White Collar Factory
London EC1Y 8AF
T +44 (0)20 7250 7777
info@akt-uk.com
www.akt-uk.com

BUILDING ENVELOPE –
Technical Performance Specification
CTH_AKT_XXX_SP_25_R_001

Project Name: Camden Town Hall

AKT Project Number: 4254E

Status: Stage 4 Performance Specification

Rev	Purpose	Date	By	
01	Stage 3 Submission	20/3/2019	SMcD	
02	Stage 3 with LL comments incorporated	18/04/2019	SMcD	
03	Stage 4 WIP Draft	06/09/2019	SMcD	
T04	Stage 4 Issue	27/9/2019	SMcD	

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1 Executive Summary at Stage 4

This specification relates to four procurement packages defined by LL;

- C3100 Refurbish Windows & Doors
- C3260 Curtain Walling & Lightwell Roof
- C3500 Secondary Windows
- C_____ External Stone Cladding

This specification does not include;

- Demolition and removal of existing parts of the facade, or making good existing openings.
- Refurbishment of existing external timber doors at ground floor.

Preliminary tenders for the first three packages were issued during Stage4 and the tender returns have partly informed the development of this specification. The fourth package (external stone) has not been formally tendered, but LL has procured a condition survey from a specialist contractor which has also informed the development of this specification. The likely extent of remedial work to the stone has been established by a visual inspection and an initial intrusive investigation carried out by a specialist in July 2019. Following that survey, a scope and method statement has been agreed with LL. The survey has provided some information on the condition of the structural steel elements concealed behind the stone cladding. That information has been considered by the structural engineers and a schedule of remedial work to the structural steel has been formulated. The remedial work to structural steel, stone cladding and windows is described in this specification which is intended to form the basis of procurement by LL.

Several alternative options for refurbishing or replacing the existing steel windows were proposed to the Client and the Planning Department at LBC. The Design Team had recommended replacement of the primary windows with thermally broken frames, which would have sufficient thermal and acoustic properties to make internal secondary windows unnecessary for the majority of the building. Whilst the Client favoured this approach, the Planner deemed that retaining as much of the original fabric as possible was of utmost importance. Therefore, it was decided to retain the primary steel windows and to compensate for their poor performance by installing double glazed secondary windows. The combined effects of primary and secondary windows have been studied in a thermal analysis to confirm that the facade will perform as assumed in the building energy model.

Construction details for windows are largely dependent on the interfaces around the window reveals and the need for the inward opening portions of the external windows to pass within the perimeter frame of the inner windows. Those details have been established in Stage 4, after intrusive site investigation of typical window openings and obtaining samples from prospective window contractors.

Outstanding matters to be resolved;

Fire - High level windows in the basement of the SME are used for smoke ventilation. This strategy is currently with the LFB who will provide comments by the end of September 2019. Changes may need to be made following LFB review.

Access for Cleaning; The Facade Access Consulatnt (Engie) is undertaking a full review of each window to assess the safe access for cleaning and maintenance. This review will establish the extent to which externally fixed eye bolts may be reused or replaced or repositioned.

2 Introduction – (NBS – A)

2.1 Building Description

The proposed refurbishment of Camden Town Hall and conversion for civic, leisure and commercial office use.

2.2 Scope of Specification

This document defines the requirements for the building envelope package of the Camden Town project and shall be read in conjunction with all reference drawings and documents, including but not limited to those mentioned below. This specification shall be read in conjunction with the Conditions of the Contract, Instructions to Tenderers and other relevant documents. This is a performance specification where the intent for the building envelope is to provide safe, dry, temperate and comfortable conditions that can be reasonably anticipated. The performance criteria specified within this document shall be considered as minimum standards with which the Contractor's Proposals shall comply.

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

2.3 Specification Format

This specification is intended to stand alone, so that it can be used to procure the facades. It is not divided into the sections defined by the NBS; however each section heading includes cross references to the comparable NBS work sections.

2.4 Terminology

The following definitions shall apply to the stakeholders of this project:

- Employer or Client; London Borough of Camden
- Main Contractor; Lend Lease
- Architect; Purcell
- Structural Engineer; AKT II
- Building services engineer; Arup
- Acoustic Engineer; Arup
- Fire engineer; Arup

2.4.1 The term 'contractor' shall refer to the specialist cladding contractors appointed by the main contractor to carry out the works as described within this specification.

2.4.2 The term 'tenderer' shall mean the specialist cladding contractor involved in preparing a tender for the works

2.4.3 The term 'works' shall mean all the elements in which the contractor is engaged to design, fabricate, manufacture, test and install on the project.

2.4.4 The term 'external' environment refers to the areas of construction that are directly exposed to rain water or exposed to external air, for example covered unheated areas subject to periodic environmental humidity.

2.4.5 The term 'internal' environment refers to areas of construction that are located on the warm side of the vapour control layer, in a heated space that is not exposed to wetting from rain water.

2.4.6 The term 'roof' shall include all sloping surfaces that are pitched less than or equal to an angle of 70° from the horizontal. Angles greater than 70° shall be considered as external walls.

2.5 Language and units of measurement

2.5.1 All the information provided by the specialist cladding contractor to the design team, other contractors or any party working on the project shall be in English.

2.5.2 All units of measurement used for this project shall be in SI units.

2.6 Codes and Standards

2.6.1 This specification is based on the British and European standards. In the event that there is a conflict between 2 standards, the more onerous shall apply. In the event that any requirements included within this specification are over and above the codes and standards, this specification shall take precedence.

2.6.2 The works shall also comply with relevant European directives governing certificates of conformity and CE markings.

2.6.3 In addition to the standards mentioned above, the works shall comply with the following:

- CWCT Guidelines
- Building and Listed Building Consent Conditions

- Access Requirements as set out in Part M of the Building Regulations
- Secure by Design Standards (SBD certification is not required, but the standards are to be incorporated in the design where they do not conflict with heritage considerations)
- BREEAM Requirements

2.7 Drawing and Document References

2.7.1 Drawing References

- Facade scope drawings: Refer to Purcell Architects Window Strategy
- Architectural drawings: Refer to Purcell Architects drawing register
- Structural drawings: Refer to AKT II Structural Engineers drawing register
- Mechanical and Electrical drawings: Refer to Arup drawing register

2.7.2 Document References

- Contract Preliminaries and General Conditions
- Relevant specifications provided with the tender documentation
- Movement and Tolerances report
- Structural engineers loading report
- Glass replacement strategy report
- Door and window schedules
- Fire strategy report
- Acoustics report
- Security consultants report
- Conservation Strategy Report

2.8 Design Intent

2.8.1 The Works will withstand and accommodate the stresses and movements induced by the specified cambers, estimated deflections, relative deflections and the long term movements associated with the settlement of the foundations, or any other movements of the structure, changes in temperature and chemical changes. They will include suitable allowances for the specified construction tolerances. They will withstand the specified deleterious and degrading effects of radiation from the sun, weathering, atmospheric pollution, vandalism, vermin, fungi and other growths for the required service life described herein without maintenance in excess of routine cleaning and minor repairs. They will have a resistance to combustion and fire spread appropriate to each part and will prevent casual and unlawful entry into the building,

all as specified. The Works shall be configured to facilitate safe and efficient cleaning and maintenance.

2.9 Design Responsibility

2.9.1 The Architects Drawings and this Contract Document are indicative of design intent and define the performance criteria, the mandatory geometry of the exposed surfaces and joint positions, and detail the required principal materials and visible finishes.

2.9.2 The Contractor can put forward alternatives for consideration by the Architect. Additionally, any suggested solutions described on the Architects Drawings will not in any way relieve the Contractor from its responsibility for the design and construction of the whole of the Works.

1.7.3 The Cladding contractor(s) shall allow for interface with other trades as follows:

- Structural frame contractor – concrete and primary steelwork
- Secondary steelwork (where not supplied by cladding contractor)
- M&E
- Lighting
- Security (cameras, doors etc.)
- Signage
- Drainage / public Health
- Facade access / maintenance
- Fit out
- Roofing
- External paving
- Architectural metalwork
- Waterproofing
- Refer also to the Main Contractor's list of interfaces.

3 Stone Cladding (NBS H92)

3.1 Existing Facade Condition

3.1.1 The pattern of cracks and stains on the facades indicates factors which have affected the rate of deterioration of the building fabric in the past and may continue to do so in the future, unless the causes are identified and rectified. There are no as built drawings to assess the interfaces between facades and structure, so the relevant

information has been obtained by visual inspections and further information will be obtained by intrusive investigations..

3.1.2 Staining on the facades indicates that the flow of water across the stone surfaces has created areas of moisture retention, leading to staining in locations which are difficult to clean (e.g. the underside of lintels). More effective cleaning and stain removal may be possible when the windows are removed during the refurbishment.

3.1.3 Moisture retention in parts of the stone cladding has probably contributed to the corrosion of the perimeter structural elements. Cracks in the external stone cladding indicate the likelihood of expansive rust formation around the structural steel. In these locations it is necessary to temporarily remove the stone in order to treat the structural steel to inhibit further corrosion and to prevent consequent deterioration of the retained cladding,

3.1.4 Some of the cracks observed at site may be due to differential movements in the structure under occupancy loads. The intrusive surveys should establish if any of the cracks in the cladding are due to structural movement rather than expansive rust formation.

3.1.5 Generally,the following remedial works are required;

- Intrusive condition surveys.
- Repairs to structural steel (e.g. removing rust, applying rust inhibitor, strengthening or replacement of corroded elements)
- Repairs to the stone cladding (e.g. filling cracks, resealing mortar joints, replacing heavily weathered and exfoliated stone, etc)

3.1.6 The extent and scope of remedial works to both the cladding and the perimeter structure will depend on the findings of the condition survey. To carry out an effective condition survey, many areas of external facades must be opened up and resealed. It has not been practical to start the full intrusive external surveys until such time as the perimeter of the site can be made safe and overhead work can be carried out without risk of materials falling on to public areas. Therefore , initial intrusive surveys were carried out at three typical locations at the accessible part of the facade at the corner of Judd St and Bidborough St.

3.2 Available Survey Information

This specification is to be read with the Facade Condition Survey carried out by Paye Stone ref DM/19038/006 dated 17 July 2019, plus Purcell Architects repair drawings ref. CTH-PUR-XXX-DR-21-A-(39) Series, Repair schedule Ref. CTH-PUR-XXX-SCH-21-A-3901 and related NBS specification which identifies and describes the defect and repair.

The scope of the refurbishment and repair work to the stone cladding is is generally shown on the over-marked elevations in the survey report by Paye.

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3.3 Refurbishment

3.3.1 The guidance and recommendations of the relevant parts of BS 8298 shall be adopted by the contractor in carrying out the repairs and the design and execution of any additions.

3.3.2 Stone for repairs and additions shall be selected and processed and the surfaces treated to match the existing Portland stone within the range of appearance demonstrated by the approved benchmark.

3.3.3 Wherever practicable the existing fabric shall be retained, provided that it can reasonably be expected to maintain its integrity for a period of 35 years with minimal maintenance.

3.3.4 Wherever practical, whole stones which are not fractured but must be removed in order to effect the refurbishment should be salvaged and reused.

3.3.5 Where practicable, plan to cut the stone joint to joint, so that the original arrangement is not disrupted and is maintained in accordance with the historic architectural design.

3.3.6 The introduction of new joints shall be avoided wherever practicable. Where fracturing passes though long section stones which could be cut through but still maintain a supporting bond to masonry above, this may require listed building consent and may only be done with the Architect's approval.

3.3.7 Where a new joint is necessary, it shall be placed at a minimum distance of 100-150mm away from others in both the vertical and horizontal planes to provide continued support and bond of associated masonry.

3.4 Repair and adaption of Stone

The Contractor shall;

3.4.1 Review all relevant drawings and specifications for the proposed work. Where these are not fully developed, undertake intrusive investigations, provide elevation and sectional drawings of existing masonry and provide technical advice to the Architect as required

3.4.2 Verify the received information is sufficient and accurate.

3.4.3 Produce scale drawings showing the stone to be adapted.

3.4.4 Coordinate site activities with the Main Contractor and other Trades.

3.4.5 Carry out on site adaptions using mason's hand tools and hand operated plant.

3.4.6 Cut out and square up existing stone in readiness to receive new.

3.4.7 Produce cutting schedules of new stone indents.

3.4.8 Secure the new stone indents using stainless steel threaded dowels and restraint brackets as required.

3.4.9 Trim in new indents into existing retained stonework as required.

3.4.10 Re-point joints to match the benchmark samples.

3.5 Remedial work to steel

Where cracks in the stone cladding are deemed to have resulted from corrosion of underlying steel elements, the Contractor shall, in addition to the repair and adaption procedure above, carry out the following;

3.5.1 Determine how best to remove the stone cladding and grouting to expose the underlying steel.

3.5.2 Immediately upon removal of the stone cladding, measure and record the dimensions of the steel sections and the thickness of corrosion lamination to each surface of the steel section. Measurements are to be taken with Vernier Scale Callipers. Measurements of areas where lamination occurs shall be compared with areas where no lamination is observed. The difference between the two measurements shall be reported as the total thickness of the lamination.

3.5.3 Check that the corrosion is within the limits permitted by the structural engineer's specification. Should the corrosion exceeds the specified limits, report immediately to the resident engineer and await instructions.

3.5.4 Pre-treat the steel to remove corrosion in accordance with the structural engineer's specification.

3.5.5 Apply corrosion protection in accordance with the structural engineer's specification.

3.5.6 Where corrosion at the top or bottom extents of the open course exceeds the limits specified in the structural engineer's specification, repeat the above procedure for the adjacent stone course. In order to minimise the work the opening up should proceed from top down.

3.6 Deconstruction and Rebuilding Stone Cladding

3.6.1 There are two areas of existing facade which must be taken down and rebuilt to form the entrances at the SME entrance on Bidborough Street and the entrance to the Camden Centre in Tonbridge Walk. The scope of these works is shown on the Purcell demolition drawings and the part elevation drawings CTH-PUR-G0-DR-08-A-4004 to 4006.

3.6.2 It is expected that a high proportion of the existing stonework could be successfully deconstructed, salvaged and re-used. Deconstruction would require potential sacrifice of individual stones to unlock the remainder from the facade, but the majority of the existing fabric shall be retained wherever reasonably practicable and where the stone can reasonably be expected to maintain its integrity for a period of 35 years with minimal maintenance.

3.6.3 Where new door openings are to be formed, the existing masonry should be carefully cut out and reinstated with new moulded indents forming the door reveals.

3.6.4 Procedure for Salvage and Re-use – The Contractor shall;

- Review all relevant drawings and specifications for the proposed work. Where these are not fully developed undertake intrusive investigations, provide

elevation and sectional drawings of existing masonry and provide technical advice to the Architect as required

- Verify the received information is sufficient and accurate.
- Carry out initial intrusive investigations to establish how the existing stone is supported and the load paths through the existing stone. If the stone is supported by the structural steel members that must be removed to form the new entrances, then the stone shall be fully deconstructed before the steel is removed. Where there is no direct restraint or support of the stone from the steel, the Contractor shall cut through and remove the steel without affecting the stability and integrity of the masonry.
- Carry out a detailed dimensional and condition survey of masonry to be removed.
- Produce scale drawings showing each individual stone and existing joint arrangement.
- Identify each stone by a unique reference number.
- Coordinate site activities with the Main Contractor and other Trades.
- Clean down existing masonry to remove surface soiling.
- Remove stone using masons hand tools, hand held plant, block and tackles, spider cranes.
- Mark each stone removed on an unseen face with its unique number with permanent marker.
- Place the salvaged stone on a pallet which shall be identified by its own unique reference.
- Record the location of each of the referenced stones on an elevation drawing
- Record any damage to the removed stone.
- Strap and shrink wrap the pallets and transport them to a mason's yard.
- Return the salvaged, modified and replaced stones to site.
- Re-fix stone back to suitable backing structure restrained using stainless steel fixings as required.
- Carry out repairs as necessary.
- Clean down masonry.
- Re-point the joints to match the benchmark samples.

4 Windows to Outward Facing Elevations

4.1.1 Read this section with the Architect's coded elevations and window schedules which show size and location of all windows and doors openings..

4.1.2 The structural openings within the stone clad elevations to the external perimeter of the building are in-filled with primary steel casement windows and secondary internal windows. Generally, the primary units are to be refurbished and the secondary units are to be replaced, but there are a wide variety of conditions and technical requirements which result in a large number of window types. The following paragraphs explain the requirements within each type of structural opening. For example; opening type WT102 refers to a structural opening on the first floor which is fitted with an external window WT102X and an internal secondary window WT102N.

4.1.3 All dimensions are approximate. Final dimensions to be determined by site surveys to be carried out by the contractor.

4.1.4 Existing primary windows to be refurbished in accordance with Section 14 of this specification.

4.1.5 New Secondary windows as section 13 of this specification.

4.1.6 For Quantities and locations of all units refer to Purcell Window Strategy Report_CTH-PUR-XX-XX-RP-A-00012

4.1.7 It is not practical to fit secondary windows in staircases A,C,D,E,F and G because of the handrails and balustrades.

4.2 Existing Primary Windows (WT_X)

4.2.1 The existing casement windows were installed in 1937. The windows to the panelled rooms on the first floor are brass (architectural broze). Those to the remainder of the building are steel. The building is Grade II listed and it is necessary to retain as much of the original fabric as possible, including the windows. The existing windows have no weather-strips and many do not close adequately, but the metalwork and many of the fittings are suitable for refurbishment. The frames have been repainted several times over the past 80 years, and it is expected that the paint will have a significant lead content which will pose a hazard to health which the contractor shall manage with suitable and sufficient controls and safety measures during refurbishment.

4.2.2 All units must be carefully removed from the structural openings without damaging the existing external stonework or any retained reveals and timber wall panels, some of which are listed and must be retained in their current state. The existing windows will be deglazed and removed from site for refurbishment and the openings temporarily boarded up with plywood (FSA compliant). The refurbished windows shall be brought back to site and reinstalled in their original positions and the perimeters made weather-tight with silicone seals and backer rods. All site applied sealants must be checked for compatibility with the existing limestone cladding to ensure that there is no staining or migration of materials between sealant and stone.

4.2.3 All paint shall be stripped from the existing metalwork in controlled factory conditions. Frames shall be grit blasted, pre-treated and polyester powder coated

4.2.4 The existing window fittings shall be retained where they are serviceable, replated, reconditioned, and re-fitted. Broken fittings shall be replaced with cast identical copies. In some cases the original fittings have been supplemented with devices such as keeps or pegs to retain operating chords. Where these additions are superfluous to the function of the refurbished window, they will be scrapped and the holes in the frames made good by welding.

4.2.5 The existing glass and applied film shall be scrapped and replaced with 4.4.2 laminated panes (8.8mm thick) with acoustic pvb interlayers. The laminated construction is to provide acoustic performance and security enhancement as recommended by CPNI guidelines. Existing glazing beads are in poor condition and shall be scrapped and replaced with new aluminium or steel beads which shall be mechanically fixed to the frames. Timber beads may also be proposed, subject to approval of paint finish and painting method.

4.2.6 The existing windows are fabricated from rolled steel profiles similar to W20 sections. The opening vents shall be retained for cleaning and maintenance purposes, but they are not intended for ventilation purposes. Opening vents shall be retrofitted with draught proof strips bonded to the non-visible surfaces within the moving frames or fixed frames There are four types of opening casements;

- Horizontal pivoting – with the pivot either positioned centrally, or with the pivot off-set towards the bottom of the frame, so that the window predominantly opens outwards with a small portion opening inwards. Fitted with spring catches at the head. Many of the existing catches are operated by cord, but the refurbished windows shall not be fitted with cords and shall have spring catches with loops suitable for operation by pole. The existing pivoting mechanisms shall be replaced with new pivot bearings and cups to fit within the notches in the existing frames.
- Vertical Pivoting – with the pivot off-set close to the jamb so that the window predominantly opens outwards with a small portion opening inwards. The existing pivoting mechanisms shall be replaced with new pivot bearings and cups to fit within the notches in the existing frames.
- Side hung – outward opening on butt hinges. Fitted with surface mounted espagnolette handles or linked cockspur handles at the jamb and surface mounted sliding friction stays at the cill.
- Side hung casement doors to the Juliette balconies on Judd Street and Euston Road elevations and to the terraces on all elevations on the 3rd floor. These are fitted with lever handles and cylinder locks.

4.3 New Internal Secondary windows (WT_N)

4.3.1 Fabricated from non- thermally broken aluminium window profiles with narrow sightlines to match the width of the existing primary windows as closely as possible..

4.3.2 Secondary windows are double glazed to compensate for the poor air permeability and acoustic performance of the existing primary windows.

4.3.3 The secondary windows shall be larger than the primary windows to allow the inward opening portions of the outer pivoted vents to pass within the outer frame of the secondary window. In order to make an opening for the secondary unit, which is larger than the primary, the internal window reveals and linings shall be modified and / or extended.

4.3.4 The design of the secondary windows shall be coordinated with the internal finishes to ensure that inward opening leaves do not clash with the ceiling.

5 Windows to Inward Facing elevations and Lightwells

5.1.1 Read this section with the Architect's partial elevations of the window types and the Architect's window schedules which show the sizes and location of all items described below. There are six existing lightwells;

- LW 01 and 02 at the West end of the building will be capped with new glazed rooflights.
- LW 04, to the South East the building will be capped by the new 3rd floor pavilion extension.
- LW 03, the services lightwell to the North East and LW05 and 06 the small lightwells to the West of the Council Chamber will remain exposed to the external environment.

The inward facing elevations above the lightwells at 2nd, 3rd floor and roof levels have primary windows and louvres exposed to the external environment

5.1.2 The automated doors to the bottom of the lightwells are described in the doors section of this specification.

5.1.3 Some existing window openings have glazed bricks which shall be removed and replaced with new steel casement screens to match the existing adjacent windows.

5.1.4 Fire rated glazing is required in some parts of the Lightwells. These are identified on the architect's window and door drawings and schedules.

5.1.5 Acoustic enhancements are required in some parts of the Lightwells.. These are identified on the architect's drawings and schedules.

5.1.6 The architect's drawings and schedules indicate approximate dimensions for pricing purpose only. Manufacturing dimensions shall be established by the specialist subcontractor by a site survey of existing openings.

5.2 All the above items to be read in conjunction with Section 13 of this specification

6 Third Floor Pavillion and SME Entrance (NBS - H11)

6.1.1 Stick Construction curtainwall with vision glazing, obscured glazing and insulation opaque panels as shown on architect's drawings. Horizontal spandrel panels in zones between ceiling level and finished floor, vertical opaque panels in front of structural columns. Mullion and transom sections 60mm wide x 150mm deep. External snap covers to project by 100mm.

6.2 General

6.2.1 The recommendations of CWCT "Standard for systemised building Envelopes" are to be followed.

6.3 Wind resistance

6.3.1 Permanent deformation to framing members will not exceed 1/500 of the span measured between points of attachment to the structure after loading.

6.4 Resistance against impact

6.4.1 Internal Impact – Glazed walls will be class I4 in accordance with EN 14019

6.4.2 External Impact – Glazed walls will be class E4 in accordance with EN 14019.

6.4.3 The Works will satisfy the requirements of Tables 3 and 4 of BS 8200 "Design of non-load bearing vertical enclosures" for categories B and E in Table 2.

6.4.4 The maximum visually acceptable dent in metal surfaces will be 5mm in diameter and 2mm in depth.

6.5 Air Permeability

6.5.1 Curtain walling will be class A4 in accordance with BS EN 12152. Windows and doors incorporated into curtain walling will have the same air permeability performance as the curtain wall.

6.6 Weather tightness

Curtain walling will be Class R7 in accordance with BS EN 12154. Windows and doors incorporated into curtain walling will have the same performance as the curtain walling.

6.7 Acoustic Performance

6.7.1 Movement and wind noise control – The contractor shall take into account the following:

- Noise generated from the effects of thermal and structural movements
- Noise generated from wind and air movements including creaking, rattling, whistling, 'slip-stick' noise.

6.7.2 Acoustic transmission and flanking – refer to the General Requirements Section 12.6

6.8 Thermal Transmittance

6.8.1 The aggregate overall value of the curtainwall shall not exceed 1.1 W/m2.K.

6.8.2 The specified values are overall U-values for the different cladding types / elements. Overall U-values are calculated as the area-weighted averages of the centre of pane U-value (glazing and panel) and frame U-value including all edge effects (spacer and frame).

6.8.3 Detailed calculations prepared by the Contractor, in accordance with this specification and EN13947:2006 or EN ISO 10077, shall be submitted to the Architect for review during the design development stage.

6.8.4 Solar Factor (g value) should be calculated in accordance with EN410. Refer to the glass descriptions for the required g value.

6.8.5 Detailed solar shading calculations prepared by the Contractor, shall be submitted to the Architect for review during the design development stage.

6.9 Prescriptive requirements for Curtainwall

- Be designed as dry glazed pressure equalised system.
- Incorporate a secondary drainage system behind the weathering seals, which drains to the outside.
- Allow complete drainage of water from rebates to outside.
- Allow ventilation of the edges of the double glazed units, panes and panels.
- Incorporate an internal air seal and vapour check that will also act as second line of defence against water ingress.
- Eliminate standing water on/or around the edge of double glazed units, panes and panels.
- Incorporate isolation devices to minimise thermal bridging

6.9.1 Provide the following when all tolerances are accommodated and the most onerous combination of movements occur (including wind sway):

- Sufficient edge cover on all double glazed units, panes and panels to maintain weathering and structural performance around their perimeter.
- Clearance to edges of all glass panes or panels of at least 2 mm everywhere around their perimeter.
- Be capable of being re-glazed from outside of the building.
- Be provided with a gasketed interlocking jointing system with 2 lines of defence against water penetration.
- Incorporate bottom edge support to panes of single and both panes of double glazed units, and panels to prevent the gravity loads of the glass and panels being supported by the structural silicone seals alone.

7 Rooflights (NBS L10)

7.1 Rooflights RL 01-05 over Council Chamber

7.1.1 Double pitch lantern lights. Existing single glazed lantern lights removed and replaced with new self-supporting, double glazedaluminium rooflights manufactured from Vitral A74 modular factory sealed and glazed panel system, or similar and approved.

7.1.2 Roof is classified as fragile Class 3 according to CWCT Technical Note 66. Edge protection and restraint measures to be in place to prevent maintenance operatives walking or falling on to the roof surfaces.

7.1.3 Glass type GL42- see section 10

7.1.4 Frame: Thermally broken aluminium frame with thermal break of at least 20mm.

7.1.5 Frame width: Sightlines between fixed &/or opening profiles to be 50mm or less Incl dual gaskets and drainage system.

7.1.6 Finish: PPC coated aluminium frame in accordance with Section 16. .

7.1.7 Thermal transmittance: U-value (combined frame and glass) to be less than 1.6 W/m2°C according to EN12567-1:200: Thermal performance of windows and doors – determination of thermal transmittance by hot box method – Part1: Complete windows and doors.

7.1.8 Air permeability Class 4 at 600 Pa according to EN12207 – Windows and doors - Air permeability - Classification

7.1.9 Water permeability: Rooflight system shall achieve water permeability Class E1200 according to EN12208.

7.1.10 Acoustic requirements: Provide independent laboratory test results for airborne sound insulation for the same frame and glass build up as specified. Measurement to be accordance with EN ISO140-3:1995, EN ISO 717-1:1994 including 2006 amendment. Sound reduction Rw to be 34dB (or higher).

7.1.11 Verification of Performance: Rooflight to meet the requirements of EN14351-1 with declaration of performance and accompanied by a CE Label to prove complete system has been tested for watertightness, thermal transmittance, air permeability.

7.1.12 All external weatherproofing and internal finishes of upstands to be included.

7.1.13 Support structure: All continuous structural supports at the cill, hip, valley and verge shaped & aligned to suit the pitch of the glazing to be provided & fixed by others.

7.1.14 Contractor to provide loadings and reaction forces applied to the kerb by the self-supporting rooflight assembly for review by the structural engineer.

7.1.15 No vents, actuators or controls required to lantern light roofs

7.2 Rooflights to Lightwells 01 and 02 at West end of the building

7.2.1 Two mono-pitched rooflights with glazed upstands and automatic opening vents.

7.2.2 Supporting frame to be provided as an integral part of the roof . Formed from RHS steel sections welded into portal frames to span across atrium void.

7.2.3 Steel portal frames to have attachment points at the inner surface for the rail from which the cleaning and maintenance system is to be suspended– Loads TBC by the Access and Maintenance Consultant

7.2.4 Raico Therm+ S-I or similar glazing profiles fixed to outer surface of supporting portal frames to form flush glass joints with no projections.

7.2.5 Double glazed units with structural seals secured to the framework with concealed toggle fixings. Minimum fall of 5 degrees to minimise the risk of ponding and staining of glass. See Glass type GL40 and GL41 in section 10

7.2.6 Roof classified as Class 2 according to CWCT Technical Note 66. The requirement may be demonstrated either by testing in accordance with TN67, or else by adopting the guidance in TN92 (Simplified method for assessing glazing in Class 2 roofs)

7.2.7 Automatic Opening Vents (AOVs) installed to full height of one end wall and to the top of one side wall . Refer to Arup Smoke Ventilation strategy and the architects' drawings for AOV requirements.

7.2.8 Cables and conduits for AOVs to be concealed within the portal frames

7.2.9 One side hung window to provide access to the lightwell for window cleaning and maintenance operations. Fitted with lockable handle to outside face and a stay to hold the window securely in the open position during window cleaning operations. TBC by the access and maintenance consultant.

8 External Doors (NBS L10)

8.1.1 Read this section with the Architect's coded elevations and window schedules which show size and location of all items described below.

8.1.2 DT01 – Existing timber doors to Camden Centre on Bidborough Street. Doors refurbished and fitted with new hardware.

- This item is excluded from this specification – please refer to the joinery specification by Purcell

8.1.3 DT02 – Existing timber doors to Stairs A on Bidborough Street. Doors refurbished and fitted with new hardware.

- . This item is excluded from this specification – please refer to the joinery specification by Purcell

8.1.4 DT03 – Existing timber doors to Stairs B on Bidborough Street. Doors refurbished and fitted with new hardware.

- . This item is excluded from this specification – please refer to the joinery specification by Purcell

8.1.5 DT04 – New glazed aluminium doors to sides of the Camden Centre side lobby in Tonbridge Walk.

- Double leaf folding door, single action, outward opening,
- Manual operation with panic exit hardware and overhead closers.
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved.
- Fitted with full height tubular handles to outside.

8.1.6 DT05 – New glazed aluminium doors to entrance of the Camden Centre Entrance lobby in Tonbridge Walk.

- Double leaf folding door, single action, outward opening,
- Manual operation with panic exit hardware and overhead closers.
- Fitted with full height tubular handles to outside

8.1.7 DT06 – New glazed aluminium doors to the Camden Centre side lobby in Tonbridge Walk. DG.EX-17 (Fire exit door from Stair E), DG.EX-18 (tertiary exit from Camden Centre)

- Double leaf folding door, single action, outward opening,
- Manual operation with panic exit hardware and overhead closers.

- Schuco ADS75HD door sets and FWS75 frame, or similar and approved.
- Fitted with full height tubular handles to outside.

8.1.8 DT07 – New glazed aluminium doors to SME lobby.

- Double leaf folding door, single action, outward opening,
- Fitted with full height tubular handles.
- N.B. One of the two doors will have automated operation with low energy closer actuated by wall mounted push-pads
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved.
-

8.1.9 DT08 – External escape door at Bidborough Street ground floor, Stair D

- Double leaf folding door, single action, outward opening
- Fitted with panic exit hardware and overhead closers.

8.1.10 DT09 – External escape door at Euston Road ground floor, Stairs F & G

- Double leaf folding door, single action, outward opening,
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved.
- Fitted with panic exit hardware and overhead closers.

8.1.11 DT09M (DG.EX26 & 27)– Existing timber doors with metal facing panels external to DT09,inward opening, but held open to ensure fire exit route during occupancy of the building.

- This item is excluded from this specification – please refer to the joinery specification by Purcell

8.1.12 DT10,11 and 12 – Existing timber door screens to Judd Street main entrance lobby.

- . This item is excluded from this specification – please refer to the joinery specification by Purcell

8.1.13 DT13 – External access door to bike store lobby at Bidborough Street ground floor

- Double leaf door, single action, inward opening, with automated overhead closers.
- Full height tubular handles.

8.1.14 DT14 – Automated door for smoke ventilation strategy in Lightwell basement. DB.LW01-1, DB.LW02-2, DB.LW02-3

- Remote automatic opening for smoke ventilation.
- 60min fire rated

- Double leaf door, single action, outward opening, with automated overhead closers.
- Controls linked in to BMS and fire control system.
- Glazed double door set comprising; Forsters'Fuego' EI 60 (integrity & insulation) fire rated mild steel framed fire resistant latched single action double doorsetcomplete with fixed fanlight above.
- Framework: All items to be manufactured from profiles and ancillary components drawn exclusively from the Forster 'Fuego' system consisting of architectural grade cold rolled mild steel thermally isolated structural members and matching snap-in bead profiles through-out.
- Finish: All mild steel framing members and associated glazing beads shall be polyester powder coated.
- Ironmongery to the door sets will be consist of standard heavy duty weld-on hinges, DDA compliant Dorma TS 93 surface mounted overhead fire resistant closers and 600mm long stainless steel back to back pull handles.
- All frames and ancillary components will be configured to provide 60 minute fire resistance in terms of integrity and insulation and in accordance with BS 476: Part 22: 1987
- Glass: Fire Rated: EI60 Mid Iron 45mm overall thickness double glazed units; 25mm EI60 pane, 14mm spacer, 6mm toughened pane.

8.1.15 DT15 – Automated door for smoke ventilation strategy in Lightwell basement. DB.LW03-1, DB.LW03-3

- Double leaf door, single action, outward opening, with automated overhead closers.
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved.
- Remote automatic opening for smoke ventilation. Controls linked in to BMS and fire control system
- Not fire rated
- .

8.1.16 DT16 – New aluminium door to external Lightwell 03. No smoke ventilation or FR required. DB.LW03-2

- Schuco ADS75HD door sets and FWS75 frame, or similar and approved Not fire rated
- Double leaf door, single action, inward opening,
- Lever handle and cylinder lock

8.1.17 DT17 – Disabled entry door to Judd Street ramp.

- Single leaf door, single action, inward opening,
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved
- Automated low energy overhead closers operated by wall mounted pushpads externally and internally

8.1.18 DT18 – Sliding doors to sides of Judd Street Entrance.

- Double leaf horizontal sliding door,
- DormaKaba ST Flex Secure fine framed, single glazed automatic door system, or similar and approved.–
- ES200 Microprocessor controlled, modular designed Automatic sliding door operator
- Tested and certified to 1,000,000 operation cycles
- Burglar resistance certified to WK2
- Class P4 A glazing as per EN 356
- 4 Point Locking device
- Full width floor guide
- Night/Bank Facility for first and last entrance
- 5 position mode switch (off, automatic, partial opening, exit only and hold open)
- 150mm high Drive unit encased in purpose designed extruded aluminium profile
- DORMA Prosecure Opti Combi combined radar activation and threshold infrared safety sensor
- Wireless wall switch actuation satin stainless steel 150 x 150mm (Option)
- Slimline jamb switch satin stainless steel 115 x 45mm (Option)
- Linked to access control via a normally open volt free contact momentarily closed on receipt of a valid signal from the access control system
- Power Failure/Fire Alarm Monitored battery back-up system to automatically open the doors in the case of a power failure or upon a signal from the interfaced fire alarm system
- No Break Out Facility – TBC with fire engineer
- Self-regulating safety system monitoring all door movements including closing force.
- Auto reverse function if the doors make contact with an obstruction during the closing cycle (infrared threshold safety sensor)

- Emergency Break Glass (Option)
- Rear Edge Safety - Full height frameless pocket screens constructed from 10mm toughened safety glass and patch fittings
- DORMA Prosecure Opti Scan Rear Edge Presence Sensors reducing the door to "Low Energy Speed" upon activation
- Door leaves and fixed side screens constructed from single glazed burglary resistant toughened or laminated P4 A glazing in fine framed profiles
- Aluminium Polyester Powder Coating
- DORMA Secure 4 point locking device - Type 3 Pivoting bolt lock with 4 swing bolts
- Applicable Standards The installation shall comply with BS EN 16005
- Electrical Requirements The electrical contractor shall provide a 240-volt AC mains spur to the right-hand side of the opening above and on the same face that each drive unit is fitted. The spur must be switched and fused with a central flex outlet faceplate. A 10 amp residual circuit breaker at the mains board and a 5-amp fuse at the spur shall protect the circuit.
- Fire Alarm Requirements The fire alarm specialist shall provide a normally open volt free contact that is closed on alarm. The contacts shall be terminated adjacent to the fused spurs
- Real Time Remote Monitoring System Dorvision GPRS based wireless system concealed within the operator; system shall monitor each door location remotely via the internet incorporating facility to lock / unlock doors, timed automatic locking, reset, diagnostic system check and to provide data capture on usage and performance

8.1.19 DT19 – Pivoting doors to centre of Judd Street Entrance.

- Double leaf door, single action, inward opening,
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved
- Automated low energy overhead closers operated by wall mounted push-pads externally and internally
- Fitted with full height tubular handles

8.1.20 SME draft lobby screen

8.1.20.1 Aluminium stick construction curtainwall mullions and transoms, 60mm wide spanning double height lobby. Schuco FW60+ or similar and approved.

8.1.20.2 DT20 Revolving door to Office / SME draft lobby DG.42-1 As described in Section 13.

8.1.20.3 DT 21Glazed single leaf automated pass door to Office / SME draft lobby DG.42-2

- Single leaf door, single action, inward opening,
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved
- Automated low energy overhead closers operated by wall mounted push-pads externally and internally

8.1.21 Casement Doors to 3rd Floor Terraces

These are refurbished steel casements and are included in the architect's window schedules – see references WT304,306 and 309. The existing lock casings and lever handle sets are to be refurbished. New cylinders and keys are to be provided.

8.1.22 Casement Doors to 1st Floor Balconies

These are refurbished bronze casements and are included in the architect's window schedules – see references WT103 and 108. . The existing lock casings and lever handle sets are to be refurbished. New cylinders and keys are to be provided.

8.1.23 Casement Doors to Basement

These are refurbished steel casements and are included in the architect's window schedules – see references WTB03. The existing lock casings and lever handle sets are to be refurbished. New cylinders and keys are to be provided.

8.2 All the above items to be read in conjunction with Section 13 of this specification

9 Louvres – (NBS - L10)

9.1 Scope

This includes louvres that form a part of the external building envelope. These louvres fall within the following categories:

- Mechanical Duct Louvres
- Plant room louvres
- AOVs

9.2 Types

9.2.1 LV01 – New louvres with fixed horizontal aluminium blades and insect mesh installed behind existing metal grilles at pavement level either side of main entrance on Judd Street

9.2.2 LV02 – New louvres with fixed horizontal aluminium blades and insect mesh installed behind existing metal grilles at pavement level on Euston Road

9.2.3 LV03 – New louvres with fixed horizontal aluminium blades and insect mesh installed behind existing metal grilles at pavement level on Bidborough Street

9.2.4 LV04 – New AOV louvre to suit the requirements of Arup smoke ventilation strategy for the lightwell. Installed behind existing metal grilles at pavement level on Euston Road, adjacent to Stair F.

9.2.5 LV05 – Air intake louvre to basement of services lightwell

9.2.6 LV06 – LV06 – Double leaf folding side hung louvred doors to roof on inward facing elevation

9.3 Mechanical Duct Louvres

- The cladding contractor shall be provided with the setting out and list of such locations on the building envelope with opening dimensions.
- Ductworks shall be connected to the rear of the louvre opening by the M&E trade contractors as per the building services engineers' specification. The connection shall be made either directly to the perimeter frame of the louvre; to a spigot connection that has been installed within an insulated composite metal panel blanking plate with cut outs. This connection shall be weather tight in the event that any wind driven rain penetrates the external louvre. Any water that penetrates past the louvre shall be drained to the external zone at the cill, which shall be controlled and shall not lead to any staining on the facade.

- The louvre shall incorporate an aluminium or stainless steel insect mesh
- The louvre shall have a minimum free area of 50%
- Maximum allowable pressure drop to be as per the M&E consultant's specification document.
- Rain exclusion: Class C to BS EN 13030
- Acoustic performance: As per acoustic consultant's specification document.

9.3.1 All metal louvre systems shall be designed, fabricated and installed in accordance with the system supplier's recommendations

9.3.2 Metal weather louvre shall be constructed from extruded aluminium profiles, stainless steel and shall comprise of perimeter frame and cill with structural supporting mullions and individual louvre blades. They shall have performance values in accordance with the performance requirements of this specification. The cill section shall be continuous and drain externally.

9.3.3 The design of the louvre blades shall be to an aerodynamically efficient profile and shall accommodate the calculated design wind loads.

9.3.4 Non functional louvres shall be blanked off with a fully fixed and sealed insulated blanking panel.

9.3.5 The secondary support structure/ rails and fixings supporting the louvres shall be aluminium or austenitic stainless steel grade 304 (C3 and C4 environment category)

9.3.6 All fasteners shall be non-visible and austenitic stainless steel grade A4.

9.3.7 All louvres shall incorporate an aluminium or stainless steel insect mesh.

10 Glass Types – (NBS - L40)

10.1 Description of glass types

10.1.1 GL01 - Single glazing to existing steel primary windows.

- The single glazed units shall have two plys of 4mm clear float glass two 0.38mm clear acoustic pvb interlayers and a minimum thickness of 4mm for each ply. The units shall have the following performance criteria:
- VLT (visible light transmittance) – 89% min
- Internal and external reflectance – 8% max
- CRI (colour rendition index) – 99% min
- Substrate and interlayer colour – Clear / Neutral
- Acoustic Rw (C,Ctr) – 37 (0;-2) dB

10.1.2 GL02 – As GL01 but obscured interlayer and reduced VLT.

10.1.3 GL03 - Single glazing to secondary windows in lightwell.

- The single glazed units shall have two plys of 5mm clear float glass two 0.38mm clear acoustic pvb interlayers. The units shall have the following performance criteria:
- VLT (visible light transmittance) – 88% min
- Internal and external reflectance – 8% max
- CRI (colour rendition index) – 98% min
- Substrate and interlayer colour – Clear / Neutral
- Acoustic Rw (C,Ctr) – 39 (0;-2) dB

10.1.4 GL11 - Double glazed units to internal secondary windows where bottom of glass is more than 800mm from FFL.

- The double glazed units shall include a 10mm monolithic outer pane and 6.8mm laminated inner panes with acoustic pvb interlayers and shall incorporate a LowE coating (e.g. Planitherm Ultra N or approved equivalent) to the inner pane on the surface towards the cavity. The units shall incorporate a 16mm thick argon filled cavity with high performance warm edge spacer bars in black colour. The double glazed units shall have the following performance criteria:

- VLT (visible light transmittance) – 77% min
- Internal and external reflectance – 12% max
- 'g' value – 0.59
- Ug – 1.1 W/m^2.K
- CRI (colour rendition index) – 85% min
- Substrate and coating colour – Clear / Neutral

10.1.5 GL12 – As GL11 but with obscured interlayer.

10.1.6 GL13 - Double glazed units to internal secondary windows where bottom of glass is less than 800mm from FFL.

- The double glazed units shall include a 10.8mm monolithic outer pane and 6.8mm laminated inner panes with acoustic pvb interlayers and shall incorporate a LowE coating (e.g. Planitherm Ultra N or approved equivalent) to the inner pane on the surface towards the cavity. The units shall incorporate a 16mm thick argon filled cavity with high performance warm edge spacer bars in black colour. The double glazed units shall have the following performance criteria:
- VLT (visible light transmittance) – 77% min
- Internal and external reflectance – 12% max
- 'g' value – 0.59
- Ug – 1.1 W/m^2.K
- CRI (colour rendition index) – 85% min
- Substrate and coating colour – Clear / Neutral

10.1.7 GL14 – As GL13 but with obscured interlayer.

10.1.8 GL21 - Double glazed units to 3rd Floor Pavilion Curtainwall.

- The double glazed units shall include a 10mm monolithic outer pane and 6.8mm laminated inner panes with acoustic pvb interlayers and shall incorporate a high performance solar control coating (e.g. Cool-Lite SKN 165 or similar or approved equivalent) to the inner pane on the surface towards the cavity. The units shall incorporate a 16mm thick argon filled cavity with high performance warm edge spacer bars in black colour. The double glazed units shall have the following performance criteria:
- VLT (visible light transmittance) – 60% min
- External reflectance – 16% max

- Internal reflectance – 28% max
- 'g' value – 0.33
- Ug – 1.0 W/m².K
- CRI (colour rendition index) – 85% min
- Substrate and coating colour – Clear / Neutral

10.1.9 GL32 - Double glazing fire-rated glass to Lightwell.

- Pyropane 231-28 E60 double glazed units with intumescent transparent layers to provide E60 fire-rating. With Obscured laminate interlayer.

10.1.10 GL33 - Double glazing fire-rated glass to Lightwell.

- Pyropane 231-28 E60 double glazed units with intumescent transparent layers to provide E60 fire-rating. Clear vision glazing.

10.1.11 GL40 – Monopitch Rooflight Glazing.

- The double glazed units shall include a 12mm toughened monolithic outer pane and 21.5mm laminated inner pane with acoustic pvb interlayers and shall incorporate a high performance solar control coating (e.g. Cool-Lite SKN 165 or similar or approved equivalent) to surface #2. The units shall incorporate a 16mm thick argon filled cavity with high performance warm edge spacer bars in black colour. The double glazed units shall have the following performance criteria:
- VLT (visible light transmittance) – 60% min
- External reflectance – 16% max
- Internal reflectance – 28% max
- 'g' value – 0.33
- Ug – 1.1 W/m².K
- CRI (colour rendition index) – 85% min
- Substrate and coating colour – Clear / Neutral

10.1.12 GL41 – Vertical Glazing immediately below Monopitch Rooflights

- The double glazed units shall include an outer pane of 9.5mm heat strengthened glass, PVB laminate with Cool-lite clear SKN 165 II coating, a 16mm argon cavity and an inner pane of 9.5mm heat strengthened laminate. All glass to be mid iron. Inner panes to have acoustic laminate.
- The double glazed units shall have the following performance criteria:
- VLT (visible light transmittance) – 60% min
- External reflectance – 16% max
- Internal reflectance – 28% max
- 'g' value – 0.33
- Ug – 1.1 W/m^2.K
- CRI (colour rendition index) – 85% min
- Substrate and coating colour – Clear / Neutral

10.1.13 GL42 – Lantern Light Glazing.

- Double glazed, Low E insulated units. Outer pane 6.8 mm heat strengthened laminate with opaque pvb interlayer, 16mm argon cavity, inner pane 6.8mm clear heat strengthened laminated. Opaque interlayer subject to sample submission and approval.
- VLT (visible light transmittance) – n/a
- External reflectance – 16% max
- Internal reflectance – n/a
- 'g' value – N/a
- Ug – 1.1 W/m^2.K
- CRI (colour rendition index) – n/a
- Substrate and coating colour – Clear / Neutral
-

10.2 General

10.2.1 All basic soda lime silicate flat glass (except patterned or wired) shall be manufactured by the 'float' process and shall comply with BS 572 and BS 952.

10.2.2 The thickness and dimensions of glass shown on the Architects Drawings are not prescribed thickness or dimensions. The Contractor shall calculate the glass thickness, using validated design methods to meet the structural, environmental, and acoustic and safety requirements.

10.2.3 The Contractor shall obtain the total quantity of each glass material from the same material manufacturer. In the case of coated glasses, or other processed glass products, the Contractor shall ensure that all products are processed from 'raw' glass material obtained from one manufacturer.

10.2.4 Glass shall comply with the relevant parts of the following standards generally:

- BS EN 572 for basic soda lime silicate glass
- BS EN 1096 for coated glass
- BS EN 1748 for borosilicate glass
- BS EN ISO 12543 for laminated glass and laminated safety glass
- BS EN 12150 and BS EN 14179 for heat soaked thermally toughened glass
- BS EN 1863 for heat strengthened glass

10.2.5 All glass edges (except ground edges) shall be clean cut, undamaged and free from any defects like vents, chips and shells or any other defects that are likely to be detrimental to the visual and performance criteria of the glazing. No cutting or nipping of the glass shall be allowed on site.

10.2.6 All visible glass edges shall be:

- A 'smooth ground edge' in accordance to BS EN 14179-1 Part 1 or BS EN 12150 Part 1 or BS EN 1863 Part 1 or BS EN 12543 Part 5 or
- An arrised edge (smooth ground) in accordance with BS 952 Part 2.

10.2.7 Glass shall be selected to resist the windloads and variations in atmospheric pressure without excessive deflection, but it is also important to maintain visual consistency of glass where different specifications can be view concurrently. If the contractor proposes to use differing thickness, coatings, or substrates of glass, the visual impact of these selections must be communicated to the architect before materials are procured. The architect will be entitled to request full size samples to be set up in a manner simulating their intended installation conditions.

10.2.8 Thermal shock – The cladding contractor shall allow for any necessary heat treatment required for the glass to eliminate any risk of thermal shock in its installed

position. Allowance shall also be made for any shadows cast by overhanging balconies and for dark coloured blinds or drapes being placed within 75mm of the inside surface of the glass.

10.2.9 Nickel sulphide inclusions – All toughened glass shall be heat soak tested according to BS EN 14179 to minimise the risk of NiS failure. The cladding contractor shall replace any failure due to NiS inclusions prior to Practical Completion of the project..

10.2.10 The edges of all panes and double glazed units shall be inspected during processing and before and after installation in their frames. Any edges with defects likely to initiate cracks in service including feather (shark's teeth) or whisker (serration's) deeper than half the thickness' of the pane, vents (flake chips) greater than 6mm across, or impact damage shall not be incorporated in the Works.

10.3 Tolerances on width (W) and length(L)

10.3.1 The maximum allowable tolerances for double glazed units are given below:

Length and Width on units up to $3m^2$	+3mm, - 0mm
Length and Width on units $3m^2$ to $8.5m^2$	+4.5mm, - 0mm
Length and width on units over $8.5m^2$	+6mm, - 0mm
Thickness for 2 panes of glass each 6mm or less plus air space	+ or – 1.0mm
Thickness for 2 panes of glass each over 6mm plus air space	+ or – 1.5mm
Variation in thickness round the perimeter of any one unit.	Not more than 1mm

10.3.2 Maximum allowable tolerances for annealed, toughened and heat strengthened panes:

Nominal dimension of side in mm	Tolerance in mm
< 2000	+/- 1
2000 ≤ W or L ≤ 4000	+/- 2
> 4000	+/- 3

10.3.3 Maximum allowable tolerances for laminated glass panes:

Nominal dimension of side in mm	Tolerance in mm
< 2000	+/- 1.5
2000 ≤ W or L ≤ 4000	+/- 2.5

> 4000	+/- 3.5

10.4 Insulating glass units

10.4.1 Insulating glass units shall comply with BS EN 1279. The visual quality of the installed units shall be assessed in accordance with the next section of this specification.

10.4.2 The spacers separating the panes of glass shall be aluminium alloy with a black anodised finish, stainless steel, glass fibre reinforced plastic, thermoplastic or silicone foam and shall have adequate rigidity for their purpose. They shall be specifically designed to accommodate the seal and contain desiccant, allowing both to operate at maximum efficiency. All bent edge spacers shall be limited to a maximum two joints in any one assembly. Spacer pieces shall not be less than 200mm in length. Joints shall not be allowed within 50mm of any corner.

10.4.3 The units shall have a mechanically applied primary polyisobutylene seal, located between glass and spacer providing a vapour-proof barrier, which shall be continuous and of a minimum width of 3mm, and a secondary two part silicone seal extending around the perimeter of the double glazed unit.

10.4.4 All breather tubes shall be nipped closed.

10.4.5 Where argon filled units are proposed, the supplier of the units shall provide written evidence that the units have undergone accelerated ageing tests in accordance with BS EN 1279 -3.

10.4.6 The units shall not employ edge tape. The edges shall be finished in a way which permits visual inspection of the glass edge, edge seals and the positions of the metal spacers.

10.4.7 Identification marks and /or manufacturers' logos shall be sized as small as possible. They shall be located in the bottom left hand corner of the double glazed units when viewed from the inside to the outside.

10.4.8 Glass units used with structural silicone glazing shall comply with BS EN 15434:2006+A1:2010.

10.5 Visual acceptance criteria for float glass

10.5.1 All glass shall be clear float glass, without significant edge faults (including feathered edges, shells or other imperfections) and free from bubbles, inclusions, cracks ripping dimples or other defects. Distortion shall be kept to an absolute minimum and no local defects producing irregular reflections shall be allowed.

10.5.2 The quality of all glass off the float line shall be assessed for optical and visual faults as described in BS EN 572-2. Spot faults shall not be worse than category C. There

shall be no linear/extended faults. For optical faults, acceptance levels shall be as described.

10.5.3 Visual acceptance criteria for as-installed glass shall be as described elsewhere in this specification.

10.5.4 Sizes - All glass shall be cut to accurate sizes and, if applicable, delivered to site in the required sizes. No on-site cutting or nipping shall be allowed. The glass shall be clearly marked to show its intended final position and orientation.

10.5.5 Safety marking on glass - shall comply with Building Regulations Approved Document Part N.

10.6 Thermally toughened glass

10.6.1 The use of thoughened glass shall be avoided wherever practicable , but where it cannot be avoided the following requirements shall apply

10.6.2 All toughened glass shall be tempered on a roller hearth furnace eliminating tong marks and shall confirm to BS EN 12600 class 1C1.

10.6.3 Thermally toughened glass shall comply with BS EN 12150 and shall be heat soak tested in accordance to BS EN 14179. Each panel of toughened glass shall be traceable to individual heat soak test batches to ensure that in the event of a failure, it shall be possible to identify and locate all panels from the heat soak test batch.

10.6.4 Edge working shall be ground smooth. Corners shall be dubbed. Small shells and / or chips shall be ground out prior to toughening. Any remaining chips and/or shells shall not affect the structural performance of the glass and shall not be visible in the installed Works.

10.6.5 The appearance of anisotropy or 'Leopard Spots', a multi-coloured pattern, is known to be associated with toughened glass under certain polarised lighting conditions. Processing shall be strictly controlled to ensure that this effect is kept to an absolute minimum.

10.7 Heat Strengthened glass

10.7.1 Heat strengthened glass shall comply with BS EN 1863. All flat glass shall be processed horizontally.

10.7.2 Edge working shall be ground smooth. Corners shall be dubbed. Small shells and / or chips shall be ground out prior to heat strengthening. Any remaining chips and/or shells shall not affect the structural performance of the glass and shall not be visible in the installed Works.

10.7.3 The appearance of anisotropy or 'Leopard Spots', a multi-coloured pattern, is known to be associated with toughened glass under certain polarised lighting conditions. Processing shall be strictly controlled to ensure that this effect is kept to an absolute minimum.

10.7.4 Rollerwave shall be limited to the values given in the glass fabrication tolerances section of this document.

10.8 Laminated glass

10.8.1 All laminated glass panes shall comply with BS EN 12543. Delamination within the vision area as defined in BS En 12543 shall not be accepted.

10.8.2 . Edge delamination will be limited to the perimeter zones (edge areas) identified in BSEN 12543-6. For pane sizes that are less than 5 m2, the width of the edge area is 15 mm. The width of the edge area is increased to 20 mm for pane sizes that are greater than 5 m2.

10.8.3 Where the edge of the laminate glass is to be exposed, the interlayer material must be shown to be resistant to the effects of moisture absorption, including clouding and delamination.

10.8.4 After lamination, individual pieces of laminated glass shall be within the tolerances given in BS EN ISO 12543-5.

10.9 Coated glass

10.9.1 Coated glass shall comply with BS EN 1096.

10.9.2 Processing shall be strictly controlled to ensure even coating, minimum colour variation and no streaking or patching. Where coatings are applied to thermally toughened glass or heat strengthened glass, these must not increase the tendency to show these effects.

10.9.3 Low emissivity coating, if required to achieve the performance criteria specified, shall be positioned on surfaces 2 or 3, shall be nominally neutral in colour and uniform in tone, hue, colour, texture, pattern and opacity and shall provide a consistent appearance to the glazed units. The emissivity shall be less than 0.2.

10.10 Screen printing

10.10.1 Ceramic ink shall be applied to areas of heat treated glass as indicated on the Contract Documents using the silk screen process.

10.10.2 Samples shall be submitted prior to manufacture for review by the Architect.

10.10.3 The ceramic ink shall be fused to the surface of the glass during the heat treatment process and be permanent and durable and shall be resistant during the design life of the Works to:

10.10.4 Attack from mechanical damage or abrasion, during normal use and maintenance as specified by this Contract Document.

10.10.5 Weathering, fading, or discolouration due to attack from climatic conditions, UV or atmospheric pollutants.

10.10.6 The screen printed face of the glass shall face the inside of the building in the final construction.

10.11 All double glazed units shall incorporate black coloured spacer bars.

10.12 Fabrication Tolerances

10.12.1 Annealed glass

Tolerances on cut annealed glass shall be in accordance with BS EN 572-2.

10.12.2 Thermally toughened and heat strengthened glass

After processing, individual pieces of heat treated glass shall be within the following tolerances:

Length and width	As required by BS EN 12150 and 1863
Squareness measured along the diagonals	As required by BS EN 12150 and 1863
Roller wave	For glass thickness: ≥6mm rollerwave shall not exceed 0.08mm /300 mm <6mm rollerwave shall not exceed 0.12mm/300mm between peak and trough
Edge dip	0.25mm
Bow/Local bow	As required by BS EN 12150 and 1863

10.13 Combined effects of Rollerwaves

The combined effects of rollerwaves on 2 or more panes of heat treated glass when assembled in a laminated construction or as part of an insulated glazing unit, has the potential to generate localised lensing effects. In order to limit the probability of such effects,

the cladding contractor shall propose an inspection and test plan to demonstrate by sampling and statistical analysis that the probability of 2 or 3 glass panes with rollerwaves in excess of 0.08mm being combined in a laminated pane of insulated glazing unit is less than 1:50.

Each batch of monolithic heat treated glass shall be sampled and measured before lamination. Measurements shall be recorded and analysed to report the statistical distribution of results, including but not limited to the mean value and standard deviation. A total of 5% of the glazing shall be sampled for this report. The inspection and test plan shall be submitted to the main contractor for approval.

11 Contractor's Works – (NBS – A)

11.1 The Contractor's Obligations

- Comply with all the relevant National and Local Government Regulations
- Liaise with the Principal designer, Design team, local authorities and provide all information necessary to complete the Health and Safety file required by CDM regulations 2015.
- Use recognised industry good practice standards and comply with all the relevant standards and codes of practice listed in this document. The contractor shall provide detailed design information for the works to be undertaken to demonstrate compliance with this performance specification document.
- Prepare a detailed programme for the execution of the works allowing for design development, visual mock ups, prototype testing, procurement of samples and submit within 4 weeks of the award of the contract.
- Prepare a detailed drawing list, related to elevations showing locations of 2 and 3D drawings and identify within the programme when will these be produced.
- Provide relevant product literature, samples of components, test certificates for the works to demonstrate quality of the materials, design, workmanship and fabrication techniques.
- Produce and submit formally, design drawings based on compliant solutions, calculations and samples. As these are developed ongoing checks shall be made to ensure that the principles mentioned above are maintained.
- Prepare the necessary shop drawings when the designs have been completed in compliance with this contract document for the system concerned and approved by the design team.
- Include any secondary support members/ bracketry, required to support and/or restrain the works/ (which will be fixed to the primary structural frame), on the detailed design drawings. The contractor shall produce these drawings in accordance with the programme to allow other sub-contractors to incorporate these into their works.
- Fabricate the visual and performance mock-ups identified in sections 17 and 18 when the necessary shop drawings have been completed.
- Provide samples, design development mock ups, weather performance tests, acoustic and fire separation tests where identified in the following sections of this specification.
- Carry out modifications to the design and construction of the specimens and retest them in the event of failure during the test. Ensure any modifications to the design are incorporated into the design development drawings.
- The contractor shall carry out a survey to obtain critical dimensions of applicable existing elements on site, including verticality, prior to manufacture of components.

- The contractor shall assure themselves of the suitability of the design and that it is fit for the building, is compliant with the architectural requirements and this specification before the commencement of procurement, manufacture and installation. It is the contractor's responsibility to coordinate with all other trade sub contractors where building cladding interfaces occur between elements of the works.
- Proceed with fabrication when the particular specimen has been tested successfully.
- Organise the delivery of components to the site so that the works can be installed in proper sequence without omissions which would require modification of the design.
- Ensure that the works are installed to the agreed standards set by the quality control benchmark samples
- Instruct all those engaged in the installation of the works of the principles of its design, of any unusual details which might be overlooked and of the particular techniques to be used in its construction.
- Carry out hose tests on agreed areas of the project as identified in section 18.
- Protect the works, check the proper operation of all opening vents and carry out final clean down.
- Provide comprehensive maintenance manual and 'as-built' drawings.

11.2 Submissions (Post contract)

11.2.1 Design drawings

- The contract drawings shall be provided using a central electronic document transfer system (Conject) provided by the Main Contractor.
- The contractor shall be deemed to have satisfied themselves that the design contained within the design drawings are capable of achieving the required level of performance and are buildable.
- The contractor shall indicate on their design drawings the position of their works in relation to interfaces with the works of other trades.
- Fixing bracket locations, arrangements, types, dimensions, materials, welds and position of anchors, bolts and cast in inserts shall be indicated within the drawings.
- All drainage and ventilation routes shall be indicated within the design drawings.
- The contractor shall indicate all materials, finishes, metal/ glass types, weather / vapour membranes, gaskets, seals, insulation, fire/acoustic stops and all other components utilised in the works.
- The contractor shall show provisions for accommodating all relevant cladding movements indicating movement allowances.
- Glass edge finishes shall be indicated within the design drawings.

- The CAD drawing format shall be agreed with the design team prior to issue of the documents to ensure these are compatible for importing and reviews.

11.2.2 Samples, Prototypes and General Submissions (see following sections in this specification for details)

11.2.3 Calculations (General considerations)

- A full set of calculations shall be provided to demonstrate that the works comply with the requirements of this specification.
- Calculations will be readable, comprehensively tabulated and cross referenced. Calculations will be done in accordance with appropriate recognised standards, codes of practice and procedures, using diagrams and extracts from drawings to explain what is being analysed. Basic data used and all assumptions made must be clearly stated.
- Evidence that the engineer responsible for the calculations has appropriate qualifications and is a chartered member of an appropriate recognised professional institution will be provided. Evidence of internal checking of the calculations by the Contractors will also be provided.

11.2.3.1 Structural

- Structural calculations shall be provided by the cladding contractor and include (but not be limited to) calculations for all panel sections, connections, fixing assemblies, anchors, bolts, fasteners and glazing panel sizes.
- All load cases, load factors and combination of load cases including dead loads, imposed loads and barrier loads where appropriate shall be included within the calculations.
- Where appropriate, the calculations shall include assessment of overall stability and resistance to progressive collapse.
- The calculations shall include assumptions for stress limits for factored and unfactored loads as appropriate for different materials.
- Where finite element analysis is used, these shall identify restraint types, property types, axis systems and applied loads.
- Fixing assembly calculations shall incorporate the worst combination of the structural frame tolerances as per the structural engineers, 'building movement and tolerances' report.
- The calculations shall be in accordance to all the relevant British Standards for the materials to be used. Refer to the materials section of this document for related standards.

11.2.3.2 Thermal Performance

- The cladding contractor shall produce detailed 2D and 3D thermal performance calculations to demonstrate compliance with the target U-value requirements of this document. The analysis shall include all the facade components supplied and / or installed by the contractor and comply with the relevant British standards mentioned within this document.
- The software used for this analysis shall be shown to be validated against the examples given in Annex D of EN ISO 10077-2. . The results of the assessment will be summarized as thermal transmittance (U value) for the centre of the panels, edge effects and frames of each relevant window, curtain walling and metal cladding type. Overall U values for each relevant window, curtain walling and metal cladding type will be calculated as a weighted average of constituent areas. The calculation method will take into account the internal and external surface heat transfer resistances. These resistances and the parameters, which affect them, will be quoted. The method will take into account the effects of any air spaces and the thermal interaction between elements of the facade. The calculation will be carried out in accordance with the requirements of BS EN ISO 12631: 2017. Guidance can be found in the Centre for Window and Cladding Technology, Standard for systemised building envelopes, Part 5; Thermal, moisture and acoustic performance and the joint CWCT/CAB publication, The thermal assessment of window assemblies, curtain walling and non-traditional building envelopes.

11.2.3.3 Condensation Risk

- Condensation risk analysis calculations shall be carried out and submitted by the cladding contractor to demonstrate that no surface or interstitial condensation shall form on the cladding elements supplied and / or installed by the contractor under the design psychometric conditions.
- The calculations shall be carried out as per the relevant standards and CWCT guidelines.

11.2.3.4 Glazing thermal stress calculations

- The cladding contractor shall carry out thermal stress calculations for glass supplied and / or installed by the contractor to demonstrate that there is no likelihood of any glazing pane fractures/ failure as a result of excessive thermal edge stresses as a result of the factors (including but not limited to) mentioned below –

- External and internal shading devices
- Coloured glass substrates and coloured interlayers
- Fritting
- Internal bulkheads
- Projections/ recesses within the building envelope

11.3 Quality Control

11.3.1 The Contractor shall comply with the Quality Control requiremenst set out in the Lend Lease Contractors' Requirements documents.

11.3.2 The contractor shall establish, document and maintain a quality control system as per the guidelines of BS EN ISO 9001 to demonstrate how quality management shall be implemented from award of contract to completion of the works.

11.3.3 The quality control programme shall be defined in a quality control manual or similar document in which the organisation systems, inspections and test plan procedures are fully described to ensure that all the essential inspection requirements are determined and satisfied throughout the works. The quality control procedures shall be based on the most up to date revisions of drawings, specification and contract document.

11.3.4 The contractor shall establish a separate tolerance quality control manual to cover compliance with tolerances related to the works. This shall include the different types of quality control checks that shall be carried out during each stage of the works, the person responsible for such checks and details of check records.

11.3.5 The procedures mentioned below shall be followed and the contractor's proposals shall meet the requirements of this section as a minimum and be submitted to the D&B Contractor.

- Submit a comprehensive quality control plan within 30 days of appointment to the construction manager for review and approval.
- Include with the quality control manual an inspection and test plan for each major item of work or type of fabrication which shall detail the following:
    - The primary activities to be carried out
    - The type, method and frequency of inspections and tests to be carried out.
    - The inspecting authority
    - The acceptance criteria
    - Details of records to be kept.
- As a minimum the quality control plan shall include the following information and procedures:
    - Organisation and management .i.e. details of the quality management team
    - Assessment of quality
    - List of design development drawings required

- Inspection and test procedures to be adopted in checking the works
- Stages at which checklists will be used and samples of those checklists
- Statements on work procedures on the correct use of materials and components both on and off site
- List of product information with latest revisions
- List of trade contractors appointed by the contractor and involved in the works
- The trade contractors quality systems and checklists
- Calibration records of measuring equipment
- Compliance with the requirements of the CDM regulations
- Storage, handling and transportation
- Fabrication and erection
- Tolerance control plan
- Prototypes
- Painting and coating
- Inspection and testing of materials and workmanship
- Non-conforming items
- Detailed design drawings
- Control of purchased materials and services
- Completed items, inspection and test results
- Records and review of the quality system

11.4 Protection, Handling and Storage

11.4.1 The Contractor shall comply with the protection handling and storage requiremenst set out in the Lend Lease Contractors' Requirements documents.

11.4.2 Assembled units, materials and all components shall be protected in such a manner that will prevent damage, distortion, uneven weathering or degradation under normal conditions of handling and storage. Particular attention shall be given to the protection of edges, projecting features, corners and other vulnerable areas. Temporary protection materials shall like Correx or approved equivalent shall be used during handling and transportation.

11.4.3 Low tack tape shall be provided to all profiles along the full width and height of the panel and glazing. There must be sufficient ventilation to the glazing protection to avoid thermal shock.

11.4.4 The contractor shall supervise, check, alter, adapt and maintain all protective devices as necessary until practical completion. The contractor shall allow for progressive removal of the protection in coordination with the main contractor to ensure that the final removal of protection is not partially trapped by the works of interfacing trades.

11.4.5 The finished works shall be free from distortion, cracks, defective finishes, scratches and other damage.

11.4.6 Cement mortar and concrete droppings or splashes shall not be allowed to dry onto the glazing or framing members. Subsequent removal of this material will expose alkaline etching of the glass and mechanical scratches will occur during removal.

11.4.7 The cladding contractor shall provide a method statement detailing the proposed method of storage and handling, including transportation. All materials shall be clearly labelled for identification and traceability.

11.5 Installation

11.5.1 The Contractor shall comply with the installation requirements set out in the Lend Lease Contractors' Requirements documents.

11.5.2 The works shall be installed in accordance with the contractor's drawings and reviewed method statements, modified as necessary to meet the requirements of the contract document.

11.5.3 Installation methods for the works shall be selected to ensure compliance with the specified performance criteria of the envelope.

11.5.4 Installation method statements shall include programme, sequence of installation, temporary works, dealing with adverse conditions, tools and plant, ancillary materials, labour, protection, coordination with other elements of works and regular inspections.

11.5.5 If it is anticipated that the cladding shall be erected from behind an edge protection system, the contractor shall liaise with the edge protection contractor to ensure that the installation procedure is agreed and the protection removed in agreed manner.

11.5.6 The installation drawings, method statement and procedures shall detail all the elements used to construct the works and shall clearly describe all operations including the following:

- Setting out and control points
- Details of isolation and packing
- Joint sealant application and cleaning procedures.
- Backer rod application locations, sizes and details of bond release tapes
- Torque requirements for all fixings
- Details of all lifting equipment
- Details of points that are susceptible to damage and not to be loaded during installation
- Details of protection
- Positions of all hidden fixings
- Compliance with all relevant CDM regulations associated with installation works

11.6 Operations and Maintenance Manuals

11.6.1 The Contractor shall produce an Operations and Maintenance manual for the Works. Two copies of the manual will be required. A draft copy of the proposed manual shall be submitted to the Architect not less than six weeks before the programmed date for

Completion. The manual shall be developed in parallel with the design and shall include, but not be limited to, the following information:

- The name, address and telephone number of each firm and/or Contractor involved in the supply or fabrication of materials, components, assemblies and finishes.
- A clear and concise description of the construction used to form the various elements within the Works. It shall be set out in chapters dealing with each element in turn. Its contents shall be comprehensively tabulated and its text cross-referenced. It shall be illustrated with sketches and Trade Literature and shall refer to the 'as-built' drawings.
- Copies of material, components and finishes certification and test reports as required by the Contract Documents.
- A method statement showing the means of access to all parts of the Works with recommended safe loading.
- A method statement covering the procedures for replacement of damaged or otherwise defective materials or components, and materials and components that have a design life less than the design life of the Works and will therefore require replacement during its life.
- Quality management record sheets including records of repairs to coatings.
- Recommendations and procedures for inspections, routine maintenance, lubrication, cleaning, suitable cleaning agents and painting.
- A full set of as-built construction drawings, updated to include any changes made up to the time of completion.
- The terms and conditions of any Warranties. Note that all Warranties for finishes shall be valid for periods of one year between cleaning.

11.6.2 Warranties

Warranties are required for the system and its components. Warranties or letters of certification, in writing are also required from material suppliers confirming that the materials are being used as per the requirements of the contract documents.
Collateral warranties and Professional Indemnity insurance for the external cladding works shall be provided in accordance with the time frame and quantities defined in the contract documents.

12 General Technical Requirements – (NBS - A)

12.1 Design and Service life

12.1.1 The works shall have a design life as defined in clause 3.1.4 of BS ISO 15686-1 of 30 years. The whole of the works and each component of the works shall perform for a service life as defined in clause 3.1.1 of BS ISO 15686-1 of 30 years. Within that period, the works shall perform or exceed the performance levels specified in this document with maintenance level 1 as defined in table 1 of BS 7543.

The following table gives an overview of the predicted service life and maintenance levels of the different components of the cladding system as per BS ISO 15686-1:2006 and BS 7543 –

	Item	*Predicted service life (years)*	*Maintenance Level (category)*
1	Cladding Systems	30	3
2	Steel windows frames and profiles	30	3
3	Aluminium frames and profiles	30	3
4	Galvanised steel sheet (internal)	30	3
5	Glass units	30	1
6	Laminated glass	25	1
7	Paint coating: PPC	25	2
8	Paint coating: epoxy, acrylic	25	2
9	Anodising	30	2
10	Gaskets	30 (internal) 25 (external)	1
11	Exposed sealant at external joints	15	1
12	Structural silicone sealant	30	1
13	Insulating material	30	3
14	Fire stops at slab edges	30	3
15	Doors, door mechanisms, pivots, hinges and moving parts	5	1
16	Ironmongery (excluding those given in 15 above)	10	2
17	Blinds (excluding motors and moving parts)	20	1
18	Motors and other electrical items	5	1
19	Composite panels	30	2
20	Miscellaneous materials	5	3
21	Stone	30	3
22	Stone composite	30	3

23	Glazed ceramic composite system	30	2

12.1.2 Materials and components which under the specified service conditions cannot meet the specified service life, i.e. need "repair" as defined in clause 3.5.1 of BS ISO 15686-1, will be identified and brought to the attention of the Architect. Details will be provided together with methods of renewal, replacement or mending.

12.1.3 Materials and components which under the specified service meet the service life of the cladding without loss of performance below those specified in this specification, but require maintenance as defined in clause 3.5.2 of BS ISO 15686-1 to the maintenance level specified, will be identified by the Contractor. These recommendations will be submitted to the Architect for review.

12.1.4 All structural fixings, framing, angles and other load bearing components will remain in position and support all specified combinations of loading for a period in excess of the service life of the Works without repair or maintenance.

12.2 Prescriptive Requirements

- The cladding contractor shall comply with the following general prescriptive requirements during design, fabrication and installation of the works:
- All fixings outside the vapour control layer (VCL) shall be stainless steel.
- Flexible vapour control sheets or membranes shall be continuously sealed and positively clamped together when connected together or to other systems.
- Site applied structural sealant is not acceptable.
- Smoke and fire stops shall be provided as per the building regulation requirements.
- Both inner and outer panes of double glazed units shall be laminated where these are subject to impacts.
- All gaskets, as far as possible, shall be accessible for inspection/ replacement.
- Wherever glass is used as a barrier, it shall be laminated safety glass class 1C1, as defined in BS 6180.
- Flexible vapour control membranes shall not span more than 100mm without support and shall be designed to resist maximum design wind load.
- No visible fixings shall be allowed to the face of the cladding when viewed both from the inside or outside

12.3 Corrosion Protection

12.3.1 As described in BS EN ISO 12944-2 'Corrosion protection of steel structures by protective paint systems' the environment shall be "C3 Medium".

12.3.2 The exposure conditions for concrete shall be classed as XC3/4 + XF1 as per BS 8500-1.

12.3.3 Where different metals are used together, provisions shall be allowed for adequate separation to prevent bimetallic corrosion. Please refer to publication PD 6484, 'Commentary on corrosion at bimetallic contacts and its alleviation'.

12.3.4 The use of bituminous paint will not be accepted.

12.3.5 The contractor shall carry out a corrosion risk assessment to demonstrate that the materials and their finishes comply with the design and service life mentioned in section 2.1.1 of this specification.

12.4 Infestation

The works shall resist attack or infested by micro-organisms, fungi, insects or other vermin.

12.5 Fire Propagation

Please refer to the fire strategy document for details of surface spread of flames class requirements, compartmentation requirements, fire and smoke stopping and smoke venting requirements.

12.6 Acoustic Performance

12.6.1 Airborme sound insulation of new glazing – the following minimum sound reduction performances shall be demonstrated by a laboratory testing of elements in accordance with BS EN ISO 14010-2. or if test data of the exact frame and glass configuration is not available, by assessment of test data of comparable systems.

Element	**Minimum Sound Reduction Index, R, Hz**					
	125	**250**	**500**	**1k**	**2k**	**4k**
New 8.8mm laminated glass to all internal and external refurbished frames (glass only)	23	28	34	37	37	41
New 10/12/6.4mm laminated secondary glazing to all external windows, included framework	27	28	36	41	42	50
New 10.8mm laminated secondary glazing to all internal windows including framework	27	31	35	38	38	45
New rooflights to west lightwells	TBC	TBC	TBC	TBC	TBC	TBC

12.6.2 Cavities between outer and inner secondary windows

The combined acoustic performance of primary and secondary windows is partly determined by the gap between them. The table below sets out the minimum cavities between the outer glazing and inner secondary glazing. The contractor responsible for the secondary windows shall ensure that these minimum values are maintained.

Zone	**Minimum cavity between outer and inner secondary glazing**
Euston Road, Ground and first floor	50mm, but if more space is available should be increased as much as possible
Euston Road, Second and third floor	20mm
Bidborough Street, all levels	20mm
Judd Street, Ground and first floor	40mm, but if more space is available should be increased as much as possible
Judd Street, Second and third floor	20mm
Tonbridge Walk, Camden Centre	150mm, but if more space is available should be increased as much as possible
Tonbridge Walk, Second and third floor	20mm
External lightwell G.LW.03 Interview room, Wedding Suite, Office	50mm, but if more space is available should be increased as much as possible
External lightwell G.LW.03, other areas	20mm
Internal lightwells	35mm

12.6.3 The new rooflights to the west lightwells shall have a laminated layer to help control impact noise from rainfall.

12.6.4 Please refer to the acoustic consultant's strategy report for details of vertical and horizontal flanking transmission requirements.

12.6.5 Movement and wind noise control – Incorporate measures in the detailed design to eliminate noise generated by:

- The effects of thermal and structural movements
- Wind and air movements, including creaking, rattling, whistling, 'slip-stick' noise.
- Helmhotz resonance. Apply baffles to any cavities which might generate tonal noise as a result of wind blowing through projecting features or over the facade surface.
- Vortex shedding. Leading edges of projecting features shall be shaped to eliminate vortex shedding.

12.6.6 Acoustic testing of sample - An advanced works sample window upgrade shall be carried out to one of the offices or meeting rooms overlooking Euston Road on Level 1. An appropriate room for this would be Office 1.04 or 1.03, each of which have a single window. Once this is done, acoustic measurements shall be conducted of traffic noise ingress to verify the achieved level against the target value of NR35 and to provide an indication of the expected noise ingress to the wedding suites.

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12.7 Air permeability

12.7.1 The cladding shall achieve a maximum of $5m^3/hr/m^2$ @ 50Pa as a minimum (whole building air tightness value).

12.7.2 The air permeability of the window openings s will be mainly achieved by the new secondary windows, rather than the retained primary windows. Therefore the secondary windows and their perimeter seals shall be selected and installed to achieve this standard.

12.7.3 Additionally, for pressure and suctions P (Pa), below 600 Pa, the air leakage shall not exceed q m3/hr/m where q is given by:

$$q = \left(\frac{P}{600}\right)^{\frac{2}{3}} \times 1.5 m^3 / hr / m$$

12.8 Wind Resistance

In the absence of a wind tunnel test report, wind loads shall be calculated as per BS EN 1991 1-4:2005 + Amendment 1:2010 Euro Code 1. All doors and windows shall

confirm to BS EN 12210 and EN 12211 for classification performance in accordance with the above calculated wind load.

When tested to positive and negative applications of design wind loads with a factor of safety of 1.5, there shall be no permanent damage to assemblies, framing members, panels and anchors.

12.9 Vertical loads due to building occupants

Generally, internal ledges and framing members shall resist vertical loads due to building occupants and shall carry a point load of 1kN or a distributed load of 0.6kN/m. Ledges and framing members greater than 200mm deep and within 100mm of the finished floor level shall carry a point load of 1.6 kN or a distributed load of 1.0 kN/m.

12.10 Insulation

12.10.1 Thermal insulation shall be inert, durable, rot and vermin proof, CFC and HCFC free, have a global warming potential (GWP) of <5, shall not support mould fungal or bacteria growth and shall provide the specified performance for the service life of the works. Due allowance shall be made for the reduced performance of the insulation due to the effects of moisture and ageing.

12.10.2 The material used for thermal insulation shall confirm to the requirements of the Building regulations approved document Part B and thermal performance requirements of approved document Part L.

12.11 Vibration

12.11.1 The primary brackets and all fixings will be designed so that there will be no risk of loosening due to the effects of vibrations, or to the cyclic effects of load, deflections and thermal movement.

12.12 Security

Refer to architects window/ door schedules for security requirements.

12.13 Brackets and Fixings

12.13.1 Brackets, anchor bolts, screws, rivets, nuts and other associated fastening components used within the cladding assemblies shall support their self weight and transmit this weight back safety to the supporting structure without overloading or permanently displacing any of these components.

12.13.2 All anchors and supports shall be designed, fabricated and installed as per the performance criteria within this document without any distress to components. The general requirements for torquing of bolts/ screws shall be highlighted within the cladding contractor's drawings and tightening torque values to be clearly stated.

12.13.3 The choice of bracket and fixing material shall comply with the corrosion resistance requirements highlighted in section 2.2 above and allow for the following:

- Any movements due to thermal changes, deflections, settlement or creep.
- Constructional inaccuracies of supporting structure
- Shimming to accommodate local variations
- In case of any on site fixings to structural steelwork frames, the integrity of the steel corrosion protection shall not be compromised.

12.14 Locked in Stresses

Locked in stresses are those that can develop within individual panels as a result of various fixings that are so secure and rigid that they do not allow for thermal or other movements within the panel. The cladding contractor shall avoid such instances within their design and detailing of the cladding elements that may be detrimental to the performance of the works during their service life.

12.15 Tolerances

12.15.1 Fabrication tolerances

The following tolerances apply to fabricated metal panels and components:

- Length/ width: maximum allowed deviation +0/-1mm up to 3metres; +0/-2mm over 3 metres.
- Straightness/ flatness: Any surface or edge shall not deviate more than 2mm from a straight edge of length 2 metres placed alongside it.
- Twist – No section shall twist more than +/- 1 degree over the length of the section.
- The gaps in butt and mitred joints shall be no greater than 0.5mm.

12.15.2 Installation tolerances

The cladding contractor shall check and confirm dimensions on site prior to installation. The setting out of the works shall be from the grid and datum lines (established by others). The following tolerances are applicable during installation:

- Line and level : +/- 2mm for one storey height and structural bay width and +/- 5mm overall
- Plumb and Plane: +/- 2mm for one storey height and structural bay width and +/- 5mm overall
- Please refer to CWCT standard for systemised building envelopes (clause 7.4.6) for joint variation allowances.

12.16 Accommodation of building movement

The works shall accommodate the following movements noted below without any reduction in the performance –

- Deflections due to design dead loads and live loads
- Deflections under repeated cycles of the design wind loads
- Changes in dimension and shape arising from specified building movements, including settlement, shrinkage, elastic shortening, floor beam deflections, creep, wind sway, twisting and racking and thermal and moisture movements.

12.17 Water vapour permeability and condensation

The works shall be designed to mitigate any risk of condensation on or behind the building side of the vapour barrier, or on surfaces or in areas which compromise the performance of the building envelope. The existing primary steel windows have non-thermally broken frames. The new secondary aluminium windows will also be provided without thermal breaks. Therefore some condensation is permissible in the cavity between the primary and secondary windows. This risk shall be mitigated by limited air exchange between the cavity and the external environment and maintaining low permeability of the inner secondary windows. Condensation shall not occur on the room facing surfaces of the inner windows. All materials in areas where condensation may form shall be resistant to moisture. The contractor shall prepare detailed condensation risk assessment calculations and submit these to the architects for review during the design development stage. These calculations shall be as per BS EN ISO 13788 document.

12.18 Service temperature ranges

12.18.1 The following service temperature ranges shall be allowed for the works. These values are taken from BRE digest 228 and CWCT standard for systemised building envelopes.

External Surface Temperatures (BRE Digest 228)	
Cladding walling and roofing	
Heavyweight Light colour	-20°C to + 50°C
Heavyweight dark colour	-20°C to + 65°C
Lightweight insulated Light colour	-25°C to + 60°C
Lightweight insulated dark colour	-25°C to + 80°C
Glass	
Clear	-25°C to + 40°C
Coloured or solar control	-25°C to + 90°C

12.19 Barrier Loads

Where part of the facade acts as a barrier it shall be designed in accordance with BS 6180 and CWCT TN 69.

13 Doors and Windows – (NBS - L10 and L20)

The requirements in this section shall apply to all doors and windows, other than steel casements, which are specified in section 14.

13.1 References

This section is based on EN 14351-1:2006 'Windows and Doors – Product standard, performance characteristic'. In addition to this, the works shall comply with BS 6375 which is the national application document for EN 14351.

13.2 Wind Loads

Design windload = 1200 Pa. Refer also to BS 6375-1

13.3 Resistance to snow and permanent load

As per BS 6375-3

13.4 Fire characteristics

Refer to the fire consultant's strategy report for details of cladding related fire characteristics

13.5 Watertightness

13.5.1 All external doors and windows shall comply with EN 12208 and prEN 1027 for calculations and weather tightness testing respectively. The external doors and windows at the ground level retail areas shall be Class 7A and 7B (fully exposed and partially shielded respectively). The swing and sliding external doors/ windows at typical levels / balconies etc shall be Class 9A (unshielded) and Class 7B (shielded).

13.5.2 Refer to BS 6375-1

13.6 Impact resistance (drop height)

13.6.1 Refer to section 5 of this document for details. Drop height shall be class __ as per BS EN 13049: 2003.

13.6.2 The doors and windows must have an impact resistance equivalent to that of the glass which it holds in place.

13.7 Load bearing capacity of safety devices

13.7.1 Windows shall be a minimum of class 3 as defined in BS EN 13115:2011 when tested to BS EN 14609, with safety devices engaged and the loads applied, 'in the most unfavourable position and/or direction'.

13.8 Ability to release

13.8.1 This clause does not apply to windows

13.8.2 Emergency exit devices, hinges and panic devices installed on external pedestrian doorsets in escape routes shall comply with EN 179, EN 1125, EN 1935, prEN 13633 or prEN 13637.

13.8.3 Doorsets on escape routes with emergency exit or panic device shall conform to BSEN 179 or BSEN 1125 as appropriate.

13.9 Acoustic Performance

13.9.1 The façade and glazing shall be capable of minimum performance levels stated in the Acoustics section of General Requirements section 12.6.

13.9.2 Acoustic requirements shall apply to the window or door system as a whole, including framework and perimeter seals.

13.10 Thermal Transmittance and radiation properties of glazing

13.10.1 Refer to the performance requirements section of this specification for criteria.

13.11 Air permeability

13.11.1 All external doors and windows shall comply with EN 12207 and prEN 1026 for calculation and air permeability testing respectively. All external doors and windows shall be Class 2.

13.12 Durability general

13.12.1 The durability of a product shall be determined in accordance with the relevant national material product standard. For UK these include, but are not limited to, BS 644 (timber windows), BS 4873 (aluminium windows), BS 6510 (Steel windows and glazed doors) and BS 7412 (PVC-U windows).

13.12.2 The mechanical durability of doors will be class 7 in accordance with BS EN 12400.

13.12.3 The mechanical durability of opening windows in curtain walling will be class 3 in accordance with BS EN 12400.

13.13 Operating forces

13.13.1 Windows – The declared performance of the windows shall not exceed Class 1 for operating forces as defined in BS EN 13115:2011, when tested to BS EN 12046-1.

13.13.2 Doors – The declared performance of the doorsets shall not exceed Class 1(External Doorsets) and Class 2 (Internal Doorsets) for operating forces as defined in BS EN 12217, when tested to BS EN 12046-2.

13.14 Mechanical strength

13.14.1 The strength of doors will be class 3-4 in accordance with BS EN 1192.

13.14.2 BS 6375-2 para 5.2.1 requires windows to satisfy class 3 for static torsion as defined in BS EN 13115:2011, when tested to BS EN 14609.

13.14.3 BS 6375-2 para 5.2.2 requires windows to satisfy class 3 for racking as defined in BS EN 13115:2011, when tested to BS EN 14608.

13.15 Ventilation

13.15.1 The works shall be designed to satisfy EN 13141-1 for the declared values specified by the M&E engineer.

13.16 Bullet resistance

13.16.1 Not applicable

13.17 Explosion resistance

13.17.1 Not applicable

13.18 Resistance to repeat opening and closing

13.18.1 Windows - The declared performance achieved by the windows shall not be less than Class 2 / 10000 cycles (minimum requirement as per BS 6375-2) as specified in EN 12400 and tested in accordance with EN 1191.

13.18.2 Doors - The doorsets shall comply with Class*__* as per BS EN 12400 (based on their category of duty as defined in table A2- usage) when tested in accordance with BS EN 1191.

13.19 Behaviour between climates

13.19.1 Windows – A climate test on windows with frames manufactured from a combination of materials shall be carried out in accordance to BS EN 13420. The windows shall have no reduction in performance or visible damage following the test.

13.19.2 Doors – A climate test on external pedestrian doorsets shall be carried out in accordance with BS EN 1121 and the results shall be expressed in accordance to BS EN 12219. The doors shall have no reduction in performance or visible damage following the test. (*Note – This test is only applicable to doors 'which contain hygroscopic material which might influence their behaviour during this test .i.e. timber/ timber composite systems. This is stated in section 1 of BS EN 1294)

13.20 Burglar resistance

13.20.1 Basic resistance shall be demonstrated by the test method given in appendix A of BS6375-3.

13.20.2 Enhanced security for doorsets shall comply with the requirements of PAS 24

13.21 Power operated external pedestrian doorsets

13.21.1 Safety in use – comply with BS EN 16005: 2012

13.21.2 Controlled door closing devices will comply with BS EN 1154.

13.21.3 Electrically powered hold-open devices for swing doors will comply with BS EN 1155.

13.22 Power operated windows

13.22.1 Electrically operated windows shall conform to BS EN 60335-2-103.

13.22.2 Pneumatically and hydraulically driven equipment shall conform to BS EN 12453:2001, 5.2.3 and 5.2.4.

13.23 Revolving Doors

13.23.1 The revolving door shall be:

- Four leaf, central axis, automatic/ power assist revolving glass door with metal/glazed drum walls, glass side panels and glass roof. The system shall include an overhead automatic drive unit, anti-vandalism brake, ceiling integrated down lights, program switch for adjustment of functionality, sequential operation rotating in both directions and including a suite of radar and presence sensing safety system comprising of movement sensors, passive and active safety devices.
- Diameter and height of the doors shall be as indicated in the Architect's drawings.
- All visible framework and ironmongery shall be as per the Architect's drawings/ ironmongery schedule.

13.23.2 The door shall confirm to the requirements of:

- BS 7036-0:2014, Power operated pedestrian doorsets – Safety in Use – Code of practice for risk assessment and risk reduction
- BS EN 16005:2012 Power operated pedestrian doorsets – Safety in use – requirements and test methods

13.23.3 Sensors shall be ceiling mounted.

13.23.4 The drum walls shall be a curved framed safety glass/ metal with metal panelling.

13.23.5 The door wings shall be safety glass with central column and central midrails.

13.23.6 The door leafs shall incorporate easily exchangeable brush seals to the surrounding framework/ panels to mitigate drafts.

13.23.7 The door shall have a manual breakout facility (.i.e. collapsing mechanism permitting the leafs to fold to emergency exit position) for emergencies.

13.23.8 The door assembly shall be lockable with key operated patch fittings located on the lower edge of the door leaf and only accessible from inside the building.

13.23.9 The door assembly shall be fitted with an electro-magnetic lock system with an unlocked failed state.

13.23.10 Any moving parts of the door assembly which require lubrication on a regular basis shall be designed to be easily lubricated without the removal of excessive door components.

13.23.11 The revolving door shall have a damped action such that after operation the door shall slow gradually to a stop. The door operation shall be smooth and quiet at all times. The drive mechanism shall also incorporate safety cut-off features in case of emergency.

13.23.12 The revolving door system shall include provision for an Air curtain that shall be supplied with custom plenum/ ducting to suit the curvature of the door. A plenum cover shall be available and is recommended for most installations. The air curtain shall be available with a choice of water, electric heating or ambient unheated and include all relevant accessories .i.e. automatic controls with manual overrides, BMS interface etc. The design of the air curtain shall be co-ordinated with the MEP heating and ventilation strategy.

13.23.13 The electrical power supply requirement of the door, heater and any associated control gear shall be co-ordinated with the Main Contractor.

13.23.14 The door shall incorporate a concealed key-activated control panel which shall allow change of operating mode at a local level.

13.23.15 The contractor shall make an allowance sufficient to cover any of the following:

- Infra / microwave sensors concealed into the roof / side panel framing on both the inside and outside of the building.

- Push pad mounted on a pedestal adjacent to the door on both the inside and outside of the building.
- Contactless card sensor mounted on a pedestal adjacent to the door on both the inside and outside of the building.
- Numerical keypad mounted on a pedestal adjacent to the door on both the inside and outside of the building.

13.23.16 Provision shall be made for linking of the door control gear to the Building Management System. As a minimum this shall include:

- Remote 'lock down' functions.
- Fire alarm interface.
- Door position feedback.

14 Steel and Brass Casement Windows (NBS L10)

Note that this project has a combination of retained products and new products. The requirements listed in the section shall apply to new products only. Requirements for refurbished products shall be agreed separately.

14.1 Product reference:

W20 range mild steel window sections.
- Mild steel: To BS EN 10025-2 and cold straightened.
- Manufactured in accordance with BS 6510: 2010 and recognised good practice.
- Weather tightness: To BS 6375-1:2015+A1:2016
- Exposure category (design wind pressure): 1200 (Pa) unless otherwise specified.
- Air permeability, water-tightness and window resistance test data:

Window Type	Air permeability	Water Tightness	Wind Resistance	Exposure Category
Fixed light	600 Pa	300 Pa	2400 Pa	2400 Pa
Top / side hung open out	300 Pa	200 Pa	2000Pa	2000 Pa
Side / bottom hung open in	300 Pa	200 Pa	2000 Pa	2000 Pa
Horizontal pivot casement	200 Pa	100 Pa	1600 Pa	1200 Pa
Vertical pivot casement	200 Pa	50 Pa	1600 Pa	1200 Pa

- Operation and strength characteristics: To European harmonized testing methods specified in the window and door product standard BS EN 14351-1 and to BS 6375-2 Performance of Windows and Doors – Operation and Strength.
- Construction: Frames shall have welded corners, dressed square and flat, and be sized within tolerances of +/2mm. Tee glazing bars shall be tenon riveted and/or welded to frames and interlock with rigid joints displaying face gaps of no more than 1mm.
- Hot dip galvanising: Frames and ancillary profiles (steel attachments, coupling members and ancillaries) shall be positively rust-proofed by hot-dip galvanising to BS EN ISO 1461.
- Acoustic insulation: Sound insulation of weather stripped windows/doors to be as stated in section 12.6).
- Weather-stripping: Black polymer rubber gaskets retained in groove within the sections and secured using adhesive.
- Sightlines (typical) of window range to be no more than:
- Fixed light: 35mm (using extended perimeter fixing legs) / 22mm (using short perimeter fixing legs)
- Opening window: 69mm (using extended perimeter fixing legs) / 56mm (using short perimeter fixing legs)

- Glazing bar: True steel "T" section (not face applied): 29mm on elevation and 32mm deep.

14.2 IRONMONGERY / ACCESSORIES (installed at factory):

- Hinged casements shall have rust-proofed steel or brass hinges, face mounted and welded, screwed or riveted to the frame. A variety of handles, catches, stays and openers, with locking options, are available in chromed or toned brass, anodised or painted aluminium, and chromed or painted zinc alloy. Double fasteners shall be fitted on ventilators over 1200mm long or 1500mm high.

14.3 FINISH COATING

- Type / reference: Polyester powder coating to BS 6497 or BS EN 13438
- Preparation: Following galvanising, windows are chemically cleaned and pre-treated to provide a surface to which powder coating will adhere.
- Covering: Minimum 60 microns on all significant surfaces.
- Colours: Any standard RAL colour reference
- Gloss level: Standard matt (30% +/- 7% gloss level). Optional semi-gloss and full gloss levels available.
- Process: Coating will be undertaken by our specialised polyester powder coat applicator.

14.4 PRIMING / SEALING

- Timber surfaces inaccessible after installation: Prime or seal as specified before fixing components.

14.5 REPLACEMENT WINDOW INSTALLATION

- Standard: To BS 8213-4.

14.6 WINDOW INSTALLATION GENERALLY

- Installation: Into prepared openings.
- Gap between frame edge and surrounding construction: Minimum: 2mm / Maximum: 8mm
- Distortion: Install windows without twist or diagonal racking.

14.7 FIXING OF WOOD FRAMES (timber subframes where required)

- Standard: As section Z20.
- Fasteners: Windows shall be supplied with rust-proofed screws, plugs, and/or lugs to suit specified openings.
- Spacing: When not pre-drilled or specified otherwise, position fasteners not less than 150mm from ends of each jamb, adjacent to each hanging point of opening lights and at maximum 450mm centres.

14.8 FIXING OF STEEL FRAMES

- Standard: As section Z20.
- Fasteners: Windows shall be supplied with rust-proofed screws, plugs, and/or lugs to suit specified openings.
- Spacing: When not pre-drilled or specified otherwise, position fasteners not less than 50mm and nor more than 190mm from ends of each jamb, adjacent to each hanging point of opening lights and at maximum 900mm centres.
- Composite assemblies: Shall be delivered in separate units to be coupled together on site.

14.9 BACKFILLING OF STEEL FRAME SECTIONS

- Windows fixed direct into openings: When required for weathering - after fixing, fill back of steel frame with waterproof cement fillet, or use an impregnated expanding sealing tape.

14.10 IRONMONGERY installed at site

- Fixing: Assemble and fix carefully and accurately using fasteners with matching finish supplied by ironmongery manufacturer. Do not damage ironmongery and adjacent surfaces.
- Checking / adjusting / lubricating: Carry out at completion and ensure correct functioning.
- Material compatibility: Glass/plastics, surround materials, sealers primers and paints/clear finishes to be compatible.

- Fully protect putty with coating system as soon as it is sufficiently hard
- Extend finishing coats on to glass up to sight line.

14.11 FASTENERS GENERALLY

- Materials: To have:
- Bimetallic corrosion resistance appropriate to items being fixed.
- Atmospheric corrosion resistance appropriate to fixing location.
- Appearance: Submit samples on request.

14.12 PACKINGS

- Materials: Non-compressible, non-corrodible, rot proof.
- Area of packings: Sufficient to transfer loads.

14.13 MASONRY FIXINGS

- Light Duty: Plugs and screws
- Heavy Duty: Expansion anchors or chemical anchors

- Integrity of supported components: Select types, sizes, quantities and spacing of fixings, fasteners and packings to retain supported components without distortion or loss of support.
- Components, substrates, fixings and fasteners of dissimilar metals: Isolate with washers/ sleeves to avoid bimetallic corrosion.
- Appearance: Fixings to be in straight lines at regular centres.

14.14 FIXING THROUGH FINISHES

- Penetration of fasteners and plugs into substrate: To achieve a secure fixing.

14.15 FIXING PACKINGS

- Function: To take up tolerances and prevent distortion of materials and components.
- Limits: Do not use packings beyond thicknesses recommended by fixings and fasteners manufacturer.
- Locations: Not within zones to be filled with sealant.

14.16 SCREW FIXING

- Finished level of countersunk screw heads:
- Exposed: Flush with timber surface.
- Concealed (holes filled or stopped): Sink minimum 2 mm below surface.

15 Materials – Z11 (metalwork), Z12 (Steel Finishes) and 20 (Fixings/Adhesives)

15.1 Identification of materials

All primary material delivered to the fabrication factory or the site shall bear details of the manufacturer's name and all associated data required to verify the exact nature of the material and relate it to the contract requirements. The materials shall bear the work test certificates, British standards certification, Trade Marks, CE Marks and British Board of Agreement certificate mark. Test certificates shall include, whenever applicable, the location in the works or the delivery or batch which the sample represents.

All the selected materials shall remain compatible to other materials around conform to the general requirements within this document. Unspecified materials shall be reviewed and approved by the architects.

15.2 Deleterious materials

Materials shall be selected by reference to, 'Good practice in the selection of materials' available from the British Council of offices (BCO) and the British Property Federation.

15.3 Standards

All materials shall conform to the appropriate British and European Standard specifications. The contractor shall provide the architects with guarantees, certificates of conformity from the material suppliers proving that the materials to be used conform to such specifications.

15.4 Framework and metal assemblies

15.4.1 Metals shall be welded in accordance with the relevant standards using methods to avoid distortion and physical integrity. The type, size and shaping of any welds shall be indicated on cladding contractors design drawings and approved by the architects before fabrication.

15.4.2 Welds shall be fully bonded throughout their length without holes, inclusions, cracks or porosity to ensure that long term performance is not compromised and the welds are strong enough for the design requirements. Where visible or impinging on other work, the welds shall be ground smooth and flush with the adjoining surfaces. Site welding shall not be allowed. All completed welded constructions shall be finished to prevent corrosion and all welds shall be cleaned as necessary to ensure durability of the connections.

15.4.3 Grinding, cutting and shaping of all metals shall be carried out using equipment that do not contaminate them with particles which could lead to staining or corrosion.

15.4.4 Arc cutting and acetylene gas cutting shall not be used except where necessary to modify existing steel products off-site.

15.4.5 Joints shall be accurately formed without lipping or offsets in visible surfaces unless designed otherwise. Other joints shall be rigidly secured to prevent all but designed movement, unless shown otherwise.

15.4.6 Maximum allowable tolerances for framework shall be:

- +/- 1.5mm for length of mullion (3m storey high)
- +/- 1mm on length of transom (1.5m c/c)
- +/- 0.5mm on length and width of pressed aluminium sheets (1.5m c/c)
- +/- 1mm on length of diagonal of sheet and not more than 2mm between 2 diagonals. (1.5m c/c)

15.5 Aluminium Components

15.5.1 Aluminium extrusions

All extruded aluminium components shall comply with BS EN 755, BS 1161 and BS EN 515. The extrusions and their applied finishes shall be fit for purpose. The design shall comply with BS 8118. The extrusions shall have wall thicknesses appropriate for their structural requirements and shall eliminate permanent distortion in the finished works. Extruded profiles shall be free of weld lines or die lines which are visible from a distance of 2m, after the specified finish has been applied

15.5.2 Pressed Aluminium sheets

Sheets for hidden flashings shall not be less than 1.6 mm thick. Sheets for all components exposed to view or to impact including copings, panels and visible closures shall not be less than 3 mm, and shall have the chemical composition and temper appropriate for its function. They shall comply with BS EN 485 and BS EN 573

15.5.3 Welding and consumables

Welding procedures shall comply with BS EN 288-4 and welders shall be certified to BS EN 287. Welding shall comply with BS EN 1011-4 and shall be tested in accordance with BS 3451, BS EN 895 and BS EN 910.

15.6 Steel Components

15.6.1 Stainless Steel – Plates, sheets and strips

- Stainless steel sections shall comply with BS EN 10088-3.

15.6.2 Mild Steel

- The use of mild steel shall only be permitted where the component is readily accessible for regular inspection and maintenance. The use of mild steel shall be restricted in accordance with section 2 of this specification. Where used, it shall be one of the following:
- Hot rolled steel complying with the requirements of BS EN 10025.
- Hot rolled sections to BS 4: Part 1, BS EN 10210-2 and BS EN 10021-1, tubes to BS 6323: Parts 1, 2 & 3 and angles to BS 4848: Part 4.
- cold formed pre-galvanised steel sections to BS EN 10327, BS EN 10143, BS EN 10147
- Steel sheet to BS 1449: Part 1.
- Ordinary bolts and nuts to BS EN ISO 4032, BS EN ISO 4033, BS EN 24034.
- All plain and tapered washers to BS 4320, Form E.

15.6.3 Hot dip galvanising

Where mild steel sections or fabrications are hot dip galvanised, the following additional specification shall apply –

- Mild steel shall have a carbon equivalent equal to or less than 0.43%
- All welding procedures and welding procedure specifications shall be limited to a maximum carbon equivalent of 0.43%

15.7 Insulation

Thermal insulation shall be inert, durable, rot and vermin proof, CFC (Chloro fluoro carbon) free, HCFC free (Hydro Chloro Fluoro Carbon), shall not support mould growth and shall provide the required thermal performance for the service life of the works. Allowances shall be included for reduction in thermal performance due to effects of moisture and ageing within the thermal calculations. Insulation materials shall not be injurious to human health in service and during removal and replacement.

Insulation shall be Class A2-s1,d0 or better and one of the following materials:

- Mineral wool - EN 13162
- Cellular glass – EN 13167

15.8 Fixings and fasteners

15.8.1 Fixings and fasteners shall comply with BS EN ISO 3506-1 and BS EN ISO 3506-2

15.8.2 Unless noted otherwise, grade A4 shall be used for visible fasteners, in all other circumstances grade A2 shall be used.

15.8.3 Set screws shall comply with BS EN ISO 3506-3

15.8.4 Self tapping screws shall conform to BS EN ISO 3506-4.

15.9 Gaskets

15.9.1 Gaskets and seals used to achieve the required weather and air tightness shall be selected in accordance with BS EN 12365-1 to fully accommodate the range of dimensional tolerances associated with fabrication and installation of the works.

15.9.2 The gaskets shall be free from contact and migration stain and shall be compatible with all substrate, sealant and finishes with which they are likely to come into contact. The gaskets shall be free of mould flash.

15.9.3 Extruded rubber gaskets shall comply with BS 4255.All materials must be compatible with substrate, sealants, finishes and other materials in the joint system.

15.9.4 The gasket materials shall be able to maintain their elastic properties, dimensions and resistance to physical and chemical attack sufficiently to maintain the full performance during its design life. All gaskets providing the water and air seals shall be formed into complete frames with factory formed injection moulded vulcanised corner joints.

15.10 Setting blocks

Setting blocks shall be silicone rubber, polychloroprene (Neoprene), polypropylene or EPDM of an appropriate hardness. Carbon compounds for fillers and durability agents shall not leach out over time and cause staining.

15.11 Sealants (non-structural)

Sealants shall be selected and applied in accordance with the guidelines contained in BS 6213, BS En ISO 11600 and CIRIA guide 178. Sealant shall be:

- Silicone sealant

- Two part polysulphide sealant
- As proposed by the cladding contractor to the appropriate British or European standards, subject to written confirmation from the manufacturer that the product is fir for purpose.
- Backing rods shall be closed cell polyethylene foam. When closed cell sections are used non-gassed produced shall be selected. Colour of the visible sealant used shall be as specified on the architects drawings.

15.12 Flashings and Vapour control layers

All flashings and vapour control layers shall resist the deleterious effects of water, cleaning agents, temperature variations expected from the specified temperature ranges, gaseous pollutants (including ozone), weak acids deriving gaseous pollutants dissolved in water and UV radiation to which they may be exposed during installation and in service.

15.12.1 Vapour control Layers

- All vapour control layers shall have a minimum vapour resistance of 200 mN.s/g. The vapour resistance shall be as per BS EN ISO 13788 and BS 5250. The material shall preclude the movement of water from internal areas to the cold side of the construction to avoid any interstitial condensation. Any water vapour already within the construction shall be allowed to evaporate to the outside. Performance shall be maintained at joints between the individual pieces of the vapour control layer material and joints shall be overlapped and positively sealed.
- All proprietary membrane waterproofing systems shall be CE marked and shall have product data sheets giving details of their performance and test verifications. The cladding contractor shall provide all related technical information for the material to demonstrate compliance with this specification.

15.12.2 Flashings

- Materials used for flashings shall be stainless steel, coated aluminium or one of the following membranes;
- Flexible ethylene-propylene diene monomer (EPDM)
- Flexible chlorosulphonated polyethylene
- Flexible chloroprene, non-cellular chloroprene products shall comply with the requirements of BS 4255-1.
- Flexible butyl rubber
- Flexible Polyvinyl Chloride (PVC)

Flashings shall maintain their performance and properties for the expected service life of the product. They shall have the necessary mechanical properties to withstand installation and specified design loads.

16 Powder Coating – (NBS - Z31)

16.1 General

- .

16.1.1 The coating shall be applied by an Applicator recognised and approved by the manufacturer of the powder.

16.1.2 The Applicator shall be nominated by the Contractor and subject to the approval of the Architect. The same Applicator shall be used for the duration of the Works. The Applicator shall operate an ISO 9001 approved quality assurance system.

16.1.3 Applicators shall be licensed members of Qualicoat and / or Qualisteelcoat organistaions.

16.2 Aluminium-

16.2.1 Aluminium surfaces shall be coated with the Interpon D2525 system or equal approved and must comply with AAMA2605-05, Qualicoat Class 2 and EN12206

16.3 Steel

16.3.1 New steel surfaces shall be galvanised and coated with the Interpon D2525 system or equal approved and must comply with AAMA2605-05, Class 2 and EN12206

16.3.2 Refurbished steel surfaces – shall be grit blasted, pre-treated and coated with the Interpon D2525 system or equal approved and must comply with AAMA2605-05, Qualicoat Class 2 and EN12206

16.3.3

16.4 Brass (Architectural Bronze)

16.4.1 Refurbished brass surfaces shall be powder coated

16.5 Fabrication Requirements

Fabrications may be from pre-finished lineal or machine lengths at the recommendation of the Applicator. Care shall be taken to avoid scratching and damage to the coatings during the fabrication. Where machining could leave exposed un-coated surfaces, e.g. pivot hung ventilators, etc or visible cut edges on sheet metalwork, the work shall be coated after all machining. Where coating is to be carried out after machining, satisfactory jigging points

shall be agreed between the Contractor and the coating Applicator and then the Architect. Two sample joints shall be submitted to the Architect for approval, prior to fabrication.

16.5.1 Colour and colour control

The finish colour shall be as per the architect's drawings subject to sample approval. Colour control and gloss limits shall be submitted by the cladding contractor for the review and approval of the architects. The following samples showing the variations in colour and texture:

- 2 extrusions, typical for the works, each 1200mm long
- 2 sheets, typical for the works, each not less than 1200 x 300mm
- Upon approval of the architect, these samples shall be labelled and distributed among the following as benchmarks for the duration of the works –
- Main contractor
- Architect
- Applicator
- Independent inspector

16.6 Coating Conditions

Coating shall be carried out under conditions of acceptable good practice for architectural applications. The processing conditions shall be held constant for the duration of the period required for completion of the contract. Records of these conditions shall be kept and made available for inspection in the event of a dispute as to the quality of the finished coating.

16.7 Acceptance testing

16.7.1 Third party inspections

- Provisions for a minimum of 3 acceptance inspections to be conducted by an independent inspection authority by the cladding contractor. The cladding contractor shall provide details of the proposed independent inspection authority and shall be subject to the approval of the architect.

16.7.2 Sampling procedures

Sampling procedures and plans shall comply with Qualicoat guidelines.

16.7.3 Certifications

Inspection certificates demonstrating that all relevant tests required by EN 12206 and this specification have been carried out and that the coating complies with the minimum requirements in all respects, shall be submitted on request, to the architect for review.

16.8 Temporary protection

All coated surfaces vulnerable to damage during handling and installation or by subsequent site operations, shall be fully protected for the duration of the Works. Protective coverings shall be resistant to all weathers. Prior to installation, they shall be removed from areas inaccessible after installation. Where necessary, they shall be partially removable and replaceable for access to fixing points during installation and/or subsequent site operations. Any protective tapes used in direct contact with the coating shall be low tack, self-adhesive type in white or any colour lighter than the coating to be covered. It shall be applied and removed in accordance with the recommendations of the Applicators guidelines. Protective tapes shall not be kept in contact with coated surfaces for longer than 6 months. Should the protective covering need to remain in place following installation, the Contractor, shall, with the Architect, agree a programme for periodic inspections and make good/replace the coverings as may be required. See also the Lend Lease Contractor's requirements for temporary protection.

16.9 Damaged surfaces

The viewing distance for damage shall be 1.0 m for internal surfaces and 2.0 m for external surfaces. The rectification of damage to coated surfaces finishes shall be permitted, but only in accordance with an agreed method, which must be endorsed by the manufacturer of the powder, the Applicator and the Architect. Sample patches of touch-up rectifications will be submitted on the same basis as the colour control samples listed above.

16.10 Cleaning and maintenance

The cladding contractor shall provide detailed instructions for maintenance of the coating and ensure that the manufacturer's recommendations are complied and fulfil the requirements of the coating warranty.

These recommendations include but are not limited to:

- Washing frequency
- Cleaning agents to be used and their dilution levels
- Type of cleaning materials
- Recommendations for deep cleaning and their frequency.

17 Visual Mock-Ups and Samples – (NBS - A)

17.1 Visual mock ups

- The contractor shall remove and reinstall one reconditioned primary steel window, together with a new secondary window into one typical structural opening on the First floor at a location to be agreed with Lend Lease and the Design Team. Note that this mock-up shall also serve as an acoustic testing sample – see section 12.6
- Similarly, the Contractor shall install a primary and secondary to one structural opening on the second floor.
- The above mock-ups shall be fitted with all the proposed hardware and shall demonstrate the operation of the opening windows and the method of cleaning and maintaining them.
- The visual mock ups shall include the proposed frame profiles (colour and finish), the glass proposed in the works, replicating the internal and external appearance of the systems as in the finished works. Any deviations to the above shall be proposed to the architects for approval.
- The mock-ups shall include the timber reveals between the primary and secondary windows and the interfaces with the existing wall panels on the first floor.

17.2 Quality control samples (Benchmarking)

17.2.1 The standard of workmanship for the Works will be to an agreed standard established by the construction of the On-site Quality Control Samples. The Architect will review and comment on the Onsite Quality Control Samples. If the Contractor continues with the installation of any of the Works before the Architect has reviewed and commented on the On-site Quality Control Samples, it does so at its own risk. The Architect may require parts of the sample to be dismantled to allow inspection of concealed details. Upon acceptance, the on-site control samples will remain as part of the installed permanent Works. The Architect will reject workmanship that falls below the accepted standard and will require the Contractors to remove it and re-install it to the acceptable standard.

17.3 Post contract samples

The following post contract samples shall be provided to the architects after the award of contract:

- Double glazed units and single glazed panes(600x600mm)

- Aluminium extrusions in the required finishes (600mm length)
- Steel profiles in the required finishes (600mm length)
- All ironmongery (two pieces of each type of window and door fittings)

18 Performance Testing – (NBS - A)

18.1 General

The cladding contractor shall demonstrate compliance with the performance criteria of this document with the following:

- Producing existing test data for proprietary cladding systems.
- Submitting detailed design drawings.
- Site hose testing of the completed works
- Carrying out all other performance testing as set out in the final contract documents
- Construction of off-site and on-site quality control samples as described in the final contract documents.
- Providing samples and constructing of all mock ups.
- Producing calculations

18.2 Site hose tests This section does not apply to refurbished products.

18.2.1 Areas – Site hose tests shall be carried out by an independent testing authority and arranged by the cladding contractor. These shall be carried out on 10% of the areas of completed works. The areas shall be marked by the cladding contractor and submitted to the architects for approval.

18.2.2 Hose tests shall be carried out in accordance with the requirements of the Centre for Window and Cladding Technology Standard for systemised building envelopes, Section 8 – Testing and Standard test methods for building envelopes, Section 9.

18.2.3 The independent testing authority shall check for leaks at the test area and at the floor below the test area inside the building.

18.2.4 Format of test reports – 2 copies of the site hose testing reports shall be prepared and submitted to the architects for review. The reports shall include the following information –

- Date of testing and of report
- Identification of the tested areas.
- A note of the prevalent weather conditions (wind) during the time of test.
- Testing methodology

- Statement that the test was carried out as per the CWCT standards and a description of any noted deviations from the above.
- A statement indicating whether the test was successful and notes of any leakages through and/or directly below the tested areas together with indication of the severity of leakage.
- Name and author of report
- Name and address of the independent testing authority that conducted the tests and the requester of the tests.
- List of official observers and supervisors of the test and their signatures.

18.3 Building air leakage test

18.3.1 The test shall be carried out by an independent test authority accredited by ATTMA in accordance with BS EN 13829. The air leakage test shall not exceed the values given in this document.

18.3.2 In the event of air leakage exceeding the specified values included within this specification, the cladding contractor shall identify all the leakage paths and carry out remedial works. The architects shall be provided with a report showing the extent of the leakage and the proposed remedial measures for approval. The building shall be tested again to demonstrate compliance with the required air leakage limits upon completion of the remedial works.

18.3.3 Note that the air permeability of the facades will be achieved by the new secondary windows, rather than the retained primary windows.

18.4 Acoustic tests

See section 12.6

19 Technical Processes and Quality Control (NBS - A)

19.1 Technical Processes

- Comply with all the relevant National and Local Government Regulations
- Liaise with the Principal designer, Design team, local authorities and provide all information necessary to complete the Health and Safety file required by CDM regulations 2015.
- Use recognised industry good practice standards and comply with all the relevant standards and codes of practice listed in this document.
- Prepare a detailed programme for the execution of the works allowing for design development, visual mock ups, prototype testing, and procurement of samples and submit 2 copies to the architect within 4 weeks of the award of the contract.
- Prepare a detailed drawing list, related to elevations showing locations of 2 and 3D drawings and identifying within the programme when will these be produced.
- Provide relevant product literature, samples of components, and test certificates for the works to demonstrate quality of the materials, design, workmanship and fabrication techniques.
- Produce and submit formally, design drawings based on compliant solutions, calculations and samples. As these are developed ongoing checks shall be made to ensure that the principles mentioned above are maintained.
- Prepare the necessary shop drawings when and only when the design have been completed in compliance with this contract document for the system concerned and approved by the design team.
- Include any secondary support members/ bracketry, required to support and/or restrain the works/(which will be fixed to the primary structural frame), on his detailed design drawings. The subcontractor shall produce these drawings in accordance with the programme to allow other sub-contractors to incorporate these into their works.
- Fabricate the specimen for testing when and only when the necessary shop drawings have been completed.
- Provide samples, design development mock ups, weather performance tests, acoustic and fire separation tests.
- Test the specimens
- Carry out modifications to the design and construction of the specimens and retest them in the event of failure during the test. Ensure any modifications to the design are incorporated into the design development drawings.

- Proceed with fabrication when and only when the particular specimen has been tested successfully.
- Organise the delivery of components to the sire so that the works can be installed in proper sequence without omissions which would require modification of the design.
- Ensure that the works are installed to the agreed standards set by the quality control benchmark samples
- Instruct all those engaged in the installation of the works of the principles of its design, of any unusual details which might be overlooked and of the particular techniques to be used in its construction.
- Carry out hose tests on other areas, as selected by the Architect.
- Protect the works check the proper operation of all opening vents and carry out final clean down.
- Provide a comprehensive maintenance manual and 'as-built' drawings.

19.2 Computer Analysis

Where computer analysis is used the following information shall be presented:

- A clear statement of the method of analysis.
- Proprietary program used.
- The nature of the program e.g. finite element, linear flow, steady state, standard compliance etc.
- Where used, a clear statement of whether finite analysis is linear or non-linear.
- The input data.
- All assumptions made and used.
- The output data.
- A clear statement of the method of interpretation of the results.
- The interpretation of the results.

19.3 Test Reports

All test reports shall include:

- The nature and objectives of the test, measurement or chemical analysis.
- The credentials of the organization undertaking the test including their accreditation for such testing, measurement or analysis.
- The dates, weather and witnesses present.
- Details of the samples, the method used and the limits of accuracy.
- A factual account of the results (N.B. not an opinion on the results interpretation)

19.4 Quality control

19.4.1 Quality Plan

As required by the Schedule of Submissions an outline Quality Plan and a project specific Quality Plan shall be produced by the Contractor following the principles and guidelines of BS EN ISO 9001 to demonstrate how quality management will be implemented from award of Contract through to Contract Completion.

19.5 Quality control procedures

19.5.1 The Contractor shall develop inspection procedures, check lists and audits for monitoring the Works at the various stages.

19.5.2 A clear system shall be implemented to track information flow and check that work is being designed and installed to the most up-to-date revisions of specifications, drawings, interface drawings and this Contract Document.

20 Installation

20.1 Documents

20.1.1 The installation drawings, method statements and procedures shall detail all the elements used to construct the Works and shall clearly describe all operations including the following:

- Installation sequencing plan and details
- References for the identification of the elements
- Relevant setting out and control points
- Details of protection for cladding elements
- Details of isolation and packing around cladding elements
- Details of joints requiring sealants including cleaning and priming of surface details
- All applicable target tolerances at the location of elements and alignment of joints
- Details of location, type and size of backing rods and bond release tapes.
- Torquing requirements of all the fixings along with their locations
- List of equipments required to manoeuvre the elements and components on the building, hold in place, line and levelling once in the designated location.
- Areas susceptible to damage and not to be loaded during installation
- Position of all hidden fixings
- Details of all CDM requirements that are in place within the installation process.

20.1.2 On site benchmarked control samples demonstrating the standard of workmanship agreed by the architects shall remain on site as part of the works.

20.2 Tolerances

20.2.1 Accuracy of erection – Aluminium works

Structural aluminium shall be erected in accordance with the tolerances given in the structural engineer's movement and tolerances report.

20.2.2 Curtain walling

The works shall be installed to the following deviations:

Line and level	+/- 2.0mm in any one storey height or bay width

Plumb	+/- 2.0mm in any storey height
Plane	+/- 2.0 mm in any one storey height or bay
Intersection	+/- 2.0mm in alignment in any direction in the plane of the wall, between any 2 adjoining panels, at a 4 way intersection of panels

20.3 Fixings

All primary and secondary fixings to the cladding and building structure shall be installed in accordance to the fixing manufacturer's recommendations and required procedures. The details of primary fixings shall be check and recorded.

20.4 Cast in Channels

20.4.1 The cladding contractor shall issue cast in channels and their locations to the concreting contractor. The cast in channels shall be demonstrated to have sufficient strength and shall be adequately embedded to ensure that the loads are applied to them are sufficiently distributed to avoid over stressing the concrete.

20.4.2 Materials for the cast in channels shall comply with the requirement of this specification.

20.4.3 Protection of cast in channels – The concreting contractor shall ensure that the channels do not get blocked with concrete, slurry or any other material that prevents the cladding fixings from being installed.

20.4.4 The cast in channels shall have a permitted deviation (non cumulative) from the required positions as shown in the table below:

Cast in fixings to concrete wall	Location relative to grid: +/- 25mm Location relative to nearest point of reference: +/- 15mm Location relative to the face of the wall : +0/ -15mm (positive outwards) Level : +/- 15mm
Cast in fixings generally	Location: +/- 10mm Level: +/-10mm

20.4.5 The minimum distance from the edge of any cast in channels and a concrete edge shall not be less than 100mm.

20.4.6 After installation, exact position and condition of the cast in channels shall be checked and verified by the contractor and any inaccuracy shall be reported to the architect immediately.

20.4.7 The contractor shall verify the adequacy of all remedial work by means of load testing.

20.5 Glass

20.5.1 General

- Glazing shall be carried out in accordance with manufacturer's recommendations, which shall take into account the recommendations of the Glass and Glazing Federation, and the requirements of BS 6262, and BS 8000-7.
- Setting blocks and anti-walk devices shall be installed in accordance with the requirements of BS 6262, modified where noted in this specification.
- It is envisaged that the large panels of glass will be gravity supported in locations outside those described in BS 6262 and BS 8200. The Contractor shall provide calculations to justify the support conditions. No grinding or welding shall be permitted within 10m of unprotected glass.

20.5.2 Visual acceptance criteria for double glazed units

The guideline prepared by the Technical Advisory Board of the Institute of Glazing Trade for Glazing Technology and Window Manufacture, Hadamar (IGH, Hadamar) and the Federal Association for Wholesale Architectural Glazing, Insulating Glass Manufacture, High Performance Glazing, Troisdorf dated October 1996 shall be used to assess the visual quality of insulating glass units.

20.6 Visual acceptance criteria for laminated glass

The guideline prepared by the Technical Advisory Board of the Institute of Glazing Trade for Glazing Technology and Window Manufacture, Hadamar (IGH, Hadamar) and the Federal Association for Wholesale Architectural Glazing, Insulating Glass Manufacture, High Performance Glazing, Troisdorf dated October 1996 shall be used to assess the visual quality of laminated safety glass – monolithic.

20.7 Protection and cleaning

20.7.1 The cladding elements including frames and glazing shall be provided specific protection from anticipated hazards from both interior and exteriors. These include,

but are not limited to, vulnerable coated surfaces, glass, metal edges, corners and features (feature fins).

20.7.2 The protection shall remain in place until all potentially damaging works around the cladding components has been completed.

20.7.3 Protection materials shall be compatible with the surface and finishes and shall allow removal without detrimental effects to the finish and components. The component suppliers and finishers shall approve the method of removal.

20.7.4 Protection removal and cleaning of the works shall be carried out on completion or as per clause 15.6.2 above.

20.8 Where existing steel windows are temporarily removed from site for refurbishment, the structurally opening shall be fully boarded out with ply and made weather-tight with sheeting and sealants to protect the internal surfaces and finishes from the elements. The protection shall be applied immediately upon removal of the window and shall remain intact and weather-tight until the refurbished windows are re-installed.

21 Cleaning and Maintenance Risk Assessments – (NBS - A)

Please refer to the cleaning and maintenance manual/ facade access consultants documentation for details.

21.1 Access for cleaning and maintenance

The Contractor shall recommend methods and procedures to be utilised to allow replacements of damaged or worn components. These method statements shall be incorporated into the Operations and Maintenance Manual.

21.2 Inspections

The Contractor shall recommend methods and procedures to be utilised to allow inspection at the intervals stated in the Operations and Maintenance Manual. This will allow systematic monitoring of the condition of the Works, assist in the prediction of the need for preventative maintenance and redecoration during the life of the Works, and inspection and testing of structural silicone glazing as required by this Contract Document

End of Document.

White Collar Factory
London EC1Y 8AF
T +44 (0)20 7250 7777
info@akt-uk.com
www.akt-uk.com

BUILDING ENVELOPE – Technical Performance Specification CTH_AKT_XXX_SP_25_R_001~~3~~

Project Name: Camden Town Hall

AKT Project Number: 4254E

Status: Stage ~~4~~3 Performance~~Outline~~ Specification

Rev	Purpose	Date	By	
01	Stage 3 Submission	20/3/2019	SMcD	
02	Stage 3 with LL comments incorporated	18/04/2019	SMcD	
03	Stage 4 WIP Draft	06/09/2019	SMcD	
T04	Stage 4 Issue	27/9/2019	SMcD	

White Collar Factory
London EC1Y 8AF
T +44 (0)20 7250 7777
info@akt-uk.com
www.akt-uk.com

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T04	Stage 4 Issue	27/9/2019	SMcD	

1 Executive Summary at Stage ~~4~~3

This specification relates to four procurement packages defined by LL;

- C3100 Refurbish Windows & Doors
- C3260 Curtain Walling & Lightwell Roof
- C3500 Secondary Windows
- C External Stone Cladding

This specification does not include;

- Demolition and removal of existing parts of the facade, or making good existing openings.
- Refurbishment of existing external timber doors at ground floor.

Preliminary tenders for the first three packages were issued during Stage4 and the tender returns have partly informed the development of this specification. The fourth package (external stone) has not been formally tendered, but LL has procured a condition survey from a specialist contractor which has also informed the development of this specification. ~~The strategy for the refurbishment of the existing stone cladding has been clarified during Stage 3 and an outline method statement agreed following consultations with specialist stone contractors.~~ The likely extent of remedial work to the stone ~~will be~~ has been established by a visual inspection and an initial intrusive investigation carried out by a specialist ~~when the appointed stone contractor completes its visual inspection and initial intrusive investigation at the end of~~in July~~ne~~ 2019. Following~~r~~ that survey, a ~~full~~ scope and method statement has been ~~will be~~ agreed with~~between the stone contractor and~~ LL. The survey has provided ~~will also provide~~some information on the condition of the structural steel elements concealed behind the stone cladding. That information ~~will be~~has been considered by the structural engineers and a schedule of remedial work to the structural steel has been~~will be~~ formulated. ~~That~~ The remedial work to structural steel, stone cladding and windows is described in this specification which is intended to form the basis of ~~will have to the coordinated~~ procurement ~~with stone restoration and window installation~~by LL~~.~~ ~~Therefore, the implications on overall cost and programme will become clearer during Stage 4~~.

S~~During Stage 3, s~~everal alternative options for refurbishing or replacing the existing steel windows were proposed to the Client and the Planning Department at LBC. The Design Team had recommended replacement of the primary windows with thermally broken frames, which would have sufficient thermal and acoustic properties to make internal secondary windows unnecessary for the majority of the building. Whilst the Client favoured this approach, the Planner deemed that retaining as much of the original fabric as possible was of utmost importance. Therefore, it was decided to retain the primary steel windows and to compensate for their poor performance by installing ~~thermal broken~~double glazed secondary windows. The combined effects of primary and secondary windows have been studied in a thermal analysis to confirm that the facade will perform as assumed in the building energy model.

~~The decision to retain the existing primary windows was made at the end of the Stage 3, establishing the main requirements which are captured in the facade performance specification~~

~~.~~Construction details for windows are largely dependent on the interfaces around the window reveals and the need for the inward opening portions of the external windows to pass within the perimeter frame of the inner windows. Those details have been~~will be~~ established in Stage 4, after intrusive site investigation of typical window openings ~~the window reveals~~ and obtaining samples from prospective window contractors.

Outstanding matters to be resolved;

Fire - High level windows in the basement of the SME are used for smoke ventilation. This strategy is currently with the LFB who will provide comments by the end of September 2019. Changes may need to be made following LFB review.

Access for Cleaning; The Facade Access Consulatnt (Engie) is undertaking a full review of each window to assess the safe access for cleaning and maintenance. This review will establish the extent to which externally fixed eye bolts may be reused or replaced or repositioned.

2 Introduction – (NBS – A)

2.1 Building Description

The proposed refurbishment of Camden Town Hall and conversion for civic, leisure and commercial office use.

2.2 Scope of Specification

This document defines the requirements for the building envelope package of the Camden Town project and shall be read in conjunction with all reference drawings and documents, including but not limited to those mentioned below. This specification shall be read in conjunction with the Conditions of the Contract, Instructions to Tenderers and other relevant documents. This is a performance specification where the intent for the building envelope is to provide safe, dry, temperate and comfortable conditions that can be reasonably anticipated. The performance criteria specified within this document shall be considered as minimum standards with which the Contractor's Proposals shall comply.

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

2.3 Specification Format

This specification is intended to stand alone, so that it can be used to procure the facades. It is not divided into the sections defined by the NBS; however each section heading includes cross references to the comparable NBS work sections.

2.4 Terminology

The following definitions shall apply to the stakeholders of this project:

- Employer or Client; London Borough of Camden
- Main Contractor; Lend Lease
- Architect; Purcell
- Structural Engineer; AKT II
- Building services engineer; Arup
- Acoustic Engineer; Arup
- Fire engineer; Arup

2.4.1 The term 'contractor' shall refer to the specialist cladding contractors appointed by the main contractor to carry out the works as described within this specification.

2.4.2 The term 'tenderer' shall mean the specialist cladding contractor involved in preparing a tender for the works

2.4.3 The term 'works' shall mean all the elements in which the contractor is engaged to design, fabricate, manufacture, test and install on the project.

2.4.4 The term 'external' environment refers to the areas of construction that are directly exposed to rain water or exposed to external air, for example covered unheated areas subject to periodic environmental humidity.

2.4.5 The term 'internal' environment refers to areas of construction that are located on the warm side of the vapour control layer, in a heated space that is not exposed to wetting from rain water.

2.4.6 The term 'roof' shall include all sloping surfaces that are pitched less than or equal to an angle of 70° from the horizontal. Angles greater than 70° shall be considered as external walls.

2.5 Language and units of measurement

2.5.1 All the information provided by the specialist cladding contractor to the design team, other contractors or any party working on the project shall be in English.

2.5.2 All units of measurement used for this project shall be in SI units.

2.6 Codes and Standards

2.6.1 This specification is based on the British and European standards. In the event that there is a conflict between 2 standards, the more onerous shall apply. In the event that any requirements included within this specification are over and above the codes and standards, this specification shall take precedence.

2.6.2 The works shall also comply with relevant European directives governing certificates of conformity and CE markings.

2.6.3 In addition to the standards mentioned above, the works shall comply with the following:

- CWCT Guidelines
- Building and Listed Building Consent ~~Planning Control~~ Conditions

- Access Requirements as set out in Part M of the Building Regulations
- Secure by Design Standards (SBD certification is not required, but the standards are to be incorporated in the design where they do not conflict with heritage considerations)
- BREEAM Requirements

2.7 Drawing and Document References

2.7.1 Drawing References

- Facade scope drawings: Refer to Purcell Architects Window Strategy
- Architectural drawings: Refer to Purcell Architects drawing register
- Structural drawings: Refer to AKT II Structural Engineers drawing register
- Mechanical and Electrical drawings: Refer to Arup drawing register

2.7.2 Document References

- Contract Preliminaries and General Conditions
- Relevant specifications provided with the tender documentation
- Movement and Tolerances report
- Structural engineers loading report
- Glass replacement strategy report
- Door and window schedules
- Fire strategy report
- Acoustics report
- Security consultants report
- Conservation Strategy Report

2.8 Design Intent

2.8.1 The Works will withstand and accommodate the stresses and movements induced by the specified cambers, estimated deflections, relative deflections and the long term movements associated with the settlement of the foundations, or any other movements of the structure, changes in temperature and chemical changes. They will include suitable allowances for the specified construction tolerances. They will withstand the specified deleterious and degrading effects of radiation from the sun, weathering, atmospheric pollution, vandalism, vermin, fungi and other growths for the required service life described herein without maintenance in excess of routine cleaning and minor repairs. They will have a resistance to combustion and fire spread appropriate to each part and will prevent casual and unlawful entry into the building,

all as specified. The Works shall be configured to facilitate safe and efficient cleaning and maintenance.

2.9 Design Responsibility

2.9.1 The Architects Drawings and this Contract Document are indicative of design intent and define the performance criteria, the mandatory geometry of the exposed surfaces and joint positions, and detail the required principal materials and visible finishes.

2.9.2 The Contractor can put forward alternatives for consideration by the Architect. Additionally, any suggested solutions described on the Architects Drawings will not in any way relieve the Contractor from its responsibility for the design and construction of the whole of the Works.

1.7.3 The Cladding contractor(s) shall allow for interface with other trades as follows:

- Structural frame contractor – concrete and primary steelwork
- Secondary steelwork (where not supplied by cladding contractor)
- M&E
- Lighting
- Security (cameras, doors etc.)
- Signage
- Drainage / public Health
- Facade access / maintenance
- Fit out
- Roofing
- External paving
- Architectural metalwork
- Waterproofing
- Refer also to the Main Contractor's list of interfaces.

3 Stone Cladding (NBS H92)

3.1 Existing Facade Condition

3.1.1 The pattern of cracks and stains on the facades indicates factors which have affected the rate of deterioration of the building fabric in the past and may continue to do so in the future, unless the causes are identified and rectified. There are no as built drawings to assess the interfaces between facades and structure, so the relevant information ~~must be~~ has been obtained by visual inspections ~~and~~ further information will be obtained by intrusive investigations.~~surveys~~.

~~3.1.2~~

~~3.1.3~~3.1.2 Staining on the facades indicates that the flow of water across the stone surfaces has created areas of moisture retention, leading to staining in locations which are difficult to clean (e.g. the underside of lintels). More effective cleaning and stain removal may be possible when the windows are removed during the refurbishment.

~~3.1.4~~

3.1.3 Moisture retention in parts of the stone cladding has probably contributed to the corrosion of the perimeter structural elements. Cracks in the external stone cladding indicate the likelihood of expansive rust formation around the structural steel. In these locations it is necessary to temporarily remove the stone in order to treat the structural steel ~~In order~~ to inhibit further corrosion ~~of the structural frame~~ and to prevent consequent deterioration of the retained cladding, ~~it will be necessary to~~

~~3.1.5~~

~~3.1.6 Carry out intrusive investigative surveys of the stone cladding~~

~~3.1.7 Establish the scope of remedial works to the structural steel~~

~~3.1.8 Establish the scope of repair and replacement work to the external cladding~~

~~3.1.9 Carry out the repairs to structural steel (e.g. removing rust, applying rust inhibitor, strengthening or replacement of corroded elements)~~

~~3.1.10 Carry out repairs to the stone cladding (e.g. filling cracks, resealing mortar joints, replacing heavily weathered and exfoliated stone, etc)~~

~~3.1.11~~

3.1.4 Some of the cracks observed at site may be due to differential movements in the structure under occupancy loads. The intrusive surveys should establish if any of the

cracks in the cladding are due to structural movement rather than expansive rust formation.

3.1.5 Generally,the following remedial works are required;

- Intrusive condition surveys.
- Repairs to structural steel (e.g. removing rust, applying rust inhibitor, strengthening or replacement of corroded elements)
- Repairs to the stone cladding (e.g. filling cracks, resealing mortar joints, replacing heavily weathered and exfoliated stone, etc)

~~3.1.12~~3.1.6 The extent and scope of remedial works to both the cladding and the perimeter structure will depend on the findings of the condition survey. To carry out an effective condition survey, many areas of external facades must be opened up and resealed. It has~~is~~ not been practical to start the full intrusive external surveys until such time as the perimeter of the site can be made safe and overhead work can be carried out without risk of materials falling on to public areas. Therefore ~~Nevertheless~~, initial intrusive surveys were ~~shall be~~ carried out at three typical locations at the accessible part of the facade at the corner of Judd St and Bidborough St.

3.2 Available Survey Information~~Brief for external visual Survey and quality benchmark~~

This ~~brief~~ specification is to be read with the Facade C~~c~~ondition S~~s~~urvey carried out by Paye Stone ref DM/19038/006 dated 17 July 2019, plus Purcell Architects repair drawings ref. CTH-PUR-XXX-DR-21-A-(39) Series, Repair schedule Ref. CTH-PUR-XXX-SCH-21-A-3901 and related NBS specification which identifies and describes the defect and repair.

The scope of the refurbishment and repair work to the stone cladding is is generally shown on the over-marked elevations in the survey report by Paye.

~~.Conisbee, reported in June 2014 – External Fabric Structural Condition Report.~~

1. ~~The historic repair records should be reviewed and a set of elevations drawings marked up to record the location and extent of past repairs.~~
2. ~~All future survey observations to be recorded on the same set of elevation drawings as above.~~
3. ~~The entire external facade and lightwells should be visually inspected using long reach cherry pickers or rope access to verify the observations made by Conisbee in~~

~~June 2014 and to note any areas where further deterioration has occurred since that time.~~

4. ~~In any locations where moderate or severe cracks are observed, the surveyor should mark up the elevation drawing to indicate the extent of opening up considered necessary to investigate the underlying causes.~~
5. ~~Should any cracks be observed in areas which have previously been repaired, the surveyor should record these recurrent failures on the marked up elevation drawings and indicate the extent of opening up considered necessary to investigate the underlying causes.~~
6. ~~Minor cracks and the recommended method of filling them are to be recorded on the drawings.~~
7. ~~A method statement and risk assessment should be prepared for the full intrusive investigations to the areas identified on the drawings. The method should include suitable and sufficient means of protection against the risk of materials falling from height.~~
8. ~~A cost estimate and programme should be prepared for;~~
   - ~~intrusive investigations to the areas identified on the drawings~~
   - ~~remedial work to the underlying structure assuming wire brushing of structural steel and the application of a waterproofing surface treatment~~
   - ~~the reinstatement of the cladding including, replacement stone where the removed stone is beyond repair~~
   - ~~filling of minor cracks and repairs to mortar joints~~
   - ~~helical pinning of de-bonded stone where replacement would be very difficult or very costly~~
9. ~~A benchmark area of approximately 12m^2 shall be indentified where; cracks and staining are relatively minor, an intrusive survey is unnecessary and work may be carried out without disruption to the occupants and the neighbours. This area should be cleaned and repaired by the surveyor to demonstrate the methods to be employed on the project and the standards of workmanship to be achieved.~~

~~The above investigation and preparation of proposals and benchmark shall be carried out by a specialist stone restoration contractor appointed by Lend Lease. The proposed refurbishment methods and the quality benchmark should be agreed with the design team before being offered to the Planning and heritage authorities.~~

3.3 ~~Execution of~~ Refurbishment

3.3.1 The guidance and recommendations of the relevant parts of BS 8298 shall be adopted by the contractor in carrying out the repairs and the design and execution of any additions.

3.3.2 Stone for repairs and additions shall be selected and processed and the surfaces treated to match the existing Portland stone within the range of appearance demonstrated by the approved benchmark.

3.3.3 Wherever practicable the existing fabric shall be retained, provided that it can reasonably be expected to maintain its integrity for a period of 35 years with minimal maintenance.

3.3.4 Wherever practical, whole stones which are not fractured but must be removed in order to effect the refurbishment should be salvaged and reused.

3.3.5 Where practicable, plan to cut the stone joint to joint, so that the original arrangement is not disrupted and is maintained in accordance with the historic architectural design.

3.3.6 The introduction of new joints shall be avoided wherever practicable. Where fracturing passes though long section stones which could be cut through but still maintain a supporting bond to masonry above, this may require listed building consent and may only be done with the Architect's approval.

3.3.7 Where a new joint is necessary, it shall be placed at a minimum distance of 100-150mm away from others in both the vertical and horizontal planes to provide continued support and bond of associated masonry.

3.4 Repair and adaption of Stone

The Contractor shall;

3.4.1 Review all relevant drawings and specifications for the proposed work. Where these are not fully developed, undertake intrusive investigations, provide elevation and sectional drawings of existing masonry and provide technical advice to the Architect as required

3.4.2 Verify the received information is sufficient and accurate.

3.4.3 Produce scale drawings showing the stone to be adapted.

3.4.4 Coordinate site activities with the Main Contractor and other Trades.

3.4.5 Carry out on site adaptions using mason's hand tools and hand operated plant.

3.4.6 Cut out and square up existing stone in readiness to receive new.

3.4.7 Produce cutting schedules of new stone indents.

3.4.8 Secure the new stone indents using stainless steel threaded dowels and restraint brackets as required.

3.4.9 Trim in new indents into existing retained stonework as required.

3.4.10 Re-point joints to match the benchmark samples.

3.5 Remedial work to steel

Where cracks in the stone cladding are deemed to have resulted from corrosion of underlying steel elements, the Contractor shall, in addition to the repair and adaption procedure above, carry out the following;

3.5.1 Determine how best to remove the stone cladding and grouting to expose the underlying steel.

3.5.2 Immediately upon removal of the stone cladding, measure and record the dimensions of the steel sections and the thickness of corrosion lamination to each surface of the steel section. Measurements are to be taken with Vernier Scale Callipers. Measurements of areas where lamination occurs shall be compared with areas where no lamination is observed. The difference between the two measurements shall be reported as the total thickness of the lamination.

3.5.3 Check that the corrosion is within the limits permitted by the structural engineer's specification. Should the corrosion exceeds the specified limits, report immediately to the resident engineer and await instructions.

3.5.4 Pre-treat the steel to remove corrosion in accordance with the structural engineer's specification.

3.5.5 Apply corrosion protection in accordance with the structural engineer's specification.

3.5.6 Where corrosion at the top or bottom extents of the open course exceeds the limits specified in the structural engineer's specification, repeat the above procedure for the adjacent stone course. In order to minimise the work the opening up should proceed from top down.

3.6 Deconstruction and Rebuilding Stone Cladding

3.6.1 There are two areas of existing facade which must be taken down and rebuilt to form the entrances at the SME entrance on Bidborough Street and the entrance to the Camden Centre in Tonbridge Walk. The scope of these works is shown on the Purcell demolition drawings and the part elevation drawings CTH-PUR-G0-DR-08-A-4004 to 4006.

3.6.2 It is expected that a high proportion of the existing stonework could be successfully deconstructed, salvaged and re-used. Deconstruction would require potential sacrifice of individual stones to unlock the remainder from the facade, but the majority of the existing fabric shall be retained wherever reasonably practicable and where the stone can reasonably be expected to maintain its integrity for a period of 35 years with minimal maintenance.

3.6.3 Where new door openings are to be formed, the existing masonry should be carefully cut out and reinstated with new moulded indents forming the door reveals.

3.6.4 Procedure for Salvage and Re-use – The Contractor shall;

- Review all relevant drawings and specifications for the proposed work. Where these are not fully developed undertake intrusive investigations, provide

elevation and sectional drawings of existing masonry and provide technical advice to the Architect as required

- Verify the received information is sufficient and accurate.
- Carry out initial intrusive investigations to establish how the existing stone is supported and the load paths through the existing stone. If the stone is supported by the structural steel members that must be removed to form the new entrances, then the stone shall be fully deconstructed before the steel is removed. Where there is no direct restraint or support of the stone from the steel, the Contractor shall cut through and remove the steel without affecting the stability and integrity of the masonry.
- Carry out a detailed dimensional and condition survey of masonry to be removed.
- Produce scale drawings showing each individual stone and existing joint arrangement.
- Identify each stone by a unique reference number.
- Coordinate site activities with the Main Contractor and other Trades.
- Clean down existing masonry to remove surface soiling.
- Remove stone using masons hand tools, hand held plant, block and tackles, spider cranes.
- Mark each stone removed on an unseen face with its unique number with permanent marker.
- Place the salvaged stone on a pallet which shall be identified by its own unique reference.
- Record the location of each of the referenced stones on an elevation drawing
- Record any damage to the removed stone.
- Strap and shrink wrap the pallets and transport them to a mason's yard.
- Return the salvaged, modified and replaced stones to site.
- Re-fix stone back to suitable backing structure restrained using stainless steel fixings as required.
- Carry out repairs as necessary.
- Clean down masonry.
- Re-point the joints to match the benchmark samples.

4 Windows to Outward Facing Elevations

4.1.1 Read this section with the Architect's coded elevations and window schedules which show size and location of all ~~items described below~~windows and doors openings..

4.1.2 The structural openings within the stone clad elevations to the external perimeter of the building are in-filled with primary steel casement windows and secondary internal windows. Generally, the primary units are to be refurbished and the secondary units are to be replaced, but there are a wide variety of conditions and technical requirements which result in a large number of window types. The following paragraphs explain the requirements within each type of structural opening. For example; opening type WT102 refers to a structural opening on the first floor which is fitted with an external window WT102X and an internal secondary window WT102N.

~~4.1.3 General Notes Concerning Facade Descriptions:~~

~~4.1.4~~4.1.3 ~~[1] –~~All dimensions are approximate. Final dimensions to be determined by site surveys to be carried out by the contractor.

~~4.1.5~~4.1.4 ~~[2] –~~Existing primary windows to be refurbished in accordance with Section 14 of this specification.

~~4.1.6~~4.1.5 ~~[3] –~~New Secondary windows as section 13 of this specification.

~~4.1.7~~4.1.6 ~~[4] -~~For Quantities and locations of all units refer to Purcell Window Strategy Report_CTH-PUR-XX-XX-RP-A-00012

4.1.7 ~~[5] –~~It is not practical to fit secondary windows in staircases A,C,D,E,F and G because of the handrails and balustrades.

4.2 Existing Primary Windows (WT_X)

4.2.1 The existing ~~steel~~ casement windows were installed in 1937. The windows to the panelled rooms on the first floor are brass (architectural broze). Those to the remainder of the building are steel. The building is Grade II listed and it is necessary to retain as much of the original fabric as possible, including the windows. The existing windows have no weather-strips and many do not close adequately, but the metalwork and many of the fittings are suitable for refurbishment. The frames have been repainted several times over the past 80 years, and it is expected that the paint will have a significant lead content which will pose a hazard to health which the

contractor shall manage with suitable and sufficient controls and safety measures during refurbishment.

4.2.2 All units must be carefully removed from the structural openings without damaging the existing external stonework or any retained reveals and timber wall panels, some of which are listed and must be retained in their current state. The existing windows will be deglazed and removed from site for refurbishment and the openings temporarily boarded up with plywood (FSA compliant). The refurbished windows shall be brought back to site and reinstalled in their original positions and the perimeters made weather-tight with silicone seals and backer rods. All site applied sealants must be checked for compatibility with the existing limestone cladding to ensure that there is no staining or migration of materials between sealant and stone.

4.2.3 All paint shall be stripped from the existing metalwork in controlled factory conditions. Frames shall be grit blasted, ~~galvanized~~ pre-treated and polyester powder coated

4.2.4 The existing window fittings shall be retained where they are serviceable, replated, reconditioned, and re-fitted. Broken fittings shall be replaced with cast identical copies. In some cases the original fittings have been supplemented with devices such as keeps or pegs to retain operating chords. Where these additions are superfluous to the function of the refurbished window, they will be scrapped and the holes in the frames made good by welding.

4.2.5 The existing glass and applied film shall be scrapped and replaced with 4.4.2 laminated panes (8.8mm thick) with acoustic pvb interlayers. The laminated construction is to provide acoustic performance and security enhancement as recommended by CPNI guidelines. Existing glazing beads are in poor condition and shall be scrapped and replaced with new aluminium or steel beads which shall be mechanically fixed to the frames. Timber beads may also be proposed, subject to approval of paint finish and painting method.

4.2.6 The existing windows are fabricated from rolled steel profiles similar to W20 sections. The opening vents shall be retained for cleaning and maintenance purposes, but they are not intended for ventilation purposes. Opening vents shall be retrofitted with draught proof strips bonded to the non-visible surfaces within the moving frames or fixed frames There are four types of opening casements;

- Horizontal pivoting – with the pivot either positioned centrally, or with the pivot off-set towards the bottom of the frame, so that the window predominantly opens outwards with a small portion opening inwards. Fitted with spring catches at the head. Many of the existing catches are operated by cord, but the refurbished windows shall not be fitted with cords and shall have spring catches with loops suitable for operation by pole. The existing pivoting mechanisms shall be replaced with new pivot bearings and cups to fit within the notches in the existing frames.

- Vertical Pivoting – with the pivot off-set close to the jamb so that the window predominantly opens outwards with a small portion opening inwards. The existing pivoting mechanisms shall be replaced with new pivot bearings and cups to fit within the notches in the existing frames.
- Side hung – outward opening on butt hinges. Fitted with surface mounted espagnolette handles or linked cockspur handles at the jamb and surface mounted sliding friction stays at the cill.
- Side hung casement doors to the Juliette balconies on Judd Street and Euston Road elevations and to the terraces on all elevations on the 3rd floor. These are fitted with lever handles and cylinder locks.

4.3 New Internal Secondary windows (WT_N)

4.3.1 Fabricated from non- thermally broken aluminium window profiles with narrow sightlines to match the width of the existing primary windows as closely as possible..

4.3.2 Secondary windows are double glazed to compensate for the poor air permeability and acoustic performance of the existing primary windows.

4.3.3 The secondary windows shall be larger than the primary windows to allow the inward opening portions of the outer pivoted vents to pass within the outer frame of the secondary window. In order to make an opening for the secondary unit, which is larger than the primary, the internal window reveals and linings shall be modified and / or extended.

4.3.4 The ~~-~~design of the secondary windows shall be~~-~~ coordinated with the internal finishes to ensure that inward opening leaves do not clash with the ceiling.

~~4.4 Structural Openings~~

~~4.4.1 WT001 – Judd Street at ground floor~~

- ~~Dimensions [1]; 1465 wide x 2420 high.~~
- ~~WT001_X - Existing primary windows [2]; comprising two horizontal centre pivoting casements over two side hung casements. Single glazed; 4 panes wide x 5 panes high = 20 panes.~~
- ~~WT001_N New secondary windows [3]; comprising a pair of inward opening folding side hung casements with no fixed meeting rail. Double glazed; two panes wide x one pane high = 2 panes.~~

~~4.4.2 WT002 – Judd Street at ground floor~~

- ~~Dimensions [1]; 1000 wide x 2420 high.~~

- ~~WT002_X - Existing primary windows [2]; comprising a horizontal centre pivoting casement over an off-set vertical pivoting casement. Single glazed; 3 panes wide x 5 panes high = 15 panes.~~
- ~~WT002_N – New secondary windows [3]; comprising one full height, inward opening side hung casement. Double glazed; one pane wide x one pane high = 1 pane.~~

~~4.4.3 WT03 – Judd Street at ground floor~~

- ~~Dimensions [1]; 1000 wide x 2020 high.~~
- ~~WT003_X - Existing primary windows [2]; comprising a horizontal centre pivoting casement over a horizontal centre pivoting casement. Single glazed; 3 panes wide x 4 panes high = 12 panes.~~
- ~~WT003_N – New secondary windows [3]; comprising one full height, inward opening side hung casement. Double glazed; one pane wide x one pane high = 1 pane.~~

~~4.4.4 WT004 – Judd Street at ground floor. Fanlight above roller shutter at top of disabled ramp.~~

- ~~Dimensions [1]; 1050 wide x 1000 high.~~
- ~~WT004_X - Existing primary windows [2]; comprising a horizontal centre pivoting casement. Single glazed; 3 panes wide x 2 panes high = 6 panes.~~
- ~~No secondary window required.~~

~~4.4.5 WT005 – Euston Rd at ground floor~~

- ~~Dimensions [1]; 1465 wide x 2420 high.~~
- ~~WT005_X – Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 5 panes high = 20 panes.~~
- ~~WT005_N – New secondary windows [3]; comprising a pair of inward opening folding side hung casements with no fixed meeting rail. Double glazed; two panes wide x one pane high = 2 panes.~~

~~4.4.6 WT006 – Euston Rd at ground floor~~

- ~~Dimensions [1]; 1000 wide x 2420 high.~~
- ~~WT006_X - Existing primary windows [2]; comprising a horizontal centre pivoting casement over an off-set vertical pivoting casement. Single glazed; 3 panes wide x 5 panes high = 15 panes.~~

- ~~WT006_N – New secondary windows [3]; comprising one full height, inward opening side hung casement. Double glazed; one pane wide x one pane high = 1 pane.~~

~~4.4.7 WT007 – Euston Rd at ground floor Stair G~~

- ~~Dimensions [1]; 1000 wide x 2420 high.~~
- ~~WT007_X – Existing primary windows [2]; comprising a horizontal pivoting casement over an off-set vertical pivoting casement. Single glazed; 3 panes wide x 5 panes high = 15 panes.~~
- ~~No secondary window~~

~~4.4.8 WT008 – Tonbridge Walk at ground floor to stairwells,~~

- ~~Dimensions [1]; 1450 wide x 2350 high.~~
- ~~WT008_X – Existing primary windows [2]; comprising a horizontal pivoting casement above two side hung casements. Single glazed; 4 panes wide x 5 panes high = 20 panes.~~

~~4.4.9 WT009 – Bidborough Street at ground floor~~

- ~~Dimensions [1]; 1465 wide x 2420 high.~~
- ~~WT009_X – Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 5 panes high = 20 panes.~~
- ~~WT009_N – New secondary windows [3]; comprising a pair of inward opening folding side hung casements with no fixed meeting rail. Double glazed; two panes wide x one pane high = 2 panes.~~

~~4.4.10 WT010 – Bidborough Street at ground floor, above entrance to SME.~~

- ~~Dimensions [1]; 1465 wide x 2030 high. (existing opening is 2420, reduced size is 2030)~~
- ~~WT010_X – Existing primary windows modified and reduced in height [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~WT010_N – New secondary windows [3]; comprising a pair of inward opening folding side hung casements with no fixed meeting rail. Double glazed; two panes wide x one pane high = 2 panes.~~

~~4.4.11 WT011 – Bidborough Street at ground floor, bike and refuse lobby~~

- ~~Dimensions [1]; 1465 wide x 2420 high.~~

- ~~WT011_X - Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 5 panes high = 20 panes.~~
- ~~WT011_L – New louvre fitted in to upper part of existing frame to replace the two pivoting casements. Louvre blades to be PPC steel with 50% free area. Insect mesh. (Check that louvre is satisfatorty for venting from UKPN room).~~
- ~~WT011_N – New secondary windows [3] to lower part of opening; comprising a pair of inward opening folding side hung casements with no fixed meeting rail. Double glazed; two panes wide x one pane high = 2 panes.~~

~~4.4.12 WT012 – Bidborough Street at ground floor, above door to bike and refuse lobby~~

- ~~Dimensions [1]; 1465 wide x 2030 high.~~
- ~~WT012_X - Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 5 panes high = 20 panes.~~
- ~~WT012_L – New louvre fitted in to upper part of existing frame to replace the two pivoting casements. Louvre blades to be PPC steel with 50% free area. Insect mesh. (Check that louvre is satisfatorty for venting from UKPN room).~~
- ~~WT012_N – New secondary windows [3] to lower part of opening; comprising a pair of inward opening folding side hung casements with no fixed meeting rail. Double glazed; two panes wide x one pane high = 2 panes.~~

~~4.4.13 WT013 – Bidborough St above entry doors~~

- ~~Dimensions [1]; 750 wide x 800 high.~~
- ~~WT013_X – Existing primary window [2]; comprising a horizontal pivoting casement. Single glazed; 3 panes wide x 2 panes high = 6 panes.~~
- ~~No secondary window~~

~~4.4.14 WT014 – Bidborough St above entry doors~~

- ~~Dimensions [1]; 750 wide x 800 high.~~
- ~~WT014_X – Existing primary window [2]; comprising a horizontal pivoting casement. Single glazed; 3 panes wide x 2 panes high = 6 panes.~~
- ~~No secondary window~~

~~4.4.15 WT015 – Tonbridge Walk above entry doors~~

- ~~Dimensions [1]; 750 wide x 800 high.~~
- ~~WT015_X – Existing primary window [2]; comprising a horizontal pivoting casement. Single glazed; 3 panes wide x 2 panes high = 6 panes.~~

- ~~No secondary window~~

~~4.4.16 WT016 – Euston Rd at ground floor, Stair E~~

- ~~Dimensions [1]; 1465 wide x 2420 high.~~
- ~~WT016_X – Existing primary windows [2]; comprising a horizontal pivoting casement over two side hung casements. Single glazed; 4 panes wide x 5 panes high = 20 panes.~~
- ~~No secondary window~~

~~4.4.17 WT017 – NOT Used~~

~~4.4.18 WT018 – Euston Rd at ground floor, Stair F & G~~

- ~~Dimensions [1]; 750 wide x 800 high.~~
- ~~WT018_X – Existing primary windows [2]; comprising a horizontal pivoting casement. Single glazed; 3 panes wide x 2 panes high = 6 panes.~~
- ~~No secondary window~~

~~4.4.19 WT019 – Tonbridge Walk above entry doors~~

- ~~Dimensions [1]; 750 wide x 800 high.~~
- ~~WT019_X – New primary window to match existing adjacent windows [2]; comprising a horizontal pivoting casement. Single glazed; 3 panes wide x 2 panes high = 6 panes.~~
- ~~No secondary window~~

~~4.4.20 WT020 – Judd Street at ground floor in open disabled access route.~~

- ~~Dimensions [1]; 1000 wide x 2020 high.~~
- ~~WT020_X – Existing primary windows [2]; comprising a horizontal pivoting casement over an off-set vertical pivoting casement. Single glazed; 3 panes wide x 5 panes high = 15 panes.~~
- ~~No secondary window.~~

~~4.4.21 WT101 – Judd Street at first floor~~

- ~~Dimensions [1]; 1465 wide x 2780 high.~~
- ~~WT101_X – Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 6 panes high = 24 panes.~~
- ~~WT101_N – New secondary windows [3]; comprising a pair of inward opening folding side hung casements above a pair of inward opening folding side hung~~

~~casements. One fixed transom, but no fixed meeting rails. Double glazed; 2 panes wide x 2 panes high = 4 panes.~~

~~4.4.22 WT102 – Judd Street at first floor~~

- ~~Dimensions [1]; 1465 wide x 2800 high.~~
- ~~WT102_X - Existing primary windows [2]; comprising two horizontal pivoting casements over two off-set vertical pivoting casements. Single glazed; 4 panes wide x 6 panes high = 24 panes.~~
- ~~WT102_N – New secondary windows [3]; comprising a pair of inward opening folding side hung casements above a pair of inward opening folding side hung casements. One fixed transom, but no fixed meeting rails. Double glazed; 2 panes wide x 2 panes high = 4 panes.~~

~~4.4.23 WT103 – Judd Street at first floor – balconies over main entrance~~

- ~~Dimensions [1]; 1500 wide x 3600 high.~~
- ~~WT103_X - Existing primary windows [2]; comprising two horizontal centre pivoting casements above two side hung casements, above two side hung casement doors. Single glazed; 4 panes wide x 8 panes high = 32 panes.~~
- ~~WT103_N – New secondary windows [3]; comprising a pair of inward opening folding side hung casements above a pair of inward opening folding side hung doors. One fixed transom, but no fixed meeting rails. Double glazed;2 panes wide x 2 panes high = 4 panes.~~

~~4.4.24 WT104 – Euston Rd at first floor~~

- ~~Dimensions [1]; 1465 wide x 2780 high.~~
- ~~WT104_X - Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 6 panes high = 24 panes.~~
- ~~WT104_N – New secondary windows [3]; WT101_N – New secondary windows [3]; comprising a pair of inward opening folding side hung casements above a pair of inward opening folding side hung casements. One fixed transom, but no fixed meeting rails. Double glazed; 2 panes wide x 2 panes high = 4 panes.~~

~~4.4.25 WT105 – Euston Rd at first floor~~

- ~~Dimensions [1]; 1465 wide x 2800 high.~~
- ~~WT105_X - Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 6 panes high = 24 panes.~~
- ~~WT105_N – New secondary windows [3]; WT101_N – New secondary windows [3]; comprising a pair of inward opening folding side hung casements above a pair~~

~~of inward opening folding side hung casements. One fixed transom, but no fixed meeting rails. Double glazed; 2 panes wide x 2 panes high = 4 panes.~~

~~4.4.26 WT106 – Euston Rd at first floor~~

- ~~Dimensions [1]; 1000 wide x 2600 high.~~
- ~~WT106_X – Existing primary windows [2]; comprising one horizontal pivoting casement over one off-set vertical pivoting casement. Single glazed; 3 panes wide x 6 panes high = 18 panes.~~
- ~~WT106_N – New secondary windows [3]; one inward opening folding side hung casements above another inward opening folding side hung casement. One fixed transom rail. Double glazed; 2 panes wide x 2 panes high = 4 panes.~~

~~4.4.27 WT107 – Euston Rd at first floor Stairs F& G~~

- ~~Dimensions [1]; 1000 wide x 2600 high.~~
- ~~WT107_X – Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 6 panes high = 24 panes.~~
- ~~No internal window~~

~~4.4.28 WT108 – Euston Rd at first floor – balconies at centre of elevation~~

- ~~Dimensions [1]; 1500 wide x 3600 high.~~
- ~~WT108_X – Existing primary windows [2]; comprising two horizontal centre pivoting casements above two side hung casements, above two side hung casement doors. Single glazed; 4 panes wide x 8 panes high = 32 panes.~~
- ~~WT108_N – New secondary windows [3]; comprising a pair of inward opening folding side hung casements above a pair of inward opening folding side hung doors. One fixed transom, but no fixed meeting rails. Double glazed; 2 panes wide x 2 panes high = 4 panes.~~

~~4.4.29 WT 109- Bidborough St at first floor - All as type WT113 except obscured glass in secondary window~~

~~4.4.30 WT110 – Tonbridge Walk at first floor to Stairs A and E~~

- ~~Dimensions [1]; 1465 wide x 2780 high.~~
- ~~WT110_X – Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 6 panes high = 24 panes.~~
- ~~No secondary window required.~~

~~4.4.31 WT111 – Tonbridge Walk at first floor~~

- ~~Dimensions [1]; 1465 wide x 2780 high.~~
- ~~WT111_X - Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 6 panes high = 24 panes.~~
- ~~WT111_N – New secondary windows [3]; comprising a pair of inward opening folding side hung casements above a pair of inward opening folding side hung casements. One fixed transom, but no fixed meeting rails. Double glazed; 2 panes wide x 2 panes high = 4 panes~~

~~4.4.32 WT112 – Tonbridge Walk at first floor~~

- ~~Dimensions [1]; 1465 wide x 2780 high.~~
- ~~WT112_X - Existing primary windows [2]; comprising one semicircular fixed light with radial glazing bars, four horizontal pivoting casements over two side hung casements. Single glazed; 6 panes wide x 8 panes high = 48 rectangular panes, plus 18 triangular radial panes.~~
- ~~WT112_N – New secondary windows [3]; comprising a bottom hung semi circular vent over two pairs of inward opening folding side hung casements… Three fixed transom, but no fixed meeting rails. Double glazed; 2 panes wide x 3 panes high = 6 rectangular panes, plus one semi-circular pane.~~

~~4.4.33 WT113 – Bidborough St at first floor~~

- ~~Dimensions [1]; 1465 wide x 2780 high.~~
- ~~WT113_X - Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 6 panes high = 24 panes.~~
- ~~WT113_N – New secondary windows [3];– New secondary windows [3]; comprising a pair of inward opening folding side hung casements above a pair of inward opening folding side hung casements. One fixed transom, but no fixed meeting rails. Double glazed; 2 panes wide x 2 panes high = 4 panes.~~

~~4.4.34 WT114 – Bidborough St at first floor Stairs C and D~~

- ~~Dimensions [1]; 1465 wide x 2780 high.~~
- ~~WT114_X - Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 6 panes high = 24 panes.~~
- ~~No secondary window required~~

~~4.4.35 WT115 – Bidborough St at first floor WCs~~

- ~~Dimensions [1]; 1465 wide x 2780 high.~~
- ~~WT115_X - Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 6 panes high = 24 panes.~~
- ~~WT115_N – New secondary windows [3]; WT101_N – New secondary windows [3]; comprising a pair of inward opening folding side hung casements above a pair of inward opening folding side hung casements. One fixed transom, but no fixed meeting rails. Double glazed; 2 panes wide x 2 panes high = 4 panes. Obscured interlayer for privacy in WCs.~~

~~4.4.36 WT116 – Euston Rd at first floor, Stair E~~

- ~~Dimensions [1]; 1465 wide x 2780 high.~~
- ~~WT116_X - Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 6 panes high = 24 panes.~~
- ~~No secondary window.~~

~~4.4.37 WT117 – Judd Street at first floor to WC~~

- ~~Dimensions [1]; 1465 wide x 2780 high.~~
- ~~WT117_X - Existing primary windows [2]; comprising two horizontal pivoting casements over two side hung casements. Single glazed; 4 panes wide x 6 panes high = 24 panes.~~
- ~~WT117_N – New secondary windows [3]; comprising a pair of inward opening folding side hung casements above a pair of inward opening folding side hung casements. One fixed transom, but no fixed meeting rails. Double glazed; 2 panes wide x 2 panes high = 4 panes. Obscured glazing.~~

~~4.4.38 WT201 – Judd Street at second floor~~

- ~~Dimensions [1]; 1350 wide x 1850 high.~~
- ~~WT201_X - Existing primary windows [2]; comprising a fixed light and a horizontal pivoting casement over a fixed light and an off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~WT201_N – New secondary windows [3]; comprising a pair of, full height, inward opening folding side hung casements with no fixed meeting rail. Double glazed; 2 panes wide x 1 panes high = 2 panes.~~

~~4.4.39 WT202 – Judd Street at second floor, central window with special cill condition.~~

- ~~Dimensions [1]; 1350 wide x 1850 high.~~

- ~~WT202_X – Existing primary windows [2]; comprising a fixed light and a horizontal pivoting casement over a fixed light and an off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~WT202_N – New secondary windows [3]; comprising a pair of full height, inward opening folding side hung casements with fixed meeting rail. Double glazed; 2 panes wide x 1 panes high = 2 panes.~~

~~4.4.40 WT203 – Euston Rd at second floor~~

- ~~Dimensions [1]; 1350 wide x 1850 high.~~
- ~~WT203_X – Existing primary windows [2]; comprising a fixed light and a horizontal pivoting casement over a fixed light and an off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~WT203_N – New secondary windows [3]; comprising a pair of, full height, inward opening folding side hung casements with no fixed meeting rail. Double glazed; 2 panes wide x 1 panes high = 2 panes. Obscured glass~~

~~4.4.41 WT204 – Euston Rd at second floor~~

- ~~Dimensions [1]; 1350 wide x 1850 high.~~
- ~~WT204_X – Existing primary windows [2]; comprising a fixed light and a horizontal pivoting casement over a fixed light and an off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~WT204_N – New secondary windows [3]; comprising a pair of, full height, inward opening folding side hung casements with no fixed meeting rail. Double glazed; 2 panes wide x 1 panes high = 2 panes.~~

~~4.4.42 WT205 – Euston Rd at second floor~~

- ~~Dimensions [1]; 1000 wide x 1850 high.~~
- ~~WT205_X – Existing primary windows [2]; comprising one horizontal pivoting casement over one off-set vertical pivoting casement. Single glazed; 3 panes wide x 4 panes high = 12 panes.~~
- ~~WT205_N – New secondary windows [3]; comprising one, full height, inward opening side hung casement. Double glazed; 1 panes wide x 1 panes high = 1 panes.~~

~~4.4.43 WT206 – Euston Rd at second floor, Stairs F & G~~

- ~~Dimensions [1]; 1350 wide x 1850 high.~~
- ~~WT206_X – Existing primary windows [2]; comprising one fixed light and one horizontal pivoting casement over one fixed light and one off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~

- ~~No secondary window~~

~~4.4.44 WT207 – Tonbridge Walk at second floor~~

- ~~Dimensions [1]; 1350 wide x 1850 high.~~
- ~~WT207_X – Existing primary windows [2]; comprising a fixed light and a horizontal pivoting casement over a fixed light and an off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~WT207_N – New secondary windows [3]; comprising a pair of, full height, inward opening folding side hung casements with no fixed meeting rail. Double glazed; 2 panes wide x 1 panes high = 2 panes.~~

~~4.4.45 WT208 – Bidborough St at second floor~~

- ~~Dimensions [1]; 1350 wide x 1850 high.~~
- ~~WT208_X – Existing primary windows [2]; comprising a fixed light and a horizontal pivoting casement over a fixed light and an off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~WT208_N – New secondary windows [3]; comprising a pair of, full height, inward opening folding side hung casements with no fixed meeting rail. Double glazed; 2 panes wide x 1 panes high = 2 panes.~~

~~4.4.46 WT209 – Bidborough St at second floor Stairs C and D~~

- ~~Dimensions [1]; 1350 wide x 1850 high.~~
- ~~WT209_X – Existing primary windows [2]; comprising a fixed light and a horizontal pivoting casement over a fixed light and an off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~No secondary window required~~

~~4.4.47 WT210 – Bidborough St at second floor WCs~~

- ~~Dimensions [1]; 1350 wide x 1850 high.~~
- ~~WT210_X – Existing primary windows [2]; comprising a fixed light and a horizontal pivoting casement over a fixed light and an off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~WT210_N – New secondary windows [3]; comprising a pair of, full height, inward opening folding side hung casements with no fixed meeting rail. Double glazed; 2 panes wide x 1 panes high = 2 panes. Obscured interlayer for privacy in WCs.~~

~~4.4.48 WT211 – Euston Rd at second floor at Stair E~~

- ~~Dimensions [1]; 1350 wide x 1850 high.~~

- ~~WT211_X - Existing primary windows [2]; comprising one fixed light and one horizontal pivoting casement over one fixed light and one off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~No secondary window~~

~~4.4.49 WT212 – Tonbridge Walk at second floor (two openings)~~

- ~~Dimensions [1]; 1350 wide x 1850 high.~~
- ~~WT212_X – Existing primary window, recently installed as part of the Crosstree Development when the link bridge was removed. This should not require any refurbishment.~~
- ~~WT212_N – New secondary windows [3]; comprising a pair of, full height, inward opening folding side hung casements with no fixed meeting rail. Double glazed; 2 panes wide x 1 panes high = 2 panes.~~

~~4.4.50 WT213 – Tonbridge Walk at second floor~~

- ~~Dimensions [1]; 1350 wide x 1850 high.~~
- ~~WT213_X - Existing louvre unit removed and replaced with new primary windows [2]; comprising a fixed light and a horizontal pivoting casement over a fixed light and an off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~WT213_N – New secondary windows [3]; comprising a pair of, full height, inward opening folding side hung casements with no fixed meeting rail. Double glazed; 2 panes wide x 1 panes high = 2 panes.~~
- ~~—~~

~~4.4.51 WT255 – Euston Rd at second floor~~

- ~~All as WT 205 except obscured glass to secondary windows.~~

~~4.4.52 WT301 – Terrace windows at third floor~~

- ~~Dimensions [1]; 1220 wide x 1650 high.~~
- ~~WT301_X - Existing primary windows [2]; comprising one fixed light and one horizontal pivoting casement over one fixed light and one off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~WT301_N – New secondary windows [3]; comprising two, full height, inward opening folding side hung casements with no fixed meeting rail. Double glazed; 2 panes wide x 1 panes high = 2 panes.~~

~~4.4.53 WT302 – Windows at third floor~~

- ~~Dimensions [1]; 1220 wide x 1300 high.~~

- ~~WT302_X - Existing primary windows [2]; comprising one fixed light and one horizontal pivoting casement over one fixed light and one off-set vertical pivoting casement. Single glazed; 4 panes wide x 3 panes high = 12 panes.~~
- ~~WT302_N – New secondary windows [3]; comprising two, full height, inward opening folding side hung casements with no fixed meeting rail. Double glazed; 2 panes wide x 1 panes high = 2 panes.~~

~~4.4.54 WT303 – Terraces windows at third floor~~

- ~~Dimensions [1]; 350 wide x 1650 high.~~
- ~~WT303_X - Existing primary windows [2]; comprising one horizontal centre pivoting casements over one side hung casement. Single glazed; 1 panes wide x 4 panes high = 4 panes.~~
- ~~WT303_N – New secondary windows [3]; comprising one, full height, inward opening side hung casements. Double glazed; 1 panes wide x 1 panes high = 1 panes.~~

~~4.4.55 WT304 – Doors at third floor with secondary doors between room spaces and terraces.~~

- ~~Dimensions [1]; 1250 wide x 2640 high.~~
- ~~WT304_X - Existing primary double leaf door [2]. Single glazed; 4 panes wide x 5 panes high with horizontal pivoting casement over 4 panes wide x 1 pane high= 24 panes.~~
- ~~WT304_N - secondary door [3]; comprising a pair of full height folding side hung doors.~~

~~4.4.56 WT305 – Euston Rd and Bidborough St at third floor~~

- ~~Dimensions [1]; 1250 wide x 1700 high.~~
- ~~WT305_X - Existing primary windows [2]; comprising one fixed light and one horizontal pivoting casement, over one fixed and one off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~WT305_N – New secondary windows [3]; comprising a pair of full height, inward opening folding side hung casements. Double glazed; 2 panes wide x 1 panes high = 2 panes.~~

~~4.4.57 WT306 – Doors at third floor terraces between rooms and terraces~~

- ~~Dimensions [1]; 1250 wide x 2640 high.~~
- ~~WT306_X - Existing single glazed door unit [2]. Single glazed; 4 panes wide x 5 panes high with horizontal pivoting fanlight 4 panes wide x 1 pane high= 24 panes.~~

- ~~WT306N – New full height side hung door in one pane.~~

~~4.4.58 WT307 – Bidborough St at third floor~~

- ~~Dimensions [1]; 610 wide x 1400 high.~~
- ~~WT307_X - Existing primary windows [2]; comprising one off-set vertical pivoting casement. Single glazed; 2 panes wide x 3 panes high = 6 panes.~~
- ~~WT307_N – New secondary windows [3]; comprising a full height, inward opening side hung casements. Double glazed; 1 pane.~~

~~4.4.59 WT308 – Bidborough St at third floor Stairs C and D~~

- ~~Dimensions [1]; 1250 wide x 1700 high.~~
- ~~WT308_X - Existing primary windows [2]; comprising one fixed light and one horizontal pivoting casement, over one fixed and one off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~No secondary window required~~

~~4.4.60 WT309 – Doors at third floor terraces between corridors and terraces~~

- ~~Dimensions [1]; 1250 wide x 2100 high.~~
- ~~WT309_X - Existing single glazed door unit [2]. Single glazed; 4 panes wide x 5 panes high = 20 panes.~~
- ~~No secondary doors required~~

~~4.4.61 WT310 –Bidborough St at third floor WC~~

- ~~Dimensions [1]; 1250 wide x 1700 high.~~
- ~~WT310_X - Existing primary windows [2]; comprising one fixed light and one horizontal pivoting casement, over one fixed and one off-set vertical pivoting casement. Single glazed; 4 panes wide x 4 panes high = 16 panes.~~
- ~~WT310_N – New secondary windows [3]; comprising a pair of full height, inward opening folding side hung casements. Double glazed; 2 panes wide x 1 panes high = 2 panes. Obscured interlayer for privacy in WCs~~

~~4.4.62 WT311 – Bidborough St at third floor~~

- ~~Dimensions [1]; 610 wide x 1400 high.~~
- ~~WT311_X - Existing primary windows [2]; comprising one off-set vertical pivoting casement. Single glazed; 2 panes wide x 3 panes high = 6 panes.~~
- ~~WT311_N – New secondary windows [3]; comprising a full height, inward opening side hung casements. Double glazed; 1 pane. Obscured interlayer for privacy in WCs~~

~~4.4.63 WT312 – Judd at third floor Portico~~

- ~~Dimensions [1]; 800 wide x 1100 high.~~
- ~~WT312_X - Existing primary windows [2]; medallion shaped off-set pivoting casement~~
- ~~No secondary required~~

~~4.5 All the above items to be read in conjunction with Section 13 of this specification (Windows and Doors) and Section 14 (steel casement windows)~~

5 Windows to Inward Facing elevations and Lightwells

5.1.1 Read this section with the Architect's partial elevations of the window types and the ~~Appendix X of this specification which is a temporary set of elevations to show the arrangement of the secondary windows. The drawings, together with the~~ Architect's window schedules which~~-~~ show the sizes and location of all items described below. There are six existing lightwells;

- LW 01 and 02 at the West end of the building will be capped with new glazed rooflights.
- LW 04, to the South East ~~of~~ the building will be capped by the new 3rd floor pavilion extension.
- LW 03, the services lightwell to the North East and LW05 and 06 the small lightwells to the West of the Council Chamber will remain exposed to the external environment.

The inward facing elevations above the lightwells at 2nd, 3rd floor and roof levels have primary windows and ~~louvers~~louvres exposed to the external environment

5.1.2 The automated doors to the bottom of the lightwells are described in the doors section of this specification.

5.1.3 Some existing window openings have glazed bricks which shall be removed and replaced with new steel casement screens to match the existing adjacent windows.

5.1.4 Fire rated glazing is required in some parts of the Lightwells. These are ~~colour coded on the Appendix X~~identified on the architect's window and door ~~-~~drawings and schedules.

5.1.5 Acoustic enhancements are required~~s~~ in some parts of the Lightwells.. These are ~~coloured coded on the Appendix X~~ identified on the architect's drawings and schedules.

5.1.6 The ~~Appendix X~~architect's drawings and schedules indicate approximate dimensions for pricing purpose only. Manufacturing dimensions shall be established by the specialist subcontractor by a site survey of existing openings.

5.2 All the above items to be read in conjunction with Section 13 of this specification

6 Third Floor Pavillion and SME Entrance (NBS - H11)

6.1.1 Stick Construction curtainwall with vision glazing, obscured glazing and insulation opaque panels as shown on architect's drawings. Horizontal spandrel panels in zones between ceiling level and finished floor, vertical opaque panels in front of structural columns. Mullion and transom sections 60mm wide x 150mm deep. External snap covers to project by 100mm.

6.2 General

6.2.1 The recommendations of CWCT "Standard for systemised building Envelopes" are to be followed.

6.3 Wind resistance

6.3.1 Permanent deformation to framing members will not exceed 1/500 of the span measured between points of attachment to the structure after loading.

6.4 Resistance against impact

6.4.1 Internal Impact – Glazed walls will be class I4 in accordance with EN 14019

6.4.2 External Impact – Glazed walls will be class E4 in accordance with EN 14019.

6.4.3 The Works will satisfy the requirements of Tables 3 and 4 of BS 8200 "Design of non-load bearing vertical enclosures" for categories B and E in Table 2.

6.4.4 The maximum visually acceptable dent in metal surfaces will be 5mm in diameter and 2mm in depth.

6.5 Air Permeability

6.5.1 Curtain walling will be class A4 in accordance with BS EN 12152. Windows and doors incorporated into curtain walling will have the same air permeability performance as the curtain wall.

6.6 Weather tightness

Curtain walling will be Class R7 in accordance with BS EN 12154. Windows and doors incorporated into curtain walling will have the same performance as the curtain walling.

6.7 Acoustic Performance

6.7.1 Movement and wind noise control – The contractor shall take into account the following:

- Noise generated from the effects of thermal and structural movements
- Noise generated from wind and air movements including creaking, rattling, whistling, 'slip-stick' noise.

6.7.2 Acoustic transmission and flanking – refer to the General Requirements Section 12.6

~~6.7.2~~

6.8 Thermal Transmittance

6.8.1 The aggregate overall value of the curtainwall shall not exceed 1.1 W/m2.K.

6.8.2 The specified values are overall U-values for the different cladding types / elements. Overall U-values are calculated as the area-weighted averages of the centre of pane U-value (glazing and panel) and frame U-value including all edge effects (spacer and frame).

6.8.3 Detailed calculations prepared by the Contractor, in accordance with this specification and EN13947:2006 or EN ISO 10077, shall be submitted to the Architect for review during the design development stage.

6.8.4 Solar Factor (g value) should be calculated in accordance with EN410. Refer to the glass descriptions for the required g value.

6.8.5 Detailed solar shading calculations prepared by the Contractor, shall be submitted to the Architect for review during the design development stage.

6.9 Prescriptive requirements for Curtainwall

- Be designed as dry glazed pressure equalised system.
- Incorporate a secondary drainage system behind the weathering seals, which drains to the outside.
- Allow complete drainage of water from rebates to outside.
- Allow ventilation of the edges of the double glazed units, panes and panels.
- Incorporate an internal air seal and vapour check that will also act as second line of defence against water ingress.
- Eliminate standing water on/or around the edge of double glazed units, panes and panels.
- Incorporate isolation devices to minimise thermal bridging

6.9.1 Provide the following when all tolerances are accommodated and the most onerous combination of movements occur (including wind sway):

- Sufficient edge cover on all double glazed units, panes and panels to maintain weathering and structural performance around their perimeter.
- Clearance to edges of all glass panes or panels of at least 2 mm everywhere around their perimeter.
- Be capable of being re-glazed from outside of the building.
- Be provided with a gasketed interlocking jointing system with 2 lines of defence against water penetration.
- Incorporate bottom edge support to panes of single and both panes of double glazed units, and panels to prevent the gravity loads of the glass and panels being supported by the structural silicone seals alone.

7 Rooflights (NBS L10)

7.1 Rooflights RL 01-05 over Council Chamber

7.1.1 Double pitch l~~L~~antern lights ~~and glazed upstands~~. Existing single glazed lantern lights removed and replaced with new self-supporting, double glazed ~~steel~~aluminium rooflights manufactured from Vitral A74 modular factory sealed and glazed panel system, or similar and approved.~~.~~

7.1.2 Roof is classified as fragile Class 3 according to CWCT Technical Note 66. Edge protection and restraint measures to be in place to prevent maintenance operatives walking or falling on to the roof surfaces.

7.1.3 Glass type GL42~~0~~- see section 10

7.1.4 Frame: Thermally broken aluminium frame with thermal break of at least 20mm.

7.1.5 Frame width: Sightlines between fixed &/or opening profiles to be 50mm or less Incl dual gaskets and drainage system.

7.1.6 Finish: PPC coated aluminium frame in accordance with Section 16. .

7.1.7 Thermal transmittance: U-value (combined frame and glass) to be less than 1.6 W/m2°C according to EN12567-1:200: Thermal performance of windows and doors – determination of thermal transmittance by hot box method – Part1: Complete windows and doors.

7.1.8 Air permeability Class 4 at 600 Pa according to EN12207 – Windows and doors - Air permeability - Classification

7.1.9 Water permeability: Rooflight system shall achieve water permeability Class E1200 according to EN12208.

7.1.10 Acoustic requirements: Provide independent laboratory test results for airborne sound insulation for the same frame and glass build up as specified. Measurement to be accordance with EN ISO140-3:1995, EN ISO 717-1:1994 including 2006 amendment. Sound reduction Rw to be 34dB (or higher).

7.1.11 Verification of Performance: Rooflight to meet the requirements of EN14351-1 with declaration of performance and accompanied by a CE Label to prove complete system has been tested for watertightness, thermal transmittance, air permeability.

7.1.12 All external weatherproofing and internal finishes of upstands to be included.

7.1.13 Support structure: All continuous structural supports at the cill, hip, valley and verge shaped & aligned to suit the pitch of the glazing to be provided & fixed by others.

7.1.14 Contractor to provide loadings and reaction forces applied to the kerb by the self-supporting rooflight assembly for review by the structural engineer.

7.1.15 No vents, actuators or controls required to lantern light roofs

7.2 Rooflights to Lightwells 01 and 02 at West end of the building

7.2.1 Two mono-pitched rooflights with glazed upstands and automatic opening vents.

7.2.2 Supporting frame to be provided as an integral part of the roof . ~~Mullions~~ F~~f~~ormed from RHS steel sections welded into portal frames to span across atrium void.

7.2.3 Steel portal frames to have attachment points at the inner surface for the rail from which the cleaning and maintenance system is to be suspended– Loads TBC by the Access and Maintenance Consultant

7.2.4 Raico Therm+ S-I or similar glazing profiles fixed to outer surface of supporting portal frames ~~mullions and transoms~~ to form flush glass joints with no projections.

7.2.5 Double glazed units with structural seals secured to the framework with concealed toggle fixings. Minimum fall of 5~~4~~ degrees to minimise the risk of ponding and staining of glass. See Glass type GL40 and GL41 in section 10

~~7.2.2~~

~~7.2.3~~7.2.6 Roof classified as Class 2 according to CWCT Technical Note 66. The requirement may be demonstrated either by testing in accordance with TN67, or else

by adopting the guidance in TN92 (Simplified method for assessing glazing in Class 2 roofs)

~~7.2.4~~7.2.7 Automatic Opening Vents (AOVs) installed to full height of ~~in~~ one end wall and to the top of one side wall ~~two side of upstand~~. Refer to Arup Smoke Ventilation strategy and the architects' drawings for AOV requirements.

7.2.8 Cables and conduits for AOVs to be concealed within the portal frames

7.2.9 One side hung window to provide access to the lightwell for window cleaning and maintenance operations. Fitted with lockable handle to outside face and a stay to hold the window securely in the open position during window cleaning operations. TBC by the access and maintenance consultant.

8 ~~Ground Floor~~External ~~-~~Doors (NBS L10)

8.1.1 Read this section with the Architect's coded elevations and window schedules which show size and location of all items described below.

8.1.2 ~~D~~RDT01 – Existing timber doors to Camden Centre on Bidborough Street. Doors refurbished and fitted with new hardware.

- ~~Double leaf folding door, single action, outward opening, with panic exit hardware and overhead closers.~~This item is excluded from this specification – please refer to the joinery specification by Purcell

8.1.3 ~~D~~RDT02 – Existing timber doors to Stairs A on Bidborough Street. Doors refurbished and fitted with new hardware.

- ~~Double leaf folding door, single action, outward opening, with panic exit hardware and overhead closers~~. This item is excluded from this specification – please refer to the joinery specification by Purcell

8.1.4 ~~D~~RDT03 – Existing timber doors to Stairs B on Bidborough Street. Doors refurbished and fitted with new hardware.

- ~~Double leaf folding door, single action, outward opening, with panic exit hardware and overhead closers~~. This item is excluded from this specification – please refer to the joinery specification by Purcell

8.1.5 ~~D~~RDT04 – New glazed aluminium doors to sides of the Camden Centre side lobby in Tonbridge Walk.

- Double leaf folding door, single action, outward opening,
- Manual operation with panic exit hardware and overhead closers.
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved.
- Fitted with full height tubular handles to outside.

8.1.6 ~~D~~RDT05 – New glazed aluminium doors to entrance of the Camden Centre Entrance lobby in Tonbridge Walk.

- Double leaf folding door, single action, outward opening,
- Manual operation with panic exit hardware and overhead closers.
- Fitted with full height tubular handles to outside~~.~~

8.1.7 ~~DR~~DT06 – New glazed aluminium doors to ~~entrance of~~ the Camden Centre side lobby in Tonbridge Walk. DG.EX-17 (Fire exit door from Stair E), DG.EX-18 (tertiary exit from Camden Centre)

- Double leaf folding door, single action, outward opening,
- Manual operation with panic exit hardware and overhead closers.
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved.
- Fitted with full height tubular handles to outside.

~~8.1.7~~8.1.8 ~~DR~~DT07 – New glazed aluminium ~~double leaf outward opening~~ doors to SME ~~and Office~~ lobby.

- Double leaf folding door, single action, outward opening,
- Fitted with full height tubular handles.
- N.B. One of the two doors will have automated operation with low energy closer actuated by wall mounted push-pads
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved.
- ~~.~~
- ~~Note also that the internal lobby screen and doors are specified as part of the internal door package.~~

~~8.1.8~~8.1.9 ~~DR~~DT08 – External escape door at Bidborough Street ground floor, Stair D

- Double leaf folding door, single action, outward opening
- Fitted ~~,~~ with panic exit hardware and overhead closers.

~~8.1.9~~8.1.10 ~~DR~~DT09 – External escape door at Euston Road ground floor, Stairs F & G

- ~~Existing inward opening double leaf door to be modified and refurbished to act as an outward opening escape door. Timber with bronze facaing panels.~~ Double leaf folding door, single action, outward opening,
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved.
- Fitted with panic exit hardware and overhead closers.

8.1.11 DT09M (DG.EX26 & 27)– Existing timber doors with metal facing panels external to DT09,inward opening, but held open to ensure fire exit route during occupancy of the building.

- This item is excluded from this specification – please refer to the joinery specification by Purcell

~~8.1.10~~8.1.12 ~~DR~~DT10,11 and 12 – Existing timber door screens ~~Disabled entry door~~ to Judd Street main entrance lobby.

- . ~~Double leaf door, single action, outward opening, with automated low energy overhead closers.~~ This item is excluded from this specification – please refer to the joinery specification by Purcell

~~8.1.11 DR11 – Revolving Entrance door to Judd Street main entrance lobby~~

~~8.1.12 DR12 – Fixed Screen to Judd Street entrance~~

8.1.13 ~~DR~~DT13 – External access door to bike store lobby at Bidborough Street ground floor

- Double leaf door, single action, inward opening, with automated overhead closers.
- Full height tubular handles.

8.1.14 ~~DR~~DT14 – Automated door for smoke ventilation strategy in Lightwell basement. DB.LW01-1, DB.LW02-2, DB.LW02-3

- Remote automatic opening for smoke ventilation.
- 60min fire rated
- Double leaf door, single action, outward opening, with automated overhead closers.
- Controls linked in to BMS and fire control system.
- Glazed double door set comprising; Forsters'Fuego' EI 60 (integrity & insulation) fire rated mild steel framed fire resistant latched single action double doorsetcomplete with fixed fanlight above.
- Framework: All items to be manufactured from profiles and ancillary components drawn exclusively from the Forster 'Fuego' system consisting of architectural grade cold rolled mild steel thermally isolated structural members and matching snap-in bead profiles through-out.
- Finish: All mild steel framing members and associated glazing beads shall be polyester powder coated.
- Ironmongery to the door sets will be consist of standard heavy duty weld-on hinges, DDA compliant Dorma TS 93 surface mounted overhead fire resistant closers and 600mm long stainless steel back to back pull handles.
- All frames and ancillary components will be configured to provide 60 minute fire resistance in terms of integrity and insulation and in accordance with BS 476: Part 22: 1987

- Glass: Fire Rated: EI60 Mid Iron 45mm overall thickness double glazed units; 25mm EI60 pane, 14mm spacer, 6mm toughened pane.

8.1.15 ~~DR~~DT15 – Automated door for smoke ventilation strategy in Lightwell basement. DB.LW03-1, DB.LW03-3

~~8.1.14~~

- Double leaf door, single action, outward opening, with automated overhead closers.
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved.
- Remote automatic opening for smoke ventilation. Controls linked in to BMS and fire control system
- Not fire rated
- ~~Double leaf door, single action, outward opening, with automated overhead closers.~~
- ~~Controls linked in to BMS and fire control system~~.

8.1.16 DT16 – New aluminium door to external Lightwell 03. No smoke ventilation or FR required. DB.LW03-2

- Schuco ADS75HD door sets and FWS75 frame, or similar and approved Not fire rated
- Double leaf door, single action, inward opening,
- Lever handle and cylinder lock

8.1.17 DT17 – Disabled entry door to Judd Street ramp.

- Single leaf door, single action, inward opening,
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved
- Automated low energy overhead closers operated by wall mounted pushpads externally and internally

8.1.18 DT18 – Sliding doors to sides of Judd Street Entrance.

- Double leaf horizontal sliding door,
- DormaKaba ST Flex Secure fine framed, single glazed automatic door system, or similar and approved.–
- ES200 Microprocessor controlled, modular designed Automatic sliding door operator
- Tested and certified to 1,000,000 operation cycles

- Burglar resistance certified to WK2
- Class P4 A glazing as per EN 356
- 4 Point Locking device
- Full width floor guide
- Night/Bank Facility for first and last entrance
- 5 position mode switch (off, automatic, partial opening, exit only and hold open)
- 150mm high Drive unit encased in purpose designed extruded aluminium profile
- DORMA Prosecure Opti Combi combined radar activation and threshold infrared safety sensor
- Wireless wall switch actuation satin stainless steel 150 x 150mm (Option)
- Slimline jamb switch satin stainless steel 115 x 45mm (Option)
- Linked to access control via a normally open volt free contact momentarily closed on receipt of a valid signal from the access control system
- Power Failure/Fire Alarm Monitored battery back-up system to automatically open the doors in the case of a power failure or upon a signal from the interfaced fire alarm system
- No Break Out Facility – TBC with fire engineer
- Self-regulating safety system monitoring all door movements including closing force.
- Auto reverse function if the doors make contact with an obstruction during the closing cycle (infrared threshold safety sensor)
- Emergency Break Glass (Option)
- Rear Edge Safety - Full height frameless pocket screens constructed from 10mm toughened safety glass and patch fittings
- DORMA Prosecure Opti Scan Rear Edge Presence Sensors reducing the door to "Low Energy Speed" upon activation
- Door leaves and fixed side screens constructed from single glazed burglary resistant toughened or laminated P4 A glazing in fine framed profiles
- Aluminium Polyester Powder Coating
- DORMA Secure 4 point locking device - Type 3 Pivoting bolt lock with 4 swing bolts
- Applicable Standards The installation shall comply with BS EN 16005
- Electrical Requirements The electrical contractor shall provide a 240-volt AC mains spur to the right-hand side of the opening above and on the same face that

each drive unit is fitted. The spur must be switched and fused with a central flex outlet faceplate. A 10 amp residual circuit breaker at the mains board and a 5-amp fuse at the spur shall protect the circuit.

- Fire Alarm Requirements The fire alarm specialist shall provide a normally open volt free contact that is closed on alarm. The contacts shall be terminated adjacent to the fused spurs
- Real Time Remote Monitoring System Dorvision GPRS based wireless system concealed within the operator; system shall monitor each door location remotely via the internet incorporating facility to lock / unlock doors, timed automatic locking, reset, diagnostic system check and to provide data capture on usage and performance

8.1.19 DT19 – Pivoting doors to centre of Judd Street Entrance.

- Double leaf door, single action, inward opening,
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved
- Automated low energy overhead closers operated by wall mounted push-pads externally and internally
- Fitted with full height tubular handles

8.1.20 SME draft lobby screen

8.1.20.1 Aluminium stick construction curtainwall mullions and transoms, 60mm wide spanning double height lobby. Schuco FW60+ or similar and approved.

8.1.20.2 DT20 Revolving door to Office / SME draft lobby DG.42-1 As described in Section 13.

8.1.20.3 DT 21Glazed single leaf automated pass door to Office / SME draft lobby DG.42-2

- Single leaf door, single action, inward opening,
- Schuco ADS75HD door sets and FWS75 frame, or similar and approved
- Automated low energy overhead closers operated by wall mounted push-pads externally and internally

8.1.21 Casement Doors to 3rd Floor Terraces

These are refurbished steel casements and are included in the architect's window schedules – see references WT304,306 and 309. The existing lock casings and lever handle sets are to be refurbished. New cylinders and keys are to be provided.

8.1.22 Casement Doors to 1st Floor Balconies

These are refurbished bronze casements and are included in the architect's window schedules – see references WT103 and 108. . The existing lock casings and lever handle sets are to be refurbished. New cylinders and keys are to be provided.

8.1.23 Casement Doors to Basement

These are refurbished steel casements and are included in the architect's window schedules – see references WTB03. The existing lock casings and lever handle sets are to be refurbished. New cylinders and keys are to be provided.

8.2 All the above items to be read in conjunction with Section 13 of this specification

9 Louvres – (NBS - L10)

9.1 Scope

This includes ~~louvers~~louvres that form a part of the external building envelope. These ~~louvers~~louvres fall within the following categories:

- Mechanical Duct Louvres
- Plant room ~~louvers~~louvres
- AOVs

9.2 Types

9.2.1 LV01 – New louvres with fixed horizontal aluminium blades and insect mesh installed behind existing metal grilles at pavement level either side of main entrance on Judd Street

9.2.2 LV02 – New louvres with fixed horizontal aluminium blades and insect mesh installed behind existing metal grilles at pavement level on Euston Road

9.2.3 LV03 – New louvres with fixed horizontal aluminium blades and insect mesh installed behind existing metal grilles at pavement level on Bidborough Street

9.2.4 LV04 – New AOV louvre to suit the requirements of Arup smoke ventilation strategy for the lightwell. Installed behind existing metal grilles at pavement level on Euston Road, adjacent to Stair F.

9.2.5 LV05 – Air intake louvre to basement of services lightwell

9.2.6 LV06 – LV06 – Double leaf folding side hung louvred doors to roof on inward facing elevation

9.3 Mechanical Duct Louvres

- The cladding contractor shall be provided with the setting out and list of such locations on the building envelope with opening dimensions.
- Ductworks shall be connected to the rear of the louvre opening by the M&E trade contractors as per the building services engineers' specification. The connection shall be made either directly to the perimeter frame of the louvre; to a spigot connection that has been installed within an insulated composite metal panel blanking plate with cut outs. This connection shall be weather tight in the event that any wind driven rain penetrates the external louvre. Any water that penetrates past the louvre shall be drained to the

external zone at the cill, which shall be controlled and shall not lead to any staining on the facade.

- The louvre shall incorporate an aluminium or stainless steel insect mesh
- The louvre shall have a minimum free area of 50~~—~~%
- Maximum allowable pressure drop to be as per the M&E consultant's specification document.
- Rain exclusion: Class C to BS EN 13030
- Acoustic performance: As per acoustic consultant's specification document.

9.3.1 All metal louvre systems shall be designed, fabricated and installed in accordance with the system supplier's recommendations

9.3.2 Metal weather ~~louvers~~louvre shall be constructed from extruded aluminium profiles, stainless steel and shall comprise of perimeter frame and cill with structural supporting mullions and individual louvre blades. They shall have performance values in accordance with the performance requirements of this specification. The cill section shall be continuous and drain externally.

9.3.3 The design of the louvre blades shall be to an aerodynamically efficient profile and shall accommodate the calculated design wind loads.

9.3.4 Non functional ~~louvers~~louvres shall be blanked off with a fully fixed and sealed insulated bla~~c~~nking panel.

9.3.5 The secondary support structure/ rails and fixings supporting the ~~louvers~~louvres shall be aluminium or austenitic stainless steel grade 304 (C3 and C4 environment category)

9.3.6 All fasteners shall be non-visible and austenitic stainless steel grade A4.

9.3.7 All ~~louvers~~louvres shall incorporate an aluminium or stainless steel insect mesh.

10 Glass Types – (NBS - L40)

10.1 Description of glass types

10.1.1 GL01 - Single glazing to existing steel primary windows.

- The single glazed units shall have two plys of 4mm clear float glass two 0.38mm clear acoustic pvb interlayers and a minimum thickness of 4mm for each ply. The units shall have the following performance criteria:
- VLT (visible light transmittance) – 89% min
- Internal and external reflectance – 8% max
- CRI (colour rendition index) – 99% min
- Substrate and interlayer colour – Clear / Neutral
- Acoustic Rw (C,Ctr) – 37 (0;-2) dB

10.1.2 GL02 – As GL01 but obscured interlayer and reduced VLT.

10.1.3 GL03 - Single glazing to secondary windows in lightwell.

- The single glazed units shall have two plys of 5mm clear float glass two 0.38mm clear acoustic pvb interlayers. The units shall have the following performance criteria:
- VLT (visible light transmittance) – 88% min
- Internal and external reflectance – 8% max
- CRI (colour rendition index) – 98% min
- Substrate and interlayer colour – Clear / Neutral
- Acoustic Rw (C,Ctr) – 39 (0;-2) dB

10.1.4 GL11 - Double glazed units to internal secondary windows where bottom of glass is more than 800mm from FFL.

- The double glazed units shall include a 10mm monolithic outer pane and 6.8mm laminated inner panes with acoustic pvb interlayers and shall incorporate a LowE coating (e.g. Planitherm Ultra N or approved equivalent) to the inner pane on the surface towards the cavity. The units shall incorporate a 16mm thick argon filled cavity with high performance warm edge spacer bars in black colour. The double glazed units shall have the following performance criteria:

- VLT (visible light transmittance) – 77% min
- Internal and external reflectance – 12% max
- 'g' value – 0.59
- Ug – 1.1 W/m².K
- CRI (colour rendition index) – 85% min
- Substrate and coating colour – Clear / Neutral

10.1.5 GL12 – As GL11 but with obscured interlayer.

10.1.6 GL13 - Double glazed units to internal secondary windows where bottom of glass is less than 800mm from FFL.

- The double glazed units shall include a 10.8mm monolithic outer pane and 6.8mm laminated inner panes with acoustic pvb interlayers and shall incorporate a LowE coating (e.g. Planitherm Ultra N or approved equivalent) to the inner pane on the surface towards the cavity. The units shall incorporate a 16mm thick argon filled cavity with high performance warm edge spacer bars in black colour. The double glazed units shall have the following performance criteria:
- VLT (visible light transmittance) – 77% min
- Internal and external reflectance – 12% max
- 'g' value – 0.59
- Ug – 1.1 W/m².K
- CRI (colour rendition index) – 85% min
- Substrate and coating colour – Clear / Neutral

10.1.7 GL14 – As GL13 but with obscured interlayer.

10.1.8 GL21 - Double glazed units to 3rd Floor Pavilion Curtainwall.

- The double glazed units shall include a 10mm monolithic outer pane and 6.8mm laminated inner panes with acoustic pvb interlayers and shall incorporate a high performance solar control coating (e.g. Cool-Lite SKN 165 or similar or approved equivalent) to the inner pane on the surface towards the cavity. The units shall incorporate a 16mm thick argon filled cavity with high performance warm edge spacer bars in black colour. The double glazed units shall have the following performance criteria:
- VLT (visible light transmittance) – 60% min
- External reflectance – 16% max

- Internal reflectance – 28% max
- 'g' value – 0.33
- Ug – 1.0 W/m².K
- CRI (colour rendition index) – 85% min
- Substrate and coating colour – Clear / Neutral

~~10.1.9 GL31 - Single glazing fire-rated glass to Lightwell.~~

~~- Pyrobelite 12 Internal Grade with intumescent transparent layers to provide EW60~~

~~10.1.10~~10.1.9 GL32 - Double glazing fire-rated glass to Lightwell.

- Pyropane 231-28 E60 double glazed units with intumescent transparent layers to provide E60 fire-rating. With Obscured laminate interlayer.

~~10.1.11~~10.1.10 GL33 - Double glazing fire-rated glass to Lightwell.

- Pyropane 231-28 E60 double glazed units with intumescent transparent layers to provide E60 fire-rating. Clear vision glazing.

~~10.1.12~~10.1.11 GL40 – Monopitch Rooflight Glazing.

- The double glazed units shall include a ~~10mm~~ 12mm toughened monolithic outer pane and ~~6.8~~21.5mm laminated inner pane~~s~~ with acoustic pvb interlayers and shall incorporate a high performance solar control coating (e.g. Cool-Lite SKN 165 or similar or approved equivalent) to surface #2. The units shall incorporate a 16mm thick argon filled cavity with high performance warm edge spacer bars in black colour. The double glazed units shall have the following performance criteria:
- VLT (visible light transmittance) – 60% min
- External reflectance – 16% max
- Internal reflectance – 28% max
- 'g' value – 0.33
- Ug – 1.1 W/m².K
- CRI (colour rendition index) – 85% min

- Substrate and coating colour – Clear / Neutral

10.1.12 GL41 – Vertical Glazing immediately below Monopitch Rooflights

- The double glazed units shall include an outer pane of 9.5mm heat strengthened glass, PVB laminate with Cool-lite clear SKN 165 II coating, a 16mm argon cavity and an inner pane of 9.5mm heat strengthened laminate. All glass to be mid iron. Inner panes to have acoustic laminate.
- The double glazed units shall have the following performance criteria:
- VLT (visible light transmittance) – 60% min
- External reflectance – 16% max
- Internal reflectance – 28% max
- 'g' value – 0.33
- Ug – 1.1 W/m^2.K
- CRI (colour rendition index) – 85% min
- Substrate and coating colour – Clear / Neutral

10.1.13 GL42 – Lantern Light Glazing.

- Double glazed, Low E insulated units. Outer pane 6.8 mm heat strengthened laminate with opaque pvb interlayer, 16mm argon cavity, inner pane 6.8mm clear heat strengthened laminated. Opaque interlayer subject to sample submission and approval.
- VLT (visible light transmittance) – n/a
- External reflectance – 16% max
- Internal reflectance – n/a
- 'g' value – N/a
- Ug – 1.1 W/m^2.K
- CRI (colour rendition index) – n/a
- Substrate and coating colour – Clear / Neutral
-

10.2 General

10.2.1 All basic soda lime silicate flat glass (except patterned or wired) shall be manufactured by the 'float' process and shall comply with BS 572 and BS 952.

10.2.2 The thickness and dimensions of glass shown on the Architects Drawings are not prescribed thickness or dimensions. The Contractor shall calculate the glass

thickness, using validated design methods to meet the structural, environmental, and acoustic and safety requirements.

10.2.3 The Contractor shall obtain the total quantity of each glass material from the same material manufacturer. In the case of coated glasses, or other processed glass products, the Contractor shall ensure that all products are processed from 'raw' glass material obtained from one manufacturer.

10.2.4 Glass shall comply with the relevant parts of the following standards generally:

- BS EN 572 for basic soda lime silicate glass
- BS EN 1096 for coated glass
- BS EN 1748 for borosilicate glass
- BS EN ISO 12543 for laminated glass and laminated safety glass
- BS EN 12150 and BS EN 14179 for heat soaked thermally toughened glass
- BS EN 1863 for heat strengthened glass

10.2.5 All glass edges (except ground edges) shall be clean cut, undamaged and free from any defects like vents, chips and shells or any other defects that are likely to be detrimental to the visual and performance criteria of the glazing. No cutting or nipping of the glass shall be allowed on site.

10.2.6 All visible glass edges shall be:

- A 'smooth ground edge' in accordance to BS EN 14179-1 Part 1 or BS EN 12150 Part 1 or BS EN 1863 Part 1 or BS EN 12543 Part 5 or
- An arrised edge (smooth ground) in accordance with BS 952 Part 2.

10.2.7 Glass shall be selected to resist the windloads and variations in atmospheric pressure without excessive deflection, but it is also important to maintain visual consistency of glass where different specifications can be view concurrently. If the contractor proposes to use differing thickness, coatings, or substrates of glass, the visual impact of these selections must be communicated to the architect before materials are procured. The architect will be entitled to request full size samples to be set up in a manner simulating their intended installation conditions.

10.2.8 Thermal shock – The cladding contractor shall allow for any necessary heat treatment required for the glass to eliminate any risk of thermal shock in its installed position. Allowance shall also be made for any shadows cast by overhanging balconies and for dark coloured blinds or drapes being placed within 75mm of the inside surface of the glass.

10.2.9 Nickel sulphide inclusions – All toughened glass shall be heat soak tested according to BS EN 14179 to minimise the risk of NiS failure. The cladding contractor shall replace any failure due to NiS inclusions prior to Practical Completion of the project..

10.2.10 The edges of all panes and double glazed units shall be inspected during processing and before and after installation in their frames. Any edges with defects likely to initiate cracks in service including feather (shark's teeth) or whisker (serration's) deeper than half the thickness' of the pane, vents (flake chips) greater than 6mm across, or impact damage shall not be incorporated in the Works.

10.3 Tolerances on width (W) and length(L)

10.3.1 The maximum allowable tolerances for double glazed units are given below:

Length and Width on units up to $3m^2$	+3mm, - 0mm
Length and Width on units $3m^2$ to $8.5m^2$	+4.5mm, - 0mm
Length and width on units over $8.5m^2$	+6mm, - 0mm
Thickness for 2 panes of glass each 6mm or less plus air space	+ or – 1.0mm
Thickness for 2 panes of glass each over 6mm plus air space	+ or – 1.5mm
Variation in thickness round the perimeter of any one unit.	Not more than 1mm

10.3.2 Maximum allowable tolerances for annealed, toughened and heat strengthened panes:

Nominal dimension of side in mm	Tolerance in mm
< 2000	+/- 1

2000 ≤ W or L ≤ 4000	+/- 2
> 4000	+/- 3

10.3.3 Maximum allowable tolerances for laminated glass panes:

Nominal dimension of side in mm	Tolerance in mm
< 2000	+/- 1.5
2000 ≤ W or L ≤ 4000	+/- 2.5
> 4000	+/- 3.5

10.4 Insulating glass units

10.4.1 Insulating glass units shall comply with BS EN 1279. The visual quality of the installed units shall be assessed in accordance with the next section of this specification.

10.4.2 The spacers separating the panes of glass shall be aluminium alloy with a black anodised finish, stainless steel, glass fibre reinforced plastic, thermoplastic or silicone foam and shall have adequate rigidity for their purpose. They shall be specifically designed to accommodate the seal and contain desiccant, allowing both to operate at maximum efficiency. All bent edge spacers shall be limited to a maximum two joints in any one assembly. Spacer pieces shall not be less than 200mm in length. Joints shall not be allowed within 50mm of any corner.

10.4.3 The units shall have a mechanically applied primary polyisobutylene seal, located between glass and spacer providing a vapour-proof barrier, which shall be continuous and of a minimum width of 3mm, and a secondary two part silicone seal extending around the perimeter of the double glazed unit.

10.4.4 All breather tubes shall be nipped closed.

10.4.5 Where argon filled units are proposed, the supplier of the units shall provide written evidence that the units have undergone accelerated ageing tests in accordance with BS EN 1279 -3.

10.4.6 The units shall not employ edge tape. The edges shall be finished in a way which permits visual inspection of the glass edge, edge seals and the positions of the metal spacers.

10.4.7 Identification marks and /or manufacturers' logos shall be sized as small as possible. They shall be located in the bottom left hand corner of the double glazed units when viewed from the inside to the outside.

10.4.8 Glass units used with structural silicone glazing shall comply with BS EN 15434:2006+A1:2010.

10.5 Visual acceptance criteria for float glass

10.5.1 All glass shall be clear float glass, without significant edge faults (including feathered edges, shells or other imperfections) and free from bubbles, inclusions, cracks ripping dimples or other defects. Distortion shall be kept to an absolute minimum and no local defects producing irregular reflections shall be allowed.

10.5.2 The quality of all glass off the float line shall be assessed for optical and visual faults as described in BS EN 572-2. Spot faults shall not be worse than category C. There

shall be no linear/extended faults. For optical faults, acceptance levels shall be as described.

10.5.3 Visual acceptance criteria for as-installed glass shall be as described elsewhere in this specification.

10.5.4 Sizes - All glass shall be cut to accurate sizes and, if applicable, delivered to site in the required sizes. No on-site cutting or nipping shall be allowed. The glass shall be clearly marked to show its intended final position and orientation.

10.5.5 Safety marking on glass - shall comply with Building Regulations Approved Document Part N.

10.6 Thermally toughened glass

10.6.1 The use of thoughened glass shall be avoided wherever practicable , but where it cannot be avoided the following requirements shall apply

10.6.2 All toughened glass shall be tempered on a roller hearth furnace eliminating tong marks and shall confirm to BS EN 12600 class 1C1.

10.6.3 Thermally toughened glass shall comply with BS EN 12150 and shall be heat soak tested in accordance to BS EN 14179. Each panel of toughened glass shall be traceable to individual heat soak test batches to ensure that in the event of a failure, it shall be possible to identify and locate all panels from the heat soak test batch.

10.6.4 Edge working shall be ground smooth. Corners shall be dubbed. Small shells and / or chips shall be ground out prior to toughening. Any remaining chips and/or shells shall not affect the structural performance of the glass and shall not be visible in the installed Works.

10.6.5 The appearance of anisotropy or 'Leopard Spots', a multi-coloured pattern, is known to be associated with toughened glass under certain polarised lighting conditions. Processing shall be strictly controlled to ensure that this effect is kept to an absolute minimum.

10.7 Heat Strengthened glass

10.7.1 Heat strengthened glass shall comply with BS EN 1863. All flat glass shall be processed horizontally.

10.7.2 Edge working shall be ground smooth. Corners shall be dubbed. Small shells and / or chips shall be ground out prior to heat strengthening. Any remaining chips and/or shells shall not affect the structural performance of the glass and shall not be visible in the installed Works.

10.7.3 The appearance of anisotropy or 'Leopard Spots', a multi-coloured pattern, is known to be associated with toughened glass under certain polarised lighting conditions. Processing shall be strictly controlled to ensure that this effect is kept to an absolute minimum.

10.7.4 Rollerwave shall be limited to the values given in the glass fabrication tolerances section of this document.

10.8 Laminated glass

10.8.1 All laminated glass panes shall comply with BS EN 12543. Delamination within the vision area as defined in BS En 12543 shall not be accepted.

10.8.2 . Edge delamination will be limited to the perimeter zones (edge areas) identified in BSEN 12543-6. For pane sizes that are less than 5 m2, the width of the edge area is 15 mm. The width of the edge area is increased to 20 mm for pane sizes that are greater than 5 m2.

10.8.3 Where the edge of the laminate glass is to be exposed, the interlayer material must be shown to be resistant to the effects of moisture absorption, including clouding and delamination.

10.8.4 After lamination, individual pieces of laminated glass shall be within the tolerances given in BS EN ISO 12543-5.

10.9 Coated glass

10.9.1 Coated glass shall comply with BS EN 1096.

10.9.2 Processing shall be strictly controlled to ensure even coating, minimum colour variation and no streaking or patching. Where coatings are applied to thermally toughened glass or heat strengthened glass, these must not increase the tendency to show these effects.

10.9.3 Low emissivity coating, if required to achieve the performance criteria specified, shall be positioned on surfaces 2 or 3, shall be nominally neutral in colour and uniform in tone, hue, colour, texture, pattern and opacity and shall provide a consistent appearance to the glazed units. The emissivity shall be less than 0.2.

10.10 Screen printing

10.10.1 Ceramic ink shall be applied to areas of heat treated glass as indicated on the Contract Documents using the silk screen process.

10.10.2 Samples shall be submitted prior to manufacture for review by the Architect.

10.10.3 The ceramic ink shall be fused to the surface of the glass during the heat treatment process and be permanent and durable and shall be resistant during the design life of the Works to:

10.10.4 Attack from mechanical damage or abrasion, during normal use and maintenance as specified by this Contract Document.

10.10.5 Weathering, fading, or discolouration due to attack from climatic conditions, UV or atmospheric pollutants.

10.10.6 The screen printed face of the glass shall face the inside of the building in the final construction.

10.11 All double glazed units shall incorporate black coloured spacer bars.

10.12 Fabrication Tolerances

10.12.1 Annealed glass

Tolerances on cut annealed glass shall be in accordance with BS EN 572-2.

10.12.2 Thermally toughened and heat strengthened glass

After processing, individual pieces of heat treated glass shall be within the following tolerances:

Length and width	As required by BS EN 12150 and 1863
Squareness measured along the diagonals	As required by BS EN 12150 and 1863
Roller wave	For glass thickness: ≥6mm rollerwave shall not exceed 0.08mm /300 mm <6mm rollerwave shall not exceed 0.12mm/300mm between peak and trough
Edge dip	0.25mm
Bow/Local bow	As required by BS EN 12150 and 1863

10.13 Combined effects of Rollerwaves

The combined effects of rollerwaves on 2 or more panes of heat treated glass when assembled in a laminated construction or as part of an insulated glazing unit, has the potential to generate localised lensing effects. In order to limit the probability of such effects,

the cladding contractor shall propose an inspection and test plan to demonstrate by sampling and statistical analysis that the probability of 2 or 3 glass panes with rollerwaves in excess of 0.08mm being combined in a laminated pane of insulated glazing unit is less than 1:50.

Each batch of monolithic heat treated glass shall be sampled and measured before lamination. Measurements shall be recorded and analysed to report the statistical distribution of results, including but not limited to the mean value and standard deviation. A total of 5% of the glazing shall be sampled for this report. The inspection and test plan shall be submitted to the main contractor for approval.

11 Contractor's Works – (NBS – A)

11.1 The Contractor's Obligations

- Comply with all the relevant National and Local Government Regulations
- Liaise with the Principal designer, Design team, local authorities and provide all information necessary to complete the Health and Safety file required by CDM regulations 2015.
- Use recognised industry good practice standards and comply with all the relevant standards and codes of practice listed in this document. The contractor shall provide detailed design information for the works to be undertaken to demonstrate compliance with this performance specification document.
- Prepare a detailed programme for the execution of the works allowing for design development, visual mock ups, prototype testing, procurement of samples and submit within 4 weeks of the award of the contract.
- Prepare a detailed drawing list, related to elevations showing locations of 2 and 3D drawings and identify within the programme when will these be produced.
- Provide relevant product literature, samples of components, test certificates for the works to demonstrate quality of the materials, design, workmanship and fabrication techniques.
- Produce and submit formally, design drawings based on compliant solutions, calculations and samples. As these are developed ongoing checks shall be made to ensure that the principles mentioned above are maintained.
- Prepare the necessary shop drawings when the designs have been completed in compliance with this contract document for the system concerned and approved by the design team.
- Include any secondary support members/ bracketry, required to support and/or restrain the works/ (which will be fixed to the primary structural frame), on the detailed design drawings. The contractor shall produce these drawings in accordance with the programme to allow other sub-contractors to incorporate these into their works.
- Fabricate the visual and performance mock-ups identified in sections 17 and 18 when the necessary shop drawings have been completed.
- Provide samples, design development mock ups, weather performance tests, acoustic and fire separation tests where identified in the following sections of this specification.
- Carry out modifications to the design and construction of the specimens and retest them in the event of failure during the test. Ensure any modifications to the design are incorporated into the design development drawings.
- The contractor shall carry out a survey to obtain critical dimensions of applicable existing elements on site, including verticality, prior to manufacture of components.

- The contractor shall assure themselves of the suitability of the design and that it is fit for the building, is compliant with the architectural requirements and this specification before the commencement of procurement, manufacture and installation. It is the contractor's responsibility to coordinate with all other trade sub contractors where building cladding interfaces occur between elements of the works.
- Proceed with fabrication when the particular specimen has been tested successfully.
- Organise the delivery of components to the site so that the works can be installed in proper sequence without omissions which would require modification of the design.
- Ensure that the works are installed to the agreed standards set by the quality control benchmark samples
- Instruct all those engaged in the installation of the works of the principles of its design, of any unusual details which might be overlooked and of the particular techniques to be used in its construction.
- Carry out hose tests on agreed areas of the project as identified in section 18.
- Protect the works, check the proper operation of all opening vents and carry out final clean down.
- Provide comprehensive maintenance manual and 'as-built' drawings.

11.2 Submissions (Post contract)

11.2.1 Design drawings

- The contract drawings shall be provided using a central electronic document transfer system (Conject) provided by the Main Contractor.
- The contractor shall be deemed to have satisfied themselves that the design contained within the design drawings are capable of achieving the required level of performance and are buildable.
- The contractor shall indicate on their design drawings the position of their works in relation to interfaces with the works of other trades.
- Fixing bracket locations, arrangements, types, dimensions, materials, welds and position of anchors, bolts and cast in inserts shall be indicated within the drawings.
- All drainage and ventilation routes shall be indicated within the design drawings.
- The contractor shall indicate all materials, finishes, metal/ glass types, weather / vapour membranes, gaskets, seals, insulation, fire/acoustic stops and all other components utilised in the works.
- The contractor shall show provisions for accommodating all relevant cladding movements indicating movement allowances.
- Glass edge finishes shall be indicated within the design drawings.

- The CAD drawing format shall be agreed with the design team prior to issue of the documents to ensure these are compatible for importing and reviews.

11.2.2 Samples, Prototypes and General Submissions (see following sections in this specification for details)

11.2.3 Calculations (General considerations)

- A full set of calculations shall be provided to demonstrate that the works comply with the requirements of this specification.
- Calculations will be readable, comprehensively tabulated and cross referenced. Calculations will be done in accordance with appropriate recognised standards, codes of practice and procedures, using diagrams and extracts from drawings to explain what is being analysed. Basic data used and all assumptions made must be clearly stated.
- Evidence that the engineer responsible for the calculations has appropriate qualifications and is a chartered member of an appropriate recognised professional institution will be provided. Evidence of internal checking of the calculations by the Contractors will also be provided.

11.2.3.1 Structural

- Structural calculations shall be provided by the cladding contractor and include (but not be limited to) calculations for all panel sections, connections, fixing assemblies, anchors, bolts, fasteners and glazing panel sizes.
- All load cases, load factors and combination of load cases including dead loads, imposed loads and barrier loads where appropriate shall be included within the calculations.
- Where appropriate, the calculations shall include assessment of overall stability and resistance to progressive collapse.
- The calculations shall include assumptions for stress limits for factored and unfactored loads as appropriate for different materials.
- Where finite element analysis is used, these shall identify restraint types, property types, axis systems and applied loads.
- Fixing assembly calculations shall incorporate the worst combination of the structural frame tolerances as per the structural engineers, 'building movement and tolerances' report.
- The calculations shall be in accordance to all the relevant British Standards for the materials to be used. Refer to the materials section of this document for related standards.

11.2.3.2 Thermal Performance

- The cladding contractor shall produce detailed 2D and 3D thermal performance calculations to demonstrate compliance with the target U-value requirements of this document. The analysis shall include all the facade components supplied and / or installed by the contractor and comply with the relevant British standards mentioned within this document.
- The software used for this analysis shall be shown to be validated against the examples given in Annex D of EN ISO 10077-2. . The results of the assessment will be summarized as thermal transmittance (U value) for the centre of the panels, edge effects and frames of each relevant window, curtain walling and metal cladding type. Overall U values for each relevant window, curtain walling and metal cladding type will be calculated as a weighted average of constituent areas. The calculation method will take into account the internal and external surface heat transfer resistances. These resistances and the parameters, which affect them, will be quoted. The method will take into account the effects of any air spaces and the thermal interaction between elements of the facade. The calculation will be carried out in accordance with the requirements of BS EN ISO 12631: 2017. Guidance can be found in the Centre for Window and Cladding Technology, Standard for systemised building envelopes, Part 5; Thermal, moisture and acoustic performance and the joint CWCT/CAB publication, The thermal assessment of window assemblies, curtain walling and non-traditional building envelopes.

11.2.3.3 Condensation Risk

- Condensation risk analysis calculations shall be carried out and submitted by the cladding contractor to demonstrate that no surface or interstitial condensation shall form on the cladding elements supplied and / or installed by the contractor under the design psychometric conditions.
- The calculations shall be carried out as per the relevant standards and CWCT guidelines.

11.2.3.4 Glazing thermal stress calculations

- The cladding contractor shall carry out thermal stress calculations for glass supplied and / or installed by the contractor to demonstrate that there is no likelihood of any glazing pane fractures/ failure as a result of excessive thermal edge stresses as a result of the factors (including but not limited to) mentioned below –

- External and internal shading devices
- Coloured glass substrates and coloured interlayers
- Fritting
- Internal bulkheads
- Projections/ recesses within the building envelope

11.3 Quality Control

11.3.1 The Contractor shall comply with the Quality Control requiremenst set out in the Lend Lease Contractors' Requirements documents.

11.3.2 The contractor shall establish, document and maintain a quality control system as per the guidelines of BS EN ISO 9001 to demonstrate how quality management shall be implemented from award of contract to completion of the works.

11.3.3 The quality control programme shall be defined in a quality control manual or similar document in which the organisation systems, inspections and test plan procedures are fully described to ensure that all the essential inspection requirements are determined and satisfied throughout the works. The quality control procedures shall be based on the most up to date revisions of drawings, specification and contract document.

11.3.4 The contractor shall establish a separate tolerance quality control manual to cover compliance with tolerances related to the works. This shall include the different types of quality control checks that shall be carried out during each stage of the works, the person responsible for such checks and details of check records.

11.3.5 The procedures mentioned below shall be followed and the contractor's proposals shall meet the requirements of this section as a minimum and be submitted to the D&B Contractor.

- Submit a comprehensive quality control plan within 30 days of appointment to the construction manager for review and approval.
- Include with the quality control manual an inspection and test plan for each major item of work or type of fabrication which shall detail the following:
    - The primary activities to be carried out
    - The type, method and frequency of inspections and tests to be carried out.
    - The inspecting authority
    - The acceptance criteria
    - Details of records to be kept.
- As a minimum the quality control plan shall include the following information and procedures:
    - Organisation and management .i.e. details of the quality management team
    - Assessment of quality
    - List of design development drawings required

- Inspection and test procedures to be adopted in checking the works
- Stages at which checklists will be used and samples of those checklists
- Statements on work procedures on the correct use of materials and components both on and off site
- List of product information with latest revisions
- List of trade contractors appointed by the contractor and involved in the works
- The trade contractors quality systems and checklists
- Calibration records of measuring equipment
- Compliance with the requirements of the CDM regulations
- Storage, handling and transportation
- Fabrication and erection
- Tolerance control plan
- Prototypes
- Painting and coating
- Inspection and testing of materials and workmanship
- Non-conforming items
- Detailed design drawings
- Control of purchased materials and services
- Completed items, inspection and test results
- Records and review of the quality system

11.4 Protection, Handling and Storage

11.4.1 The Contractor shall comply with the protection handling and storage requiremenst set out in the Lend Lease Contractors' Requirements documents.

11.4.2 Assembled units, materials and all components shall be protected in such a manner that will prevent damage, distortion, uneven weathering or degradation under normal conditions of handling and storage. Particular attention shall be given to the protection of edges, projecting features, corners and other vulnerable areas. Temporary protection materials shall like Correx or approved equivalent shall be used during handling and transportation.

11.4.3 Low tack tape shall be provided to all profiles along the full width and height of the panel and glazing. There must be sufficient ventilation to the glazing protection to avoid thermal shock.

11.4.4 The contractor shall supervise, check, alter, adapt and maintain all protective devices as necessary until practical completion. The contractor shall allow for progressive removal of the protection in coordination with the main contractor to ensure that the final removal of protection is not partially trapped by the works of interfacing trades.

11.4.5 The finished works shall be free from distortion, cracks, defective finishes, scratches and other damage.

11.4.6 Cement mortar and concrete droppings or splashes shall not be allowed to dry onto the glazing or framing members. Subsequent removal of this material will expose alkaline etching of the glass and mechanical scratches will occur during removal.

11.4.7 The cladding contractor shall provide a method statement detailing the proposed method of storage and handling, including transportation. All materials shall be clearly labelled for identification and traceability.

11.5 Installation

11.5.1 The Contractor shall comply with the installation requirements set out in the Lend Lease Contractors' Requirements documents.

11.5.2 The works shall be installed in accordance with the contractor's drawings and reviewed method statements, modified as necessary to meet the requirements of the contract document.

11.5.3 Installation methods for the works shall be selected to ensure compliance with the specified performance criteria of the envelope.

11.5.4 Installation method statements shall include programme, sequence of installation, temporary works, dealing with adverse conditions, tools and plant, ancillary materials, labour, protection, coordination with other elements of works and regular inspections.

11.5.5 If it is anticipated that the cladding shall be erected from behind an edge protection system, the contractor shall liaise with the edge protection contractor to ensure that the installation procedure is agreed and the protection removed in agreed manner.

11.5.6 The installation drawings, method statement and procedures shall detail all the elements used to construct the works and shall clearly describe all operations including the following:

- Setting out and control points
- Details of isolation and packing
- Joint sealant application and cleaning procedures.
- Backer rod application locations, sizes and details of bond release tapes
- Torque requirements for all fixings
- Details of all lifting equipment
- Details of points that are susceptible to damage and not to be loaded during installation
- Details of protection
- Positions of all hidden fixings
- Compliance with all relevant CDM regulations associated with installation works

11.6 Operations and Maintenance Manuals

11.6.1 The Contractor shall produce an Operations and Maintenance manual for the Works. Two copies of the manual will be required. A draft copy of the proposed manual shall be submitted to the Architect not less than six weeks before the programmed date for

Completion. The manual shall be developed in parallel with the design and shall include, but not be limited to, the following information:

- The name, address and telephone number of each firm and/or Contractor involved in the supply or fabrication of materials, components, assemblies and finishes.
- A clear and concise description of the construction used to form the various elements within the Works. It shall be set out in chapters dealing with each element in turn. Its contents shall be comprehensively tabulated and its text cross-referenced. It shall be illustrated with sketches and Trade Literature and shall refer to the 'as-built' drawings.
- Copies of material, components and finishes certification and test reports as required by the Contract Documents.
- A method statement showing the means of access to all parts of the Works with recommended safe loading.
- A method statement covering the procedures for replacement of damaged or otherwise defective materials or components, and materials and components that have a design life less than the design life of the Works and will therefore require replacement during its life.
- Quality management record sheets including records of repairs to coatings.
- Recommendations and procedures for inspections, routine maintenance, lubrication, cleaning, suitable cleaning agents and painting.
- A full set of as-built construction drawings, updated to include any changes made up to the time of completion.
- The terms and conditions of any Warranties. Note that all Warranties for finishes shall be valid for periods of one year between cleaning.

11.6.2 Warranties

Warranties are required for the system and its components. Warranties or letters of certification, in writing are also required from material suppliers confirming that the materials are being used as per the requirements of the contract documents.
Collateral warranties and Professional Indemnity insurance for the external cladding works shall be provided in accordance with the time frame and quantities defined in the contract documents.

12 General Technical Requirements – (NBS - A)

12.1 Design and Service life

12.1.1 The works shall have a design life as defined in clause 3.1.4 of BS ISO 15686-1 of 30 years. The whole of the works and each component of the works shall perform for a service life as defined in clause 3.1.1 of BS ISO 15686-1 of 30 years. Within that period, the works shall perform or exceed the performance levels specified in this document with maintenance level 1 as defined in table 1 of BS 7543.

The following table gives an overview of the predicted service life and maintenance levels of the different components of the cladding system as per BS ISO 15686-1:2006 and BS 7543 –

	Item	*Predicted service life (years)*	*Maintenance Level (category)*
1	Cladding Systems	30	3
2	Steel windows frames and profiles	30	3
3	Aluminium frames and profiles	30	3
4	Galvanised steel sheet (internal)	30	3
5	Glass units	30	1
6	Laminated glass	25	1
7	Paint coating: PPC	25	2
8	Paint coating: epoxy, acrylic	25	2
9	Anodising	30	2
10	Gaskets	30 (internal) 25 (external)	1
11	Exposed sealant at external joints	15	1
12	Structural silicone sealant	30	1
13	Insulating material	30	3
14	Fire stops at slab edges	30	3
15	Doors, door mechanisms, pivots, hinges and moving parts	5	1
16	Ironmongery (excluding those given in 15 above)	10	2
17	Blinds (excluding motors and moving parts)	20	1
18	Motors and other electrical items	5	1
19	Composite panels	30	2
20	Miscellaneous materials	5	3
21	Stone	30	3
22	Stone composite	30	3

23	Glazed ceramic composite system	30	2

12.1.2 Materials and components which under the specified service conditions cannot meet the specified service life, i.e. need "repair" as defined in clause 3.5.1 of BS ISO 15686-1, will be identified and brought to the attention of the Architect. Details will be provided together with methods of renewal, replacement or mending.

12.1.3 Materials and components which under the specified service meet the service life of the cladding without loss of performance below those specified in this specification, but require maintenance as defined in clause 3.5.2 of BS ISO 15686-1 to the maintenance level specified, will be identified by the Contractor. These recommendations will be submitted to the Architect for review.

12.1.4 All structural fixings, framing, angles and other load bearing components will remain in position and support all specified combinations of loading for a period in excess of the service life of the Works without repair or maintenance.

12.2 Prescriptive Requirements

- The cladding contractor shall comply with the following general prescriptive requirements during design, fabrication and installation of the works:
- All fixings outside the vapour control layer (VCL) shall be stainless steel.
- Flexible vapour control sheets or membranes shall be continuously sealed and positively clamped together when connected together or to other systems.
- Site applied structural sealant is not acceptable.
- Smoke and fire stops shall be provided as per the building regulation requirements.
- Both inner and outer panes of double glazed units shall be laminated where these are subject to impacts.
- All gaskets, as far as possible, shall be accessible for inspection/ replacement.
- Wherever glass is used as a barrier, it shall be laminated safety glass class 1C1, as defined in BS 6180.
- Flexible vapour control membranes shall not span more than 100mm without support and shall be designed to resist maximum design wind load.
- No visible fixings shall be allowed to the face of the cladding when viewed both from the inside or outside

12.3 Corrosion Protection

12.3.1 As described in BS EN ISO 12944-2 'Corrosion protection of steel structures by protective paint systems' the environment shall be "C3 Medium".

12.3.2 The exposure conditions for concrete shall be classed as XC3/4 + XF1 as per BS 8500-1.

12.3.3 Where different metals are used together, provisions shall be allowed for adequate separation to prevent bimetallic corrosion. Please refer to publication PD 6484, 'Commentary on corrosion at bimetallic contacts and its alleviation'.

12.3.4 The use of bituminous paint will not be accepted.

12.3.5 The contractor shall carry out a corrosion risk assessment to demonstrate that the materials and their finishes comply with the design and service life mentioned in section 2.1.1 of this specification.

12.4 Infestation

The works shall ~~not be~~resist attack~~ed~~ or infested by micro-organisms, fungi, insects or other vermin.

12.5 Fire Propagation

Please refer to the fire strategy document for details of surface spread of flames class requirements, compartmentation requirements, fire and smoke stopping and smoke venting requirements.

12.6 Acoustic Performance

12.6.1 Airborme sound insulation of new glazing – the following minimum sound reduction performances shall be demonstrated by a laboratory testing of elements in accordance with BS EN ISO 14010-2. or if test data of the exact frame and glass configuration is not available, by assessment of test data of comparable systems.

Element	Minimum Sound Reduction Index, R, Hz					
	125	250	500	1k	2k	4k
New 8.8mm laminated glass to all internal and external refurbished frames (glass only)	23	28	34	37	37	41
New 10/12/6.4mm laminated secondary glazing to all external windows, included framework	27	28	36	41	42	50
New 10.8mm laminated secondary glazing to all internal windows including framework	27	31	35	38	38	45
New rooflights to west lightwells	TBC	TBC	TBC	TBC	TBC	TBC

12.6.2 Cavities between outer and inner secondary windows

The combined acoustic performance of primary and secondary windows is partly determined by the gap between them. The table below sets out the minimum cavities between the outer glazing and inner secondary glazing. The contractor responsible for the secondary windows shall ensure that these minimum values are maintained.

Zone	**Minimum cavity between outer and inner secondary glazing**
Euston Road, Ground and first floor	50mm, but if more space is available should be increased as much as possible
Euston Road, Second and third floor	20mm
Bidborough Street, all levels	20mm
Judd Street, Ground and first floor	40mm, but if more space is available should be increased as much as possible
Judd Street, Second and third floor	20mm
Tonbridge Walk, Camden Centre	150mm, but if more space is available should be increased as much as possible
Tonbridge Walk, Second and third floor	20mm
External lightwell G.LW.03 Interview room, Wedding Suite, Office	50mm, but if more space is available should be increased as much as possible
External lightwell G.LW.03, other areas	20mm
Internal lightwells	35mm

12.6.3 The new rooflights to the west lightwells shall have a laminated layer to help control impact noise from rainfall.

~~12.6.1~~12.6.4 Please refer to the acoustic consultant's strategy report for details of vertical and horizontal flanking transmission requirements.

~~12.6.2~~12.6.5 Movement and wind noise control – Incorporate measures in the detailed design to eliminate noise generated by:

- The effects of thermal and structural movements
- Wind and air movements, including creaking, rattling, whistling, 'slip-stick' noise.
- Helmhotz resonance. Apply baffles to any cavities which might generate tonal noise as a result of wind blowing through projecting features or over the facade surface.
- Vortex shedding. Leading edges of projecting features shall be shaped to eliminate vortex shedding.

12.6.6 Acoustic testing of sample - An advanced works sample window upgrade shall be carried out to one of the offices or meeting rooms overlooking Euston Road on Level 1. An appropriate room for this would be Office 1.04 or 1.03, each of which have a single window. Once this is done, acoustic measurements shall be conducted of traffic noise ingress to verify the achieved level against the target value of NR35 and to provide an indication of the expected noise ingress to the wedding suites.

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12.7 Air permeability

12.7.1 The cladding shall achieve a maximum of 5m³/hr/m² @ 50Pa as a minimum (whole building air tightness value).

~~12.7.1~~12.7.2 ~~Note that t~~The air permeability of the window openings ~~facade~~s will be mainly achieved by the new secondary windows, rather than the retained primary windows. Therefore the secondary windows and their perimeter seals shall be selected and installed to achieve this standard.

~~12.7.2~~12.7.3 Additionally, for pressure and suctions P (Pa), below 600 Pa, the air leakage shall not exceed q m3/hr/m where q is given by:

$$q = \left(\frac{P}{600}\right)^{\frac{2}{3}} \times 1.5 m^3/hr/m$$

12.8 Wind Resistance

In the absence of a wind tunnel test report, wind loads shall be calculated as per BS EN 1991 1-4:2005 + Amendment 1:2010 Euro Code 1. All doors and windows shall

confirm to BS EN 12210 and EN 12211 for classification performance in accordance with the above calculated wind load.

When tested to positive and negative applications of design wind loads with a factor of safety of 1.5, there shall be no permanent damage to assemblies, framing members, panels and anchors.

12.9 Vertical loads due to building occupants

Generally, internal ledges and framing members shall resist vertical loads due to building occupants and shall carry a point load of 1kN or a distributed load of 0.6kN/m. Ledges and framing members greater than 200mm deep and within 100mm of the finished floor level shall carry a point load of 1.6 kN or a distributed load of 1.0 kN/m.

12.10 Insulation

12.10.1 Thermal insulation shall be inert, durable, rot and vermin proof, CFC and HCFC free, have a global warming potential (GWP) of <5, shall not support mould fungal or bacteria growth and shall provide the specified performance for the service life of the works. Due allowance shall be made for the reduced performance of the insulation due to the effects of moisture and ageing.

12.10.2 The material used for thermal insulation shall confirm to the requirements of the Building regulations approved document Part B and thermal performance requirements of approved document Part L.

12.11 Vibration

12.11.1 The primary brackets and all fixings will be designed so that there will be no risk of loosening due to the effects of vibrations, or to the cyclic effects of load, deflections and thermal movement.

12.12 Security

Refer to architects window/ door schedules for security requirements.

12.13 Brackets and Fixings

12.13.1 Brackets, anchor bolts, screws, rivets, nuts and other associated fastening components used within the cladding assemblies shall support their self weight and transmit this weight back safety to the supporting structure without overloading or permanently displacing any of these components.

12.13.2 All anchors and supports shall be designed, fabricated and installed as per the performance criteria within this document without any distress to components. The general requirements for torquing of bolts/ screws shall be highlighted within the cladding contractor's drawings and tightening torque values to be clearly stated.

12.13.3 The choice of bracket and fixing material shall comply with the corrosion resistance requirements highlighted in section 2.2 above and allow for the following:

- Any movements due to thermal changes, deflections, settlement or creep.
- Constructional inaccuracies of supporting structure
- Shimming to accommodate local variations
- In case of any on site fixings to structural steelwork frames, the integrity of the steel corrosion protection shall not be compromised.

12.14 Locked in Stresses

Locked in stresses are those that can develop within individual panels as a result of various fixings that are so secure and rigid that they do not allow for thermal or other movements within the panel. The cladding contractor shall avoid such instances within their design and detailing of the cladding elements that may be detrimental to the performance of the works during their service life.

12.15 Tolerances

12.15.1 Fabrication tolerances

The following tolerances apply to fabricated metal panels and components:

- Length/ width: maximum allowed deviation +0/-1mm up to 3metres; +0/-2mm over 3 metres.
- Straightness/ flatness: Any surface or edge shall not deviate more than 2mm from a straight edge of length 2 metres placed alongside it.
- Twist – No section shall twist more than +/- 1 degree over the length of the section.
- The gaps in butt and mitred joints shall be no greater than 0.5mm.

12.15.2 Installation tolerances

The cladding contractor shall check and confirm dimensions on site prior to installation. The setting out of the works shall be from the grid and datum lines (established by others). The following tolerances are applicable during installation:

- Line and level : +/- 2mm for one storey height and structural bay width and +/- 5mm overall
- Plumb and Plane: +/- 2mm for one storey height and structural bay width and +/- 5mm overall
- Please refer to CWCT standard for systemised building envelopes (clause 7.4.6) for joint variation allowances.

12.16 Accommodation of building movement

The works shall accommodate the following movements noted below without any reduction in the performance –

- Deflections due to design dead loads and live loads
- Deflections under repeated cycles of the design wind loads
- Changes in dimension and shape arising from specified building movements, including settlement, shrinkage, elastic shortening, floor beam deflections, creep, wind sway, twisting and racking and thermal and moisture movements.

12.17 Water vapour permeability and condensation

The works shall be designed to mitigate any risk of condensation on or behind the building side of the vapour barrier, or on surfaces or in areas which compromise the performance of the building envelope. The existing primary steel windows have non-thermally broken frames. The new secondary aluminium windows will also be provided without thermal breaks. Therefore some condensation is permissible in the cavity between the primary and secondary windows. This risk shall be mitigated by limited air exchange between the cavity and the external environment and maintaining low permeability of the inner secondary windows. Condensation shall not occur on the room facing surfaces of the inner windows. All materials in areas where condensation may form shall be resistant to moisture. The contractor shall prepare detailed condensation risk assessment calculations and submit these to the architects for review during the design development stage. These calculations shall be as per BS EN ISO 13788 document.

12.18 Service temperature ranges

12.18.1 The following service temperature ranges shall be allowed for the works. These values are taken from BRE digest 228 and CWCT standard for systemised building envelopes.

External Surface Temperatures (BRE Digest 228)	
Cladding walling and roofing	
Heavyweight Light colour	-20°C to + 50°C
Heavyweight dark colour	-20°C to + 65°C
Lightweight insulated Light colour	-25°C to + 60°C
Lightweight insulated dark colour	-25°C to + 80°C
Glass	
Clear	-25°C to + 40°C
Coloured or solar control	-25°C to + 90°C

12.19 Barrier Loads

Where part of the facade acts as a barrier it shall be designed in accordance with BS 6180 and CWCT TN 69.

13 Doors and Windows – (NBS - L10 and L20)

The requirements in this section shall apply to all doors and windows, other than steel casements, which are specified in section 14.

13.1 References

This section is based on EN 14351-1:2006 'Windows and Doors – Product standard, performance characteristic'. In addition to this, the works shall comply with BS 6375 which is the national application document for EN 14351.

13.2 Wind Loads

Design windload = 1200 Pa. Refer also to BS 6375-1

13.3 Resistance to snow and permanent load

As per BS 6375-3

13.4 Fire characteristics

Refer to the fire consultant's strategy report for details of cladding related fire characteristics

13.5 Watertightness

13.5.1 All external doors and windows shall comply with EN 12208 and prEN 1027 for calculations and weather tightness testing respectively. The external doors and windows at the ground level retail areas shall be Class 7A and 7B (fully exposed and partially shielded respectively). The swing and sliding external doors/ windows at typical levels / balconies etc shall be Class 9A (unshielded) and Class 7B (shielded).

13.5.2 Refer to BS 6375-1

13.6 Impact resistance (drop height)

13.6.1 Refer to section 5 of this document for details. Drop height shall be class __ as per BS EN 13049: 2003.

13.6.2 The doors and windows must have an impact resistance equivalent to that of the glass which it holds in place.

13.7 Load bearing capacity of safety devices

13.7.1 Windows shall be a minimum of class 3 as defined in BS EN 13115:2011 when tested to BS EN 14609, with safety devices engaged and the loads applied, 'in the most unfavourable position and/or direction'.

13.8 Ability to release

13.8.1 This clause does not apply to windows

13.8.2 Emergency exit devices, hinges and panic devices installed on external pedestrian doorsets in escape routes shall comply with EN 179, EN 1125, EN 1935, prEN 13633 or prEN 13637.

13.8.3 Doorsets on escape routes with emergency exit or panic device shall conform to BSEN 179 or BSEN 1125 as appropriate.

13.9 Acoustic Performance

13.9.1 The façade and glazing shall be capable of minimum performance levels stated in the Acoustics section of General Requirements section 12.6.

13.9.2 Acoustic requirements shall apply to the window or door system as a whole, including framework and perimeter seals.

13.10 Thermal Transmittance and radiation properties of glazing

13.10.1 Refer to the performance requirements section of this specification for criteria.

13.11 Air permeability

13.11.1 All external doors and windows shall comply with EN 12207 and prEN 1026 for calculation and air permeability testing respectively. All external doors and windows shall be Class 2.

13.12 Durability general

13.12.1 The durability of a product shall be determined in accordance with the relevant national material product standard. For UK these include, but are not limited to, BS 644 (timber windows), BS 4873 (aluminium windows), BS 6510 (Steel windows and glazed doors) and BS 7412 (PVC-U windows).

13.12.2 The mechanical durability of doors will be class 7 in accordance with BS EN 12400.

13.12.3 The mechanical durability of opening windows in curtain walling will be class 3 in accordance with BS EN 12400.

13.13 Operating forces

13.13.1 Windows – The declared performance of the windows shall not exceed Class 1 for operating forces as defined in BS EN 13115:2011, when tested to BS EN 12046-1.

13.13.2 Doors – The declared performance of the doorsets shall not exceed Class 1(External Doorsets) and Class 2 (Internal Doorsets) for operating forces as defined in BS EN 12217, when tested to BS EN 12046-2.

13.14 Mechanical strength

13.14.1 The strength of doors will be class 3-4 in accordance with BS EN 1192.

13.14.2 BS 6375-2 para 5.2.1 requires windows to satisfy class 3 for static torsion as defined in BS EN 13115:2011, when tested to BS EN 14609.

13.14.3 BS 6375-2 para 5.2.2 requires windows to satisfy class 3 for racking as defined in BS EN 13115:2011, when tested to BS EN 14608.

13.15 Ventilation

13.15.1 The works shall be designed to satisfy EN 13141-1 for the declared values specified by the M&E engineer.

13.16 Bullet resistance

13.16.1 Not applicable

13.17 Explosion resistance

13.17.1 Not applicable

13.18 Resistance to repeat opening and closing

13.18.1 Windows - The declared performance achieved by the windows shall not be less than Class 2 / 10000 cycles (minimum requirement as per BS 6375-2) as specified in EN 12400 and tested in accordance with EN 1191.

13.18.2 Doors - The doorsets shall comply with Class*__* as per BS EN 12400 (based on their category of duty as defined in table A2- usage) when tested in accordance with BS EN 1191.

13.19 Behaviour between climates

13.19.1 Windows – A climate test on windows with frames manufactured from a combination of materials shall be carried out in accordance to BS EN 13420. The windows shall have no reduction in performance or visible damage following the test.

13.19.2 Doors – A climate test on external pedestrian doorsets shall be carried out in accordance with BS EN 1121 and the results shall be expressed in accordance to BS EN 12219. The doors shall have no reduction in performance or visible damage following the test. (*Note – This test is only applicable to doors 'which contain hygroscopic material which might influence their behaviour during this test .i.e. timber/ timber composite systems. This is stated in section 1 of BS EN 1294)

13.20 Burglar resistance

13.20.1 Basic resistance shall be demonstrated by the test method given in appendix A of BS6375-3.

13.20.2 Enhanced security for doorsets shall comply with the requirements of PAS 24

13.21 Power operated external pedestrian doorsets

13.21.1 Safety in use – comply with BS EN 16005: 2012

13.21.2 Controlled door closing devices will comply with BS EN 1154.

13.21.3 Electrically powered hold-open devices for swing doors will comply with BS EN 1155.

13.22 Power operated windows

13.22.1 Electrically operated windows shall conform to BS EN 60335-2-103.

13.22.2 Pneumatically and hydraulically driven equipment shall conform to BS EN 12453:2001, 5.2.3 and 5.2.4.

13.23 Revolving Doors

13.23.1 The revolving door shall be:

- Four leaf, central axis, automatic/ power assist revolving glass door with metal/glazed drum walls, glass side panels and glass roof. The system shall include ~~a floor mounted~~an overhead automatic drive unit, anti-vandalism brake, ceiling integrated down lights, program switch for adjustment of functionality, sequential operation rotating in both directions and including a suite of radar and presence sensing safety system comprising of movement sensors, passive and active safety devices.
- Diameter and height of the doors shall be as indicated in the Architect's drawings.
- All visible framework and ironmongery shall be as per the Architect's drawings/ ironmongery schedule.

13.23.2 The door shall confirm to the requirements of:

- BS 7036-0:2014, Power operated pedestrian doorsets – Safety in Use – Code of practice for risk assessment and risk reduction
- BS EN 16005:2012 Power operated pedestrian doorsets – Safety in use – requirements and test methods

13.23.3 Sensors shall be ceiling mounted.

13.23.4 The drum walls shall be a curved framed safety glass/ metal with metal panelling.

13.23.5 The door wings shall be safety glass with central column and central midrails.

13.23.6 The door leafs shall incorporate easily exchangeable brush seals to the surrounding framework/ panels to mitigate drafts.

13.23.7 The door shall have a manual breakout facility (.i.e. collapsing mechanism permitting the leafs to fold to emergency exit position) for emergencies.

13.23.8 The door assembly shall be lockable with key operated patch fittings located on the lower edge of the door leaf and only accessible from inside the building.

13.23.9 The door assembly shall be fitted with an electro-magnetic lock system with an unlocked failed state.

13.23.10 Any moving parts of the door assembly which require lubrication on a regular basis shall be designed to be easily lubricated without the removal of excessive door components.

13.23.11 The revolving door shall have a damped action such that after operation the door shall slow gradually to a stop. The door operation shall be smooth and quiet at all times. The drive mechanism shall also incorporate safety cut-off features in case of emergency.

13.23.12 The revolving door system shall include provision for an Air curtain that shall be supplied with custom plenum/ ducting to suit the curvature of the door. A plenum cover shall be available and is recommended for most installations. The air curtain shall be available with a choice of water, electric heating or ambient unheated and include all relevant accessories .i.e. automatic controls with manual overrides, BMS interface etc. The design of the air curtain shall be co-ordinated with the MEP heating and ventilation strategy.

13.23.13 The electrical power supply requirement of the door, heater and any associated control gear shall be co-ordinated with the Main Contractor.

13.23.14 The door shall incorporate a concealed key-activated control panel which shall allow change of operating mode at a local level.

13.23.15 The contractor shall make an allowance sufficient to cover any of the following:

- Infra / microwave sensors concealed into the roof / side panel framing on both the inside and outside of the building.

- Push pad mounted on a pedestal adjacent to the door on both the inside and outside of the building.
- Contactless card sensor mounted on a pedestal adjacent to the door on both the inside and outside of the building.
- Numerical keypad mounted on a pedestal adjacent to the door on both the inside and outside of the building.

13.23.16 Provision shall be made for linking of the door control gear to the Building Management System. As a minimum this shall include:

- Remote 'lock down' functions.
- Fire alarm interface.
- Door position feedback.

14 Steel and Brass Casement Windows (NBS L10)

Note that this project has a combination of retained products and new products. The requirements listed in the section shall apply to new products only. Requirements for refurbished products shall be agreed separately.

14.1 Product reference:

W20 range mild steel window sections.
- Mild steel: To BS EN 10025-2 and cold straightened.
- Manufactured in accordance with BS 6510: 2010 and recognised good practice.
- Weather tightness: To BS 6375-1:2015+A1:2016
- Exposure category (design wind pressure): 1200 (Pa) unless otherwise specified.
- Air permeability, water-tightness and window resistance test data:

Window Type	Air permeability	Water Tightness	Wind Resistance	Exposure Category
Fixed light	600 Pa	300 Pa	2400 Pa	2400 Pa
Top / side hung open out	300 Pa	200 Pa	2000Pa	2000 Pa
Side / bottom hung open in	300 Pa	200 Pa	2000 Pa	2000 Pa
Horizontal pivot casement	200 Pa	100 Pa	1600 Pa	1200 Pa
Vertical pivot casement	200 Pa	50 Pa	1600 Pa	1200 Pa

- Operation and strength characteristics: To European harmonized testing methods specified in the window and door product standard BS EN 14351-1 and to BS 6375-2 Performance of Windows and Doors – Operation and Strength.
- Construction: Frames shall have welded corners, dressed square and flat, and be sized within tolerances of +/2mm. Tee glazing bars shall be tenon riveted and/or welded to frames and interlock with rigid joints displaying face gaps of no more than 1mm.
- Hot dip galvanising: Frames and ancillary profiles (steel attachments, coupling members and ancillaries) shall be positively rust-proofed by hot-dip galvanising to BS EN ISO 1461.
- Acoustic insulation: Sound insulation of weather stripped windows/doors ~~(approximate values averaged over a frequency range of 100 to 3150Hz) to be 20-28dB reduction (Single Glass) / 28-30dB reduction (Double Glass) / 35-40dB reduction (with secondary window and 200mm cavity~~to be as stated in section 12.6).
- Weather-stripping: Black polymer rubber gaskets retained in groove within the sections and secured using adhesive.
- Sightlines (typical) of window range to be no more than:
  - Fixed light: 35mm (using extended perimeter fixing legs) / 22mm (using short perimeter fixing legs)

- Opening window: 69mm (using extended perimeter fixing legs) / 56mm (using short perimeter fixing legs)
- Glazing bar: True steel "T" section (not face applied): 29mm on elevation and 32mm deep.

14.2 IRONMONGERY / ACCESSORIES (installed at factory):

- Hinged casements shall have rust-proofed steel or brass hinges, face mounted and welded, screwed or riveted to the frame. A variety of handles, catches, stays and openers, with locking options, are available in chromed or toned brass, anodised or painted aluminium, and chromed or painted zinc alloy. Double fasteners shall be fitted on ventilators over 1200mm long or 1500mm high.

14.3 FINISH COATING

- Type / reference: Polyester powder coating to BS 6497 or BS EN 13438
- Preparation: Following galvanising, windows are chemically cleaned and pre-treated to provide a surface to which powder coating will adhere.
- Covering: Minimum 60 microns on all significant surfaces.
- Colours: Any standard RAL colour reference
- Gloss level: Standard matt (30% +/- 7% gloss level). Optional semi-gloss and full gloss levels available.
- Process: Coating will be undertaken by our specialised polyester powder coat applicator.

14.4 PRIMING / SEALING

- Timber surfaces inaccessible after installation: Prime or seal as specified before fixing components.

14.5 REPLACEMENT WINDOW INSTALLATION

- Standard: To BS 8213-4.

14.6 WINDOW INSTALLATION GENERALLY

- Installation: Into prepared openings.
- Gap between frame edge and surrounding construction: Minimum: 2mm / Maximum: 8mm
- Distortion: Install windows without twist or diagonal racking.

14.7 FIXING OF WOOD FRAMES (timber subframes where required)

- Standard: As section Z20.
- Fasteners: Windows shall be supplied with rust-proofed screws, plugs, and/or lugs to suit specified openings.

- Spacing: When not pre-drilled or specified otherwise, position fasteners not less than 150mm from ends of each jamb, adjacent to each hanging point of opening lights and at maximum 450mm centres.

14.8 FIXING OF STEEL FRAMES

- Standard: As section Z20.
- Fasteners: Windows shall be supplied with rust-proofed screws, plugs, and/or lugs to suit specified openings.
- Spacing: When not pre-drilled or specified otherwise, position fasteners not less than 50mm and nor more than 190mm from ends of each jamb, adjacent to each hanging point of opening lights and at maximum 900mm centres.
- Composite assemblies: Shall be delivered in separate units to be coupled together on site.

14.9 BACKFILLING OF STEEL FRAME SECTIONS

- Windows fixed direct into openings: When required for weathering - after fixing, fill back of steel frame with waterproof cement fillet, or use an impregnated expanding sealing tape.

14.10 IRONMONGERY installed at site

- Fixing: Assemble and fix carefully and accurately using fasteners with matching finish supplied by ironmongery manufacturer. Do not damage ironmongery and adjacent surfaces.
- Checking / adjusting / lubricating: Carry out at completion and ensure correct functioning.
- Material compatibility: Glass/plastics, surround materials, sealers primers and paints/clear finishes to be compatible.

- Fully protect putty with coating system as soon as it is sufficiently hard
- Extend finishing coats on to glass up to sight line.

14.11 FASTENERS GENERALLY

- Materials: To have:
- Bimetallic corrosion resistance appropriate to items being fixed.
- Atmospheric corrosion resistance appropriate to fixing location.
- Appearance: Submit samples on request.

14.12 PACKINGS

- Materials: Non-compressible, non-corrodible, rot proof.
- Area of packings: Sufficient to transfer loads.

14.13 MASONRY FIXINGS

- Light Duty: Plugs and screws
- Heavy Duty: Expansion anchors or chemical anchors

- Integrity of supported components: Select types, sizes, quantities and spacing of fixings, fasteners and packings to retain supported components without distortion or loss of support.
- Components, substrates, fixings and fasteners of dissimilar metals: Isolate with washers/ sleeves to avoid bimetallic corrosion.
- Appearance: Fixings to be in straight lines at regular centres.

14.14 FIXING THROUGH FINISHES

- Penetration of fasteners and plugs into substrate: To achieve a secure fixing.

14.15 FIXING PACKINGS

- Function: To take up tolerances and prevent distortion of materials and components.
- Limits: Do not use packings beyond thicknesses recommended by fixings and fasteners manufacturer.
- Locations: Not within zones to be filled with sealant.

14.16 SCREW FIXING

- Finished level of countersunk screw heads:
- Exposed: Flush with timber surface.
- Concealed (holes filled or stopped): Sink minimum 2 mm below surface.

15 Materials – Z11 (metalwork), Z12 (Steel Finishes) and 20 (Fixings/Adhesives)

15.1 Identification of materials

All primary material delivered to the fabrication factory or the site shall bear details of the manufacturer's name and all associated data required to verify the exact nature of the material and relate it to the contract requirements. The materials shall bear the work test certificates, British standards certification, Trade Marks, CE Marks and British Board of Agreement certificate mark. Test certificates shall include, whenever applicable, the location in the works or the delivery or batch which the sample represents.

All the selected materials shall remain compatible to other materials around conform to the general requirements within this document. Unspecified materials shall be reviewed and approved by the architects.

15.2 Deleterious materials

Materials shall be selected by reference to, 'Good practice in the selection of materials' available from the British Council of offices (BCO) and the British Property Federation.

15.3 Standards

All materials shall conform to the appropriate British and European Standard specifications. The contractor shall provide the architects with guarantees, certificates of conformity from the material suppliers proving that the materials to be used conform to such specifications.

15.4 Framework and metal assemblies

15.4.1 Metals shall be welded in accordance with the relevant standards using methods to avoid distortion and physical integrity. The type, size and shaping of any welds shall be indicated on cladding contractors design drawings and approved by the architects before fabrication.

15.4.2 Welds shall be fully bonded throughout their length without holes, inclusions, cracks or porosity to ensure that long term performance is not compromised and the welds are strong enough for the design requirements. Where visible or impinging on other work, the welds shall be ground smooth and flush with the adjoining surfaces. Site welding shall not be allowed. All completed welded constructions shall be finished to prevent corrosion and all welds shall be cleaned as necessary to ensure durability of the connections.

15.4.3 Grinding, cutting and shaping of all metals shall be carried out using equipment that do not contaminate them with particles which could lead to staining or corrosion.

15.4.4 Arc cutting and acetylene gas cutting shall not be used except where necessary to modify existing steel products off-site.

15.4.5 Joints shall be accurately formed without lipping or offsets in visible surfaces unless designed otherwise. Other joints shall be rigidly secured to prevent all but designed movement, unless shown otherwise.

15.4.6 Maximum allowable tolerances for framework shall be:

- +/- 1.5mm for length of mullion (3m storey high)
- +/- 1mm on length of transom (1.5m c/c)
- +/- 0.5mm on length and width of pressed aluminium sheets (1.5m c/c)
- +/- 1mm on length of diagonal of sheet and not more than 2mm between 2 diagonals. (1.5m c/c)

15.5 Aluminium Components

15.5.1 Aluminium extrusions

All extruded aluminium components shall comply with BS EN 755, BS 1161 and BS EN 515. The extrusions and their applied finishes shall be fit for purpose. The design shall comply with BS 8118. The extrusions shall have wall thicknesses appropriate for their structural requirements and shall eliminate permanent distortion in the finished works. Extruded profiles shall be free of weld lines or die lines which are visible from a distance of 2m, after the specified finish has been applied

15.5.2 Pressed Aluminium sheets

Sheets for hidden flashings shall not be less than 1.6 mm thick. Sheets for all components exposed to view or to impact including copings, panels and visible closures shall not be less than 3 mm, and shall have the chemical composition and temper appropriate for its function. They shall comply with BS EN 485 and BS EN 573

15.5.3 Welding and consumables

Welding procedures shall comply with BS EN 288-4 and welders shall be certified to BS EN 287. Welding shall comply with BS EN 1011-4 and shall be tested in accordance with BS 3451, BS EN 895 and BS EN 910.

15.6 Steel Components

15.6.1 Stainless Steel – Plates, sheets and strips

- Stainless steel sections shall comply with BS EN 10088-3.

15.6.2 Mild Steel

- The use of mild steel shall only be permitted where the component is readily accessible for regular inspection and maintenance. The use of mild steel shall be restricted in accordance with section 2 of this specification. Where used, it shall be one of the following:
- Hot rolled steel complying with the requirements of BS EN 10025.
- Hot rolled sections to BS 4: Part 1, BS EN 10210-2 and BS EN 10021-1, tubes to BS 6323: Parts 1, 2 & 3 and angles to BS 4848: Part 4.
- cold formed pre-galvanised steel sections to BS EN 10327, BS EN 10143, BS EN 10147
- Steel sheet to BS 1449: Part 1.
- Ordinary bolts and nuts to BS EN ISO 4032, BS EN ISO 4033, BS EN 24034.
- All plain and tapered washers to BS 4320, Form E.

15.6.3 Hot dip galvanising

Where mild steel sections or fabrications are hot dip galvanised, the following additional specification shall apply –

- Mild steel shall have a carbon equivalent equal to or less than 0.43%
- All welding procedures and welding procedure specifications shall be limited to a maximum carbon equivalent of 0.43%

15.7 Insulation

Thermal insulation shall be inert, durable, rot and vermin proof, CFC (Chloro fluoro carbon) free, HCFC free (Hydro Chloro Fluoro Carbon), shall not support mould growth and shall provide the required thermal performance for the service life of the works. Allowances shall be included for reduction in thermal performance due to effects of moisture and ageing within the thermal calculations. Insulation materials shall not be injurious to human health in service and during removal and replacement.

Insulation shall be Class A2-s1,d0 or better and one of the following materials:

- Mineral wool - EN 13162
- Cellular glass – EN 13167

15.8 Fixings and fasteners

15.8.1 Fixings and fasteners shall comply with BS EN ISO 3506-1 and BS EN ISO 3506-2

15.8.2 Unless noted otherwise, grade A4 shall be used for visible fasteners, in all other circumstances grade A2 shall be used.

15.8.3 Set screws shall comply with BS EN ISO 3506-3

15.8.4 Self tapping screws shall conform to BS EN ISO 3506-4.

15.9 Gaskets

15.9.1 Gaskets and seals used to achieve the required weather and air tightness shall be selected in accordance with BS EN 12365-1 to fully accommodate the range of dimensional tolerances associated with fabrication and installation of the works.

15.9.2 The gaskets shall be free from contact and migration stain and shall be compatible with all substrate, sealant and finishes with which they are likely to come into contact. The gaskets shall be free of mould flash.

15.9.3 Extruded rubber gaskets shall comply with BS 4255.All materials must be compatible with substrate, sealants, finishes and other materials in the joint system.

15.9.4 The gasket materials shall be able to maintain their elastic properties, dimensions and resistance to physical and chemical attack sufficiently to maintain the full performance during its design life. All gaskets providing the water and air seals shall be formed into complete frames with factory formed injection moulded vulcanised corner joints.

15.10 Setting blocks

Setting blocks shall be silicone rubber, polychloroprene (Neoprene), polypropylene or EPDM of an appropriate hardness. Carbon compounds for fillers and durability agents shall not leach out over time and cause staining.

15.11 Sealants (non-structural)

Sealants shall be selected and applied in accordance with the guidelines contained in BS 6213, BS En ISO 11600 and CIRIA guide 178. Sealant shall be:

- Silicone sealant

- Two part polysulphide sealant
- As proposed by the cladding contractor to the appropriate British or European standards, subject to written confirmation from the manufacturer that the product is fir for purpose.
- Backing rods shall be closed cell polyethylene foam. When closed cell sections are used non-gassed produced shall be selected. Colour of the visible sealant used shall be as specified on the architects drawings.

15.12 Flashings and Vapour control layers

All flashings and vapour control layers shall resist the deleterious effects of water, cleaning agents, temperature variations expected from the specified temperature ranges, gaseous pollutants (including ozone), weak acids deriving gaseous pollutants dissolved in water and UV radiation to which they may be exposed during installation and in service.

15.12.1 Vapour control Layers

- All vapour control layers shall have a minimum vapour resistance of 200 mN.s/g. The vapour resistance shall be as per BS EN ISO 13788 and BS 5250. The material shall preclude the movement of water from internal areas to the cold side of the construction to avoid any interstitial condensation. Any water vapour already within the construction shall be allowed to evaporate to the outside. Performance shall be maintained at joints between the individual pieces of the vapour control layer material and joints shall be overlapped and positively sealed.
- All proprietary membrane waterproofing systems shall be CE marked and shall have product data sheets giving details of their performance and test verifications. The cladding contractor shall provide all related technical information for the material to demonstrate compliance with this specification.

15.12.2 Flashings

- Materials used for flashings shall be stainless steel, coated aluminium or one of the following membranes;
- Flexible ethylene-propylene diene monomer (EPDM)
- Flexible chlorosulphonated polyethylene
- Flexible chloroprene, non-cellular chloroprene products shall comply with the requirements of BS 4255-1.
- Flexible butyl rubber
- Flexible Polyvinyl Chloride (PVC)

Flashings shall maintain their performance and properties for the expected service life of the product. They shall have the necessary mechanical properties to withstand installation and specified design loads.

16 Powder Coating – (NBS - Z31)

16.1 General

- ~~All aluminium surfaces shall be coated with the Interpon D3000 Hyper Durable Flourcarbon system or equal approved and must comply with AAMA2605-05, Qualicoat Class 2 and EN12206~~.

16.1.1 The coating shall be applied by an Applicator recognised and approved by the manufacturer of the powder.

16.1.2 The Applicator shall be nominated by the Contractor and subject to the approval of the Architect. The same Applicator shall be used for the duration of the Works. The Applicator shall operate an ISO 9001 approved quality assurance system.

~~16.1.2~~16.1.3 Applicators shall be licensed members of Qualicoat and / or Qualisteelcoat organistaions.

16.2 Aluminium-

16.2.1 Aluminium surfaces shall be coated with the Interpon D2525 system or equal approved and must comply with AAMA2605-05, Qualicoat Class 2 and EN12206

16.3 Steel

16.3.1 New steel surfaces shall be galvanised and coated with the Interpon D2525 system or equal approved and must comply with AAMA2605-05, Class 2 and EN12206

16.3.2 Refurbished steel surfaces – shall be grit blasted, pre-treated and coated with the Interpon D2525 system or equal approved and must comply with AAMA2605-05, Qualicoat Class 2 and EN12206

16.3.3

16.4 Brass (Architectural Bronze)

16.4.1 Refurbished brass surfaces shall be powder coated

~~16.2~~16.5 Fabrication Requirements

Fabrications may be from pre-finished lineal or machine lengths at the recommendation of the Applicator. Care shall be taken to avoid scratching and damage to the coatings during the fabrication. Where machining could leave exposed un-coated surfaces, e.g. pivot hung

ventilators, etc or visible cut edges on sheet metalwork, the work shall be coated after all machining. Where coating is to be carried out after machining, satisfactory jigging points shall be agreed between the Contractor and the coating Applicator and then the Architect. Two sample joints shall be submitted to the Architect for approval, prior to fabrication.

~~16.2.1~~16.5.1 Colour and colour control

The finish colour shall be as per the architect's drawings subject to sample approval. Colour control and gloss limits shall be submitted by the cladding contractor for the review and approval of the architects. The following samples showing the variations in colour and texture:

- 2 extrusions, typical for the works, each 1200mm long
- 2 sheets, typical for the works, each not less than 1200 x 300mm
- Upon approval of the architect, these samples shall be labelled and distributed among the following as benchmarks for the duration of the works –
- Main contractor
- Architect
- Applicator
- Independent inspector

~~16.3~~16.6 Coating Conditions

Coating shall be carried out under conditions of acceptable good practice for architectural applications. The processing conditions shall be held constant for the duration of the period required for completion of the contract. Records of these conditions shall be kept and made available for inspection in the event of a dispute as to the quality of the finished coating.

~~16.4~~16.7 Acceptance testing

~~16.4.1~~16.7.1 Third party inspections

- Provisions for a minimum of 3 acceptance inspections to be conducted by an independent inspection authority by the cladding contractor. The cladding contractor shall provide details of the proposed independent inspection authority and shall be subject to the approval of the architect.

~~16.4.2~~16.7.2 Sampling procedures

Sampling procedures and plans shall comply with Qualicoat guidelines.

~~16.4.3~~16.7.3 Certifications

Inspection certificates demonstrating that all relevant tests required by EN 12206 and this specification have been carried out and that the coating complies with the minimum requirements in all respects, shall be submitted on request, to the architect for review.

~~16.5~~16.8 Temporary protection

All coated surfaces vulnerable to damage during handling and installation or by subsequent site operations, shall be fully protected for the duration of the Works. Protective coverings shall be resistant to all weathers. Prior to installation, they shall be removed from areas inaccessible after installation. Where necessary, they shall be partially removable and replaceable for access to fixing points during installation and/or subsequent site operations. Any protective tapes used in direct contact with the coating shall be low tack, self-adhesive type in white or any colour lighter than the coating to be covered. It shall be applied and removed in accordance with the recommendations of the Applicators guidelines. Protective tapes shall not be kept in contact with coated surfaces for longer than 6 months. Should the protective covering need to remain in place following installation, the Contractor, shall, with the Architect, agree a programme for periodic inspections and make good/replace the coverings as may be required. See also the Lend Lease Contractor's requirements for temporary protection.

~~16.6~~16.9 Damaged surfaces

The viewing distance for damage shall be 1.0 m for internal surfaces and 2.0 m for external surfaces. The rectification of damage to coated surfaces finishes shall be permitted, but only in accordance with an agreed method, which must be endorsed by the manufacturer of the powder, the Applicator and the Architect. Sample patches of touch-up rectifications will be submitted on the same basis as the colour control samples listed above.

~~16.7~~16.10 Cleaning and maintenance

The cladding contractor shall provide detailed instructions for maintenance of the coating and ensure that the manufacturer's recommendations are complied and fulfil the requirements of the coating warranty.

These recommendations include but are not limited to:

- Washing frequency
- Cleaning agents to be used and their dilution levels
- Type of cleaning materials
- Recommendations for deep cleaning and their frequency.

17 Visual Mock-Ups and Samples – (NBS - A)

17.1 Visual mock ups

- The contractor shall remove and reinstall one reconditioned primary steel window, together with a new secondary window into one typical structural opening on the First floor at a location to be agreed with Lend Lease and the Design Team. Note that this mock-up shall also serve as an acoustic testing sample – see section 12.6
- Similarly, the Contractor shall install a primary and secondary to one structural opening on the second floor.
- The above mock-ups shall be fitted with all the proposed hardware and shall demonstrate the operation of the opening windows and the method of cleaning and maintaining them.
- The visual mock ups shall include the proposed frame profiles (colour and finish), the glass proposed in the works, replicating the internal and external appearance of the systems as in the finished works. Any deviations to the above shall be proposed to the architects for approval.
- The mock-ups shall include the timber reveals between the primary and secondary windows and the interfaces with the existing wall panels on the first floor.

17.2 Quality control samples (Benchmarking)

17.2.1 The standard of workmanship for the Works will be to an agreed standard established by the construction of the On-site Quality Control Samples. The Architect will review and comment on the Onsite Quality Control Samples. If the Contractor continues with the installation of any of the Works before the Architect has reviewed and commented on the On-site Quality Control Samples, it does so at its own risk. The Architect may require parts of the sample to be dismantled to allow inspection of concealed details. Upon acceptance, the on-site control samples will remain as part of the installed permanent Works. The Architect will reject workmanship that falls below the accepted standard and will require the Contractors to remove it and re-install it to the acceptable standard.

17.3 Post contract samples

The following post contract samples shall be provided to the architects after the award of contract:

- Double glazed units and single glazed panes(600x600mm)

- Aluminium extrusions in the required finishes (600mm length)
- Steel profiles in the required finishes (600mm length)
- All ironmongery (two pieces of each type of window and door fittings)

18 Performance Testing – (NBS - A)

18.1 General

The cladding contractor shall demonstrate compliance with the performance criteria of this document with the following:

- Producing existing test data for proprietary cladding systems.
- Submitting detailed design drawings.
- Site hose testing of the completed works
- Carrying out all other performance testing as set out in the final contract documents
- Construction of off-site and on-site quality control samples as described in the final contract documents.
- Providing samples and constructing of all mock ups.
- Producing calculations

18.2 Site hose tests This section does not apply to refurbished products.

18.2.1 Areas – Site hose tests shall be carried out by an independent testing authority and arranged by the cladding contractor. These shall be carried out on 10% of the areas of completed works. The areas shall be marked by the cladding contractor and submitted to the architects for approval.

18.2.2 Hose tests shall be carried out in accordance with the requirements of the Centre for Window and Cladding Technology Standard for systemised building envelopes, Section 8 – Testing and Standard test methods for building envelopes, Section 9.

18.2.3 The independent testing authority shall check for leaks at the test area and at the floor below the test area inside the building.

18.2.4 Format of test reports – 2 copies of the site hose testing reports shall be prepared and submitted to the architects for review. The reports shall include the following information –

- Date of testing and of report
- Identification of the tested areas.
- A note of the prevalent weather conditions (wind) during the time of test.
- Testing methodology

- Statement that the test was carried out as per the CWCT standards and a description of any noted deviations from the above.
- A statement indicating whether the test was successful and notes of any leakages through and/or directly below the tested areas together with indication of the severity of leakage.
- Name and author of report
- Name and address of the independent testing authority that conducted the tests and the requester of the tests.
- List of official observers and supervisors of the test and their signatures.

18.3 Building air leakage test

18.3.1 The test shall be carried out by an independent test authority accredited by ATTMA in accordance with BS EN 13829. The air leakage test shall not exceed the values given in this ~~specification~~ document.

18.3.2 In the event of air leakage exceeding the specified values included within this specification, the cladding contractor shall identify all the leakage paths and carry out remedial works. The architects shall be provided with a report showing the extent of the leakage and the proposed remedial measures for approval. The building shall be tested again to demonstrate compliance with the required air leakage limits upon completion of the remedial works.

18.3.3 Note that the air permeability of the facades will be achieved by the new secondary windows, rather than the retained primary windows.

18.4 Acoustic tests

See section 12.6

19 Technical Processes and Quality Control (NBS - A)

19.1 Technical Processes

- Comply with all the relevant National and Local Government Regulations
- Liaise with the Principal designer, Design team, local authorities and provide all information necessary to complete the Health and Safety file required by CDM regulations 2015.
- Use recognised industry good practice standards and comply with all the relevant standards and codes of practice listed in this document.
- Prepare a detailed programme for the execution of the works allowing for design development, visual mock ups, prototype testing, and procurement of samples and submit 2 copies to the architect within 4 weeks of the award of the contract.
- Prepare a detailed drawing list, related to elevations showing locations of 2 and 3D drawings and identifying within the programme when will these be produced.
- Provide relevant product literature, samples of components, and test certificates for the works to demonstrate quality of the materials, design, workmanship and fabrication techniques.
- Produce and submit formally, design drawings based on compliant solutions, calculations and samples. As these are developed ongoing checks shall be made to ensure that the principles mentioned above are maintained.
- Prepare the necessary shop drawings when and only when the design have been completed in compliance with this contract document for the system concerned and approved by the design team.
- Include any secondary support members/ bracketry, required to support and/or restrain the works/(which will be fixed to the primary structural frame), on his detailed design drawings. The subcontractor shall produce these drawings in accordance with the programme to allow other sub-contractors to incorporate these into their works.
- Fabricate the specimen for testing when and only when the necessary shop drawings have been completed.
- Provide samples, design development mock ups, weather performance tests, acoustic and fire separation tests.
- Test the specimens
- Carry out modifications to the design and construction of the specimens and retest them in the event of failure during the test. Ensure any modifications to the design are incorporated into the design development drawings.

- Proceed with fabrication when and only when the particular specimen has been tested successfully.
- Organise the delivery of components to the sire so that the works can be installed in proper sequence without omissions which would require modification of the design.
- Ensure that the works are installed to the agreed standards set by the quality control benchmark samples
- Instruct all those engaged in the installation of the works of the principles of its design, of any unusual details which might be overlooked and of the particular techniques to be used in its construction.
- Carry out hose tests on other areas, as selected by the Architect.
- Protect the works check the proper operation of all opening vents and carry out final clean down.
- Provide a comprehensive maintenance manual and 'as-built' drawings.

19.2 Computer Analysis

Where computer analysis is used the following information shall be presented:

- A clear statement of the method of analysis.
- Proprietary program used.
- The nature of the program e.g. finite element, linear flow, steady state, standard compliance etc.
- Where used, a clear statement of whether finite analysis is linear or non-linear.
- The input data.
- All assumptions made and used.
- The output data.
- A clear statement of the method of interpretation of the results.
- The interpretation of the results.

19.3 Test Reports

All test reports shall include:

- The nature and objectives of the test, measurement or chemical analysis.
- The credentials of the organization undertaking the test including their accreditation for such testing, measurement or analysis.
- The dates, weather and witnesses present.
- Details of the samples, the method used and the limits of accuracy.
- A factual account of the results (N.B. not an opinion on the results interpretation)

19.4 Quality control

19.4.1 Quality Plan

As required by the Schedule of Submissions an outline Quality Plan and a project specific Quality Plan shall be produced by the Contractor following the principles and guidelines of BS EN ISO 9001 to demonstrate how quality management will be implemented from award of Contract through to Contract Completion.

19.5 Quality control procedures

19.5.1 The Contractor shall develop inspection procedures, check lists and audits for monitoring the Works at the various stages.

19.5.2 A clear system shall be implemented to track information flow and check that work is being designed and installed to the most up-to-date revisions of specifications, drawings, interface drawings and this Contract Document.

20 Installation

20.1 Documents

20.1.1 The installation drawings, method statements and procedures shall detail all the elements used to construct the Works and shall clearly describe all operations including the following:

- Installation sequencing plan and details
- References for the identification of the elements
- Relevant setting out and control points
- Details of protection for cladding elements
- Details of isolation and packing around cladding elements
- Details of joints requiring sealants including cleaning and priming of surface details
- All applicable target tolerances at the location of elements and alignment of joints
- Details of location, type and size of backing rods and bond release tapes.
- Torquing requirements of all the fixings along with their locations
- List of equipments required to manoeuvre the elements and components on the building, hold in place, line and levelling once in the designated location.
- Areas susceptible to damage and not to be loaded during installation
- Position of all hidden fixings
- Details of all CDM requirements that are in place within the installation process.

20.1.2 On site benchmarked control samples demonstrating the standard of workmanship agreed by the architects shall remain on site as part of the works.

20.2 Tolerances

20.2.1 Accuracy of erection – Aluminium works

Structural aluminium shall be erected in accordance with the tolerances given in the structural engineer's movement and tolerances report.

20.2.2 Curtain walling

The works shall be installed to the following deviations:

Line and level	+/- 2.0mm in any one storey height or bay width

Plumb	+/- 2.0mm in any storey height
Plane	+/- 2.0 mm in any one storey height or bay
Intersection	+/- 2.0mm in alignment in any direction in the plane of the wall, between any 2 adjoining panels, at a 4 way intersection of panels

20.3 Fixings

All primary and secondary fixings to the cladding and building structure shall be installed in accordance to the fixing manufacturer's recommendations and required procedures. The details of primary fixings shall be check and recorded.

20.4 Cast in Channels

20.4.1 The cladding contractor shall issue cast in channels and their locations to the concreting contractor. The cast in channels shall be demonstrated to have sufficient strength and shall be adequately embedded to ensure that the loads are applied to them are sufficiently distributed to avoid over stressing the concrete.

20.4.2 Materials for the cast in channels shall comply with the requirement of this specification.

20.4.3 Protection of cast in channels – The concreting contractor shall ensure that the channels do not get blocked with concrete, slurry or any other material that prevents the cladding fixings from being installed.

20.4.4 The cast in channels shall have a permitted deviation (non cumulative) from the required positions as shown in the table below:

Cast in fixings to concrete wall	Location relative to grid: +/- 25mm Location relative to nearest point of reference: +/- 15mm Location relative to the face of the wall : +0/ -15mm (positive outwards) Level : +/- 15mm
Cast in fixings generally	Location: +/- 10mm Level: +/-10mm

20.4.5 The minimum distance from the edge of any cast in channels and a concrete edge shall not be less than 100mm.

20.4.6 After installation, exact position and condition of the cast in channels shall be checked and verified by the contractor and any inaccuracy shall be reported to the architect immediately.

20.4.7 The contractor shall verify the adequacy of all remedial work by means of load testing.

20.5 Glass

20.5.1 General

- Glazing shall be carried out in accordance with manufacturer's recommendations, which shall take into account the recommendations of the Glass and Glazing Federation, and the requirements of BS 6262, and BS 8000-7.
- Setting blocks and anti-walk devices shall be installed in accordance with the requirements of BS 6262, modified where noted in this specification.
- It is envisaged that the large panels of glass will be gravity supported in locations outside those described in BS 6262 and BS 8200. The Contractor shall provide calculations to justify the support conditions. No grinding or welding shall be permitted within 10m of unprotected glass.

20.5.2 Visual acceptance criteria for double glazed units

The guideline prepared by the Technical Advisory Board of the Institute of Glazing Trade for Glazing Technology and Window Manufacture, Hadamar (IGH, Hadamar) and the Federal Association for Wholesale Architectural Glazing, Insulating Glass Manufacture, High Performance Glazing, Troisdorf dated October 1996 shall be used to assess the visual quality of insulating glass units.

20.6 Visual acceptance criteria for laminated glass

The guideline prepared by the Technical Advisory Board of the Institute of Glazing Trade for Glazing Technology and Window Manufacture, Hadamar (IGH, Hadamar) and the Federal Association for Wholesale Architectural Glazing, Insulating Glass Manufacture, High Performance Glazing, Troisdorf dated October 1996 shall be used to assess the visual quality of laminated safety glass – monolithic.

20.7 Protection and cleaning

20.7.1 The cladding elements including frames and glazing shall be provided specific protection from anticipated hazards from both interior and exteriors. These include,

but are not limited to, vulnerable coated surfaces, glass, metal edges, corners and features (feature fins).

20.7.2 The protection shall remain in place until all potentially damaging works around the cladding components has been completed.

20.7.3 Protection materials shall be compatible with the surface and finishes and shall allow removal without detrimental effects to the finish and components. The component suppliers and finishers shall approve the method of removal.

20.7.4 Protection removal and cleaning of the works shall be carried out on completion or as per clause 15.6.2 above.

20.8 Where existing steel windows are temporarily removed from site for refurbishment, the structurally opening shall be fully boarded out with ply and made weather-tight with sheeting and sealants to protect the internal surfaces and finishes from the elements. The protection shall be applied immediately upon removal of the window and shall remain intact and weather-tight until the refurbished windows are re-installed.

21 Cleaning and Maintenance Risk Assessments – (NBS - A)

Please refer to the cleaning and maintenance manual/ facade access consultants documentation for details.

21.1 Access for cleaning and maintenance

The Contractor shall recommend methods and procedures to be utilised to allow replacements of damaged or worn components. These method statements shall be incorporated into the Operations and Maintenance Manual.

21.2 Inspections

The Contractor shall recommend methods and procedures to be utilised to allow inspection at the intervals stated in the Operations and Maintenance Manual. This will allow systematic monitoring of the condition of the Works, assist in the prediction of the need for preventative maintenance and redecoration during the life of the Works, and inspection and testing of structural silicone glazing as required by this Contract Document

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