) Ensure that the method(s) of attachment makes sufficient provision for relative movement of materials and effects of vapour pressure; do not perforate the covering and do not reduce the performance of the vapour control layer below that required.

d) Flotation of the insulation shall be prevented.

J41- 1.3.7. THERMAL MOVEMENT:

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

b) The annual surface temperature ranges for the materials used in the works shall be confirmed by the *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.

Environmental Performance

J41- 1.3.8. MOISTURE MOVEMENT:

The works shall withstand the following movements without permanent deformation or any reduction in the specified performance:

a) Due to changes in the moisture content of their components, resulting from variations in the moisture content of the air, either inside or outside the building.

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

J41- 1.3.9. THERMAL PERFORMANCE REQUIREMENTS:

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

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

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

d) U-value calculations shall be based on wet roof conditions.

J41- 1.3.10. SOLAR PERFORMANCE:

a) Exposure to sunlight during the lifetime of the works shall not reduce the performance nor adversely affect the visual appearance of any element/ component. Take into consideration expected solar performance under varying conditions of solar radiation and external/ internal air velocity.

b) Submit independently certified test data in respect of solar and visible light performance confirming compliance with the *Specification*.

c) All insulation shall be adequately protected from ultraviolet light degradation.

J41- 1.3.11. AIR PERMEABILITY : INFILTRATION

a) No requirement.

J41- 1.3.12. AIR PERMEABILITY : EXFILTRATION

a) No requirement.

J41- 1.3.13. CONDENSATION:

a) Except under extreme conditions where the relative humidity is in excessive, 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) Determine the interstitial condensation risk of the works in accordance with BS 5250 and other specified governing codes and standards, where applicable. Provide a condensation risk assessment with the Tender return based upon the specified conditions.

c) Install, as necessary, a vapour control barrier and associated protection to provide a continuous line of protection. At interfaces between the works by other trades the interfaces shall not result in material breakdown or other failure of seals at these locations.

J41- 1.3.14. WEATHER AND WATER PENETRATION RESISTANCE:

a) Provide a secure, free draining and completely waterproof system to comply with the requirements of BS EN 1928.

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) Leakage of water shall be defined as the sign of water, in any quantity, on the inside face of the construction.

d) Prevent infiltration in case of ice dams/ water back-up.

e) Unless otherwise agreed, all roof finishes shall be installed such that no track migration of water is possible beneath the principal waterproofing membrane.

f) All waterproof membranes shall form continuous waterproofing barriers either fully bonded or mechanically fixed to their substrates as specified.

J41- 1.3.15. DRAINAGE;

a) The works shall be laid to sufficient falls to ensure effective disposal of water to outlets provided, as recommended in BS 6229.

b) The works shall effectively discharge all precipitation to outlets provided for this purpose, without adversely affecting their performance or appearance, and shall ensure the timely disposal of surface water under all weather conditions.

i) Include for all drainage outlets and provide flow rate calculations to demonstrate that the design rate of rainfall is accommodated to BS EN 12056: Part 3 and BS 8490 as applicable. Refer also to the *Services Engineer's documentation*

c) Gutters: Not required.

d) Ensure that all roof outlets are suitable/ compatible for the roofing membrane(s) used.

Acoustic

J41- 1.3.16. GENERAL;

a) No requirements.

Fire and Smoke

J41- 1.3.17. GENERAL:

Fire and smoke performance requirements shall be as indicated in the *Design Drawings* and Section A.

J41- 1.3.18. 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.

J41- 1.3.19. 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.

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

J41- 1.3.20. GENERAL:

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

b) Selected materials shall be durable and satisfy the requirements of the *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 external/ internal air velocity.

d) The works shall perform throughout the service life without failure resulting from defects in design, materials or workmanship.

e) Metal sheets shall not suffer bowing, dimpling, oil canning, sagging, pillowing, rippling, warp, abrupt transitions and other visual deformation or irregularity.

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

J41- 1.4. MATERIALS

Vapour Control Layers

J41- 1.4.1. GENERAL:

a) Products shall be as recommended by the system manufacturer.

b) Products shall have suitable gauges, moisture vapour transmission rates (g/ m²/ hr) and moisture vapour resistances (MNs/ g).

c) Products shall be Agrément certified.

J41- 1.4.2. POLYETHYLENE VAPOUR BARRIER:

a) Polyethylene based product compliant with the Packaging and Films Association (PAFA).

b) The product shall be flexible when cold, resistant to chemicals and ageing and be rot-proof.

c) Suitable tapes for jointing.

J41- 1.4.3. BITUMINOUS VAPOUR BARRIER:

a) Products shall be polyester based with expandable aluminium core and Styrene Butadiene Styrene (SBS) coating.

b) Fully adhered/ bonded in a suitable grade of bitumen.

Membranes

J41- 1.4.4. GENERAL:

Propose the use of the following high performance sheet membranes and method of attachment with regard to the system requirements and particular service conditions to comply with the requirements of the *Specification*.

J41- 1.4.5. SHEET MEMBRANES:

Polyvinylchloride (PVC).

Flexible Polyolefin (FPO).

a) High performance sheet membranes shall include fleece backing to prevent ghosting of joints in underlying system components or substrates.

b) Where required by the particular system, the membrane shall be suitable for exposure to UV light/ solar properties.

c) Joints shall be lapped and hot-air or solvent welded, unless confirmed otherwise by the system manufacturer.

d) Colour shall be as described.

Insulation

J41- 1.4.6. MATERIAL:

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.

J41- 1.4.7. PARTICULAR REQUIREMENTS:

a) Insulation shall meet the requirements of BS 6229 and be suitable for the roof construction in accordance with the system description.

b) The thermal transmittance performance of the roof shall be better than or equal to the minimum values specified.

c) The compressive strength of the insulation shall be capable of supporting the overlaying materials, pedestrian maintenance access loading and temporary loading during replacement of mechanical plant. Compressive strength shall be tested to the relevant parts of BS 4370 using the appropriate method recommended therein.

d) The insulation when laid shall be suitably even, stable and robust and capable of receiving other system components as required.

e) The insulation shall be inert, durable, rot-proof and vermin-proof and 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.

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

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

h) Insulation shall be a minimum of Euroclass A2.

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

j) 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.

k) The selected insulation shall comply with all relevant British Standards and shall be BBA certified.

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

Sub-layers/ Interlayers

J41- 1.4.8. GENERAL;

a) As recommended by the system manufacturer.

b) Polyester, polypropylene or glassfibre based fleeces, or similar, shall be installed as various sub-layers/ interlayers/ filter layers/ protection layers/ cushion layers/ levelling layers/ separation layers/ slip layers (and others as applicable) to the required system installations and with suitable values to achieve the requirements of the *Specification*.

i) Polyester based fleece:

- Tensile strength (N/ 5cm) to BS EN 29073: Part 3.
- Elongation at break (%) to BS EN 29073: Part 3.

ii) Polypropylene based fleece:

- Thickness (mm) to BS EN ISO 9863: Part 1.
- Weight (g/ m²) to BS EN ISO 9864.
- Elongation at break (%) to BS EN ISO 10319.
- Static puncture test (N) to BS EN ISO 12236.

iii) Glassfibre based fleece:

- Thickness (mm) to DIN 53855: Part 1.
- Weight (g/ m²) to DIN 52142.
- Tensile strength along (N/ 5cm) to DIN 52123.
- Tensile strength cross (N/ 5cm) to DIN 52123.

c) Fleece type shall be compatible with and suitable for the type and condition of interfacing component/ substrate.

d) Where necessary, the sub-layers shall be suitable for exposure to UV light/ solar properties.

e) Determine the requirement for fleeces to have backing materials.

Ballast and Coverings

J41- 1.4.9. PAVING SLABS;

Not required.

Sealants

J41- 1.4.10. GENERAL:

a) Refer to Section Z22.

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 or staining.

Fixings/ Adhesives

J41- 1.4.11. GENERAL:

Refer to Section Z20.

Metalwork

J41- 1.4.12. General

Refer to Section Z11.

a) Refer to Section Z30 for general finishes to metalwork.

b) Refer to Section Z31 for powder coatings.

c) Refer to Section Z33 for anodising.

J41- 2. SUBMITTALS AND TESTING

J41- 2.1. SUBMITTALS

Tender Submittals

J41- 2.1.1. TENDER RESPONSE:

Not required

J41- 2.1.2. PRE-CONTRACT SAMPLES:

Not required

J41- 2.1.3. POST CONTRACT AWARD SAMPLES:

Not Required

J41- 2.1.4. MOCK-UPS:

Not Required

J41- 2.1.5. QUALITY BENCHMARK REQUIREMENTS:

Quality benchmarks, in location(s) to be agreed with the *Project Manager*, in accordance with Section A shall be provided as follows:

a) First 10m² of each type incorporating accessories as listed in Section F30 where possible.

J41- 2.2. TESTING

J41- 2.2.1. GENERAL:

a) Refer to Section A clause series A-6 for the general requirements for testing and the approach to off-Site and on-Site testing.

b) Provide independently certified tests and Agrément certificates that demonstrate that the proposed systems meet the performance requirements of the *Specification*.

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

d) 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).

On-Site Testing

J41- 2.2.2. AIR PERMEABILITY : EXFILTRATION

a) Not required.

J41- 2.2.3. WATERPROOFING AND WATERTIGHTNESS;

a) Test the watertightness of the roof using one or a combination of the following Site tests, as appropriate, to the acceptance of the *Project Manager*. The results of each test shall be recorded and issued at the end of each test:

i) Proprietary electronic testing system:

- Testing shall be carried out before insulation (inverted roof types only) and ballast is laid.
- On completion, carry out a flood test and then certify the waterproof integrity of the roof.

ii) Flood test:

- Externally cover and seal all outlets and protect against damage from water pressure with temporary kerbs. Do not use plugs to seal outlets.
- Carefully flood to a minimum depth of 50mm, but in no case higher than existing kerb levels, and leave for a period of 48 hours. Regularly inspect for leaks.
- On completion of testing, slowly drain roofs ensuring that outlets do not overload or flood.
- After the specified procedure for leaks/ defects has been completed, the flood test shall be undertaken again. Only when a flood tested roof area has shown no leakage for a period of seven days shall further work on that part of the roof be permitted.
- Any area that cannot be flood tested shall be pressure hose tested.

iii) Simulated rain and hose test:

- Subject the designated area of the works to a 15 minute rain test using a spray rack containing sufficient hose nozzles to deliver the equivalent of 75mm of rain per hour. Check for leaks using endoscopy or other non-destructive methods, or by opening up the construction as directed. Perform repairs or replacements as necessary.

- Perform hose tests on 5% of all sealed joints not subject to other testing regimes, in accordance with the procedures prescribed in the CWCT Standard for Systemised Building Envelopes. Check for any leaks and perform repairs, replacements and additional testing and inspections.

b) Details of the system and a proposed method statement shall be submitted for acceptance at least one month prior to the proposed testing on Site.

c) A schedule of the programme for roof testing to be carried out shall be submitted, giving forewarning to the *Project Manager* of when the tests are to be carried out.

d) Prior to testing, ensure that the works have been completed to a stage where the integrity of the membrane can be tested, that obvious defects have been made good and that the roof has been cleared of all materials, debris and dust.

e) Testing shall be carried out when all works to the roof areas are complete, including that of all associated and interfacing trades.

f) 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, where applicable water shall be drained completely. Prepare a report to be submitted to the *Project Manager* 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) At completion of the test there shall be no standing water in locations intended to remain dry. Certify the waterproof integrity of the roof.

g) After making good any defects, retest locally to verify integrity of repair.

J41- 2.2.4. THERMAL PERFORMANCE TESTING:

a) Not required.

J41- 3. FABRICATION AND WORKMANSHIP

J41- 3.1. FRABRICATION

J41- 3.1.1. GENERAL:

J41- 3.1.2. TOLERANCES FOR MANUFACTURE

a) The design tolerances shall be rigidly adhered to.

b) The provisions intended to accommodate the construction tolerances and surrounding elements shall be stated and shown on the *Working Drawings*. Any further information required in formulating the design shall be obtained from the *Project Manager*.

J41- 3.2. WORKMANSHIP

Standards

J41- 3.2.1. GENERAL:

a) The installation shall be carried out by fully trained, competent and certified tradesmen.

b) Comply with BS 6229, BS EN 1928 and BS 8000.

c) Comply with the manufacturer's recommendations at all times unless specifically adjusted according to the *Specification*.

d) Any ancillary products or accessories, where not specified, shall be types recommended for the purpose.

e) When installing the roofing covering using mechanical fasteners, adhesive or tape, the recommendations of the manufacturer shall be followed:

i) Allow solvents to evaporate naturally from the adhesive.

f) The perimeter of the roofing covering membrane shall be sealed with mechanical fastenings at all roof edges, changes of plane, kerbs and upstands.

g) Lay out membrane panels in a fashion so that splices are installed to shed water.

h) Lay out membrane panels to ensure uniformity of coverage and that all joints are correctly formed.

J41- 3.2.2. ROOF MEMBRANE:

a) Do not commence installation until all roof defects have been corrected.

b) Ensure adequate overlapping, staggering of laps and full bonding to ensure watertightness.

c) Ensure that membranes are fully dressed into drainage outlets providing a watertight junction and ensuring that there are no raised laps that will interrupt the flow of draining water.

d) Ensure that the membrane is fully dressed around all penetrations and projections providing a watertight junction.

e) Protect day joints with a lapped and fully bonded strip of membrane.

f) Dress membrane and provide:

i) Vapour barrier into gutters as detailed on the *Design Drawings* to form fully weatherproof junctions.

ii) Insulation up pipework and other penetrations and provide weather flashings as detailed on the *Design Drawings*. Insulation boards shall be adhesive or mechanically bonded (to the metal deck) in accordance with the manufacturer's recommendations.

iii) Include all associated primers, separating layers, sealing products and methods, protection layers, capping sheets, surface treatments, reinforcement layers including flashings, angle fillets, upstands and all fixings to meet the performance requirements as recommended by the membrane manufacturer.

g) Mechanically fix membrane panels strictly in accordance with the manufacturer's recommendations. Ensure that fastener heads are flush to batten fixings. Locate and space batten bars strictly in accordance with the manufacturer's recommendations.

h) Adhesive fix membrane panels strictly in accordance with the manufacturer's recommendations. Compress the bonded half of the membrane onto the adhesive-coated substrate. Repeat the process to bond the other half of the membrane.

J41- 3.2.3. FIXING TO STRUCTURE:

a) Survey the structure, checking line, level, and fixing points before commencement and report immediately to the *Project Manager* if the structure is unsuitable to receive the works.

b) The works shall include the detailing of all interfacing connections to the structure.

Preparation

J41- 3.2.4. INSPECTION;

All surfaces, substrates and structures to receive the works shall be examined and verified as acceptable and proper for the application and to verify the following:

a) Structural adequacy of deck.

b) Adequate deck falls.

c) Adequate drains and other flashing details. (Note: Rainwater outlets shall be compatible with the roof covering(s)).

d) Structural movement joints.

e) The installation of the system/ assembly shall not proceed until all defects have been corrected.

J41- 3.2.5. SUITABILITY OF BASE:

a) 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.

b) The base shall have even falls with no areas subject to ponding.

c) All preliminary work including formation of upstands, kerbs, box gutters, sumps, grooves, chases, pipe sleeves and expansion joints and fixing of battens, fillets, flashings, copings, roof outlets, ventilators and anchoring plugs/ strips shall be complete and satisfactory.

d) The substrate shall be thoroughly swept prior to application of the roof membrane.

e) The substrate shall be blown clean using an air compressor to remove any remaining loose debris.

J41- 3.2.6. TEMPORARY DRAINAGE:

Temporary drainage at the low points of the roof shall be installed for the period of the works. This shall ensure dry working to allow the works to proceed without undue interruption.

J41- 3.2.7. SETTING OUT:

Accurately set out the works, particularly in relation to interfaces with other adjacent or related works.

Workmanship

J41- 3.2.8. 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 during the construction stage and from becoming wet due to adverse weather conditions.

c) The roof vapour/ air barrier shall be laid into the prevailing wind.

d) 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 of joints.

e) Material shall be fixed carefully and neatly to provide a fully sealed barrier free from tears, punctures and sagging.

f) Joints in the roof vapour/ air barrier shall be in the same direction as the roof slope and coincide with a crest of the trapezoidal liner sheet, where applicable, in order to offer a continuous bearing surface to maintain the integrity of the joint.

g) 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.

h) Substrates shall be primed as necessary to achieve a full bond.

i) Joints in a second layer, if required, shall be staggered by half a sheet.

j) At all roof perimeter edges, abutments and upstand kerbs, dress the roof vapour/ air barrier up sufficiently to provide a minimum 50mm seal when overlapped by the roof covering or turn back a minimum of 150mm over the insulation and seal down.

k) All penetrations by pipes, ducts, structural members and other components shall be completely sealed with adhesive tape as recommended by the sheet manufacturer.

l) Jointing tape shall be double sided sealant tape with vapour resistivity not less than the vapour control sheeting, as recommended by the sheet manufacturer.

m) Holes for fixing clips shall be drilled and any swarf removed prior to laying the vapour barrier.

n) Supervision shall be maintained during the installation of the vapour/ air barrier to ensure its integrity.

o) 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 *Project Manager*

J41- 3.2.9. INSULATION:

a) General:

i) Set out to minimise cutting and avoid small cut pieces at perimeters and penetrations.

ii) Accurately cut boards to accommodate abutments and system configuration.

iii) Material shall fit tightly with closely butted joints fittings and abutments and no gaps shall be left.

iv) Lay evenly, with no lipping at joints.

v) On completion of laying, ensure that boards are in good condition, well fitting and with no springing, flexing or rocking.

b) Inverted Roof Construction:

i) Not required

J41- 3.2.10. BALLAST/ COVERINGS:

Not required.

J41- 3.2.11. 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.

J41- 3.2.12. FLASHINGS/ TRIMS:

Joints in flashings/ trims shall be installed to fully accommodate thermal movement. Proprietary expansion joints shall be installed on flat sheets wherever practicable. Joints generally shall be in accordance with the system manufacturer's recommendations and/ or the recommendations contained within the latest edition of 'Profiled Sheet Metal Roofing and Cladding, A Guide to Good Practice' published by the National Federation of Roofing Contractors (NFRC) whichever the more onerous, or as otherwise stated. REFER also to Section H71 Lead Sheet Coverings / Flashings.

J41- 3.2.13. FIXINGS/ ADHESIVES:

a) Apply primers by mopping, brushing or spraying to achieve an even and full cover.

b) Allow primer to dry thoroughly prior to covering.

c) Heat and lay roof covering bonding compounds at a temperature sufficient to ensure full bonding over the whole surface. Do not overheat.

d) Bond heat sensitive insulation materials with cold bituminous adhesive as recommended by the manufacturer.

e) Use mechanical fasteners, adhesive or tape as recommended by the manufacturer.

J41- 3.2.14. STRUCTURAL MOVEMENT JOINTS:

a) Provide back-to-back supported upstands fixed either side of gaps coinciding with structural movement joints. The gap width shall match the structural movement requirements and be protected by cover flashings fixed to one side only.

b) Details shall be in accordance with the manufacturer's recommendations.

J41- 3.2.15. SKIRTINGS/ UPSTANDS:

a) Form all upstands to the manufacturer's recommendations.

b) Return insulation up all upstands as required. Include a cementitious external facing with inverted roof systems.

c) Fix protection boarding to protect insulation to all upstands. Protection boarding, insulation and flashings shall be designed and detailed to withstand wind loads/ pressures as specified.

d) Ensure that the membrane is dressed up (and over) all upstands to form continuous waterproofing as required.

e) Submit details of all upstands for acceptance.

J41- 3.2.16. ABUTMENTS:

Weathertight junctions with interfacing elements shall be correctly located and neatly dressed down.

J41- 3.2.17. VERGE TERMINATION:

a) Refer to the Design Drawings.

b) Interface with adjoining systems as required, as indicated on the Design Drawings, and provide a fully sealed interface.

J41- 3.2.18. EAVES TERMINATION:

a) Refer to the Design Drawings.

b) Interface with adjoining systems and eaves gutter, as indicated on the Design Drawings and provide a fully sealed interface.

Adverse Weather

J41- 3.2.19. WORKING IN ADVERSE CONDITIONS:

a) If unavoidable wetting of the construction does occur, take prompt action to minimise and make good any damage.

b) The membrane must not be laid in wet or damp conditions or at temperatures below 5°C.

c) Provide temporary covers and drainage as required to keep unfinished areas of the roof dry.

d) Suspend work in severe or continuously wet weather unless an effective temporary roof is provided over the working areas.

Workmanship Tolerances

J41- 3.2.20. GENERAL:

Tolerances shall be measured against the relevant Base Reference Datum; Location Reference Point; Location Reference Plane; Location Reference Surface or Reference Element as defined in Section A.

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 *Contractor* shall verify, with the appropriate supplier/ trade contractor, that such dimensions and locations are correct. Any deviation shall be agreed with the *Project Manager*.

o) Account shall be taken of the installation tolerance requirements such that repetitive elements are accurately located, relative to gridlines.

p) Tolerances shall not be cumulative. The most onerous tolerance shall apply.

J41- 4. SYSTEMS INTEGRATION AND HANDOVER

J41- 4.1. SYSTEMS INTEGRATION

J41- 4.1.1. GENERAL:

a) Integrate with Q37 RFS-02 Green Roof system overlay, H71 RFS-03 perimeter lead dressing, N25 ASE-02/02/03 roof access systems.

J41- 4.2. HANDOVER

J41- 4.2.1. GENERAL:

a) As the Contract Requirements.

End of Section

N25 PERMANENT ACCESS AND SAFETY EQUIPMENT

N25 - 1. FORMAT SYSTEMS PERFORMANCE AND MATERIALS

N25 - 1.1. SPECIFICATION TYPE

N25 - 1.1.1. DESCRIPTIVE WORKS:

a) The *Detailed Design* shall be undertaken, supplied and installed and the works warranted, complying with the visual intent indicated on the *Design Drawings* and criteria stated in the *Specification*.

b) Where no material, product or supplier is indicated in the *Specification*, the Contractor shall propose suitable materials and systems which comply with the visual intent and performance criteria stated in the Works Information and remain fully responsible for the *Detailed Design* of the works.

c) Where a particular material, product or supplier is indicated in the Specification, such material, product or supplier shall be deemed indicative representing the Employer's design intent only. The Contractor may complete the installation using that product, or equivalent confirmed as acceptable by the Project Manager, but shall remain fully responsible for the Detailed Design and performance of the works.

d) Interfaces:

i) Co-ordinate with the work of others including all interfacing as required.

ii) Performance shall be maintained at all interface conditions.

iii) Complete the *Detailed Design* of all interfaces with adjoining trades prior to commencement of manufacture.

N25 - 1.2. SYSTEM DESCRIPTIONS

Architectural and Functional Requirements

N25 - 1.2.1. SCOPE

a) This work section contains the following Permanent Access and Safety Equipment:

i) Type ASE-01 Galvanised Steel Guarding.

ii) Type ASE-02 Custom Metal Ladder Retention and Storage Systems.

iii) Type ASE-03 Existing Fall Arrest Cables Inspection and Reinstate

iv) Location: Existing Roof Areas.

N25 - 1.2.2. GENERAL:

a) The works generally shall be designed and installed by a specialist in accordance with BS 8437, BS EN 795, BS7883, BS EN 353, BS EN 365 and BS EN 360 and comply with all relevant CDM Regulations and Health and Safety requirements.

b) The components of the entire assembly shall be covered by a single source warranty.

c) Proprietary systems shall be British Board of Agrément (BBA) certified or tested to satisfy the requirements of the *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 *Contractor* shall maintain these dimensions and clearly state them on the *Working Drawings*. Any deviations to the indicated dimensions shall be stated with the Tender return.

f) Components for lightning protection and earth bonding shall be concealed and designed to satisfy Service Engineers requirements.

g) Systems 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, closures, 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 works.

h) NOTE : Contractor to develop details based on the Design Intent Drawing's and offer these for review and approval by Project Manager.

N25 - 1.2.3. TYPE ASE-01 ROOF EDGE PROTECTION GUARDING

Location: Refer to Design Drawings.

a) Custom designed guarding system with posts fixed to timber fascia and wall systems,
   i) High Access Solutions Ltd
   ii) Access House, Clun Street, Sheffield, S4 7JS
   iii) Main Contact: Ian Rennie
   iv) Tel: 0114 242 4811 / Mob: 07854 696 643
   v) Email: ian@has.email
   vi) www.highaccesssolutions.co.uk

b) System shown indicatively on drawings, design to be completed by specialist subcontractor.

c) Coordinate fixing location and type with existing timber wall assemblies.

d) Coordinate fixings with ALT-01 C90 Specification; new timber fascia systems.

e) System shall be installed in accordance with BS 7883 by the system manufacturer, or a installer approved by the system manufacturer, and then verified by the system manufacturer.

f) Submit proposals to client representative for approval.

N25 - 1.2.4. TYPE ASE-02 Custom Metal Ladder Retention and Storage Systems.

Location: Refer to Design Drawings.

a) Proprietary galvanise steel wall mounted eye plates and steel cable stay for securing ladder access from landing level to lower roof.
   i) Arrangement to be determined in consultation with client roof maintainers.
   ii) Arrangement of eye plate to be wall mounted to suit requirements to safely restrain and hold in place temporary ladder when positions for use for access to roof.
   iii) Ladder is existing supplied by client.

b) Install ladder secured to high level timber soffit panels via metal brackets and lockable cable ties, for use to provide access to high level roof.
   i) Arrangement to be determined in consultation with client roof maintainers.
   ii) Arrangement of support brackets to be mounted to existing timber fascia panels so suit requirements to securely hold in place ladder for storage when not in use.
   iii) Support bracket and cable tie arrangement to facilitate ease of release and removal of ladder for maintenance operative to safely position in place for access to the high level roof areas.
   iv) Locate eye plates to allow ladder to be secured in place when in operation.
   v) Supply custom ladder of length to suit particular requirements of location and arrangements.
   vi) Submit proposals to client representative for approval.

c) Supplier:
   i) High Access Solutions Ltd. Access House, Clun Street, Sheffield, S4 7JS. Main Contact: Ian Rennie
   ii) Tel: 0114 242 4811 / Mob: 07854 696 643
   iii) Email: ian@has.email. www.highaccesssolutions.co.uk

N25 - 1.2.5. TYPE ASE-03 Existing Horizontal Cable Safety Line Inspection, Report and Remedial Works.

Location: Refer to Design Drawings.

a) Inspect existing Fall Arrest Cable system in all location and report on conditions and suitability for future use following roof renewal work.

b) Renew and/or provide new fall arrest cable systems as required following inspection to provide certified systems.

c) Coordinate with all requirements and interfaces of new roof replacement works.

N25 - 1.2.6. FINISHES:

a) All metal components shall be corrosion protected.

b) Visible aluminium components shall be anodised.

N25 - 1.2.7. FIXINGS:

a) Fixings shall be concealed unless accepted otherwise by the Project Manager.

b) The type, size and positioning of all mechanical fixing devices shall be indicated on the Contractor's *Working Drawings* for Project Manager's approval. Full details of their installation techniques and torque settings shall be provided.

c) Where necessary fixing devices shall be capable of three-dimensional adjustment to accommodate building structure and fabrication/ installation tolerances.

d) All structural fixings shall be capable of physical inspection in accordance with BS 6037 and Health and Safety Directives.

N25 - 1.2.8. FIXING TO STRUCTURE:

a) Systems shall include all necessary mechanical fixing devices including, but not limited to, anchor bolts, fixings, sockets and other components.

b) All structural fixings shall be stainless steel grade 1.4401 of a size recommended by the manufacturer to achieve the performance criteria of the Specification..

c) Works shall include all necessary preparation such as drilling, plugging, screwing, bolting, cutting, casting-in / grouting-in and making good.

d) All Fixing shall be co-ordinated with the superstructure design and identified prior to fabrication. Any Fixing to the superstructure will not impair its corrosion protection systems or penetrate sealed sections.

N25 - 1.2.9. MAINTENANCE ACCESS EQUIPMENT COMPONENTS:

a) The integration of stainless steel restraint sockets, bracketry and other components as required shall be included for, provided by or for the Maintenance Access Equipment specialist, in accordance with the requirements of applicable standards.

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 *Project Manager*.

N25 - 1.2.10. PRESSED METAL COMPONENTS/ ACCESSORIES:

a) Systems shall incorporate all necessary pressed metal components/ accessories including flashings, copings, capping's, cills, reveals and returns.

b) Components shall be formed from fully welded and/ or sealed pressed aluminium sheets, which shall be sufficiently thick to provide a visually flat surface free from distortion and permanent deformation.

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 *Project Manager* 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) Airtightness, breather and vapour control membranes shall be included.

h) Joints:

i) Joints shall be of profiles accepted by the *Project Manager* and shall maintain the performance requirements of the *Specification*.

ii) Locations shall be as indicated on the *Design Drawings*, or to the acceptance of the *Project Manager*.

iii) Where applicable, joints shall be assembled centrally over bracketry.

iv) In all conditions simple butt straps shall not be accepted.

v) Joints shall include concealed continuous sealed gaskets with recessed/ folded interconnecting joints to provide a neat flush external appearance.

N25 - 1.3. PERFORMANCE REQUIREMENTS

N25 - 1.3.1. GENERAL;

a) Comply with the general performance requirements of Section A and the following specific performance requirements.

b) Also refer to Section L40 for the requirements of glazing panels which are to be inserted into the frame.

N25 - 1.3.2. FALL RESTRAINT SYSTEM

a) Provide suitable safety support systems for the purpose of carrying out periodic maintenance and cleaning (capable of taking the load of 2 operatives) for areas of roofing as indicated on the Design Drawings.

b) Take full responsibility for the design, final detailing, supply and installation of the works and associated components/ accessories specified herein including satisfying all testing requirements to meet the requirements of this Specification and Building Control, based on the Design Intent as indicated on the Design Drawings.

c) Systems shall be designed and installed by a specialist in accordance with BS 8437, BS EN 795, BS 7883, BS EN 353, BS EN 365 and BS EN 360.

d) Co-ordinate with the specialist safety harness manufacturer to ensure that all work related to the above is provided and agreed in the correct/ exact locations.

e) Comply with all relevant CDM Regulations and Health and Safety requirements.

f) Provide calculations and documentary evidence to demonstrate that system components, fixings and support posts as detailed on the Design Drawings are capable of satisfying the design loadings of the system. These shall be supplied to the Project Managers for acceptance.

g) Calculations must satisfy the maximum loads imposed to the structure as specified by the Structural Engineer.

h) The works shall be designed and fabricated to resist all dynamic and impact loads likely to be placed upon it without any permanent deformation, failure damage or reduction of performance as a result of the following dynamic and impact loads:

i) The dynamic load exerted by operatives performing their intended tasks.

ii) The impact loads exerted by the operation of any safety devices or sudden arrest or braking of motion.

i) The system loading requirements shall be based on the principle of supporting a minimum of 2 operatives.

j) The maintenance operative shall be attached to the system at all times to satisfy the Health and Safety Executive requirements.

k) Travelling anchors/ sliding mechanisms shall be capable of traversing over the support brackets without detachment, and capable of accepting an industry standard shock absorbing lanyard attachment.

N25 - 1.4. MATERIALS

Metalwork and Finishes

N25 - 1.4.1. METALWORK:

a) Refer to Section Z11.

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

N25 - 1.4.2. FINISHES:

a) Refer to Section Z30 for general finishes to metalwork.

b) Refer to Section Z31 for powder coatings.

c) Refer to Section Z33 for anodising.

Glass

N25 - 1.4.3. GENERAL:

Refer to Sections L40 and Z25.

Fixings

N25 - 1.4.4. GENERAL:

a) Refer to Section Z20.

b) Fixing components shall comply with all statutory requirements as to strength and type.

c) Fixings shall be inherently corrosion resistant or fully protected to prevent corrosion.

N25 - 1.4.5. 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, BS EN 20898 and BS EN ISO 898.

b) Austenitic stainless steel in accordance with BS EN ISO 3506: Parts 1 and 2.

c) Aluminium alloy of appropriate grade in accordance with BS EN 754: Parts 3-5, BS EN 755: Parts 1-9, BS EN 573: Part 3

d) , BS EN 515 and BS EN 12020: Parts 1 and 2.

Sealants and Gaskets

N25 - 1.4.6. SEALANTS:

a) Refer to Section Z22.

b) Sealant shall not leak or bleed causing any discolouration or staining.

c) Structural Silicone Sealants:

i) All 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 *Project Manager*.

ii) Structural sealant glazing design shall limit the design tensile stress of sealants to 138kPa.

N25 - 2. SUBMITTALS AND TESTING

N25 - 2.1. SUBMITTALS

Tender Submittals

N25 - 2.1.2. TENDER RESPONSE:

Not Required

N25 - 2.1.3. PRE-CONTRACT SAMPLES:

a) Not required.

N25 - 2.1.4. POST CONTRACT AWARD SAMPLES:

a) Not Required

N25 - 2.1.5. MOCK-UP REQUIREMENTS:

a) Not Required

N25 - 2.1.6. QUALITY BENCHMARK REQUIREMENTS:

Provide quality benchmarks, in location(s) to be agreed with the Project Manager with Section A.4000:

a) a) First completed installation of each type of system.

N25 - 2.2. TESTING

N25 - 2.2.1. GENERAL:

a) Refer to Section A for the general requirements for testing.

b) Where data from previous independently certified tests and Agrément certificates demonstrate that the proposed systems meet the performance requirements of the *Specification*,

c) off-Site independent testing need not be undertaken.

d) All on-Site testing specified herein shall be included for and shall be carried out by an independent testing body accredited by the United Kingdom Accreditation Service (UKAS).

e) The works shall be tested in accordance with the requirements of the CWCT Standard Test Methods for Building Envelopes.

N25 - 2.2.2. TEST REQUIREMENTS

a) Include for testing by an accredited testing specialist or provide independent certified test data to demonstrate compliance with the Specification.

b) On completion of the installation, the installer shall carry out all tests to confirm the system's competence in accordance with BS EN 795 class C and A1 anchorage system and issue a test certificate and two copies of user instructions and maintenance manuals for the overall installation.

N25 - 3. FABRICATION AND WORKMANSHIP

N25 - 3.1. FABRICATION

N25 - 3.1.1. GENERAL:

a) Fabrication of materials/ components shall, as a minimum, be in accordance with current regulations and standards.

b) Fabrication shall be based on Site measurements to accommodate construction tolerances. Dimensions given on the *Design Drawings* are indicative only and should not be used for fabrication unless confirmed by the *Project Manager* as suitable.

c) Where applicable and practical, fabrication and assembly shall take place in properly equipped workshops with sitework restricted to fixing.

d) Sections shall be formed true to shape, accurate in size, square, free from distortions, irregularities and defects to profiles indicated on the *Design Drawings*.

e) Materials/ components that are damaged or have any other physical imperfections shall not be used in the works.

f) Joints shall be fabricated so that the assembly shall be tight and close fitting to produce rigid materials/ components free from distortion.

Metalwork

N25 - 3.1.2. GENERAL:

a) Refer to Section Z11.

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) Metal components shall be protected against the effects of corrosion during and after fabrication.

d) All visible cut ends shall be polished smooth with no crude machine cut visible.

e) Cut joints/ junctions shall be clean and true without waves or deviations from the vertical and horizontal planes.

f) Preparation of surfaces to receive finishes and coatings shall be in accordance with the finishes and/ or coating manufacturer's recommendations.

g) Protective coatings and finishes on joints shall be to the same standard as the main assemblies.

h) Where welding is required, it shall be by the process known as manual inert gas tungsten-arc welding and it shall be carried out by a procedure in accordance with BS EN ISO 15614: Part 1 and by welders tested in accordance with BS EN 287: Part 1.

i) Welds shall be continuous and of a material and technique suitable to the sections being assembled.

ii) Weld finish/ welded joints shall be ground and polished smooth with all flux residues removed and no surface defects (e.g. undercut, porosity, deep ridges, etc.)

iii) Site welding shall be avoided.

Fabrication Tolerances

N25 - 3.1.3. GENERAL:

All fabrication and construction tolerances shall be in accordance with relevant British Standards.

N25 - 3.2. SITE INSTALLATION WORKMANSHIP

Workmanship

N25 - 3.2.2. GENERAL;

a) Installation shall be strictly in accordance with the manufacturer's written instructions by an approved installer.

b) Upon completion of the installation, the system shall be inspected and fully tested (as specified) and a test certificate covering a time period as agreed with the Project Manager is to be issued to the Project Manager. A 'non-perishable' notice showing date and period of validity of the test certificate shall be attached, as applicable, to the system at each access point, or device.

c) Protect all elements of the system against damage, corrosion, disfigurement and any other occurrence that will cause detriment to the performance of the system.

d) Before commencing installation carry out a visual and geometrical survey of the supporting building structure and fabric. Report immediately to the Architect if the structure/ fabric will not allow the required accuracy, security and achievement of performance when erected and fixed.

N25 - 3.2.3. INSTALLATION

a) All fixings shall be installed in accordance with the manufacturer's recommended procedures.

b) Isolating tape, plastics washers, or other suitable means to prevent bi-metallic corrosion shall be provided between dissimilar metals.

c) Workmanship shall be to BS EN 795 and BS EN 365 and Section Z11 of the Specification.

d) External systems shall be securely bonded to the lightning protection system.

N25 - 3.2.4. IDENTIFICATION AND REGISTRATION LABEL(S)

Provide and fix to each system a permanent label giving:

a) Manufacturer's name, address and telephone number.

b) Name and/ or reference code of site and system.

c) Serial number and year of manufacture.

d) Maximum number of users to be attached at any one time.

e) Date of installation and last inspection.

f) PPE requirements.

g) Whether the system is designed for 'arrest' or 'restraint'.

h) Label(s) shall be located in positions such that they can be easily read.

N25 - 3.2.5. OPERATING INSTRUCTIONS

a) Provide two complete sets of user instructions applicable to the installed works, refer also to Section A.

N25 - 3.2.6. OPERATING/ MAINTENANCE MANUAL

a) Refer to Section A.

b) Before Practical Completion provide printed instructions and recommended procedures to be established by the Project Manager for operating and routinely maintaining the equipment. Provide drawings and diagrams where appropriate. The information must include:

i) Instructions for assembling/ erecting equipment for use.

ii) Comprehensive operating instructions, including safety and emergency procedures, for all motions including upward, downward and lateral travel, and slew.

iii) Servicing and planned maintenance procedures, including assembly instructions where maintenance necessitates dismantling of machinery parts.

iv) List of replacement parts, with references.

v) Recommended procedures for testing equipment.

Fixings

N25 - 3.2.7. USE OF FIXINGS:

a) Refer to Section Z20.

b) The fixings shall be adequate to comply with the requirements of the *Specification*.

c) Fixings, within the framing components, shall not be visible unless indicated on the *Design Drawings*.

N25 - 3.2.8. GENERAL:

Repairs shall not take place without acceptance. Such acceptance shall not be given where the units are badly damaged or where the proposed repair would impair appearance or performance.

Cleaning

N25 - 3.2.9. GENERAL:

a) Any dirt or blemishes shall be cleaned from exposed surfaces.

b) Surfaces shall be washed and rinsed in accordance with the manufacturer's recommendations.

c) Adjacent surfaces shall be protected from damage due to cleaning operations.

d) Cleaning materials or processes that could alter the character of exposed finishes shall be used.

N25 - 4. SYSTEMS INTEGRATION AND HANDOVER

N25 - 4.1. SYSTEMS INTEGRATION

N25 - 4.2. HANDOVER

N25 - 4.2.1. GENERAL:

a) As the Contract Requirements.

End of Section

Q37. GREEN ROOFS

Q37- 1. FORMAT SYSTEMS PERFORMANCE AND MATERIALS

Q37- 1.1. SPECIFICATION TYPE

Q37- 1.1.1. DESCRIPTIVE WORKS:

a) Undertake the *Detailed Design*, supply, install and warrant the works complying with the visual intent indicated on the *Design Drawings* and criteria stated in the *Specification*.

b) Where no material, product or supplier is indicated in the *Specification*, the Contractor shall propose suitable materials and systems which comply with the visual intent and performance criteria stated in the Works Information and remain fully responsible for the *Detailed Design* of the works.

c) Where a particular material, product or supplier is indicated in the *Specification*, such material, product or supplier shall be deemed indicative representing the Employer's design intent only. The *Contractor* may complete the installation using that product, or equivalent confirmed as acceptable by the Project Manager, but shall remain fully responsible for the *Detailed Design* and performance of the works.

Q37- 1.2. SYSTEM DESCRIPTIONS

Architectural and Functional Requirements

Q37- 1.2.1. SCOPE:

This section of the Specification, when read in conjunction with the Design Drawings, provides particular requirements for the following:

Q37- 1.2.2. GREEN ROOF SYSTEMS

a) Type RFS-02: New Biodiverse Green Roof System

Extensive green roof system, protection fleece, drainage board, filter fleece, biodiverse substrate of varying depths and seed bed applied with Riverstone borders. Optigreen net soil retention system to 25° roof pitch. To be installed over RFS-01 Reinforced Bitumen Membrane and to coordinate will all requirements of roof membrane system to maintain overall roof system integrity.

Q37- 1.2.3. GENERAL

a) The supplier shall warrant the green roof system for the period of agreed maintenance cover. Supplier shall advise Client Representative of warranty offer and limitations associated with annual maintenance agreements.

b) The supply and install of the Green Roof system shall adhere to all requirements associated with the Warranty of the roof membrane system RFS-01. The contractor shall ensure all agreements are in place to provide a warranty to RFS-01 roof membrane system with RFS-02 Green Roof System installed over.

c) Warranty specific components such as Optigreen N system.

d) The works shall include all primers, bonding compounds, adhesives, fixings, sealants, ventilators, fillets and all other components necessary to complete the installation and meet performance requirements.

e) The works shall include all junctions and interfaces at perimeters to the external cladding, rooflights, chimney upstands, services penetrations and other interfacing works.

f) When interfacing with the waterproof membrane using mechanical fasteners, adhesive or tape, the recommendations of the manufacturer shall be followed and all requirements associated with the waterproof membrane warranty shall be adhered to.

Q37- 1.2.4. METAL COMPONENTS/ ACCESSORIES:

a) Systems shall incorporate all necessary metal accessories including edge profiles, collars, cappings to all penetrations, upstands and perimeter conditions as required.

b) Ensure all components are securely fixed in a manner compatible with maintaining the integrity of the waterproof membrane and in compliance will all requirement for the waterproof membrane warranty.

GREEN ROOF SYSTEMS

Q37- 1.2.5. TYPE: RFS-02 EXTENSIVE BIODIVERSE GREEN ROOF SYSTEM

Location: Applied to existing roof construction and new roof membrane RFS-01 Reinforced Bitumen Membrane.

a) Sky Garden Ltd Wildflower Blanket System or similar approved.

b) Sky Garden Ltd Address: 7 Keil Close, Broadway, Worcestershire, WR12 7DP T: 01242 620905 F: 01242 620739 W: www.sky-garden.co.uk.

Contact: Tom Wood T: 01242 620905

E: tom.wood@sky-garden.co.uk

c) System composed of:

i) ROOT BARRIER to Extensive Roof.

ii) PROTECTION LAYER To Extensive Roof. Product reference: SGPL0102, Material: Tensile geo-synthetic protection layer. Thickness: 3.5 mm.

iii) DRAINAGE LAYER To Extensive Roof. Product reference: SGDRRD20, Material: HDPE rigid drainage and retention board with high compressive strength. Depth: 20 mm,

iv) FILTER MEMBRANE To Extensive Roof. Product reference: SGFF01, Material: 150gsm non-woven polypropylene fibre filter membrane bonded to drainage layer. Thickness: 1.5 mm.

v) EXTENSIVE. Product reference: SGSBS50. Material: Screened blend of recycled crushed brick and lightweight mineral materials with 20% organic matter (PAS100 recycled green waste). Depth: 80-150mm.

- Ameliorant/ conditioner: N/A
- Coverage: Total.
- Declaration of analysis: Submit.
- Parameters: Varying depths to arrangement and location as described in design drawings.

vi) ROOF FINISH CONTOUR to Extensive Roof. Supplied by SkyGarden in compliance with design intent drawings.

vii) SURFACE HABITAT CREATION To Extensive Roof. Product Reference: surface habitats to increase biodiversity.

viii) SUBSTRATE RENTENTION SYSTEM.

ix) Manufactuer: Optigreen Net System. Product Reference ; As manufacturers details. Materials : As manufacturers details. Location to 25° roof pitch for extensive substrate retention as described in works information drawings.

x) VEGETATION To Extensive Roof.

Product reference: SGWB01. Density: pre-grown blanket (Species TBC) at point of installation. Vegitation coverage at installation miniumum (90% coverage) installed. Planting mix: Species, see appended seed / species mix for intent. Additional: Provide the range of species mixes as a regional pre-grown blanket.

xi) IRRIGATION.

- The green roof will need thorough saturation following installation. Immature systems will require a supplementary irrigation system to be available for the first 12 months of the establishment period. Blanket systems may need supplementary watering during periods of extended drought, especially for the first 2 years' post installation.

- Provide irrigation system that a connects at roof height to existing water supply pipe work. Green Roof supplier to test is water pressure at roof to verify 2.5-3bar and a flow rate of 60L/min is provided.
- Green Roof supplier to make recommendations for irrigations system suitable for water pressure supplied.
- Green Roof supplier to provide a permanent dripline irrigation system is required, network of above ground LDPE pipe work.

xii) AFTERCARE.

- A two-visit inspection and remedial package for year 1 maintenance (unless longer agreed) to manage the roof establishment period. Aftercare program should not cover watering but should cater for commissioning and de-commissioning of the irrigation system.
- System/drainage outlet checks and removal of invasive/unwanted plants to be included.
- Remedial aftercare to cover failure of the green roof to establish under certain criteria but not damage caused by other services, e.g. birds, theft, vandalism or extreme weather damage.

xiii) EDGE RETAINING PROFILE.

Product Reference: SGRE100100. Material: 2mm tensile aluminium upstand with corner fixings and perforations. Height 100mm, Foot 100mm.

xiv) SEPARATION PROFILE. Product Reference: SGRE100100. Material: 2mm tensile aluminium upstand with corner fixings and perforations. Height 100mm, Foot 100mm.

xv) BORDERS.

- Riverstone Pebbles. Size: 20-40mm rounded, washed.
- Colour: Multi-colour, mixed grade natural finish (minimal sharp edges but not guaranteed as stone damage during bagging and transport can occur).
- Laying: 300 mm borders around perimeters, penetrations and outlets (25kg sack units) with reduced width by agreement, according to location/adjacent finishes.

Q37- 1.3. PERFORMANCE REQUIREMENTS

Q37- 1.3.1. GENERAL:

a) Comply with the general performance requirements of Section A of the Specification and the following specific performance requirements. Proposals: Submit drawings, technical information, calculations and manufacturers' literature.

b) Roof structure: Submit all technical data to project manager to permit structural engineers to satisfy themselves that the roof structure and deck are suitable to receive the dead load of the proposed green roof system and landscape both during construction and on completion of the works.

c) Living Roof: 141kg/m2 (Dry) & 196kg/m2 (Saturated).

d) Allowance for additional loads during construction: To be advised.

e) Requirement: Restrict site activities to ensure that design loads are not exceeded, or submit proposals for temporary supports.

Q37- 1.3.2. STANDARDS

The Contractor developing the design is to comply with the current versions of the prevailing BS EN and industry best practice standards.

Structural Performance

Q37- 1.3.3. 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.

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.

Q37- 1.3.4. MOVEMENT;

a) The works shall be capable of accommodating the following movements without any permanent deformation or reduction in the specified performance:

i) Due to deflection under design loads.

ii) Due to the effects of repeated wind loading.

iii) Due to changes in dimension and shape of components arising from building movements, including settlement, creep, twisting and racking.

iv) Due to moisture movement.

Q37- 1.3.5. LIVE/ IMPOSED LOADS:

The works (green roof system, perimeter stone, and all aspects of the waterproofing system) shall be capable of accommodating the following live loads without any reduction in performance for the design life specified. Be responsible for selecting materials to suit the following loading conditions:

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

b) Vertically applied loads acting on the surface of the works arising from maintenance and cleaning operations.

c) Roof loads (including snow and snow drift loads) to be calculated in accordance with BS 6399: Part 3 for a roof with access for cleaning and maintenance.

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

e) The loads created by rainwater.

f) Loads imposed by water testing.

Q37- 1.3.6. ATTACHMENT/ WIND LOADS:

a) Design/ Select the method(s) of attachment of the roofing system to withstand, without permanent deformation, the positive and negative effects of wind loads on the roofing.

b) Design wind pressures: Refer to Section A-5.

c) Ensure that the method(s) of attachment makes sufficient provision for relative movement of materials and effects of vapour pressure; do not perforate the covering and do not reduce the performance of the vapour control layer below that required.

d) Flotation of the insulation shall be prevented.

Q37- 1.3.7. THERMAL MOVEMENT:

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

b) The annual surface temperature ranges for the materials used in the works shall be confirmed by the *Contractor* during the *tender* 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.

Environmental Performance

Q37- 1.3.8. MOISTURE MOVEMENT:

The works shall withstand the following movements without permanent deformation or any reduction in the specified performance:

a) Due to changes in the moisture content of their components, resulting from variations in the moisture content of the air, either inside or outside the building.

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

Q37- 1.3.9. THERMAL PERFORMANCE REQUIREMENTS:

a) No specific requirements

Q37- 1.3.10. SOLAR PERFORMANCE:

a) No specific requirements

Q37- 1.3.11. AIR PERMEABILITY : INFILTRATION

a) No specific requirements

Q37- 1.3.12. AIR PERMEABILITY : EXFILTRATION

a) No specific requirements

Q37- 1.3.13. CONDENSATION:

a) No specific requirements

Q37- 1.3.14. WEATHER AND WATER PENETRATION RESISTANCE:

a) Ensure Provide a secure, free draining system that maintains the integrity of the waterproof system the Green Roof is installed upon.

b) The Green Roof shall interface with works, including flashings and junctions with adjacent parts of the building, shall maintains the integrity of the weatherproofing 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) Leakage of water shall be defined as the sign of water, in any quantity, on the inside face of the construction.

d) Prevent infiltration in case of ice dams/ water back-up.

Q37- 1.3.15. DRAINAGE;

a) The works shall effectively discharge all precipitation to outlets provided for this purpose, without adversely affecting their performance or appearance, and shall ensure the timely disposal of surface water under all weather conditions.

b) Gutters: Not required.

Acoustic

Q37- 1.3.16. GENERAL;

a) No requirements.

Fire and Smoke

Q37- 1.3.17. GENERAL:

Fire and smoke performance requirements shall be as indicated in the *Design Drawings* and Section A.

Q37- 1.3.18. 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.

Q37- 1.3.19. FIRE RESISTANCE:

a) No specific requirements

Durability

Q37- 1.3.20. GENERAL:

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

b) Selected materials shall be durable and satisfy the requirements of the *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 external/ internal air velocity.

d) The works shall perform throughout the service life without failure resulting from defects in design, materials or workmanship.

Q37- 1.4. MATERIALS

Sub-layers/ Interlayers

Q37- 1.4.2. GENERAL;

a) As recommended by the system manufacturer.

b) Polyester, polypropylene or glassfibre based fleeces, or similar, shall be installed as various sub-layers/ interlayers/ filter layers/ protection layers/ cushion layers/ levelling layers/ separation layers/ slip layers (and others as applicable) to the required system installations and with suitable values to achieve the requirements of the *Specification*.

i) Polyester based fleece:

- Tensile strength (N/ 5cm) to BS EN 29073: Part 3.
- Elongation at break (%) to BS EN 29073: Part 3.

ii) Polypropylene based fleece:

- Thickness (mm) to BS EN ISO 9863: Part 1.
- Weight (g/ m²) to BS EN ISO 9864.
- Elongation at break (%) to BS EN ISO 10319.
- Static puncture test (N) to BS EN ISO 12236.

iii) Glassfibre based fleece:

- Thickness (mm) to DIN 53855: Part 1.
- Weight (g/ m²) to DIN 52142.
- Tensile strength along (N/ 5cm) to DIN 52123.
- Tensile strength cross (N/ 5cm) to DIN 52123.

c) Fleece type shall be compatible with and suitable for the type and condition of interfacing component/ substrate.

d) Where necessary, the sub-layers shall be suitable for exposure to UV light/ solar properties.

e) Determine the requirement for fleeces to have backing materials.

Ballast and Coverings

Q37- 1.4.3. PAVING SLABS;

Not required.

Sealants

Q37- 1.4.4. GENERAL:

a) Refer to Section Z22.

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 or staining.

Fixings/ Adhesives

Q37- 1.4.5. GENERAL:

Refer to Section Z20.

Metalwork

Q37- 1.4.6. General

Refer to Section Z11.

a) Refer to Section Z30 for general finishes to metalwork.

b) Refer to Section Z31 for powder coatings.

c) Refer to Section Z33 for anodising.

Q37- 2. SUBMITTALS AND TESTING

Q37- 2.1. SUBMITTALS

Tender Submittals

Q37- 2.1.1. TENDER RESPONSE:

Not required

Q37- 2.1.2. PRE-CONTRACT SAMPLES:

Not required

Q37- 2.1.3. POST CONTRACT AWARD SAMPLES:

Not Required

Q37- 2.1.4. MOCK-UPS:

Not Required

Q37- 2.1.5. QUALITY BENCHMARK REQUIREMENTS:

Quality benchmarks, in location(s) to be agreed with the *Project Manager*, in accordance with Section A shall be provided as follows:

a) First 10m² of each type .

Q37- 2.2. TESTING

Q37- 2.2.1. GENERAL:

a) Refer to Section A clause series A-6 for the general requirements for testing and the approach to off-Site and on-Site testing.

b) Include for all on-Site testing specified herein, which shall be carried out by to verify requirements associated with RFS-01 Roof Membrane warranty requirements.

On-Site Testing

Q37- 2.2.2. AIR PERMEABILITY : EXFILTRATION

a) Not required.

Q37- 2.2.3. WATERPROOFING AND WATERTIGHTNESS;

a) Comply with all requirements associated with with RFS-01 Roof Membrane warranty inspection and testing.

b) Green Roof works shall facilitate tests for the watertightness of the overall roof system.

c) Green Roof installation shall comply with any schedule of the programme for roof testing to be carried out.

d) Prior to testing, ensure that the works have been completed to a stage where the integrity of the membrane can be tested, that obvious defects have been made good and that the roof has been cleared of all materials, debris and dust.

e) Testing shall be carried out when all works to the roof areas are complete, including that of all associated and interfacing trades.

f) 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, where applicable water shall be drained completely. Prepare a report to be submitted to the *Project Manager* 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) At completion of the test there shall be no standing water in locations intended to remain dry. Certify the waterproof integrity of the roof.

g) After making good any defects, retest locally to verify integrity of repair.

Q37- 2.2.4. THERMAL PERFORMANCE TESTING:

a) No requirements.

Q37- 3. FABRICATION AND WORKMANSHIP

Q37- 3.1. FRABRICATION

Q37- 3.1.1. GENERAL:

Q37- 3.1.2. TOLERANCES FOR MANUFACTURE

a) The design tolerances shall be rigidly adhered to.

b) The provisions intended to accommodate the construction tolerances and surrounding elements shall be stated and shown on the *Working Drawings*. Any further information required in formulating the design shall be obtained from the *Project Manager*.

Q37- 3.2. WORKMANSHIP

Standards

Q37- 3.2.1. GENERAL:

a) The installation shall be carried out by fully trained, competent and certified tradesmen.

b) The components must be in compliance with roof sign off documents and using Green roof supplier compliant selections installed or supervised by Green roof supplier operatives.

c) Comply with the manufacturer's recommendations at all times unless specifically adjusted according to the Specification.

d) Preparation: Clear all surfaces of debris.

e) Timing: After certification of waterproof membrane integrity.

f) Surface condition: Visually inspect waterproof membrane, report any damage. See 3.2.3 Inspection.

g) Faults in waterproof membrane: Report.

h) Contamination: Do not use materials detrimental to healthy plant growth.

i) Storage: Do not overload.

j) Point loads: Avoid.

k) Outlets: Do not block.

l) When interfacing with RFS-01 Waterproof membrane comply with BS 6229, BS EN 1928 and BS 8000.

m) Any ancillary products or accessories, where not specified, shall be types recommended for the purpose.

n) When installing the roofing covering using mechanical fasteners, adhesive or tape, the recommendations of the manufacturer shall be followed:

i) Allow solvents to evaporate naturally from the adhesive.

o) The perimeter of the roofing covering membrane shall be sealed with mechanical fastenings at all roof edges, changes of plane, kerbs and upstands.

p) Lay out membrane panels in a fashion so that splices are installed to shed water.

q) Lay out membrane panels to ensure uniformity of coverage and that all joints are correctly formed.

Q37- 3.2.2. FIXING TO STRUCTURE:

a) Survey the structure, checking line, level, and fixing points before commencement and report immediately to the *Project Manager* if the structure is unsuitable to receive the works.

b) The works shall include the detailing of all interfacing connections to the structure.

Preparation

Q37- 3.2.3. INSPECTION;

All surfaces, substrates and structures to receive the works shall be examined and verified as acceptable and proper for the application and to verify the following:

a) Adequacy of RFS-01 Membrane installation and all interfaces in compliance with interface requirements for RFS-02 Green Roof system.

b) Report and record inspection to format and process agreed with RFS-01 Membrane warranty requirements.

c) Adequate drains and other flashing details. (Note: Rainwater outlets shall be compatible with the roof covering(s)).

d) The installation of the system/ assembly shall not proceed until all defects have been corrected.

Q37- 3.2.4. SUITABILITY OF BASE:

a) 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.

b) The base shall have even falls with no areas subject to ponding.

c) All preliminary work including formation of upstands, kerbs, box gutters, sumps, grooves, chases, pipe sleeves and expansion joints and fixing of battens, fillets, flashings, copings, roof outlets, ventilators and anchoring plugs/ strips shall be complete and satisfactory.

d) The substrate shall be thoroughly swept prior to application of the roof membrane.

e) The substrate shall be blown clean using an air compressor to remove any remaining loose debris.

Q37- 3.2.5. ROOT BARRIER INSTALLATION.

Joints: Minimise. Overlaps (minimum): 100mm.

Q37- 3.2.6. PROTECTION LAYER INSTALLATION.

Joints: Minimise. Overlaps (minimum): 100mm.

Upstands: Extend to top of growing medium.

Q37- 3.2.7. DRAINAGE LAYER INSTALLATION.

Extent: Continuous beneath living roof area. Fitting: Loose laid.

Up stands: Fit closely around penetrations and outlets.

Q37- 3.2.8. FILTER MEMBRANE INSTALLATION.

Joints: Minimise. Overlaps (minimum): 100mm. Fitting: Loose laid.

Upstands: Extend to top of growing medium.

Q37- 3.2.9. GROWING MEDIUM INSTALLATION.

Handling: Minimise. Conditions: Handle in the driest condition possible. Do not handle or install wet or frozen. Layers: N/A. Depth (maximum): as per Q37 clause 1.2.5.

Sequence: Gently firm each layer before spreading the next.

Q37- 3.2.10. VEGETATION INSTALLATION.

Handling: Minimise.

Vegetation: Foliage upright. Avoid tearing blanket. Lift from beneath root zone/carrier, not foliage. Minimise foot traffic or laying of materials on to blanket during or after installation.

Conditions: Blankets should be moist but not saturated nor dry. Do not handle or install when frozen.

Surface preparation: Ensure substrate surface is flat and even before laying blanket.

Layers: Lay blanket root zone on to substrate ensuring direct contact with substrate across entire surface. Ensure no air pockets between substrate and root zone.

Sequence: Remove from pallets on same day of delivery. Open rolls with foliage upwards and lay direct onto substrate. Gently firm blanket onto substrate surface. Water in on day of installation.

Q37- 3.2.11. EDGE RETAINING PROFILE INSTALLATION.

Cutting: Neat, accurate and without spalling.

Junctions: Vertical, secured using proprietary connectors.

Position: True to line and level. Smooth continuous lines.

Fixing: Spot bonded with manufacturers approval or system ballasted.

Retention detail used where there are system retention requirements and should be sport bonded in accordance with manufacturers approval or system ballasted.

Separation detail if for physical divide between system and slab or stone detailing and is system ballasted.

Q37- 3.2.12. LAYING BORDER.

Condition of substrate: Clean.

Gravel guards: Fit to outlets.

Laying: Generally 300 mm borders around perimeters and outlets & chimneys - spread evenly, do not pile to excessive heights. Extended border to lower roof high level upstand to clerestory glazing to provide linear border line to chimney interfaces. Refer to design drawings.

Depth (minimum): 60 mm.

Previously laid materials: Protect during the spreading of Riverstone Pebbles.

Q37- 3.2.13. TEMPORARY DRAINAGE:

Temporary drainage at the low points of the roof shall be installed as required for particular arrangements of the project for the period of the works. This shall ensure dry working to allow the works to proceed without undue interruption.

Q37- 3.2.14. SETTING OUT:

Accurately set out the works, particularly in relation to interfaces with other adjacent or related works.

Workmanship

Q37- 3.2.15. VAPOUR CONTROL LAYER/ AIR BARRIER:

a) Not required.

Q37- 3.2.16. INSULATION:

a) Not required.

Q37- 3.2.17. BALLAST/ COVERINGS:

Ballast shall be spread evenly to a nominal depth of 85mm and sufficient to prevent flotation of installations.

Q37- 3.2.18. 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.

Q37- 3.2.19. FLASHINGS/ TRIMS:

Joints in flashings/ trims shall be installed to fully accommodate thermal movement. Joints generally shall be in accordance with the system manufacturer's recommendations.

Q37- 3.2.20. FIXINGS/ ADHESIVES:

a) Apply primers by mopping, brushing or spraying to achieve an even and full cover.
b) Allow primer to dry thoroughly prior to covering.
c) Heat and lay roof covering bonding compounds at a temperature sufficient to ensure full bonding over the whole surface. Do not overheat.
d) Bond heat sensitive insulation materials with cold bituminous adhesive as recommended by the manufacturer.
e) Use mechanical fasteners, adhesive or tape as recommended by the manufacturer.

Q37- 3.2.21. STRUCTURAL MOVEMENT JOINTS:

a) Not required.

Q37- 3.2.22. SKIRTINGS/ UPSTANDS:

a) Form all upstands to the manufacturer's recommendations.

Q37- 3.2.23. ABUTMENTS:

Weathertight junctions with interfacing elements shall be correctly located and neatly dressed down.

Q37- 3.2.24. VERGE TERMINATION:

a) Refer to the Design Drawings.
b) Interface with adjoining systems as required, as indicated on the Design Drawings, and provide a fully sealed interface.

Q37- 3.2.25. EAVES TERMINATION:

a) Refer to the Design Drawings.
b) Interface with adjoining systems and eaves gutter, as indicated on the Design Drawings and provide a fully sealed interface.

Adverse Weather

Q37- 3.2.26. WORKING IN ADVERSE CONDITIONS:

a) Unfinished work: Secure from damage and wind uplift.
b) Conditions: Do not install or work with frozen materials.
c) If unavoidable wetting of the construction does occur, take prompt action to minimise and make good any damage.
d) The membrane must not be laid in wet or damp conditions or at temperatures below 5°C.

e) Provide temporary covers and drainage as required to keep unfinished areas of the roof dry.

f) Suspend work in severe or continuously wet weather unless an effective temporary roof is provided over the working areas.

Workmanship Tolerances

Q37- 3.2.27. GENERAL:

Tolerances shall be measured against the relevant Base Reference Datum; Location Reference Point; Location Reference Plane; Location Reference Surface or Reference Element as defined in Section A.

a) All elements shall be set out to their correct position as indicated on the *Design Drawings* and/ or *Working Drawings*.

b) Horizontal elements shall be level and true over length of installation relative to interfacing elements.

c) Account shall be taken of the installation tolerance requirements such that repetitive elements are accurately located, relative to gridlines.

d) Tolerances shall not be cumulative. The most onerous tolerance shall apply.

Q37- 4. SYSTEMS INTEGRATION AND HANDOVER

Q37- 4.1. SYSTEMS INTEGRATION

Q37- 4.1.1. GENERAL:

a) Integrate with Green Roof system overlay, perimeter lead dressing, roof access and edge protection systems, lightning protection systems.

Q37- 4.1.2. INSPECTION:

a) Timing: Before handover.

b) Give notice (minimum): 5 working days.

Q37- 4.1.3. COMPLETION:

a) General: Leave the works in a clean, tidy condition.

b) Surfaces: Clean immediately before handover.

c) Outlets: Clean and clear of obstructions.

d) Completed green roof: Protect from adjacent or high level working.

Q37- 4.2. HANDOVER

Q37- 4.2.1. GENERAL:

a) As the Contract Requirements.

Q37- 4.2.2. DOCUMENTATION:

a) Timing: Submit at handover.

b) Contents: Growing medium declaration of analysis.

c) Manufacturers' guarantees and warranties.

d) Procedures for maintenance of the green roof.

e) Record drawings showing the location of planting and associated features.

f) Aftercare agreement.

g) O&M Manual.

h) Irrigation guidelines.

i) Number of copies: To be advised by Client Representative.

Q37- 4.2.3. MAINTENANCE:

a) This should consist of a minimum of two visits per year by the appropriate labour force, which will be dictated by the roof area. Irrigation is unlikely to be required once the plant player is established.

b) Establishment of immature systems 18-36 months and blanket systems 12-18 months.

End of Section

Z10. JOINERY

To be read in conjunction with Section A and other related sections of the Specification, Preliminaries and Contract Conditions.

Z10 - 1. MATERIALS/ PRODUCTS AND FABRICATION

Z10 - 1.1. MATERIALS AND FABRICATIONS

Z10 - 1.1.1. TIMBER /WOOD

a) The dimensions shown in the Design Drawings and/or Working Drawings of timber subframes, material thicknesses, the dimensions of mullions, transoms, etc. shall be maintained within tolerances agreed with the Company's Representative.

b) All materials and components shall be durable and comply with the minimum standards set out in the Specification, together with the relevant British Standards.

c) Materials for wood based panels shall either have zero formaldehyde release or conform to class E1 in accordance with BS EN 13986.

d) For each material or component the total quantity shall be obtained from the same supplier or manufacturer, unless otherwise agreed with the Company's Representative.

e) 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.

f) Protection shall be provided until handover to avoid any blemishes on the finished elements.

g) 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. Concealed framework for units shall be protected and sealed in all conditions. Any cut edges shall be treated to ensure that the level of protection is

Z10 - 1.1.2. FABRICATION GENERALLY

a) Fabricate joinery components to BS 1186: Part 2.

b) Form sections out of the solid when not specified otherwise. Carefully machine timber 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) Assemble with tight, close fitting joints to produce rigid components free from distortion.

d) Screw heads shall be countersunk not less than 2mm below timber surfaces that will be visible in completed work. All screws shall have clearance holes. Screws of 8 gauge or more and all screws into hardwood shall have pilot holes.

Z10 - 1.2. WORKMANSHIP

Z10 - 1.2.1. CROSS-SECTIONAL DIMENSIONS

a) Cross-sectional dimensions of timber shown on the Design Drawings are nominal sizes unless stated otherwise. Reduction to finished sizes shall be to BS EN 1313: Part 1 for softwoods and BS EN 1313: Part 2 for hardwoods. Deviation from the stated sizes shall not be permitted unless prior acceptance is given.

Z10 - 1.2.2. PRESERVATIVE TREATED TIMBER

a) Carry out as much cutting and machining as possible before treatment.

b) Retreat all timber that is sawn, ploughed, planed or otherwise extensively processed in any way.

c) Treat surfaces exposed by minor cutting and drilling with two flood coats of a solution recommended for the purpose by the main treatment solution manufacturer.

Z10 - 1.2.3. MOISTURE CONTENT

a) The moisture content of timber and wood based sheets shall be maintained during manufacture and storage, within the range specified for the component.

Z10 - 1.2.4. BONDED DECORATIVE LAMINATES

a) a. Apply sheets in accordance with 'Recommendations for the fabrication of decorative laminated sheets' published jointly by the British Plastics Federation and the British Laminated Plastics Fabricators' Association.

b) Condition sheets before bonding. Unless specified otherwise, apply to the reverse side of flat boards a balancing veneer of similar construction to the decorative veneer and from the same manufacturer.

c) Bond in presses whenever possible.

d) Finished components shall be free from bow, twist, scratches, chipping, cracks, pimpling, depressions, glue spill, staining, defects in colour and pattern and the like.

e) All joints exposed to view in the finished work shall be tight butted and true with no lipping. Chamfer edges at all external angles.

Z10 - 1.2.5. WOOD VENEERS

a) Condition core material and veneers before bonding. Unless specified otherwise, apply to the reverse side of flat boards a balancing veneer with the same moisture and temperature movement characteristics as the facing veneer.

b) Set out veneers so that features and pattern are aligned and in regular, uniform symmetry unless specified otherwise. Apply veneers with edges tight butted, no gaps or other open defects and no lipping.

c) Bond in presses whenever possible.

d) Finished components shall be free from bow, twist, scratches, chipping, pimpling, depressions, glue spill, staining and the like.

e) Sand to a fine, smooth finish free from sanding marks.

Z10 - 1.2.6. FINISHING AND PROTECTING

a) Sand all joinery to give smooth, flat surfaces suitable to receive specified finishes. Arrises shall be eased unless specified otherwise.

b) Before assembly, seal all end grains for external components with primer or sealer as specified and allow to dry.

c) Protect completed joinery against damage, dirt, moisture and other deleterious substances.

End of Section

Z11. METALWORK

To be read in conjunction with Section A and other re sections of the *Specification*, Preliminaries and Contract Conditions.

Z11 - 1. MATERIALS/ PRODUCTS AND FABRICATION

Z11 - 1.1. MATERIALS

Z11 - 1.1.1. METAL COMPONENTS:

a) *Detailed Design* of sections, material thicknesses and the dimensions shown on the *Design Drawings* shall be maintained within specified tolerances.

b) materials and components shall be durable and to the minimum standards set out in the *Specification*, together with the relevant British Standards.

c) each material or component, the total quantity shall be obtained from the same supplier or manufacturer unless otherwise agreed with the *Project Manager*.

d) All inaccessible steel shall be properly protected against corrosion for the design life of the Works.

e) All support systems shall be of adequate thickness and strength, to meet the structural requirements and eliminate risk of distortion in finished surfaces.

f) Protection shall be provided until handover to avoid any blemishes on the finished elements.

g) All exposed metalwork shall be finished in accordance with the relevant British Standards. Unless otherwise specified, concealed items shall be mill finished aluminium in internal conditions only, or hot dip galvanised steel in accordance with BS EN ISO 1461. Any cut edges shall be treated to ensure that the level of protection is maintained.

h) Adequate measures shall be taken to prevent bimetallic corrosion between dissimilar metals and to isolate aluminium components from cementitious surfaces. To this end attention is drawn to publication PD 6484 'Commentary on corrosion at bimetallic contacts and its alleviation'.

Z11 - 1.1.2. ALUMINIUM:

a) All extruded aluminium alloy members shall be fabricated from the appropriate grade of aluminium alloy in accordance with BS EN 754: Parts 3-5 and BS EN 755: Parts 1-9 unless otherwise specified.

b) Unless specified otherwise, aluminium sheeting shall be a minimum of 3mm thick and be in accordance with BS EN 485: Parts 1-4, BS EN 515 and BS EN 573: Parts 1-3.

c) Only appropriate grades, strengths and thicknesses of aluminium shall be used to ensure that all structural and finishing requirements of the *Specification* are met. The wall thicknesses of aluminium extrusions shall be sufficient to ensure their rigidity in the lengths required in the final installation.

d) All aluminium fixing brackets and cleats shall be manufactured from the appropriate grade of alloy in accordance with BS EN 515, BS EN 573: Part 3 , and BS EN 755: Parts 1-9. If visible, they shall be finished to match the metal panels and framing members.

e) Structural aluminium shall be in accordance with BS EN 1999: Parts 1-1, 1-3 and 1-4.

f) All exposed aluminium shall be protected with low tack adhesive film during construction and prior to handover.

g) Where aluminium is to be anodised, aluminium sheeting and flat panels shall be manufactured using alloy grade J57S, or acceptable equivalent, and aluminium extrusions shall be manufactured using alloy grade 6063, or acceptable equivalent.

h) Aluminium panels shall be manufactured such that the grain on each runs in the same direction.

i) "Die Drawings" shall be issued to the *Project Manager* for review. These shall be considered as *Working Drawings*. The "Die Drawings" shall indicate polished surfaces and shape.

j) Aluminium extrusions containing score lines resulting from poorly polished surfaces shall not be acceptable.

k) Aluminium sheets shall not suffer bowing, dimpling, oil canning, sagging, pillowing, rippling, warp, abrupt transitions or other visible deformation or irregularity.

l) Aluminium shall be separated from concrete by bitumen paint or similar methods, acceptable to the *Project Manager*.

Z11 - 1.1.3. MILD STEEL:

a) All mild steelwork shall be in accordance with BS EN 1993: Parts 1-1, 1-5, 1-8 and 1-10, unless stated otherwise.

b) Long and flat products:

i) Hot rolled structural steels (excluding structural hollow sections and tubes to BS EN 10025: Parts 1 and 2.

ii) Fine grain steels including special steels to BS EN 10025: Parts 3 and 4.

iii) Steels with improved atmospheric corrosion resistance to BS EN 10025: Part 5.

c) Plate, sheet and strip:

i) High yield strength steel plates and wide flats to BS EN 10025: Part 6.

ii) Hot rolled products:

- High yield strength steel flat products for cold forming to BS EN 10149: Parts 1,2 and 3.
- Carbon steel sheet and strip for cold forming to BS EN 10111.
- Narrow strip steel products for forming and general engineering purposes to BS 1449: Part 1.

iii) Cold rolled products:

- Steel sections to BS EN 10162.
- High yield strength mico-alloyed steel flat products for cold forming to BS EN 10268.

- Carbon steel flat products for cold forming to BS EN 10130 and BS EN 10131.
- Uncoated carbon steel narrow strip for cold forming to BS EN 10139 and BS EN 10140.
- Narrow strip for general engineering purposes to BS EN 10132: Parts 1-3.
- Carbon steel flat products for vitreous enamelling to BS EN 10209.

iv) Coated flat products:

- Hot dip zinc coated carbon steel sheet and strip for cold forming to BS EN 10346 and BS EN 10143.
- Hot dip zinc coated structural steel sheet and strip to BS EN 10143 and BS EN 10346.
- Hot dip zinc-aluminium (za) coated sheet and strip to BS EN 10346.
- Hot dip aluminium-zinc (az) coated sheet and strip to BS EN 10346.
- Organic coated flat products to BS EN 10169: Part 1.

d) Structural hollow sections (SHS):
   i) Hot finished non-alloy and fine grain steels to BS EN 10210: Parts 1 and 2.
   ii) Cold formed welded non-alloy and fine grain steels to BS EN 10219: Part 2.
   iii) Hot finished weather resistant steels to BS 7668.

e) Tubes:
   i) Seamless circular tubes to BS EN 10297: Part 1.
   ii) Seamless cold drawn tubes to BS EN 10305: Part 1.
   iii) Welded and cold sized square and rectangular tubes to BS EN 10305: Part 5.
   iv) Welded circular tubes to BS EN 10296: Part 1.
   v) Welded cold drawn tubes to BS EN 10305: Part 5.
   vi) Welded cold sized tubes to BS EN 10305: Part 3.Equal flange tees to BS EN 10055.

f) Equal and unequal angles to BS EN 10056: Parts 1 and 2.

g) General wire and wire products to BS EN 10218: Part 2.

h) Carbon steel wire for general engineering purposes to BS 1052.

i) Open steel die forgings for general engineering purposes shall comply with BS EN 10250: Part 2 for non-alloy quality and special steels and BS EN 10250: Part 3 for alloy special steels.

j) Fabrication of steelwork shall be in accordance with the

k) *Specification*.

l) Before and after making permanent connections in frames and other structural elements, which are assembled before delivery to Site, the fit shall be checked for accuracy.

m) Welding procedures shall be such that distortion is reduced to a minimum and local distortion rendered negligible in the final fabrication. Corrections, if necessary, shall be undertaken by a method which has been agreed to by the *Project Manager*.

n) No welds other than those shown on the *Working Drawings*, even for temporary attachments or repairs, shall be acceptable unless agreed in advance by the *Project Manager*. If welded temporary connections are agreed upon, then the welding and removal of the connection shall be in accordance with BS EN 1011: Parts 1 and 2.

o) Vent holes in hollow sections shall be sealed in a manner that shall prevent the ingress of moisture. The proposed method of achieving this requirement shall be submitted for review by the *Project Manager*.

p) External visible lines and depressions caused by the internal welding of hollow section steelwork shall be positioned in the works so as to be non-visible.

Z11 - 1.1.4. STAINLESS STEEL;

a) Unless otherwise specified, stainless steel shall be austenitic and non-magnetic to BS EN 10088.

i) Sheet, strip and plate be in accordance BS EN 10088: Part 2.

ii) Bars, rods, wire and sections be in accordance BS EN 10088: Part 3.

iii) Welded circular tube be in accordance with BS EN 10296: Part 2.

iv) Seamless circular tube be in accordance BS EN 10297: Part 2.

b) Specific grade designations shall be either as specified in the relevant sections of the *Specification* or, where not identified specifically, selected to meet the performance criteria specified for the particular element or components.

c) Stainless steel fasteners, bolts, screws, nuts and other fixings shall be either grade A2 or grade A4 to BS EN ISO 3506: Parts 1 and 2. The property class of fastenings shall be selected to meet the performance requirements as specified.

d) Stainless steel shall be produced to 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 & 2 as appropriate.

e) Unless otherwise specified, welds to visible areas of stainless steel shall be ground smooth to achieve a seamless surface. Heat tints shall be removed using light abrasives, pickling paste, wire brushing or similar to achieve continuity with the specified finish. Areas difficult to access shall be manually finished if necessary.

f) All welds shall be in accordance with BS EN 1011: Part 3 and the definitions given in BS 499: Part 1 and Part 1 Supplement. Distortion due to thermal movement shall be minimised using jigs or other methods as appropriate during welding. Welding methods and consumables shall be chosen as most appropriate to the type, thickness, shape and location of joints to meet the performance levels required and have mechanical properties at least equal to the original base metal. In addition, consumables shall have an equal or superior corrosion resistance to the base metal being welded. All welding recommendations required to meet other relevant standards as specified shall also apply. Electrodes for manual metal arc welding shall be in accordance with BS EN 1600.

g) Stress corrosion or cracking shall not occur and all necessary precautions in 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 cold working or welding.
   iii) Aggressive local environmental conditions.
   iv) Metal temperatures that in conjunction with the above may induce stress corrosion cracking.

h) Stainless steel castings:
   i) Shall be in accordance with BS EN 10293 and BS 3146: Part 2.
   ii) Shall be of austenitic stainless steel and the casting alloy shall be determined by the *Contractor* to meet the requirements of the *Specification* but shall be equal or superior to grade EN 1.4408 with respect to corrosion resistance.
   iii) Shall be manufactured using the lost wax process or such other process as may be proposed by the *Contractor* and accepted by the *Project Manager*.
   iv) Exposed feeder ports and die lines shall not be acceptable in the finished castings.
   v) The surface finish of the castings shall be determined by the submission of samples for review and acceptance by the *Project Manager*. Samples once accepted should be the standard required for all subsequent castings to be used in the works.
   vi) The surface roughness of the casting surface prior to any subsequent finishing process shall be SCRATA A2 (Steel Castings Research and Trade Association) or better.
   vii) Allowance shall be made for two post production finishing processes to be utilised. The processes shall be agreed with the *Project Manager* and shall include blast finishes (including bead blasting) and electropolishing or acid pickling.

i) Open steel die forgings for general engineering purposes shall comply with BS EN 10250: Part 4.

j) Stainless steel wire, cold-forged fasteners and similar components shall be in accordance with BS EN 10263: Part 5.

k) Stainless steel for wall ties and other components associated with masonry construction shall be in accordance with BS EN 1996: Parts 1-2, 2 and 3 and BS EN 845: Part 1.

l) Stainless steel shall be protected where possible using appropriate adhesive film, to the film manufacturer's written recommendations.

m) If stainless steel has not been protected by adhesive film, it shall be thoroughly cleaned prior to presentation to the *Project Manager* for acceptance.

Z11 - 1.1.5. 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 Specification, and provide a consistent uniform finish as accepted by the Project Manager through sampling.

Z11 - 1.1.6. WEATHERING STEEL

a) Weathering steel shall be such as Cor-ten registered to the United States Steel Corporation (USS) or acceptable equivalent.

b) Steel shall be high strength, low alloy, atmospheric corrosion resistant steel in accordance with ASTM A 242/ A 242M, ASTM A 588/ A 588M, ASTM A606 and as described in BS EN 10025: Parts 1 and 2.

c) The protective oxide shall provide a consistent, uniform finish to all components including all perforations, welds and fixings.

d) Steel surfaces shall be prepared by blast-cleaning or pickling to remove mill scale. Contamination from grease, oil or shop marking shall be avoided.

e) All welds shall be carried out with techniques compatible with the corrosion resistant steel as recommended in writing by the manufacturer and finished by power grinding or blast cleaning to remove welding slag and spatter. Ensure that weld-points weather at the same rate as the other materials.

f) The Detailed Design shall shall ensure consistent corrosion rates and appearance fo r the design life of the building.

Z11 - 1.1.7. COPPER:

a) Copper shall be be in accordance with BS EN 1172 and BS EN 1652.

b) Where applicable, copper shall generally be in accordance with CP 143: Part 12 and current good practice as described in the current editions of the Copper Development Association publications and as recommended by the system manufacturer, unless specified or agreed otherwise.

c) Where specified to be pre-patinated, copper shall have consistency in appearance and composition of naturally aged copper and shall achieve the visual requirements of the *Project Manager* as produced through sampling.

d) Copper shall be free from inclusions, laminations and pinholes.

Z11 - 1.1.8. 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 generally be in accordance with CP 143: Part 12 and current good practice as described in the current editions of the Copper Development Association publications and as recommended by the system manufacturer, unless specified or agreed otherwise.

c) Bronze shall be free from inclusions, laminations and pinholes.

Z11 - 1.1.9. 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 generally be in accordance with CP 143: Part 12 and current good practice as described in the current editions of the Copper Development Association publications and as recommended by the system manufacturer, unless specified or agreed otherwise.

c) Brass shall be free from inclusions, laminations and pinholes.

Z11 - 1.1.10. ZINC:

a) Zinc (alloy of copper and titanium) shall be in accordance BS EN 988 and BS EN 501.

b) Where applicable, zinc shall generally be in accordance CP 143: Part 5 and current good practice as described in the current editions of the Copper Development Association publications and as recommended by the system manufacturer, unless specified or agreed otherwise.

c) Zinc shall be free from inclusions, laminations and pinholes.

Z11 - 1.1.11. CAST IRON :

a) Bollards to be manufactured to BS EN 1563 1997.

Z11 - 1.2. WORKMANSHIP

Z11 - 1.2.1. FABRICATION GENERALLY;

a) Components shall be fabricated carefully and accurately to ensure compliance with the Design and the *Specification*.

b) Contact shall not be permitted between dissimilar metals in components that are to be fixed where moisture may be present or occur.

c) Finished components shall be rigid and free from distortion, cracks, burrs and sharp arrises. Moving parts shall move freely and without binding.

d) Unless specified otherwise, corner junctions of identical sections shall be mitred.

Z11 - 1.2.2. COLD FORMED WORK;

Brake presses or cold rolling shall be used to produce accurate profiles with straight arrises.

Z11 - 1.2.3. ADHESIVE BONDING:

a) Surfaces of metals shall be prepared to receive adhesives by degreasing and abrading mechanically or chemically.

b) Adhesives shall be used to the manufacturer's written recommendations.

c) Bond shall be formed under pressure.

Z11 - 1.2.4. THERMAL CUTTING OF STAINLESS STEEL:

After cutting, material that is liable to corrode shall be ground off.

Z11 - 1.2.5. WELDING/ BRAZING GENERALLY:

a) Surfaces to be joined shall be thoroughly cleaned.

b) 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) Weld spatter shall be prevented from falling on surfaces of materials that will be self-finished and visible in completed work.

e) All traces of flux residue, slag and weld spatter shall be removed.

Z11 - 1.2.6. BRAZING:

In accordance with BS EN 14324.

Z11 - 1.2.7. FINISHING WELDED/ BRAZED JOINTS:

a) Visible butt joints in completed work shall be smooth, flush with adjacent surfaces.

b) Visible fillet joints in completed work shall be executed neatly. Grind smooth where specified.

Z11 - 1.2.8. APPLYING COATINGS:

a) Coatings shall be applied after fabrication is complete and all fixing holes have been drilled, unless otherwise specified.

b) All paint, grease, flux, rust, burrs and sharp arrises shall be removed before applying coating.

c) Make good all defects that would show after application of coating and finish surfaces smooth.

End of Section

Z20. FIXINGS/ ADHESIVES

To be read in conjunction with Section A and other related sections of the *Specification*, Preliminaries and Contract Conditions

Z20 - 1. MATERIALS / PRODUCTS AND FABRICATION

Z20 - 1.1. MATERIALS

Z20 - 1.1.1. FIXING GENERALLY:

a) All fixings shall be of sufficient strength, appropriate to their location, and are 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 satisfy the requirements of the *Specification*.

b) Unless otherwise specified, the following requirements shall be observed:

i) Durability - fixings shall be selected such that adequate protection against any corrosion likely to occur in their position of use is provided for the service life specified.

ii) Rigidity - fixings shall be used which are suited to the likely stresses, movements and vibrations in use.

iii) Appearance - unless otherwise specified, fixings shall not be visible; where fixings are visible these shall match or suit the items being fixed or comply with the *Design Drawings*.

iv) Removable items that require accessibility or removal shall be fixed with hidden screws and/ or bolts, unless otherwise specified.

c) Fixings that are suitable for their intended purpose and adequate to comply with the requirements stated in the Specification shall be used.

d) All bolts, screws, nuts, anchors and other fixings shall be of adequate strength for their designed purpose and shall, unless specified otherwise, be manufactured from the most appropriate grade of austenitic stainless steel or other materials as specified. Where specified, structural steel fixings shall comply with the grades specified.

e) Fixing components shall be of dimensions not less than those recommended by their manufacturer.

f) All necessary and appropriate fasteners, fixings, bearings, brackets, etc. necessary for the safe and proper installation plus associated flashings and closures shall be used.

g) All fixings shall conform to all statutory requirements in respect of strength and type.

h) Adequate measures shall be taken to prevent bi-metallic corrosion between dissimilar metals and to isolate aluminium components from cementitious surfaces. To this end attention is drawn to publication PD 6484 'Commentary on corrosion at bi-metallic contacts and its alleviation'.

i) Generally, fixings within aluminium framing components shall not be visible, with the exception of capping pieces fixed to vertical mullions.

j) Visible fixings shall be restricted to the assembly of non-visible elements to support steelwork, using round-headed Allen bolts into a proprietary system.

k) Any steel sub-frame assemblies shall be galvanised and effectively weatherproofed to avoid exposure to the external environment.

l) Cast-in channel fixings in concrete and fixings directly made to structural steelwork shall be provided.

m) All fixings shall be tested in accordance with BS 5080: Parts 1 and 2 by an independent Testing Authority acceptable to the *Project Manager*.

Z20 - 1.1.2. BOLTS, NUTS AND WASHERS:

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 and BS EN ISO 898.

b) Mechanical properties of corrosion-resistant stainless steel fasteners (bolts, screws, studs, nuts etc.) shall be in accordance with BS EN ISO 3506.

Z20 - 1.1.3. POWDER ACTUATED FIXING SYSTEMS:

a) Powder actuated fixing systems shall not be used without acceptance.

b) Tools shall be in accordance with BS 4078: Part 2 and Kite mark certified.

c) Fasteners, accessories and consumables shall be types recommended by the tool manufacturer.

Z20 - 1.1.4. SCREW FIXINGS:

a) Wood screws shall be in accordance with BS 1210.

b) Machine screws and machine screw nuts shall be in accordance with BS 4183.

c) Pan head screws shall be in accordance with BS EN ISO 7045 and BS EN ISO 1580.

d) Washers and screw cups, where specified, shall be of the same material as the screw.

Z20 - 1.1.5. PACKINGS GENERALLY:

a) Suitable, tight packings shall be provided at fixing points to take up tolerances and prevent distortion.

b) Non-compressible, rot-proof, non-corrodible materials positioned adjacent to fixing points shall be used.

Z20 - 1.1.6. TYPES OF NAIL;

Nails shall be in accordance with BS 1202.

Z20 - 1.1.7. MASONRY NAILS:

Shall not be used without acceptance by the *Project Manager*.

Z20 - 1.1.8. PLUGS GENERALLY:

Proprietary types selected shall be used to suit the background, loads to be supported and conditions expected in use.

Z20 - 2. SITE INSTALLATION

Z20 - 2.1. APPLICATION

Z20 - 2.1.1. ADHESIVES:

a) Surfaces to receive adhesive shall be sound, unfrozen and free from dust, grease and any other contamination likely to affect bond. Where necessary, clean surfaces using methods and materials recommended by the adhesive manufacturer.

b) Surfaces shall be sufficiently smooth and even to suit the gap-filling and bonding characteristics of the adhesive. Prepare as necessary.

c) Operatives shall observe both the manufacturers' and statutory requirements for storage and safe usage of adhesives.

d) No adhesives shall be used in unsuitable environmental conditions or beyond the manufacturer's recommended maximum shelf life or open-pot time periods.

e) Adhesives shall be applied using recommended spreaders/ applicators to ensure correct coverage. Bring surfaces together within the recommended time period and apply pressure evenly over the full area of contact surfaces to ensure full bonding.

f) Surplus adhesive shall be removed using methods and materials recommended by the adhesive manufacturer and without damage to affected surfaces.

Z20 - 2.1.2. 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 method of fixing shall not damage anything being fixed or anything receiving fixings.

c) Welding shall not be permitted, unless accepted by the *Project Manager*.

d) Fasteners shall be installed with a co-ordinated purpose design tooling system that incorporates a mechanical depth locator to ensure consistent depth setting and facilitates perpendicular installation. The fastener manufacturer shall be capable of providing on-Site instruction in the use of the fastener installation tooling system.

e) All fixings and attachments shall be secured against vibrating loose.

f) All fixings shall be in accordance with Section 2 of Approved Document A of the Building Regulations and any subsequent amendments thereto.

g) Submit QA/ QC procedures for inspection of fixings to the *Project Manager* to include, but not be limited to, checking each fixing for correct torques, depth of mortices, alignment, etc.

h) Ensure that no lock-up stresses are generated.

Z20 - 2.1.3. POWDER ACTUATED FIXING:

a) Tools shall be used in accordance with BS 4078: Part 1. Operatives shall be trained and certified as competent by the *Contractor*.

b) It shall be ensured that operatives take full precautions against injury to themselves and others.

c) All unspent cartridges shall be removed from the Site when no longer required.

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 - 2.1.4. SCREW FIXINGS;

a) All screws shall have clearance holes. Screws of 8 gauge or more and all screws into hardwood shall have pilot holes approximately half the diameter of the shank.

b) Before using brass, aluminium or other soft metal wood screws, the thread shall be pre-cut with a matching steel wood screw.

c) Screws shall not be hammered unless specifically designed to be hammered.

d) Screw heads shall be countersunk not less than 2mm below timber surfaces that will be visible in the completed work, unless specified otherwise.

Z20 - 2.1.5. PACKINGS GENERALLY:

It shall be ensured that packings do not intrude into zones that are to be filled with sealants.

Z20 - 2.1.6. NAIL FIXING:

a) In joints, not less than two nails and opposed skew nailing shall be used, unless specified otherwise.

b) Nails shall be driven in fully without splitting or crushing the material being fixed.

c) Nail heads shall be punched below surfaces that will be visible in the completed work.

Z20 - 2.1.7. PLUGS GENERALLY:

Plugs shall be located accurately in correctly sized holes in accordance with the manufacturer's recommendations.

End of Section

Z22. SEALANTS

To be read in conjunction with Section A and other related sections of the *Specification*, Preliminaries and Contract Conditions

Z22 - 1. MATERIALS/ PRODUCTS

Z22 - 1.1. MATERIALS

Z22 - 1.1.1. TYPES AND METHOD:

~~a) All sealants shall meet the fire performance criteria set out in LU Standard 1-085 A2 Fire Safety Performance of Materials (December 2008), and shall be distinguished by the level of fire resistance.~~

b) Sealant shall be suitable for the purpose intended, and used strictly in accordance with the manufacturer's instructions.

c) Sealants shall not be in any way a potential health hazard. Maintain full up-to-date records of all current published research and legislation in this respect. Obtain information from the sealant manufacturer regarding storage, handling, use and disposal of sealants.

d) Wet applied sealants shall only be used in the locations shown on the *Design Drawings* or *Working Drawings* or as and where agreed with the *Project Manager*, provided that all the requirements of the *Specification* are satisfied.

e) Sealants shall be the most appropriate type and grade suitable for the intended application.

f) Written confirmation from the sealant manufacturer shall be obtained and submitted to the *Project Manager* for consideration as to the suitability of the sealant for the application intended.

g) Proposals and reference samples shall be submitted to the *Project Manager* of the type and colour of the sealant prior to ordering.

h) The period during which the sealant shall not change in appearance or colour shall be agreed with the *Project Manager*. Any discolouration of sealant during this time shall not be acceptable.

i) The chemical composition of the sealant and primers, where any, shall be compatible with the joint substrate, and with adjacent surface treatments or building components with which they may come into contact.

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. Upon request, information shall be furnished concerning theoretical joint movement related to the anticipated temperatures at which sealants shall be installed and cured.

k) It shall be demonstrated to the satisfaction of the *Project Manager* that the sealant joints can accommodate and are compatible with any movements to which they may be subjected.

l) Sealants shall have the lowest modulus of elasticity which is 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 by traffic, including indentation.

m) Sealants that are likely to stain, discolour or bleed into adjacent building materials shall not be used. Provide independent testing evidence to this effect.

n) Where the sealant location involves special requirements, the following shall be complied with:

i) Where the sealant is used in trafficked surfaces and/ or requires to be fuel resistant, it shall be in accordance with BS EN 14188: Part 1 and BS 5212.

ii) Where the sealant is required to achieve a period of fire resistance, independent UK performance certification of the proposed sealants shall be provided to show the sealant satisfies the required fire resistance requirement.

iii) Where sealants are in contact with drinking water, evidence of compliance with UK water quality standards shall be provided.

iv) Resistance to permanently wet service environments.

o) Sealant performance shall be verified by provision of current independent test certificates.

p) Manufacturers' product descriptions shall confirm compliance with performance standards including the BS EN ISO 11600 coding and be confirmed on the package labels, in the technical data sheets and on any certificates demonstrating performance capability.

q) Sealants complying with the *Specification* shall be manufactured within an independently assessed BS EN ISO 9000 series quality system. Each pack supplied shall have a batch number and date of manufacture.

r) An on-Site test procedure as recommended by the manufacturer, shall be used as a means of assessing the extent of sealant cure and/ or adhesion to joint surfaces.

Z22 - 2. SITE INSTALLATION

Z22 - 2.1. WORKMANSHIP

Z22 - 2.1.1. APPLICATION:

a) Carefully prepare surfaces to receive sealant, using correct de-greasing solvents, primers and bonding agents as necessary.

b) Where sealants are applied, either on or off Site, they shall be in accordance with BS 6213, BS 6093 or BS 8000: Part 16 and BS EN ISO 11600 as appropriate.

c) The application of sealants shall be in accordance with the supplier's/ manufacturer's written preparatory and application procedures and the British Adhesives and Sealant Association Manual of Good Practice or acceptable equivalent.

d) Excess sealant shall be removed and all joints shall be neat and clean. Only liquids approved by the sealant manufacturer shall be used to tool freshly applied sealants.

e) Sealant shall be evenly applied without bubbles in joints.

f) Sealants shall be adequately protected during the curing process to avoid contamination or damage from other activities or conditions on Site.

g) Joint fillers, when placed in the joint, shall provide a gap consistent with the required depth of sealant. The cross section of sealant in the joint shall be of 2:1 width to depth unless otherwise accepted. Joint fillers shall be as follows:

   i) Compatible with the sealant used and surrounding construction elements.

   ii) Formed from closed cell foam.

   iii) Non-adherent to cured sealant, otherwise bond breaker tape shall be used.

h) Applicators shall operate within an approved BS EN ISO 9001 scheme.

i) Only materials meeting the *Specification* requirements and stored under appropriate conditions shall be used for installation.

End of Section