PARTICULAR SPECIFICATION

Architectural Work

PARTICULAR SPECIFICATION PS.A-01

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SECTION PS.A-01- PARTICULAR SPECIFICATION FOR ARCHITECTURAL WORKS

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SUB-SECTION PS.A-01 – PARTICULAR SPECIFICATION FOR ARCHITECTURAL WORKS

1.0 GENERAL

1.1 General and Particular Specification

The specification for the building works shall be the General Specification for Building by Architectural Services Department (2007 edition) and all current amendments thereto.

All clauses of the Specification shall be applicable to this Contract unless expressly stated in this Particular Specification. Provided where there are any discrepancies between the Specification and Particular Specification, the latter shall take precedence over the former.

1.2 Equivalent Product

The Contractor is allowed to use the proprietary products mentioned in the specification or other products having equivalent functions or performance. If the Contractor intends to use the intellectual property rights of another party in performing his obligations under the Contract, appropriate licences should be obtained from the relevant owners.

1.3 Spare Materials

The Contractor is required to supply to the Employer spare materials equal to 5% of the overall quantity of the installed materials. Spare materials are required for all tiles, ceiling panels and paints.

1.4 Engrave Identification Marks

All metal park furniture, accessories and installations (such as metal doors, metal water tap cabinet, metal notice board, metal grating, etc) and electrical products (such as hand dryers) have to be engraved with the mark 'LCSD' for identification and anti-theft purpose.

1.5 Keyhole Plugs

All keyholes of manhole or pit covers have to be provided with plastic plugs to avoid surface water accumulation.

2.0 SITE PREPARATION, CLEARANCE AND MODIFICATION WORKS

2.1 Scope of Work

The construction works involve the provision of a local open space at Chung Yee Street, Kowloon City.

The site is composed of the following areas :

(a) A raised platform presently left vacant and planted with trees, shurbs and weeds.

(b) Slopes and rock features surrounding the raised platform.

(c) An existing staircase leading from Chung Yee Street to the raised platform.

The Contractor has to clean up the site prior to construction works. In particular, the Contractor has to note the following :

(d) The existing staircase at Chung Yee Street is to be retained but upgraded and modified in accordance with Drawings.

(e) There is an existing catchpit for collection of stromwater, and this catchpit is to be retained for the same purpose but upgraded to workable condition. All subsequent drains outside site boundary but collecting discharge from the catchpit to the public drain at Hau Man Street should be well maintained for proper functioning during the contract period.

(f) Strengthening works for slopes and rock features within site area are required as per construction drawing. Similar works outside site are provisional items and may be required if directed by the Architect and Geotechnical Engineer.

2.2 Existing Site Condition

The Contractor shall be deemed to have visited the Site and has satisfied himself as to the full extent and exact nature of the Works. He shall check for any discrepancy between Drawings and the site condition, and report to the Architect before commencement of the work.

All levels shown on Drawings which are extracted from past topographical survey plans are indicated for general reference only, and may deviate from actual existing levels. The Contractor shall be responsible for verifying all existing levels to ensure the finished levels of the works at entrance locations flush with the adjoining ground. In this regard, the Contractor shall carry out a survey of the site and surrounding ground prior to commencement of the sites works, and shall submit within two (2) weeks after contract award to the Architect a survey report showing all relevant datum levels.

The Contractor shall also carry out trial trench / pit excavation to verify the actual profile of the existing foundation and underground utility services, if any, within and at the boundary of the sites, and shall submit findings with dimensions and levels to the Architect prior to construction work.

The survey report should not only cover the site but also the adjoining property (particularly the Driving Test Centre and carparking spaces, and MTRC's completed works) where there are relations to works of the site. Existing roadside planters, street furniture, channels, drainage provisions and any erections at those areas should be shown on the report.

2.3 Siteworks

The Contractor shall clear and remove from site all rubbish, debris, boulders, solid concrete blocks, grass, shrubs, bushes etc. including grubbing up roots and clearing away.

2.0 SITE PREPARATION, CLEARANCE AND MODIFICATION WORKS (Cont'd)

2.4 Hoardings, Scaffolding, Chain Link Fence, Covered Walkway and other Protective Measures

(a) The Contractor should ensure adequate safety or protective measures be provided to suit the existing site conditions. Adjacent properties and existing trees have to be properly and adequately protected to Architect's satisfaction.

(b) Existing fences separating the sites from adjoining properties shall be maintained in good condition throughout the period of the Works until receipt of Architect's permission for removal. All affected areas or damages shall be patched and made good on completion handover.

(c) Provide and erect new hoardings, chain link fence, covered walkway (where applicable) and associated gates including lighting and necessary installation at site boundary to the satisfaction of the Architect.

(d) Alter the hoardings when and as specified.

(e) Break up any surface pavings or finishes if to install new hoarding. Make good around posts and struts after installation. Extreme caution shall be exercised to prevent damages to any existing underground utilities / services.

(f) Prime and paint all surfaces of hoardings, covered walkway (where applicable) and associated gates in accordance with Section 21 of the General Specification. Mark out and paint logo symbols in thick red gloss paint of the type and in the position as agreed with and to the satisfaction of the Architect.

(g) Provide other safety and protective measures as considered necessary as a result of the Contractor's work sequence during the course of construction for the protection of the general public.

(h) All entrance/exit gates shall be provided with heavy duty locking mechanism and shall be securely locked outside construction working hours.

2.5 Signboard

(a) The Contractor shall propose and provide a project signboard to suit the project use. Writings on the signboard will be given by the Architect on approval of the shop drawing.

(b) The signboard shall become the property of the Employer and shall be maintained in good condition throughout the period of the Works and be removed at completion.

(c) Foundations for posts and struts, if required, shall be the same as those for hoarding posts. Alternative fixing proposal to suit existing site conditions should be submitted for Architect's approval.

(d) Prime and paint all surfaces of the signboard and supporting framework in accordance with Section 21 of the General Specification. Mark out and paint in thick gloss paint all necessary lettering, character writing and logo symbols.

2.6 Protective Measures

All protective measures shall comply with the following safety requirements/guidelines and any updated versions at the time of construction :-

(a) Report on Demolition Works in Architectural Services Department.

(b) A Guide to the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations - Labour Department (HK).

2.0 SITE PREPARATION, CLEARANCE AND MODIFICATION WORKS (Cont'd)

(c) Code of Practice - Avoiding Danger from Gas Pipes.

(d) Fire Protection at Construction Site - Fire Protection Notice No. 13.

(e) Works Branch Technical Circular 22/95 "Additional Mandatory Safety Measures".

(f) Checklist to Demolition Work prepared by ASD's Safety Adviser.

(g) Safety Guidelines for Demolition of Building Structures prepared by Occupational Safety and Health Council.

(h) Reference Manual for Construction Sites Inspection Report - Labour Department.

(i) Construction Site Safety Manual - Public Works Programme.

(j) Arch. S.D. Technical Information Paper - Works Procedure for Demolition.

(k) General Specification (Volume 1, Section 2) - Demolition, Site Clearance and Alterations.

(l) BS6187 : 1982 - Code of Practice for Demolition.

(m) Buildings Department Practice Notes for AP and RSE related to hoarding works.

(n) Code of Practice for the Lighting, Signing and Guarding of Road Works.

(o) All other relevant Codes of Practice, Safety Guidelines, etc.

2.7 Method Statement and Safety for Clearance / Modification Works and Material / Equipment Delivery

(a) The Contractor must submit a method statement describing the proposed method and sequence of clearance of the existing site erections and modification of existing staircase prior to commencement of work, and a safety plan which should cover the risk assessment and safety aspects for such method statement.

(b) The Contractor should also submit a method statement on construction material and equipment delivery prior to commencement of work, and a safety plan and waste disposal plan for such method statement.

(c) The Contractor has to prepare a safety plan. Under the safety plan, a part time registered safety officer and a full time safety supervisor are to be provided. Safety training shall be provided to all site supervisors by the Contractor.

(d) No work on site shall be allowed to commence until the proposed method statement has been accepted and all precautionary measures, hoardings, covered walkway, and other requirements are in place.

(e) The Contractor is responsible for obtaining all necessary permits from the Highways Department, Transport Departments, Hong Kong Police and other Government Departments, if so required.

2.8 Services

(a) The Contractor shall check all drawings and conduct surveys to ensure that all information is available as to existing services or work to be protected, disconnected and diverted in accordance with contract documents.

(b) It is the Contractor's responsibility to arrange for temporary power and water supplies for operation of plant and dust control.

2.0 SITE PREPARATION, CLEARANCE AND MODIFICATION WORKS (Cont'd)

2.9 Protection of Trees

(a) In accordance with the requirements of the General and Particular Specifications, adequate protection must be provided for existing trees, shrubs and other plants including grass which are to be retained in the final scheme.

(b) Site huts must not be erected nor materials stored close to trees where they will cause damage to the ground vegetation or to its root system by compaction.

(c) Where unforeseen pruning of tree branches is necessary in order to operate plant and equipment, permission must first be obtained from the Architect.

(d) Any accidental damage to roots or branches during the course of the work must be reported to the Architect immediately in order that remedial treatment can be carried out to save the tree.

(e) Detailed requirement for protection, felling and transplanting of trees is given in a separate section of the General Specification and Particular Specification.

2.10 Salvaging, Sorting and Dumping of Materials

(a) Attempt should be made to carefully dismantle and salvage materials from old buildings of historical or architectural interest such as Chinese grey bricks, clay roof tiles, dressed granite slabs, ceramic ornaments, sound fit roof timbers, ornamental ironwork and the like. SPSM/Antiquities and Property Services Branch/Arch S. D. should be contacted to make arrangements for collection and storage of the salvaged materials for use in future restoration projects.

(b) All other materials arising from the clearance works unless otherwise specified such as electric light fittings and appliances which should be returned to LCSD will become the property of the Contractor.

(c) All debris and waste materials shall be sorted in accordance with EPD's disposal requirements before they are carted away for dumping or land filling. In this regard, the Contractor is reminded to pay particular attention to the requirement of Waste Management Plan and Trip-ticket System as specified in PNAP ADV-19 issued by the Buildings Department and all other relevant documents issued by other Government departments.

2.11 Avoidance of Nuisance, Dust and Noise

(a) The Contractor's attention is drawn to the proximity of the entrance area of the site to a Driving Test Centre and carparking spaces and also the west portion of the site to an adjoining school. The Contractor shall so arrange his demolition and downtakings as to cause the minimum of nuisance, noise, dust or any other disturbance or inconvenience to the occupants thereof or to traffic on surrounding roads and other public roads leading therefrom.

(b) The Contractor shall provide all necessary dust-screens or similar and shall water the debris as necessary to reduce dust nuisance to a minimum.

(c) Noisy activities of site clearance in the proximity of schools should be prohibited and restricted during school hours.

(d) The Architect and Engineer may stop all work if the Contractor fails to comply with any of the preceding restrictions and no claims whatsoever will be entertained for any financial or time loss arising out of such stoppage.

2.0 SITE PREPARATION, CLEARANCE AND MODIFICATION WORKS (Cont'd)

2.12 Existing Signs and Street Furniture

All existing signs, railing and street furniture affected by construction works should be removed with great care without damage. Upon removal, the Contractor shall present those materials for inspection by the Architect's representative or any other relevant Government departments or parties before placing them in safe storage. The Contractor shall allow for the safekeeping of these materials during construction, repair to damage and replacement if necessary, retrofitting and reinstallation to the original position or a new position to be agreed by the Architect and any other relevant parties.

2.13 Enabling and Incidental Work

The Contractor shall include all demolition, alteration, subsequent make good and any enabling and incidental work, whether started or not, required for the completion of the works shown in Drawing and Specification.

3.0 EXCAVATOR

3.1 Nature of Excavation

The onus is on the Contractor to inspect the site and drawings, prior to tendering, to form his own opinion of the nature of ground to be excavated and to estimate the percentage of rock and soil to be removed. This estimate will be at the Contractor's sole risk and shall not be subject to any adjustment.

3.2 Site Levels

(a) All site levels, either spot or contour shown in the survey plan are, unless otherwise stated, reduced to Principal Datum.

(b) If the Contractor is not satisfied with the accuracy of these levels, he must give written notice with full substantiations to the Architect before excavations are commenced.

3.3 Obstructions Met during Excavation

(a) All boulders, roots, buried tree trunks, old concrete or brick foundations, non-serviceable drains, manholes and gulleys, or other obstructions met with during the course of the work shall be removed. No additional payment will be made for the removal of these obstructions. The open ends of all such drains, etc. shall be sealed with weak concrete and all voids filled in with hard dry materials well rammed and consolidated.

(b) The Contractor shall also be responsible for temporarily supporting existing pipes, ducts, drains or cables and similar services during excavation and making good any damage caused to the same.

(c) In the event that excavating by hand or taking such other precautions as are necessary to avoid damage to adjoining properties, this shall not constitute any extra cost.

3.4 Planking and Strutting

(a) The Contractor shall be responsible for the design, supply, erection and removal of all planking and strutting or shoring that may be necessary for the proper execution of the works.

(b) The Contractor shall be responsible for the safety of all excavations, and all planking and strutting, shoring etc. shall be to the approval of the Architect and Engineer. Should the Architect and Engineer provide drawings showing his requirements for planking and strutting, shoring etc. subsequent to the award of the contract for the same safety purpose, this shall not constitute any extra cost.

(c) All planking and strutting shall be removed prior to the completion of backfilling unless otherwise required by the Architect.

3.5 Bottoms and Sides of Excavations

(a) The bottoms and sides of the excavations are to be trimmed, levelled, graded or rammed to the correct levels and falls as required, and this shall include cutting out soft spots and filling with additional concrete (mix as specified for foundations).

(b) All water and sludge shall be removed and the bottoms of excavations shall be perfectly dry before any concrete is laid. The Contractor shall be responsible for providing any adequate mechanical pumping equipment for this purpose.

3.0 EXCAVATOR (Cont'd)

(c) All excavations are to be inspected and approved by the Architect and Engineer before any pipes, concrete, etc. are laid. If good foundations are not obtained at or before the depths shown on drawings, permission in writing is to be obtained before proceeding further with the excavations.

3.6 Damage to Existing Drains, Water Mains etc.

(a) Care is to be taken not to disturb or damage existing and serviceable drains, gas or water mains, cables or underground work met with during the course of the works. Should any damage occurs, the Architect and Engineer are to be notified immediately and all damages made good at the Contractor's expense.

(b) The Contractor shall inform the Architect and Engineer immediately of the presence of any unrecorded underground services.

3.7 Excavation below Required Levels

Should the Contractor excavate below the levels shown on the drawings without the Architect's written instructions, he shall, at his own expense, fill in the excess excavations with grade 20D concrete.

3.8 Return Fill in and Ram

(a) Filling

(i) All filling shall consist of suitable materials obtained from excavation on site, borrow areas or other approved sources. Specific marine deposits, old fill and boulders shall be disposed off site as soon as excavated and shall not be used as backfill.

(ii) Import fill material only when sufficient compaction plant is in operation at the place of deposit to ensure compliance with the requirements of sub-clause (c).

(iii) Where filling is to be formed on sloping ground, bench the surface in steps or trench as shown on the drawings and directed by the Architect and Engineer and provide any necessary sub-soil drains to the affected part of the site.

(iv) Keep the benching or trenches free of water.

(v) Make good to the satisfaction of the Architect and Engineer all settlement in filling and in backfilling that may occur up to the end of the Defects Liability Period.

(vi) Do not use "end tipping" in filling.

(vii) At the end of each day, leave the surface with no area that can retain water and, if necessary, cut ditches to ensure that this object is attained.

(viii) Stop all such filling work immediately when the state of the weather is, in the opinion of the Architect, very likely to adversely affect the placing of specially compacted fill.

(ix) Remove and replace without extra charge all filling materials, whether placed and/or compacted or awaiting placing and/or compaction which, in the opinion of the Architect and Engineer, does not comply with the specification or had been damaged by weather or in any other way.

3.0 EXCAVATOR (Cont'd)

(b) Fill Material

"Suitable Material" shall comprise all that which is acceptable in accordance with the Contract for use in the Works and which is capable of being compacted in accordance with Sub-Clauses (c) and (d) to form a stable fill.

"Unsuitable Material" shall mean other than suitable material and shall include :

(i) Material from swamps;

(ii) Peat, logs, stumps and perishable material;

(iii) Material susceptible to spontaneous combustion;

(iv) Clay of liquid limit exceeding 80% and/or plasticity index exceeding 55 and/or having a total of more than 20% of soil particles being less than 0.002 mm;

(v) Materials having an in-situ moisture content greater than the maximum permitted for such materials in the Contract.

(c) Performance Specification

(i) Return and fill in selected excavated material around foundations, etc. up to required levels. Compact all material in layer as soon as practicable after deposition. The thickness of each layer shall be compatible with the compaction plant used and shall be agreed with the Architect.

(ii) The moisture content of the in-situ material during compaction shall be within + 30# of the optimum moisture content determined in accordance with Sub-Clause (d). This shall be adjusted to enable the required in-situ field densities of the fill material to be obtained consistently.

(iii) Following the compaction process, in-situ field density tests shall be carried out in accordance with Sub-Clause (d).

(iv) Unless otherwise stated, the in-situ field densities of compact materials shall be not less than 95% or the maximum dry density. The zone immediately below a road formation level or other structure requires a higher degree of compaction.

(d) Compaction Tests

Compaction test shall be carried out by an independent testing agency approved by the Architect and Engineer at the Contractor's expense and to the full satisfaction of the Architect, Engineer, Geotechnical Engineering Office and other relevant Government departments.

3.9 Hardcore

Hardcore is to be composed of approved hard broken bricks, Ordinary Portland cement concrete, hard tiles, stone or other hard substance, free from dust and broken to pass through 75 mm diameter ring or as may be directed by the Architect.

4.0 CONCRETOR

4.1 Self-Finished Concrete Surface

(a) Where self-finished concrete surface is specified, the concrete surface shall be levelled, power floated, and then steel trowelled to a degree of smoothness suitable for direct application of floor finish without the necessity of application of cement floor screed, or treated to a non-slip surface as required by the Architect, the self-finished concrete surface should not vary from the specified level or gradient for more than 3mm in a 3 metre span measured in any directions.

(b) The Contractor shall, prior to concreting work, cast a 3m x 3m insitu sample self-finished concrete floor panel for Architect's inspection and approval, the degree of smoothness must be to the satisfaction of the Architect. All self-finished concrete surfaces are to be cleared of all surface imperfections prior to handing over of building to Employer.

4.2 Protection of Self-Finished Concrete Surface

The Contractor shall protect to the satisfaction of the Architect all self-finished concrete surface from damages caused by erection of formwork and steel reinforcement, concrete drippings, removal of formwork and other works inside the building. All damages and imperfections shall be made good to the Architect's satisfaction.

4.3 Pitched Slab

Where pitched slab is specified, the concrete slab shall be cast with a pitch in accordance with the drainage plans or architectural details, notwithstanding that the pitch is not shown on the structural framing plan and R.C.C. details.

4.4 Off-Form Concrete

Where off-form concrete is specified, the following requirements are to be complied with:-

(a) The use of foam releasing agents or curing compounds depositing wax or oil on the concrete surface is not allowed.

(b) Formmarks, voids, honey combs and tie holes shall be smoothened and touched up with cement sand mortar.

(c) Uneven concrete surfaces shall be made good to ensure an even surface throughout.

(d) Plywood of the maximum sheet size shall be used for concrete formwork to reduce the number of joint lines.

(e) Deposits of concrete drips between formwork panels shall be trimmed off.

(f) Offsets between concrete panels shall be made even by cement sand rendering.

(g) For voids and honey combed areas, the contractor shall submit remedial proposals to the Architect for approval prior to repair work being carried out. Repair material shall generally be polymermodified or non-shrinkage cementitions materials.

(h) All concrete surfaces shall be clean and sound, and free from dirt, laitance and stainmarks.

(i) Sharp edges or corners shall be straight and pointed.

4.0 CONCRETOR (Cont'd)

Where necessary, the Contractor shall be required to make good without charge to the Employer all defects on the concrete surfaces to the satisfaction of the Architect.

4.5 Waterproof Concrete

(a) Unless otherwise shown on drawings, all concrete water tanks shall be constructed of waterproof concrete.

(b) The Contractor shall take full precautionary measures to prevent shrinkage cracks in the waterproof concrete. Any water leakage through shrinkage cracks shall be made good by the Contractor in a manner approved by the Architect at no cost to the Employer during the guarantee period.

4.6 Light-Weight Concrete

Light weight concrete or screed where specified shall be of a maximum density of 600 kg per M^3.

4.7 Shrinkage Cracks in Concrete

All concreting works, especially for roof slab and flat roof must be damp cured with hemp sack with extreme care so as to prevent shrinkage cracks. Extra care must be afforded in this respect should ready-mixed concrete with granite fine be used.

No curing compound shall be used unless expressly approved by the Architect.

The Contractor shall be required to repair by epoxy injection free of cost to the Employer and to the satisfaction of the Architect all shrinkage cracks on the concrete which appear during construction and the Defects Liability Period. A guarantee certificate shall be provided by the Contractor to the Employer to this effect.

4.8 Structural Openings for M & E Services

All structural openings in the concrete works shall be marked by the B.S. Sub-Contractors or indicated by the B.S. Engineer as the case may be and the Contractor shall provide all necessary sleeves or forming openings required for all M & E services and seal with non-shrinkage concrete grout after pipe and cable sleeves are set in the position.

4.9 Waterproofing Additive

The waterproofing additive, when needed, will produce no less of strength in concrete, thus conforming with AS1479-A3 and shall be carried out by Specialist Sub-Contractor or strictly in accordance with the manufacturer's instructions under the supervision by the Specialist Supplier. The Contractor's particular attention is drawn to the Manufacturer's instruction, and the minimum cement content required must be strictly observed. Where the minimum cement content exceeds the structural requirement, the Contractor is deemed to have made allowance in the unit rates or tender amount for the cost of extra cement.

The Contractor shall arrange with the waterproofing Sub-Contractor to give a guarantee of not less than ten (10) years for the waterproofing concrete work. A guarantee certificate shall be provided and countersigned by the Contractor directly to the Employer for record.

4.10 Waterproofing Membrane and Treatment

Liquid waterproofing membrane and waterproofing treatment shall be those referred to in Section 6.0.

5.0 BRICKLAYER

5.1 Concrete Block Walling

All internal concrete block partitions, where specified on drawings, shall be class 2 aggregate concrete block walling.

5.2 Brick Wall

All internal brick partitions, where specified on drawings, shall be First Quality Red Brick walling.

5.3 Bonding Rods

The Contractor is required to provide 6mm diameter mild steel bonding rods 350mm long with one end cast into concrete including perforating in formwork and the other end left projecting 225mm long from concrete face and subsequently built into joints of brickwork or blockwork.

5.4 Pinning Up

The tops of all walls where built to the underside of beams, slabs, etc. shall be solidly pinned up with cement mortar, provided always that the depth of such pinning does not exceed 25mm. Where the depth of the pinning exceeds 25mm the pinning up shall be carried out with purpose made precast cement tiles of approved pattern and of the required thickness bedded solidly in cement mortar.

5.5 Bedding and Pointing Frames

Timber door frames, etc. shall be built in as the work proceeds and bedded solid on the backs and pointed in cement mortar on both sides as required including building in holdfasts.

5.6 Openings

Chases shall be formed to standard block walls to form recesses without excess cutting or chipping. All chases shall be vertical and generally horizontal chases shall not be permitted unless their horizontal length do not exceed 150mm. Chases shall be permitted within 150mm from opening. Chases are therefore to be predetermined prior to the construction of block work and expanded metal lathing reinforcement is required.

6.0 ROOFER AND WATERPROOFING

6.1 Roofing System

Roofing system installation shall be carried out by a Specialist Sub-contractor on the List of Specialist Sub-contractor for Roofing System as attached in a separate particular specification. Roofing system shall be inclusive of the screed to provide fall, roofing membrane, roof insulation, roofing tiles and associated bedding screed, paving slabs inclusive of stools, all necessary joints with roof fittings and expansion joints as appropriate.

6.2 Skylight

Skylight as indicated on drawings shall be designed, supplied and installed by a specialist contractor with at least ten (10) years experience in the field, which shall also be an approved structural steel specialist contractor to ensure the structural steelworks comply with local regulations. Track record of this specialist contractor shall be submitted to the Architect for approval. The requirements are outlined as follows :

(a) Design

(i) Description of Works

The Works described in this Specification comprise the design, supply, manufacture and installation of the skylight. This includes all areas indicated on the Drawings and specified herein.

(ii) Design Responsibilities

The Drawings are indicative of the design intent and illustrate the mandatory geometry and exposed surfaces. The Contractor has to submit shop drawings and structural calculations for approval.

The Contractor's scope includes design of steelwork, glass, composite materials and any other elements, which form part of the entire skylight and roofing system. All elements shall be entirely adequate for the designed weight of the assemblies and all service and wind loads required by this Specification or as maybe reasonably anticipated.

The Contractor shall be required to assume responsibility for developing members, details and extrusions in accordance with the Drawings to satisfy the performance requirements stated in this Specification. This may either be a development of the schematic system illustrated in the Drawings or an alternative system which will satisfy the design intent subject to approval by the Architect.

The validity of the selected system is to be established by submission and approval of drawings and computations together with tests all as later specified.

It shall be the Contractor's responsibility to ensure that all materials and work shall be entirely sufficient for their purpose and shall be so designed, fabricated and installed such that the finished structure will be rendered fully weathertight having due regard for service conditions as may be reasonably anticipated and all criteria stated in this Specification.

The Contractor shall immediately bring to the Architect attention any discrepancies or contradictions found in the Drawings and Specifications.

6.0 ROOFER AND WATERPROOFING (Cont'd)

(iii) Fabrication & Installation

The work shall be fabricated and installed in accordance with the approved shop drawings and within the prescribed construction tolerances set out in the Specification. On completion of installation, a watertightness test (100%) is required.

(iv) Warranty

The Contractor shall submit Certificates of Guarantee from the manufacturers of the entire skylight which warrant that all materials and workmanship shall be capable of a normal life span of ten (10) years commencing from the date of Practical Completion without material loss of mechanical properties and water-tightness, deterioration, corrosion, distortion and the like under normal operation conditions.

(b) Performance Criteria

(i) Design Wind Loadings

Wind loads are to be calculated in accordance with the provisions of the latest Code of Practice on Wind Effects, Hong Kong.

(ii) Structural Performance

The Contractor shall comply with the Hong Kong Building (Construction) Regulations and with the following standards unless otherwise specified.

The relevant standard shall be current edition unless otherwise specified.

Where conflicts arise between these specifications and the code or standards listed below, the more stringent requirement shall apply.

Similar codes or standards used in the home country of the manufacturer may, however, be used if applicable, subject to the acceptance of the Buildings Department. In such case it shall be the responsibility of the manufacturer to demonstrate to the satisfaction of the Architect, Structure Engineer and the Buildings Department that such code is essentially equal to the one specified.

Design Code (latest version)

Code of Practice on Wind Effect Hong Kong
The Structural Use of Steel, Hong Kong or B.S. 5950
Hong Kong Building (Construction) Regulation

Fabrication

BS 4870	Specification for Automatic Fusion Welding of Materials, Including Welding Operator Approval
BS 4871	Specification for Approval Testing of Welders Working to Approved Welding Procedures

6.0 ROOFER AND WATERPROOFING (Cont'd)

Aluminium, Steelwork and Stainless Steel

BS 8118	The Structural Use of Aluminium (British Standard) or CP 118 Structural Steel Sections
BS4	Structural Steel Sections
BS 5950	Specification for Weldable Structural Steel Building Authority
BS 4360	Hong Kong The Structural Use of Steel: 1987
BS 729	Specification for Hot-Dip Galvanized Coatings on Iron and Steel Articles
BS 1449.2	Specification for Stainless and Heat-Resisting Steel Plate, Sheet, Strip
BS 1470	Specification for wrought aluminium and aluminium alloys for general engineering purposes; plate, sheet and strip
BS 1474	Specification for wrought aluminium and aluminium alloys for general engineering purposes; bars, extruded round tubes and sections.

(c) Maintenance and Replacement

(i) Maintenance

Maintenance must be identified in terms of routine (e.g.. cleaning) and in terms of component repair/replacement.

Each system shall be analysed to define the sequence under which components are likely to fail.

The design must be developed such that removal and replacement of vision or spandrel glass and stone spandrel panels can be carried out without the cutting of framing members.

(ii) Replacement

A strategy must be developed to ensure that elements likely to deteriorate significantly can be replace or rectified.

Where materials are likely to deteriorate and there is a safety consideration, prototypes must be kept for monitoring. These are small samples which may be stored in exposed positions or the roof of the building. Monitoring of these samples will be covered in the Maintenance Manual.

A complete maintenance manual shall be prepared by the Contractor and submitted in draft form within 12 weeks of commencement of Contract.

The final version, in loose-leaf, ring binder format, shall be submitted within 4 weeks of practical completion of the Contract.

6.0 ROOFER AND WATERPROOFING (Cont'd)

The skylight maintenance manual shall consist of at least three section or volumes as follows and shall be submitted in one (1) soft copy and four (4) hard copies :

- maintenance procedures;
- supporting document/data; and
- logbook.

(d) Materials

(i) Steel Frame

All structural steel frame is to comply with BS EN 10210-1: 1994 grade S275 or S355 and hot-dip galvanized to BS EN ISO 1461: 1999.

(ii) Stainless Steel Fittings

All stainless steel fittings shall be predominantly manufactured from stainless steel Grade 316.

The stresses induced in the glass by the fittings shall be compatible with the strength of the glass and the needs of the performance specification.

The finish on the fittings shall meet the Architect's satisfaction and comply with the requirements of B.S. 1449 Part 2.

The articulated bolt shall consist of cap nut, washer and water tight rubber ring to meet the water and air tight requirements.

The articulated bolt fitting on glass shall be flush or cap type glass fitting with free rotation to release the moment induced in the glass by the fittings

(e) Glazing Materials

(i) Laminated Tempered Glass

All glass quality shall comply with B.S.952 and free from bubbles, smoke vanes, air holes, scratches or any other defects.

The manufacturer shall mark the glazing panel at location approved by the Architect. Such marking shall be permanent and provides the information necessary for replacement.

6.0 ROOFER AND WATERPROOFING (Cont'd)

(ii) Gaskets

All gaskets/weather stripping shall be neoprene or similar, except where used in contact with a structural silicone sealant. Where in parallel contact with silicone sealants, all gaskets, spacers and setting blocks shall be performed heat cured silicone rubber, chemically compatible with the silicone sealant and suitable for the specific purpose intended. All gaskets/weatherstripping/ spacers shall have continuous mechanical engagement to framing members; adhesive attachment is not acceptable. All weatherstrips and gaskets shall be continuous with vulcanized/moulded corners.

Sponge gaskets/weather stripping/spacers shall be extruded black neoprene or silicone rubber with a hardness of 40 ± 5 durometer Shore A and conform to ASTM C509 (for neoprene).

Gaskets and seals used to achieve the required weather and/or air tightness shall be selected to accommodate fully the range of dimension tolerances associated with fabrication and installation of the cladding system and shall be formed from materials capable of maintaining their elastic qualities, dimensions and resistance to physical or chemical attack sufficient to maintain the full acoustic performance during the design life of the cladding.

(iii) Setting Blocks

Setting blocks shall be dense heat cured silicone rubber with a hardness of 80-90 durometer Shore A.

Side blocks shall be dense heat cured silicone rubber with a hardness of 60-70 durometer Shore A.

(f) Sealants

(i) Sealant - Weather seals and Air seals

Sealant must be compatible, non staining and fit for their purpose.

Non-structural sealant shall be either:
- approved low modulus silicone (exposed or concealed)
- approved polyurethane (exposed or concealed)

Acrylic sealant are not acceptable for frame seals or smoke flashing.

(ii) Sealant - Structural Glazing

Structural silicone sealant shall have the following properties:

Method	Test	Unit	Result
As Supplied			
MIL-S-8802	Tack-Free Time, 50% RH	minutes	65
	Curing Time 25°C (77°F) at 50%RH	days	7-14
	Full Adhesion	days	14-21
	Flow, Sag or Slump	inches	0.1
	Working Time	minutes	10-20
	Specific Gravity		1.339
	VOC Content	g/L	30
As Cured – After 7 days at 25°C (77°F), 50%RH			
ASTM D2240	Durometer Hardness	Shore A, Point	40
ASTM D0412	Ultimate Tensile Strength	psi(Mpa)	350(2.41)
	Ultimate Elongation	%	525
ASTM D0624	Tear Strength, die B	ppi	49
ASTM C0794	Peel Strength	ppi	40
As Cured – After 21 days at 25°C (77°F), 50%RH			
ASTM C1135	Tensile at 25% Elongation	psi(Mpa)	48(0.33)
	Tensile at 50% Elongation	psi(Mpa)	75(0.51)
ASTM C719	Joint Movement Capability	%	± 50
As Cured – After 21 days at 25°C (77°F), 50%RH and 4,500 hours QUV ASTM G-53			
ASTM C1135	Tensile at 25% Elongation	psi(Mpa)	50(0.34)
	Tensile at 50% Elongation	psi(Mpa)	78(0.53)

ASTM – American Society for Testing and Materials

6.0 ROOFER AND WATERPROOFING (Cont'd)

(iii) Primer

Primers shall be the same brand manufacture as the sealants used and shall be compatible with the substrate and all adjacent materials.

(g) Samples

Samples will be required in this Specification. The Contractor shall provide a programme for the submission of these samples with his tender submission.

The Contractor shall further allow for the erection of a mock up sample as required and to the satisfaction of the Architect. On acceptance the approved samples will become the accepted criteria of the standard of workmanship or material to be supplied and any items not so complying may forthwith be rejected by the Architect and replaced and replaced by the Contractor.

The Contractor shall not start prefabrication or ordering of materials unless and until all mock-up samples are approved by the Architect.

(h) Workmanship

All materials and workmanship shall comply with Standards and Codes stated in the appropriate Section of this Specification except where specifically indicated on the Drawings or stated in this Specification.

Any trade names used in the documents mean that product or equivalent which is acceptable to the Architect.

Full water test should be performed, with method statement submitted by Contractor and approved by Architect, to ensure water-tightness. Requirements are in compliance with Cl. 9.19(k)(ii) of this specification.

6.3 Waterproofing Membrane

(a) Waterproofing membrane specified in the drawing shall be one of the approved proprietary waterproofing membrane system under 'Type A1 – sheet material requiring additional cover or protection' and 'Type B1 – liquid applied roofing material requiring protection' as described and listed in the Particular Specification for Roofing System attached in a separate Section.

The Contractor shall observe all the requirements and procedures stated in the 'Particular Specifications for Roofing Systems' which shall be read in conjunction with the General Specification.

The Contractor shall include all costs for the required non-destructive infra-red tests which shall be carried out by one of the approved contractors for the 'List of the Non-destructive Test Specialists'.

(b) Waterproofing upturn at skirting or curb shall be 150 mm minimum above finished floor level or as specified on drawings.

(c) All pipes going through roof or floor slabs shall be packed with waterproofed cement grouting and dressed around with 1.5 mm thick liquid waterproofing membrane extending 150 mm around the pipe, and with an up-stand of 150 mm above finished floor level before executing the membrane works.

(d) The Contractor shall arrange with the Waterproofing Sub-contractor to give a guarantee if not less than ten (10) years from Practical Completion for the waterproofing work directly to the Employer. The guarantee certificate shall be countersigned by the Contractor provided to the Employer for record.

6.0 ROOFER AND WATERPROOFING (Cont'd)

Proprietary Waterproofing Membrane Roofer Works shall include for :

(a) Hacking concrete surfaces to form key.

(b) Executing work at any height.

(c) All temporary rules.

(d) All narrow widths.

(e) All arrises, fair and rounded edges and turn-ins.

(f) All angles, intersections and stops to internal angle fillets, skirtings, fascias, gutters, curbs channels and the like.

(g) All laps, cutting, notching and bending of underlays and any reinforcement.

(h) Rubbing surfaces of roofing with a wood float with clean and if required.

(i) Dressing liquid waterproofing membrane to outlet pipes, dishing to gullies, forming collars around pipes, sleeves, railing standards and the like including cleaning and priming the surfaces of those items with waterproofing solution and bonding agent before executing the liquid waterproofing membrane works.

The Proprietary Roof Waterproofing Membrane Work where required to be carried out in sections, such as in underpinning and to parapet walls, shall include for jointing between sections.

6.4 Insulation Board

Thermal insulation board on flat roof shall be 50mm thick proprietary product of cellular glass insulation board to ASTM C552 and with the following properties :

Physical Properties		ATSM Test
Absorption of moisture (% by volume)	0.2% Only moisture retained is that adhering to surface cells after immersion	C 240
Water-vapor permeability	0.00 perm-com	E 96
Acid resistance	Impervious to common acids and their fumes, except hydrofluoric acid	
Capillarity	None	
Combustibility	Noncombustible, will not burn	E 136
Composition	Pure alumino-silicate cellular glass, totally inorganic, contains no binder or fibre	
Compressive strength, average	6.3 kg/cm² 620 kPa	C 165, C 240, C 552-00
Density, average	120 kg/m³	C 303
Dimensional stability	Excellent – does not shrink, swell or warp.	
Flexural strength, block average	4.9 kg/cm²	C 203, C240
Hygroscopicity	No increase in weight at 90% relative humidity	
Linear coefficient of thermal expansion (25˚C to 300˚C)	9.0 x 10^{-6}/˚C	E 228
Maximum service temperature	+ 482˚C	
Modulus of elasticity, approx	9,300 kg/cm²	C 623
Thermal conductivity	kcal/m • h • ˚C 0.033@ 0 ˚C 0.034@ 10 ˚C	C 177, C 518
Specific heat	0.20 kcal/kg • ˚C	
Thermal diffusivity	0.0042 cm²/sec	

Application

The boards are to be laid with the long side parallel to the direction of fall with all joints taped, in strict accordance with the manufacturer's instructions.

6.0 ROOFER AND WATERPROOFING (Cont'd)

Compatibility

The insulation shall be compatible with and applied on top for the waterproofing membrane in strict accordance with Manufacturer's recommendation. Proof of compatibility and Manufacturer's recommendation installation procedures shall be submitted for Architect's approval.

6.5 Roof Access Hatch

Roof access hatch where indicated on drawings shall be proprietary galvanized metal roof hatch. Shop drawings are required for Architect's approval.

Cover shall be 1.9mm galvanized steel with a 76mm beaded flange and formed reinforcing members welded to support a minimum live load of 195 kg/m^2. Insulation shall be glass fibre 1" (25.4mm) in thickness, fully covered and protected by a 0.8mm metal liner. Curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, full weld at the corners for weathertightness. Steel shall be fluorocarbon coated finish and colour sample has to be submitted for Architect's approval.

Insulation on the exterior of the curb shall be rigid fibreboard 1: (25.4mm) in thickness. Hatch shall be completely assembled with heavy pintle hinges, positive snap latch with turn handles and padlock hasps inside the outside and a mechanically retained thermoplastic rubber gasket. Compression spring operators enclosed in telescopic tubes shall be provided for smooth, easy and controlled door operation throughout the entire are of opening and closing.

Operation shall not be affected by temperature. Cover shall be equipped with an automatic hold-open arm complete with red vinyl grip handle to permit easy release and one-hand control of the cover to its closed an latched position. All hardware shall be zinc plated and chromate sealed and factory finishes shall be paint bond.

Installation shall be in accordance with manufacturer's instructions.

The Main Contractor shall arrange with the Access Hatch Contractor to provide a guarantee of not less than ten (10) years from Practical Completion for the product. The Guarantee Certificate shall be countersigned by the Main Contractor provided to the Employer for record.

6.6 Mobile Scaffold

For lift tower which is not provided with cat ladder and roof access hatch, the Main Contractor has to provide a proprietary mobile scaffold of appropriate size to allow access to the roof. The scaffold shall be of aluminium tubing and steel connectors, and fitted with clip-on stairway and platforms, and all components should be easily dismantled or assembled. Safety and quality of the product shall comply with EN1004 International Standards. Proposal with material catalogue and component sample has to be submitted for Architect's approval.

6.7 Expansion Joints and Roof Tiling Border

Lay bitumen filling to joints and borders of roofing tiles, right through the thickness of the topping screed, and allow for forming all necessary expansion joints as and where required. Trim the top of the joint filler and pointed with mastic to finish flush with the surface after the finishing material is laid.

6.0 ROOFER AND WATERPROOFING (Cont'd)

6.8 Substrate Preparation

All surfaces receiving waterproofing coating shall be reasonably flat, dry and free of all dirt, dust, laitance and loose materials. Commencement of waterproofing membrane installation shall deem to constitute acceptance by the Specialist Sub-contractor that the surface is in proper condition.

6.9 Other Waterproofing Works

Concrete capillary waterproofing system, if specified, shall have the following properties.

Performance

(a) Able to penetrate into concrete capillary system forming integral part of concrete structure, and have the same strength and durability of concrete.

(b) Being a cementitious product and is 100% compatible with concrete.

(c) With strong proof of its watertightness to resist water pressure of more than 100m water head.

(d) Capable to prevent water penetration through the capillaries of the concrete, whereas allowing the concrete to breathe.

(e) The chemical in the waterproofing shall penetrate deep enough into concrete even if water pressure is formed at the other side of concrete, so as to have waterproofing on passive side of the concrete wall.

(f) Capable to apply on damp concrete surface whereas a membrane needs a dry surface for application. Neither special machines nor plants are needed during application.

(g) Non-flammable, able to mix with water only, odourness and cause no pollution to public. Capable to be applied in enclosed area such as water tank.

(h) With lasting treatment and the waterproofing application can be carried out after all concrete imperfection of concrete, such as honeycomb, cracks, and water leakage.

(i) Should be alkaline (PH value 12) and able to protect the reinforcement.

Application

Strictly follow the system specification of the manufacturer.

Guarantee

The Contractor shall arrange with the Waterproof Sub-contractor to give a guarantee of not less than ten (10) years from Practical Completion for the waterproofing work. A guarantee certificate shall be provided and countersigned by the Main Contractor directly to the Employer for record.

7.0 CARPENTER AND JOINER

7.1 General

Unless otherwise described the whole of the Carpenter and Joiner work shall be executed in accordance with the relevant Clauses of the General Specification.

All Timber shall be wrot unless otherwise described.

All sizes are finished sizes, unless otherwise stated.

7.2 Plywood

All plywood shall be grade I and conform in all respects to B.S. 6566.

7.3 Hardwood

All hardwood where specified shall be "San Cheong" from approved source of supply, and free from knots, weighing not less than 722 kg/m^3 and have a moisture content of not less than 10% or not more than 16%.

7.4 Wood Preservative

All unexposed surfaces of timber shall be treated with two coats of timber preservative before fixing or bedding.

7.5 Laminated Plastic Sheet

All laminated plastic sheet where specified on drawings shall be 1.5 mm thick cigarette-and acid-proof grade and conform to all requirements of BS EN 438 standard or approved equivalent. The sheet shall be applied to a timber backing with approved bonding agent, used strictly in accordance with Manufacturer's instructions. Where laminated plastic sheet is specified to cabinet doors, special edging accessories in same colour of the laminated plastic sheet should be provided to finish edges of cabinet doors. Samples of A4 size should be submitted for Architect's approval. A guarantee for the material to be free from defects for two (2) years from Practical Completion is also required.

7.6 Plugging

Where joinery work is to be plugged to walls or ceiling, one of the following methods of plugging shall be used as considered appropriate by the Architect at each occasion :

- Rawiplug or plug of similar and approved pattern
- Dover-tailed hardwood cut on the twist or cast in-situ or properly pinned in.
- 'Ramset' or other power fastening system applied strictly in accordance with Manufacturer's recommendations.

7.7 Door Generally

Construct hollow or solid core flush doors framed and glued together and covered with laminated plastic sheet complete with hardwood edging as shown on drawings. All door frames have to be pre-finished with polyurethane paint in factory before delivery to site.

Vision panel if required through solid/hollow core flush doors, shall be 6mm thick clear glazing.

Shop drawings are required for Architect's approval.

For fire-rated doors, provide certificate for test in accordance with BS476 : part 22 : 1987.

7.0 CARPENTER AND JOINER (Cont'd)

Allow for cut-open inspection of at least one sample each of solid and hollow core doors if the doors are manufactured off site.

7.8 Plywood Ceiling and Bulkhead

Where plywood ceiling and bulkhead are indicated on drawing, they should be plywood and timber grid system provided with moisture proofing coating on the inside and with high PVC content skim coat (5mm thickness) completed with painting as specified. The high PVC content skim coat should conform to French Standard AFNOR, British Standard BS, American standard ASTM, Swedish Standard SIS and German Standard DIN.

7.9 Suspended Ceiling

(a) General

The work for the suspended ceiling shall include the design, fabrication, transportation, assembly and installation of suspended ceilings as described in this specification and shown on the drawings. The scope shall include all ceiling panels and accessories as well as all light fittings and building services installations. Shop drawings and samples should be submitted for the Architect's approval before installation.

(b) Suspended Metal Ceiling

Suspended metal ceiling, if specified, shall be proprietary product, of square aluminium panels type (as indicated on drawing) with concealed suspension system manufactured from a corrosion resistant aluminium alloy, interlocked, 0.63mm thick and 600 mm x 600 mm square panels with polyester-powder coating.

For exterior application, the system shall be interlocked rain-tight and materials shall be finished of excellent weather resistance of fading. The whole ceiling system shall be completed with proprietary accessories.

A corner sample of the ceiling completed with strips and accessories is required for Architect's approval.

(c) Aluminium Strip Ceiling

Aluminium strip ceiling, if specified, shall be proprietary product. The strips shall be linear type in a cross-sectional area of 28 x 100mm, made of 0.6mm aluminium alloy, fluorocarbon-coated white, and provided with proprietary end caps. The entire ceiling shall be patterned at a spacing of 100mm and suspended on proprietary runners and carriers and hung by 4mm dia. GMS hanger rod.

For exterior application, the system shall be interlocked rain-tight and materials shall be finished of excellent weather resistance of fading.

A corner sample of the ceiling completed with strips and accessories is required for Architect's approval.

(d) Access Panel

Proprietary access panels resembling the look of the ceiling system should be provided for accessing building services.

7.0 CARPENTER AND JOINER (Cont'd)

7.10 Toilet Cubicles

(a) Cubicle System

Supply and install proprietary cubicle system. The cubicle panel and hardware shall be off-white and grey in colour respectively and satisfy the following criteria for partition components:

Panels

(i) Panels to have a minimum thickness of 13mm homogeneous high-pressure solid grade laminate impregnated with phenolic resin to industry standards factory formed in one-piece divisions with pre-finished edging.

(ii) The panels are to be frameless with a carrying structure composed of stainless steel rails and feet, joined at their edge jointing system, providing the necessary resistance to external forces.

(iii) Should have built-in stability, be stress and distortion-free, shock-resistant and waterproof.

(iv) Allowance should be made for the fitting of door stops/coat hooks, shower racks, bench seats and other accessories as specified elsewhere to the partitions. For WC cubicles, one hook has to be provided and installed for each cubicle.

(v) All partition panels should be raised above finished floor level by 50mm.

(vi) Colour samples for panels have to be submitted for selection.

Doors

(i) All doors should be flush with the partitions and have provision for silent operation with door stops/rubber strips. An engaged/vacant indicator shall be provided together with a door locking lever with emergency door opening device.

(ii) All doors should be raised above finished floor level by 50mm.

(iii) Colour samples for doors have to be submitted for selection.

Hardware

(i) Spring hinges (hold door open of closed) with adjustable tension for various opening angles are to be provided.

(ii) Provide suitable height adjustment devices of stainless steel materials with covers, screw-fixed to floor, designed to minimize the permanent marking of building surfaces, and to permit height adjustment of the partition whilst remaining in contact with the floor. Note that materials are to be non-corrosive.

Wall Connection

(i) Wall Connection strips are to be adjustable to suit site conditions.

Trim

(i) Mitre and return partition mouldings at junctions with surfaces of the building structure in accordance with proprietary system. Finish the tops and base of partitions with a moulding/edging matching the partition/metal sections as per the proposed system, including end caps to partition posts if applicable.

7.0 CARPENTER AND JOINER (Cont'd)

(b) Submission

Within three (3) months of the notification of the award of the Contract, the Contractor shall submit the following:-

(i) Confirmation of providing specified component or the proposed product with name of the proposed specialist, catalogues and technical specifications and recommendations for installation for approval.

(ii) Document on property testing of the products and components with factory test data and test report certified by an independent testing authority showing compliance with the criteria of specified tests;

(iii) References of previous successfully completed local and/or overseas installation the manufacturer's written statement certifying the product complies with this specification and is suitable for the intended use, and the Manufacturer's written approval of the specialist installing firm.

(iv) Two (2) sets of shop drawings with installation details in relation to the building structure including any builder's works requirements. Shop drawings should indicate all wall connections, partition jointing, door, hardware and supporting feet details, dimension and tolerances, material and finish specifications, together with fully dimensioned plans and elevations for all areas.

(v) Colour samples of all partition and bench materials including hardware for selection.

(vi) Sample of a scaled model (minimum 1:50) of a minimum of one cubicle with wall connection details, adjacent partition jointing, door, hardware and supporting feet shown. All hardware and connections to be actual size. Samples of the panel materials including doors and finish minimum 300 x 300mm indicating both a section through the material and the proposed edging are also required.

Upon approval, four (4) sets of hard copies and one (1) set of soft copy in electronic format of the approved drawings shall be submitted to the Architect.

The approval by the Architect of the Contractor's design proposal shall not relieve the contractor of the duties and responsibilities required under the contract.

It is the Contractor's responsibility to ensure the timely submission of all required information, allowing adequate time for the review and resubmission procedures prior to actual fabrication and installation on site.

Upon completion, the Contractor shall provide four (4) sets of hard copies and one (1) set of soft copy in electronic format of the following:

(i) As installed drawings.
(ii) An operation and maintenance manual.

7.0 CARPENTER AND JOINER (Cont'd)

(c) Materials and Workmanship

Materials, workmanship and the works as a whole shall conform to, or be of a higher standard than, the minimum required by the latest edition of the Code of Practices, Ordinances of Hong Kong and Regulations made under it.

All materials are to be non-toxic, non-corrosive, compatible with the swimming pool environment, and insensitive to acids, disinfectants and any other substances used for disinfection and washing.

All homogeneous solid grade laminate shall conform to BS EN 438, impregnated with phenolic resin of anti-scratch finish and shall be of adequate thickness to resist the various load and stresses.

For the metal components of the partition system, all mild steel is to be galvanized, all exposed aluminium is to be powder-coated of anodized and metal hardware is to be polished stainless steel.

(d) Operation and Maintenance Manual

Upon completion, the specialist shall give operating instructions to the user relating to the care and use of all products.

The Contractor shall provide completed descriptive information with a full set of installation drawings to show all the features of the system construction. The manual shall also include details on the proper care, maintenance and cleaning of the system.

The manual shall also include recommendations for the care and maintenance of the partitions, instructions for demounting and relocation, and the attachment of fixtures. A list of manufacturers and suppliers of the various partition system components should be indicated with expected delivery period for ordering indicated.

(e) Installation

(i) All partitions shall be installed flush with the finished tops of adjacent wall and in accordance with drawings. Door widths are generally to be a minimum of 600mm wide for the WC cubicle doors. Height is around 1700mm.

(ii) Do not install cubicle before building is weathertight, wet trades have finished their work, wall tiling and floor finishes are completed, and the building is well dried out.

(iii) Set out accurately to ensure frames, panels, fascias and door are plumb, level and accurately aligned.

(iv) Do not cut, plane or sand prefinished surfaces except where shown on Drawings or otherwise agreed with the Architect.

(v) Fix securely, using manufacturer's fixing components without causing distortions to frames, panels and doors.

(vi) Adjust gravity hinges so that doors are closed when cubicles are not occupied.

7.0 CARPENTER AND JOINER (Cont'd)

(vii) Attach divisions and nibs to walls and fronts with purpose made proprietary fixings.

(viii) Prepare the base to receive the partitions and protect existing work from damage during the installation and make good any damage. Provide temporary coverings if necessary. Erect the partitions plumb, level, on their correct alignments, and firmly fixed.

(f) Coordination

The Contractor shall be responsible for the proper co-ordination with the following trades.

(i) Masonry

(ii) Ceramic/Homogenous wall tiling

(iii) Ceramic/Homogenous floor tiling

(iv) Sanitary fixtures and accessories

7.11 Purpose Made Joinery

The Contractor shall construct in strict accordance with Drawings and Specification for those items designated as built-in fittings, complete with the required ironmongeries and locksets (e.g. miscellaneous benches, shelves, worktops and counters).

7.12 Solid Surfacing Material

Worktops shall be built of proprietary solid surfacing material of high-performance acrylic-enhanced polyester resin and in a minimum thickness of 13mm, all in accordance with that specified on drawings. The material shall be able to stand the following tests :

Density	:	BS2782:Part 6:method 620A:1980
Water absorption	:	BS2782:Part 4:method 430A:1983
Tensile strength	:	BS2782:Part 3:method 320A:1976
Tensile elongation	:	BS2782:Part 3:method 320A:1976
Flexural strength	:	BS2782:Part 10:method 1005:1977
Resistance to mechanical damage	:	BS3962:Part 6:1980
Resistance to cold liquid	:	BS3962:Part 4:1980
Resistance to cold oil and fat	:	BS3962:Part 5:1980
Boiling water resistance	:	NEMA LD3-1995, CI3.5
High temperature resistance	:	NEMA LD3-1995, CI3.6
Ball impact resistance	:	NEMA LD3-1995, CI3.8

Colour samples with appropriate edge profiles shall be submitted to Architect for approval.

A warranty of ten (10) years from Practical Completion for the material to be free from defects is required.

7.0 CARPENTER AND JOINER (Cont'd)

7.13 Recycled Plastic

Recycled plastic shall be made of recycled polyethylene (PE) plastics and wood fibres by extrusion process in solid form, and must be non-combustible, no rotting, termites and fungus free, no splinter, water resistant, UV resistant and paint free. Accessories like end caps, post caps, joists, fascia, matching fastening screws should be available for various applications. The material shall be able to stand the following tests :

Static Coefficient of Friction	:	ASTM C1028-96, minimum 0.65 Kgf
Water Absorption and Thickness Swell Test	:	ASTM D1037-96a, minimum 1.88%
Thickness Swell Test	:	ASTM D1037-96a, minimum 0.22%
Linear Thermal Expansion Coefficient	:	ASTM D696-98, minimum 6.32 x 10^{-5} ℃
Hardness Test (Shore D)	:	ASTM D2240, minimum 71
Compression Strength	:	ASTM D695-91, minimum 24.44 Mpa
Flexural Strength	:	ASTM D790-03, minimum 25.99 Mpa
Flexural Modulus	:	ASTM D790-03, minimum 3700 Mpa
Tensile Strength	:	ASTM D638-08, minimum 15.64 Mpa
Elastic Modulus	:	ASTM D638-08, minimum 4149 Mpa
Elongation at break	:	ASTM D638-08, minimum 0.58%
Specific Gravity	:	ASTM D792-98, minimum 1178 Kg/m^3
Flammability test	:	EN71:Part2:1993 General, non-inflammable
Flexural creep test	:	ASTM D6112-97, <1.09% Strain in the Outer Fiber at the Mid-span

The material shall not crack and not rot due to temperature and humidity difference.

Material and colour sample, catalogue and job reference shall be submitted to Architect for approval. After confirmation of the material, the Contractor has to submit shop drawings showing fixing details, accessories arrangement and structural calculation for Architect's approval.

For areas where the recycled plastic is to be fixed to concrete wall without tile finishes, the wall has to be applied with cementitious paint and then sprayed finishing paint before fixing of recycled plastic.

A warranty of five (5) years from Practical Completion for the material to be free from defects is required.

7.14 Fibreglass Reinforced Plastic

Covers to steel components of arbours and pavilion as shown on Drawings shall be fibreglass reinforced plastic complying with the following properties :

Tensile strength	BS 2782 : Part 3	180 / MPa
Flexural strength	BS 2782 : Part 3	150 / MPa
Flexural strength (GRP Moulding)	BS 2782 : Part 10	160 / MPa
Compressive strength	BS 2782 : Part 3	170 / MPa
Shear strength	BS 2782 : Part 3	70 / MPa
Shear strength (GRP Moulding)	BS 2782 : Part 3	90 / MPa
Tensile modulus of elasticity	BS 2782 : Part 3	8400 / MPa
Density	BS 2782 : Part 6	1600 Kg / m^3
Water absorption	BS 2782 : Part 4	0.0525%
Hardness	BS 427 : 1990	19.6Hv /5 / 12
Expansion	ISO 11359-2 : 1999	1.93 x 10^{-6} k^{-1}
Shear force (GRP Moulding)	STMS – 1676B	8586(N)
Pull out force (GRP Moulding)	STMS – 1677	3525(N)
Heat resistance	Up to 64	-
Impact test	BS 6206 : 1981	Class A
Fire resistance	BS 476 Part 4, 5, 6, 7	-

7.0 CARPENTER AND JOINER (Cont'd)

Colour samples with timber grain texture shall be submitted to Architect for approval. The surface paint treatment shall be UV resistance.

Shop drawings and structural calculations shall also be submitted to the Architect and Structural calculations shall also be submitted to the Architect and Structural Engineer respectively for approval prior to commencement of fabrication works on or off-site. The shop drawings shall show materials, sizes, construction details, fastening methods, supporting frame design, joint treatment, and any other relevant details.

7.15 Selected Material Colour

The Contractor shall provide and apply in accordance with selected colour and texture materials for various areas as tabulated below :

Location		Material	
		Material	Colour
Interior of Service Block	Counter Top	Solid surfacing material	Quartz
	Graphic Figure	Laminated plastic sheet	Silver strip (corrugated surface)
			Bluish green (Pantone 5487C)
			Pink (Pantone 4955C)

7.16 Proprietary Materials

The Contractor shall provide and apply selected proprietary materials for various areas as tabulated below :

Location	Proprietary Material		
	Material	Colour	Brand Name and Serial / Model No.
Service block wall and skylight, screen, chess table and seat	Recycled plastic (solid board, natural timber texture)	Chocolate brown	Cheerwood-AN-B2-CL, 88 x 35mm
Pavilion, arbour	Recycled plastic (solid board, natural timber texture)	Yellow teak	Cheerwood-AN-B2-YT, 88 x 35mm
Lift tower wall screen	Recycled plastic (solid board, natural timber texture)	Chocolate brown	Cheerwood-AN-B5-CL, 57 x 35mm
Bridge deck	Recycled plastic (hollow board, natural timber texture with antislip groove	Redwood Espresso	Cheerwood-AK226-RE, 145 x 30mm

8.0 IRONMONGERY

8.1 Scope of Works

The Contractor shall supply and install ironmongery in accordance with the contract documents and this specification.

Unless otherwise stated in Specification, the Contractor should use one constant product for different ironmongery throughout.

8.2 Submission

The Contractor shall submit two (2) sets of ironmongery schedule and catalogues and one (1) sample for all specified items for Architect's approval in six (6) weeks after award of Contract.

If the Contractor proposes to submit alternatives, submission shall include :-

(a) Details of supplier and the qualifications and experience of local staff.

(b) Catalogues, full technical literature and other data, detailing each alternative item proposed.

(c) Samples of each alternative item proposed.

(d) Independent performance test data showing compliance of each alternative item with specified standards.

(e) Independent test data showing compliance with visual appearance requirements after corrosion test.

(f) Independent fire test data for each alternative item of ironmongery proposed for fire rated doors, as specified.

(g) A comparison of each proposed alterative item with specification requirements, listing all deviations therefrom.

8.3 Quality Assurance and Technical Support

Ironmongery shall be manufactured in BS EN ISO 9001 registered factories and supported by BS ISO 9002 registered suppliers. This quality management standard is additional to individual performance requirements.

The supplier shall have permanent qualified staff to provide full local technical support, properly prepare and maintain ironmongery schedules and master key layouts and advise on specification, installation and operation.

8.4 Materials, Finishes and Fixings

Materials shall not be subject to galvanic corrosion with backgrounds or other ironmongery. Finished surfaces of one material whether extruded, rolled, cast or stamped, shall match exactly in colour and texture. All finishes visible on a door face shall be visually identical.

8.0 IRONMONGERY (Cont'd)

8.5 Packaging

All material shall be packed adequately to prevent damage in shipping. Pack all ironmongery items separately, label with manufacturer name, type number and name of item. Tag with the same item number each set carries in the final ironmongery schedule. Furnish the necessary screws, instructions and installation templates for spotting mortising tools in each container or package.

Lock manufacturer shall furnish each set of keys in separate envelopes. The envelopes shall each indicate the key cut number, keying data and location. Do not pack keys with locks.

All package containing keyed sets shall have the floor and door number to which the set belongs.

All knobs and lock sets shall have the floor number, door number and inside direction deliberately marked on the shank.

All packings are to be non-returnable.

Supply ironmongery, complete with fixings and fixing instructions, in substantial, secure, protective package, and well labeled for easy identification. Each major item (e.g. each lock case, closer, panic device or set of handle) shall be individually packaged and protected. Suitable numbers of small items, such as roses, backplates or stops, may be packaged together.

Deliver the packaged ironmongery in substantial, protective boxes, suitable for the mode of transport, with no box weighing over 50 kg.

8.6 Installation and Work Incidental to Ironmongery

The Contractor shall :

(a) Provide suitable, secure, weatherproof stores and receive, check, sort, store and protect ironmongery, on labeled shelves.

(b) Drill pilot holes to receive woodscrews, etc. and replace fixings burred or otherwise damaged during installation. Provide suitable plastic plugs where woodscrews are to be fixed to masonry.

(c) Do not fix permanent ironmongery until heavy work, background finishes and decorations in the area are complete. Install temporary construction levers if a lock must be fitted before completion of such work, finishes and / or decorations.

(d) Clean and lubricate the ironmongery on completion of installation.

(e) Remove ironmongery before executing any subsequent background finishing or repair process.

(f) Fix ironmongery according to the most recent approved schedule, with the proper tools, to supplier recommendations, including drilling lead holes etc., providing suitable masonry fixings, protecting and making good finishes.

8.0 IRONMONGERY (Cont'd)

(g) Check ironmongery before and after installation for correct operation.

(h) Mount each surface mounted overhead closer body on the door face where it is least visible. If in doubt, obtain the Architect's clarification.

(i) All wood or metal doors shall be factory mortised to receive hardware, to ensure correct preparation and avoid potential for negation of fire ratings. Site mortising will not be accepted.

8.7 Completion

Upon date of completion the Contractor shall ensure that the following requirement are carried out :

(a) Removal of all protective covering, clean all items or ironmongery and ensure that they are in proper working condition.

(b) Each set of keys shall be provided with an approved circular chromium plated brass plate 25mm x 1.5mm thick stamped with the identification of Floor / Unit / Door to which it belongs for handing over to the Employer.

(c) Properly arrange, identify, classify and tag any lock spanners wrenches, spare parts and any other tools furnished by the manufacturers with the ironmongery for handing over to the School.

(d) Properly arrange in a file all certificate etc. of the manufacturers furnished with the ironmongery, if any, for handing over to Employer.

8.8 Master Key System

The exact grouping of master-keys shall be in strict accordance with instruction to be issued by the Architect.

The Contractor is required to allow for in his tender, the complete cost for the provision of approved master keying system complete with and including all necessary keys. No subsequent claim by the Contractor for an increase in the contract sum due to his failure to implement this Clause will be entertained.

Allow for 20 keys blanks of various profiles used in the master key suiting and handover direct from the supplier to Employer with the master and servant keys on completion of the project.

8.9 Protection

Provide adequate protection for all ironmongery items / articles during and after installation against possible damage of whatever cause.

Surface which are likely to be scratched during installation, such as aluminium anodizing, shall be supplied with a film or protective which can be easily removed after installation.

8.10 Stocks

The Contractor is to ensure that sufficient stocks are available to allow for replacement of any defective units.

8.0 **IRONMONGERY** (Cont'd)

8.11 Operation, Maintenance, Spares

Deliver to the Employer, on practical completion:

(a) Two (2) full sets of fixing and operating tools.

(b) Bound operation manuals with clearly labelled sections containing a copy of the manufacturer's guarantees, general maintenance and fixing instruction sheets, performance and construction specifications and operation, adjustment and maintenance instructions for all mechanical items, final as-installed ironmongery and keying schedules indicating the master key system and such other information as may be reasonably required.

9.0 STEEL AND METAL WORKER

9.1 Stainless Steel

Stainless steel shall be AISI type 304 for normal use, and type 316 for external use. Except otherwise specified on drawings, all stainless steel work shall be hairline finished. All exposed screws, fastenings, etc. shall be of appropriate materials to the approval of the Architect.

9.2 Hot-Dip Galvanized Steel

All mild steel work shall be hot-dip galvanized to BS 729 : 1971. Where welding is required to hot-dip galvanized metal surfaces, the damaged areas must be protected with an approved cold galvanizing compound such as Z.R.C.

All exposed galvanized mild steel works should be treated with fluorocarbon coating, colour samples to be submitted to Architect for approval.

9.3 Welding of Steel

Welding of steel shall be by :

(a) Gas welding to BS 693 for mild steel.
(b) Metal-arc welding to BS 5135 for mild steel.
(c) Projection welding to BS 5135 for mild steel.
(d) Seam welding to BS 2937 for mild steel sheet.
(e) Other methods, subject to approval.

9.4 Welding of Stainless Steel

Welding of stainless steel shall be by :

(a) Insert-gas are welding to BS 3019 Pt.2
(b) Other methods, subject to Architect's approval

9.5 Visible Welds

Welds visible in completed work to be as follows:

(a) Butt welds to be ground smooth and flush.
(b) Fillet welds to be ground smooth.

9.6 Expanded Metal Lathing and Walkway

Expanded metal lath shall be of the appropriate type to suit different uses, and conform to the following requirements :

(a) For strengthening cement render at all steel posts and walls fabricated in steel frame as shown on the drawings and at expansion joints where applicable, shall be diamond mesh expanded metal lath for lightweight plasters over small openings. The strips are to be cut so that the maximum stiffness is obtained across the strip. The strip is to be fixed to the concrete or brick at one edge and at the centre, at not more than 300 centres.

(b) For use with surfaces of cement render, tile or plaster, shall be conforming to BS 1449:Part 1:1983 and 52% of open area (max. 65% of open area).

(c) For bonding brickwork or masonry blockwork, shall be 300 mm long at 450 mm centres vertically.

(d) For general screed reinforcing, shall be diamond mesh type.

9.0 STEEL AND METAL WORKER (Cont'd)

(e) For reinforcement of brick or concrete block walls, use expanded metal lathing strip reinforcing in width 12 mm less than the width of the wall, laid in courses at 450 mm centre to centre vertically.

In addition, they shall be to BS1369 and to the following or other approved equivalent standard :

(a) Galvanized Steel Lath :
BSEN 10142:1991 DX51D+Z275

(b) Stainless Steel Lath :
BSEN10088-1:1995
X5CrNi18-10/1.4301

As for expanded metal walkway, they shall be stainless steel proprietary product with adequate structural strength to suit Registered Structural Engineer(RSE)'s specification and adequate for submission and endorsement by Structural Checking Unit (SCU) of ArchSD. Local test, if required by RSE and SCU has to be conducted and report submitted.

Proposals substantiated with catalogues and technical data are required to be submitted for Architect's approval.

9.7 Metal Angle Beads

Metal angle beads shall be fixed to external corners of walls or columns to ensure straight edges prior to the application of plaster.

All metal angle beads shall conform to the following standard or other approved equivalent :

(a) Galvanised Steel Beads :

BS EN 10142 : 1991
D X 51D + Z275
D X 51D + Z450

(b) Stainless Steel Beads :

BS EN 10088-1 : 1995
X5CrNi18-10/1.4301

(c) General :

BS EN ISO 9002 : 1994
ISO 14001

9.8 Holdfasts

Door and window frames shall be fixed with mild steel holdfasts 350mm x 40mm x 4mm with one end turned up, drilled, countersunk, the other end split and fish-tailed for building in. A sufficient number of holdfasts shall be provided for fixing at centres not exceeding 900mm, the end holdfasts not more than 300mm from the top and bottom of the frame.

9.9 Dowels

Dowels to door frames, etc. shall be 75mm lengths of 16mm diameter steel bar, mortised for a depth of 20mm into the frame.

9.10 Steel Tubing

Steel tubing for tubular handrail to be to B.S. 1387 - "medium" grade and galvanized.

9.0 STEEL AND METAL WORKER (Cont'd)

9.11 Chromium Plating

Chromium Plating shall be to BS 1224, for "service condition No.3", with "bright", "dull" or "satin" finish.

9.12 Rivets

Rivets for general engineering purposes shall be to BS 4620.

9.13 Rivet and Bolt Holes

Holes for rivets, bolts and other fixings shall be drilled or stamped. Holes shall be no large than those required for clearance of rivets or bolts, etc.

Countersunk holes, if required.

9.14 Rivetted Joints

Rivetted joints shall be drawn tightly together, with rivets completely filling holes.

9.15 Bolts, Screws and Nuts

Hexagon bolts, screws and nuts to be to BS 4190.

High strength friction grip bolts to be to BS 4395, Parts 1 and 2 and to BS 4606, Part 1.

9.16 Fixing Bolts

Stud anchor and fixing bolts to be as B.S. 8.32.

Foundation bolts and nuts to be to BS 1494, Part 2.

9.17 Movement Joint Cover

(a) General

Movement joint covers shall be proprietary products designed and manufactured for the intended purpose of providing flexible cover to structural movement joints.

In areas where there is a possibility of water seepage to area below, a U-shaped proprietary PVC waterstop has to be installed at the joint as a waterproofing measure.

(b) Floor Joint Cover

(i) The Contractor shall supply and install stainless steel flexible floor joint covers to all movement joints at open floor to floor junctions. The floor joint cover shall be anchored into existing structural slab using approved expansion bolts and cast in the new concrete structure with proprietary anchor plates in accordance with manufacturer's recommendation.

(ii) Any filler strips shall be secured in place in a manner that will not allow them to become disengaged as the expansion joint opens and closes. The cover plate shall be fastened in place in such a manner that it maintains a constant spring tension at its center point.

9.0 STEEL AND METAL WORKER (Cont'd)

(iii) The flexible joint covers shall be designed for structural movement joint of 25mm and 50mm. Refer to structural drawings for locations and details

(iv) All stainless steel used for the extrusions shall be stainless steel decks Type 304.

(c) Wall Joint Cover

(i) The contractor shall supply and install flexible wall joint cover to all movement joints at wall to wall flat and right angle junctions.

(ii) The flat cover units shall be 100mm wide and angle units be 75 x 75mm, design for structural movement joints of up to 50mm wide and to allow for vertical and horizontal movement without damage to the wall surfaces. Refer to structural drawings for width of movement joints.

(iii) All cover units shall be anchored on one side of the joint opening. Continuous aluminium anchor strips for flush mount "snap on" wall shall be field drilled and fixed to new walls with approved anchors in accordance with manufacturer's recommendation.

(iv) Unless otherwise indicated, all structural movement joints on external walls shall be covered with 3mm stainless plate of dimensions as specified on drawings and fixed on one side with approved stainless steel anchor bolts.

9.18 Steel Door and Gate

The Contractor shall supply and install steel door and gate, including assembly of door frame and ironmongery, complete with associated vision panels, beads, trims, seals and accessories.

Steel door, gate and frame with or without fire-resisting rating shall be a proprietary product designed and manufactured in factory prior to site installation.

(a) Construction of Doors

Steel door leaf shall be fabricated from 16 gauge (1.3mm) hot-dipped galvanized steel sheet or stainless steel sheet as specified. Doors shall be reinforced, stiffened, sound deadened and insulated with impregnated kraft honeycomb core throughout. For fire-rated steel door, the core shall be filled with non-combustible mineral fiber core to provide the required fire resistance period with respect to insulation.

All doors shall be reinforced as follows:-

14 gauge top and bottom steel reinforcement channels;
7 gauge steel for hinge reinforcement;
16 gauge steel for lock reinforcement;
14 gauge steel for closer reinforcement;

(b) Construction of frames

Flush frame of 67 x 146mm jambsize shall be formed from 16 gauge (1.3mm) galvanized steel or stainless steel with mitered knocked down corner. Mitered corners shall have reinforcements with four concealed integral tabs for secure interlocking of jamb to head. The frames shall be supplied with factory installed rubber silencers.

9.0 STEEL AND METAL WORKER (Cont'd)

(c) Finishes: Primer Painted for Galvanized Steel

(i) Phosphatize: Bonderized is the process of using a "Bonderite" solution to phosphatize metal products.

(ii) Galvanized Steel: The steels shall be hot-dipped to BS 2989.

(iii) Primer: All doors and frames shall be cleaned, Phosphatized and finished as standard with one cost of baked-on rust inhibiting prime paint.

(iv) Finish paint: Should be fluorocarbon coating

(v) Colour of paint from standard colour range and approved by the Architect.

(d) Fire Rating Standard

For fire-rated doors, provide certificate for test in accordance with BS 476: part 22: 1987.

(e) Submittals

The Contractor shall submit the following within 6 (six) weeks after the award of Contract but prior to bulk ordering, for Architect's approval.

(i) Door schedules and shop drawings fully detailing the requirements of each door assembly in sufficient detail to ensure correct manufacture.

(ii) Ironmongery schedules, each set fully detailed and listing each door to which it applies, cross-referenced to an index listing each door and its proposed set type and total quantities.

(iii) Individual, independent fire test / assessment certificates, specific to each fire rated door assembly proposed for the Works, confirming compliance with required ratings.

(iv) Independent smoke test certificates, confirming compliance of proposed smoke control assemblies with required.

(v) Independent acoustic test certificates, confirming compliance of proposed acoustic control assemblies with required rating.

(vi) Any further information required by the Architect and other certificate's required therein.

(vii) Representative quarter-size samples of doors, frames, glass, seals and accessories, indicating standards of materials, construction and finishing.

(viii) Representative sample boards, showing ironmongery and finishes for typical doors, including hinges, an operational lock or locks with door furniture fitted, a pull handle and proposed door closers.

(ix) Provide samples of veneering, to indicate quality and matching, before ordering.

(x) Before commencing full manufacture, provide a section of door assembly sample, to indicate general construction and quality, including fixings, jointing and other systems.

9.0 STEEL AND METAL WORKER (Cont'd)

The Architect shall retain approved samples for checking against items supplied. Only after approval of schedules and shop drawings by the Architect should the Contractor proceed with bulk ordering

9.19 Aluminium Windows, Louvres and Doors

The whole of the aluminium windows, louvers and doors must be carried out at the Contractor's expense by one of the Approved Specialist Contractors for Public Works. The Specialist Contractor should be approved by the Architect. The scope of works shall include the following :

(a) Scope of work

(i) Design, supply and installation of aluminium windows, louvers and doors.

(ii) Supply and application of appropriate sealant around and between aluminium frames and structural openings.

(iii) All necessary waterproof cement grout to prevent water leakages through joints between window frame and structural openings.

(iv) Provision of earthing to windows and doors in accordance with I.E.E. regulations and to integrate it into that of the rest of the building.

(v) Protection of windows and doors as instructed by the Architect. The method of protection shall be to the satisfaction of the Architect.

(vi) Allow the Architect and Employer to visit the workshop, factory, location of assembly and storage area and make inspection to the window prior to taping and delivery to site.

(vii) Supply and application of one coat of cementitious waterproofing admixture according to manufacturer's specification over the external surface of entire cement waterproofing grouting prior to the application of any finishes on top.

(viii) Submission of detailed shop drawing together with calculation (structural and free area) for Architect and Engineer's approval.

(ix) Submission of sample board of all material, accessories and hardware for Architect's approval.

(x) Laboratory test prior to bulk manufacture to demonstrate watertightness function and pressure the product can withstand. The test has to be witnessed by Employer Architect and Engineer.

(xi) Erection of visible mock-up for Architect's approval.

(xii) Carrying out of watertightness tests to waterproofing cement grouting surround to all (100%) windows and louvers.

9.0 STEEL AND METAL WORKER (Cont'd)

(xiii) Carrying out of watertightness test to all (100%) aluminium windows and doors.

(xiv) Cleaning of windows and doors upon completion of the final cleaning down of the building and the removal of protective tapes and strippings.

(xv) Provision of a guarantee of not less than ten (10) years from Substantial Completion.

(xvi) Provision of project closeout submissions.

(b) Abbreviation

The abbreviations where appeared refer to the following :

AA	Aluminium Association
AAMA	Architectural Aluminium Manufacturers Association
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
NAAMM	National Association of Architectural Metal Manufacturers
BS	British Standard
CP	British Standard Code of Practice

(c) Code and Standards

The work shall conform to the latest edition of the Code of Practice on Wind Effects of the Building (Construction) Regulations and the current Practice Notes to AP and RSE issued by Building Authority on this subject.

(d) Architect's Drawings

The aluminium windows, louvers and doors are to be manufactured strictly in accordance with this specification and the Architect's drawings. Alternative details are to be approved by the Architect.

(e) Submittals

Within six (6) weeks after the award of the Contract, the Contractor shall submit the following for the Architect's and Structural Engineer's approval :

(i) Programme of the Works

A fully detailed programmed of the Works showing the various stages of design, sampling, testing, fabrication, delivery and installation of the Works.

(ii) Plan of Delivery

Preliminary plan of the whole stage of delivery from the factory to the site paying careful attention to the traffic from factory to the site conditions with detailed description of the methods of packaging, traffic system, storage and unpacking.

(iii) Plan of Erection

Preliminary plan of erecting with detailed description of the procedure of hoisting, fixing scaffolding, protection and cleaning.

9.0 STEEL AND METAL WORKER (Cont'd)

(iv) Shop Drawings

(1) Furnish four (4) sets of shop drawings of complete scaled elevations and full size details of all the windows, louvers and doors required, showing net glazing area, working details, overall dimensions, fixing position, method of anchorage, full size sections, total quantity for each type, glazing type and sizes and the relationship of the various sections to the interior and exterior work, the points to which all dimensions are taken and the location and details of operation of all ventilators and opening lights. In all cases, the Contractor should coordinate with BS installation to ensure that airducts are fully coordinated with all louver location and sizes.

(2) Furnish full specifications of the materials offered, including product name and location on drawings.

(3) Shop drawings shall be fully co-ordinated with adjacent structure, walls, beams, columns and slabs, all fully dimensioned, and dimensionally co-ordinated. Flashing or other weatherproof installations shall also be indicated.

(4) Shop drawings shall be fully-co-ordinated with adjacent finishes, especially the finishes on the outside and ceilings and walls in the inside of the building and shall include instructions and explanatory details for installation of all materials, including the glazing procedure.

(5) The Architect will review the shop drawings to ensure their conformity to the specification. The Contractor shall make any amendments to the shop drawings upon comments from the Architect. The Architect's approval of the shop drawings shall not relieve the Contractor from any of his responsibilities for the adequacy, safety, suitability of his designs, details and drawings and other requirements as herein specified.

(v) Samples

(1) Submit for approval 2 sets of complete samples showing all typical joints and junctions of sections and fittings.

(2) Submit for approval 2 sets of labeled samples of the type of glass to be supplied. Samples to be of the required colour, thickness and photometrical performance as specified; size of samples to be 600 x 600mm. Samples must show extent of :

(a) Light transmission
(b) Reflectance
(c) Colour of transmitted light as viewed on a white surface

(3) Submit for approval 2 sets of samples of :

(i) Glazing and caulking sealants
(ii) Tapes
(iii) Setting blocks
(iv) Side blocks
(v) Gaskets
(vi) Fixing lugs and plugs or driving pins
(vii) Ironmongery
(viii) Sweep and compression seals
(ix) Waterproof compound

9.0 STEEL AND METAL WORKER (Cont'd)

(4) (a) All samples are to be clearly labeled and identified. Full technical literature and specifications must be provided with the samples.

(b) Samples should show fabrication techniques and workmanship of component parts, and the design of accessories and other concealed or exposed auxiliary items.

(c) One set of approved samples shall be retained by the Architect, for comparison with production materials and one set shall be retained at the location of assembly for quality and workmanship standard.

(d) Any windows, louvers, doors and fittings delivered to the site that are below the standard of the approved samples will be rejected, and shall be replaced at the Contractor's expense.

Before the windows, louvers and doors are installed, the Contractor shall submit the following for the Architect's approval :

(vi) Report of Inspection of Components

Report on the conditions and procedure of the manufacturing process and also results of the inspection of the products in accordance with the approved "Plan of Inspection of Components".

(vii) Plan of Inspection of Erection

Preliminary plan for the procedure for inspection during installation stage so as to maintain quality control on the site.

(viii) Plan of Protection

Preliminary plan of the method of protecting the surfaces of the window and louvres framing and glass (especially from inside) with description as to when the protection can be removed.

Immediately after the installation of the works, the Contractor shall submit a report on the inspection of the erection on the site in accordance with the approved "Plan of Inspection of Erection" for the Architect's approval.

(f) Project Closeout Submission

After submittal to the Architect for approval, the Main Contract shall supply to the Architect the following documents/materials prior to the completion or acceptance of the Main Contract works ;

(i) Five (5) sets of maintenance manuals in English and Chinese describing :

- Glass replacement procedure including all necessary details and reduced size elevations of the building(s) marked with all glass sizes.
- Details of the cleaning agents recommended for use.
- Maintenance procedures for components of the window and door system.
- Recommended procedures for periodic inspections.
- A list of parts, suppliers and any other information to enable the Employer to properly maintain the system.

9.0 STEEL AND METAL WORKER (Cont'd)

(ii) Five (5) sets of as-built drawings reduced to A3 size bound into booklets, and one (1) soft copy of the drawings.

(iii) Spare and tools as required.

(g) Material

Materials shall be free from defects and blemish and shall conform to the relevant specified standards.

Materials of common type shall be obtained from the same Manufacturer.

All materials or components for the windows, louvers and doors shall be fully compatible with each other. Submit upon the request of the Architect test results to prove compatibility of any materials or components.

(i) Aluminium

(1) Aluminium shall be an approved architectural aluminium : Alloy conforming to the requirements of BS 1470-1475 : 1972, of high corrosion resistance and of adequate strength to meet the requirement herein.

(2) The minimum aluminium thickness for main window and door frames, sash members and other components except sills, glazing beads and applied trim shall be 2.0mm.

(3) All component parts and accessories shall be of aluminium alloy, stainless steel or non-metallic materials which will neither deteriorate nor cause corrosion. All bolts or screws shall be of stainless steel or approve alloy, anodized as unit, countersunk flush where practicable or semi-countersunk round headed where not practicably to countersink fully. Isolation tape shall be provided on surfaces where dissimilar materials join or are in contact.

(4) All components, frames, transoms and mullions are to be rigidly fixed together and flash butt welding is to be used for casements and wherever possible for frames. Butt joints of aluminium members (unless flash butt welded) are to be avoided, and great care is to be taken in the design of joints between frame members of transoms and mullions. Sealing of such joints is to be carried out using approved silicone based sealant, bedded in a "V" groove formed at the joint on the outside and applied generally to the inside of sections. Any damage to the joint sealant after installation is to be made good.

(5) All aluminium surfaces shall be finished with clear or coloured anodized coating as shown on drawing and such anodic coating shall comply with BS 1615 and BS 3987 average 25 micron.

(ii) Bolts, Screws, Nuts and Washers

Bolts, screws, nuts and washers shall be to BS 4190. Bolts and screws to be strength grade 4.6 and nuts to be strength grade 4 unless otherwise specified. Washers to BS 4464. High strength friction and grip bolts, nuts and washers to be general grade to BS 4395 Part 1.

9.0 STEEL AND METAL WORKER (Cont'd)

(iii) Glass

General

(1) The Contractor is responsible for calculation of the glass thickness required to satisfy the performance requirements specified herein, and will be required to prove that the thickness of glass proposed is adequate. The minimum permitted glass thickness will be 6mm. No adjustment will be made to the Contract sum if the actual thickness of glass required in accordance with the specification requirement is thicker than those specified in the Specifications and Drawings or those assumed by the Contractor at tender stage.

(2) All glass is to be of the qualities specified in BS 952 : 1978 and is to be free from bubbles, smoke waves, air holes, scratches, distortion and other defects.

(3) In cutting glass, proper allowance is to be made for expansion and each square of glazing is to be in one sheet. Glazing is to comply with the requirements of BS Code of Practice 152 : 1972 to be back puttied, and fixed with metal beads to metal window and doors. Rebates are to be painted with one coat of primer before glazing. Setting blocks shall be in neoprene. Hardness and other criteria shall be approved by the Architect. Glass shall be set on neoprene setting blocks of proper size at quarter points of sill but no closer than 75mm to corner of the glass. Neoprene spacers shall be provided on each face of glass, spaced 900mm maximum with a minimum of 2 spaces per edge of glass.

(4) Compound for glazing to metal is to be approved special compound to maintain the glass in position under load. The compound for glazing shall meet or succeed the test requirements of :

- ASTM Specification C-920
- Federal Specification TT-S-001543A (COM-NBS)
- Federal Specification TT-S-00230C (COM-NBS)
- Canadian Specification CAN2-19.13M87

(5) Glass blades to fixed and adjustable louvers are to be of the exact widths, thickness and lengths required with edges truly parallel and ground to remove sharp arises.

(6) On completion, clean all glass inside and outside, following manufacturer's special instructions where applicable, replace all cracked or broken panes and leave the whole in good condition to Architect's satisfaction.

(7) All samples of glazing materials must be submitted to and approved by the Architect before ordering.

(8) Also refer to Section 11.0 for glass specification.

Clear Sheet Glass

(1) Sheet glass is to be of 'Ordinary Glazing' (O.G.) BS 852 1978 quality and of the following approximate thickness and weights :

3.8 – 4.2 mm thick weighing approximately 9.7 kg per m^2.
6.25 – 6.75 mm thick weighing approximately 17 kg per m^2.

9.0 STEEL AND METAL WORKER (Cont'd)

Obscured Glass

(1) Obscured glass is to be 'Arctic' or other figured rolled or weeded pattern glass, or rough cast glass standard quality, and of the following approximate thickness and weights :

4 –5mm thick weighing approximately 12.8 kg per m^2.
6 –7mm thick weighing approximately 16.76 kg per m^2.
7-10mm thick weighing approximately 24.688 kg per m^2.

(2) The Contractor should note that where obscured glass is required the glass will be chosen from the above alternatives. Samples must be submitted to the Architect for approval before ordering, and should comply with the following :

5.56 – 7.94mm thick weighing approximately 15.55 kg per m^2.
9.13 – 10.72mm thick weighing approximately 24.38 kg per m^2.
11.91 – 13.49mm thick weighing approximately 31.7 kg per m^2.

Float Glass

(1) Float glass shall be of the thicknesses required or as shown on drawings, manufactured in continuous ribbon form, floated in molten condition upon liquid metal at controlled temperatures. The finished product to be completely transparent, both surfaces of the glass being flat, parallel and fine polished, giving clear undistorted vision.

Wired Glass

(1) Georgian wired cast glass is to be of standard quality, 6.3 – 7.3mm nominal thickness and weighing approximately 17.97 kg/m

(2) Georgian wired polished plate glass is to be completely transparent or obscured as specified with both faces ground and polished and of 5.5 –7.2mm nominal thickness weighing approximately 17.07 kg/m.

(3) One way wired glass is to be 5.5 – 7.2mm polished plate glass wired in one direction only with wires at 25mm center to center.

Tempered Glass

(1) Tempered glass shall have structural integrity and shall not have any harmful scratches, pinholes or uneven, sharp angled or filled edges.

(2) All tempered glass shall be 'heat soak' tested at a constant temperature of 280℃ for a minimum of one hour. Compliances test certificates should be submitted prior to actual installation.

(iv) Setting Blocks, Edge Blocks, Spacers and Shims

(1) Setting blocks shall be solid extruded neoprene with a hardness of 85 ±5 durometer shore A, a minimum length 180 width shall be not less than the width of the glazing pocket less 3mm and shall be profiled and secured not to slip during installation and not to obstruct proper drainage of glazing cavity. Setting blocks shall be located at the 1/4 points with side setting blocks as applicable to prevent "walking" of the glazing.

9.0 STEEL AND METAL WORKER (Cont'd)

(2) Edge blocks for centering the glass shall be neoprene of 90 shore A ±5 durometer hardness.

(3) Shims used in conjunction with setting blocks must be of the same materials, hardness, length and width as the setting blocks.

(4) Spacers shall be neoprene of 50 ±5 shore A durometer hardness.

(5) Silicone setting blocks as per ASTM Standards are acceptable.

(6) Blocks, spacers, shims shall meet the requirements of AAMA SG-1-76.

(v) Gaskets and Weatherstrips

(1) Sponge gaskets and weatherstrips shall be extruded neoprene with a hardness of 40 ±5 durometer shore A and conforming to ASTM C-509-70. Design sponge gaskets to provide 35% compressions.

(2) Dense gaskets and weatherstrips shall be extruded neoprene 70 ±5 durometer shore A for hollow profiles and 60 ±5 for solid profiles (NAAMM SG-1-70 or AAMA SG-1-75).

(3) Vulcanize all corners of gaskets both sponge and dense to both sashes and frames.

(4) Silicone Gaskets are acceptable as per ASTM standards.

(5) The Contractor shall submit a Certificate from the manufacturer certifying that the neoprene will conform to ASTMC-509-70.

(vi) Grouting

(1) Waterproof cement grouting around frames shall be composed of waterproofing admixture.

(2) Waterproof compound proposed for application must be approved by the Architect.

(vii) Sealants

(a) All sealants to be use in the glazing/window system shall be high range sealants, which are capable of performing well under dynamic loads. Maximum cyclic movement capability to ±25%.

(b) Unless otherwise specified or shown on the drawings, the silicon weatherproofing sealant for pointing around all window shall meet or exceed the test requirement of :

(a) ASTM Specification C-920
(b) Federal Specification TT-S-001543A (COM-NBS)
(c) Federal Specification TT-S-00230C (COM-NBS)
(d) Fire Test for Building Construction and Materials
UL 263 (ASTM E 119)
AS 1530 Parts 3 & 4
BS 476 Part 20
(e) Canadian Specification CAN2-19.13M87

9.0 STEEL AND METAL WORKER (Cont'd)

(c) Sealants generally are to be used exactly in accordance with the Manufacturer's instructions.

(d) Sealants, which are two part mastic, must be mechanically mixed in the Manufacturer's approved mixers.

(e) Sealants are to be applied to clean dry surfaces primed with the recommended primer.

(f) Sealant pointing is to be of approved colour selected from the Manufacturer's range of available colours and straight edges, flat surfaced and neatly finished, with all excess mastic cut or cleaned off.

(g) All sealants shall be identified and located by product name on shop drawings.

(h) Unless otherwise recommended by the manufacturer, backer rods or back up materials shall be polyethylene foam sponge neoprene conforming to ASTMC509 or open cell polyurethane foam rods, density 4-6 pof, non-greasing, non-staining, non-wicking and non-hygroscopic. Diameter size of the rod is to be at least 25% large than the join width.

(i) Compatibility with contacting materials

(a) The products offered must be compatible with the characteristics and properties of the contacting and neighbouring surface.

(b) Site test of compatibility with surrounding materials substrate etc. shall be conducted before the final acceptance of the proposed sealant.

(viii) Reinforcing Members

Reinforcing members, where used, shall be completely enclosed and if fabricated from steel shall be hot dip galvanized and protected with two coats of proprietary approved metallic coating and shall be treated in the same way where welded.

(ix) Hardware for Aluminium casement windows :

- A. W. Anderberg 301 SS, 4-Bar hinges without stop.
- A. W. Anderberg FA-220SS limited opening mechanism for lower frame.
- Double action level lock handle, or
- Cam latch handle subject to Architect's approval.

The Main Contractor shall consult and obtain written confirmation from the manufacturer as to the dimension and strength of the 4-bar hinges proposed, in relation to the size of the window and thickness of glazing. If the specified hinges are not strong enough for the purpose, and alternative proposal may be submitted for Architect's consideration. The Main Contractor shall guarantee the strength of the hinge when the window is in the fully opened position.

In all cases, budget locks are required.

9.0 STEEL AND METAL WORKER (Cont'd)

(h) Performance

(i) General

(1) Individual components and the system as a whole shall be designed, transported, assembled, installed and protected until completion so that, when subject to the design loads and conditions specified, no visible or measureable damage or permanent deflection occurs.

(2) Attention is drawn to the Hong Kong Buildings Ordinance, Code of Practice on window effects, latest edition, in reference to standard adopted for calculation of horizontal forces on buildings etc. and other relevant statutory regulations.

(ii) Wind Load Calculation Deflection, Water Tightness

(1) All components of the window and louver installation including, (but not by way of limitation) frame sections and sizes, fixings, catches, locks, operating gears, glass thickness, glass locations, weather stripping and gaskets, are to meet the performance standards as described below.

(2) Windows and louvers must be able to resist minimum wind load of the order stated in Table 1 below or calculated in accordance Code of Practice of Wind Effects Hong Kong and to have adequate strength to resist bending, and distortion during fixing, during normal use and during typhoon conditions. The maximum deflection of the window installation under wind load of 3kPa must not exceed 1/180 of the clear span of the window framing member in the same direction where necessary use mild steel cores, anchors, brackets, etc. as stiffeners. Allow in the installation for acceptable thermal and structural movement.

Windows to meet standards for air infiltration, water penetration and sound insulation in accordance with Table II below.

TABLE 1 – WIND LOADING

Height of Building Above ground level	Basic Wind Pressure in kPa
0 – 10	1.2
10-30	2.2
30-50	2.5
50-100	3.0
100 – 150	3.5
150 – 200	3.8
200 – 250	4.1
Above 250	4.3

TABLE II	Windows at level above ground	
	Up to 100m	Above 100m
(a) Air infiltration m^3/h per metre length when subject to a static pressure difference of 1 kg/m^2	8	5

9.0 STEEL AND METAL WORKER (Cont'd)

(b) Water penetration kg/m i.e. no water leakage when subject to static pressure, with water sprinkling at 5 litre/min/sq.m for 10 min	50	75
(c) Sound insulation in dB	28	28

The Main Contractor is required to carry out adequate tests in accordance with BS 5368 on sample window of each type to demonstrate that the window insulation including all pointing, caulking and grouting will meet the performance requirements listed above or BS 6375.

(iii) Tolerances

(1) The Contractor will provide rectangular structural openings to the dimensions shown on the drawings with a tolerance of ±3.2mm.

(2) The tolerances for location of center lines of mullions and transoms etc. shall be ±1.6mm except when transoms or mullions form part of a continuous strip where the tolerances shall not be larger than ±0.4mm.

(iv) Anodised Aluminium Window Frame and Sections

(1) The aluminium windows, shall have unequalled frame sections and shall be manufactured for inside glazing (unless shown on the drawings), with clip on aluminium glazing beads.

(v) Opening Casements and Ventilators

(1) All opening casements shall be protected by heavy duty neoprene weatherproof strips all round, securely and mechanically fixed by a dovetail or similar groove in the frame section and jointed and vulcanized at corners.

(2) Opening casements shall be hung to open as indicated on the drawings and schedules and as follows :
. Side hung casements on projection hinges.
. Top hung ventilators on butt hinges.

(3) Side hung casements shall be fitted with adequate handles each with a two-point nose and a 30mm peg stay bracket riveted or welded to the fixed frame.

(4) Horizontally projected (awning hung) top and side hung ventilators shall be fitted with spring loaded sliding shoes and guides such that the force required to close the window is not less than 4.5 kg wt. Applied at the handle swiveled side arms with maximum opening limits and adequate handles as described for side hung casements.

(5) Ventilators out of reach for hand operation are to be fitted with manual operators in lieu of handles.

(6) All ventilators are to be fitted with adequate typhoon bolts and handles to meet the performance specified and not less than two typhoon bolts.

(7) Handle plates and stay brackets shall be removable and all handles and stays shall be interchangeable.

9.0 STEEL AND METAL WORKER (Cont'd)

(vi) Aluminium Louvres

(1) The louvers shall be of material and of the section shape shown on drawings or schedules, with thickness capable of withstanding distortion under high wind conditions. Louvre blades are to be finished as the frame, secretly fixed or adjustable as shown.

(2) Louvre blades must be provided with vertical flanges at both the front and back of blades, as shown on the drawings.

(3) Selection and analysis for external louvres should be based on test data obtained in accordance with AMCA standard 500. Specific criteria obtained according to this testing shall meet the following minimum requirements :

(a) Minimum free area
- 50% (1220mm square test section)

(b) Water penetration
- less than 60ml (m x 0.25hr)

(c) Maximum static pressure drop
- 35Pa for intake louver
- 60Pa for exhaust louvre

(d) See BS Engineer's requirements for face velocity to suit maximum pressure drop

(vii) Building Movement

Windows, louvers and glazing must be able to accommodate building movement throughout its life due to thermal changes, load deflection, shrinkage, creep and similar movement. The design shall allow for the following :

(1) Lateral movement : 1/500 per Increment of height.

(2) Vertical shortening of column/wall under load : 0.9mm per floor.

(3) Vertical deflection of supporting beam/slab due to imposed load : L/360 or 20mm whichever is the less (where L is the span or length in case of cantilever).

(4) Thermal movement arising from external ambient temperature range of 0℃, and an internal ambient temperature range of 15℃ to 25℃.

(i) Workmanship

(i) General

(1) Material, components and systems incorporated in the work shall be used in compliance with the standards and procedures of the appropriate manufactures. All works shall be of the highest quality and be carried out by competent tradesmen such that the finished work satisfies the requirements of this Specification. Practice shall conform to the relevant part and in the priority of :

9.0 STEEL AND METAL WORKER (Cont'd)

(a) CP118 - The structural use of aluminium
(b) BS 6262 - Code of Practice for glazing of buildings
(c) All current legislations, regulations and CP under the Buildings Ordinance of Hong Kong.

(2) No temporary stress of force shall be applied at any time to the assembly, units, individual components or fixing devices which these have not been designed to withstand.

(3) Conform strictly to the materials finished, shapes, sizes, thickness, and joint locations, required by the approved shop drawings and specification.

(4) Allow for storing units and components on site so as to protect them from injury.

(5) Allow for storing glass on site in a dry, well-ventilated sheltered location. Staining of glass due to improper site storage or transit will be rejected.

(6) Handling of glass shall be kept to a minimum and all glass shall be carefully protected from soiling, condensation and damage.

(7) Allow for carrying out all final fitting and assembly work on site in a workshop established and equipped for that purpose.

(8) All components exposed in the finished work shall be free from warping, oil-canning effects and the telegraphing of welds, studs and other fasteners.

(ii) Setting Out

(1) The gap or space between the aluminium window frames and the concrete structure for each window/louver openings must not exceed 25mm. If the above tolerance is exceeded, the Contractor is required to submit a remedial proposal for the Architect to approve and subsequently rectify the defects before any installation work can be proceeded.

(iii) Fixing of Windows

(1) Fixing of windows and louvers shall generally be of adequate strength to be able to withstand the loads imposed by the window frame without any movement under the conditions specified. In calculating the strength of the fixing method no account shall be taken of any waterproof cement grout or mastic pointing. Where strap fixings are used, all straps shall be hot-dip galvanized and primed and each strap shall be fixed with two or more fixings to avoid rotation of the strap at spacing not more than 400mm center to center. Where the wall thickness of the structural opening is not wide enough to accommodate two or more fixings, two straps shall be applied adjacent to each other with each fixed to the internal and external side of the structural openings. The use of timber for packing around windows is not permitted. Where a rebate is provided in the structure for overlapping of unequal leg frame sections, such overlap shall not be less than 6mm, or additional hot dip galvanized or aluminium water bars shall be installed at the Contractor expense to achieve same result.

9.0 STEEL AND METAL WORKER (Cont'd)

(2) Where frames are to be plugged to walls, etc. Rawplugs, Philiplugs or plugs of similar and approved pattern shall be used. The use of wooden plugs will not be permitted.

(3) The Contractor, with the approval of the Architect, can use approved low velocity piston type power operated fastening system in lieu of plugging. High velocity gun type tools shall be used. The Contractor shall be responsible for compliance with all local regulations regarding the purchase, storage and safety measures to be undertaken in the use of such systems and will be required to follow in detail the manufacturer's recommendations regarding the type and size of fastener suitable for the work.

(4) Where the extension of mullions and transoms for composite units are required to be built in the structural openings, the Contractor shall be responsible to provide shop drawings and to reserve pockets in the structural openings to house the extended parts. No chasing on concrete shall be allowed without prior approval of the method by the Architect.

Provide galvanized wild steel fixing lugs spaced at 300mm centers (maximum) for outer frames of each unit. Where specified, fix lugs with red-heads or Ramset fixing bolts.

(iv) Grouting

(1) Supply and apply waterproofing admixture over the external surface of entire cement waterproofing grouting prior to the application of any finishes on top, and this shall be executed according to the manufacturer's specification.

(v) Watertightness Test to Waterproofing Cement Grouting

(1) Carry out water tightness test to all (100%) the waterproofing cement grouting to surround of aluminium windows, doors, louvers and skylight including preparation of all testing reports. Water shall be maintained full and sprayed from a nozzle with diameter not exceeding 10mm at the bottom end of a water container, with size 65mm diameter and 200mm height, and not exceeding 300mm away onto the installed waterproofing cement grouting on the external face of the building to test the watertightness of the cement grouting. The procedure for testing shall be submitted to the Architect for approval prior to the carrying out of such test. Where water leakage is detected through the waterproofing cement grouting, all grouting shall be removed, redone and re-tested (only partial removal of the grouting is not acceptable).

(2) All testing shall be witnessed by the Architect or his representative. The Contractor is required to give a minimum of 3 days' advance notice to the Architect before execution of the test.

(vi) Joints

(1) Joints shall be hairline joints, tightly fitted and co-ordinated with mullion grids unless otherwise shown on drawings.

9.0 STEEL AND METAL WORKER (Cont'd)

(2) All fastening, jointing and splicing of members shall be concealed. Exposed fasteners shall only occur where expressly permitted by the Architect. Where exposed in the finished surface, screws shall be of the countersunk head type, finished to match the adjacent surface.

(vii) Corrosion Protection

(1) Avoid contact of the completed work between the following metals : -

(a) Aluminium alloys and coppers alloys, nickel, lead or stainless steel.

(b) Iron and steel and copper alloys.

(c) Zinc (including galvanizing) and copper alloys or nickel.

(2) Where unavoidable, coat contact surfaces with bituminous paint, protective tape or other materials of equivalent functions or performance.

(3) Prime with zinc chromate primer and paint two coats of bituminous paint on all steel frame work, cores, anchors and brackets.

(viii) Welding

(1) Carry out welding of steel in accordance with the requirements of BS 5135. Welding to be manual metal-arc welding unless otherwise specified.

(2) Execute welding in a flat or horizontal position wherever possible. Do not weld overhead without approval.

(3) Welding must be carried out by experienced and competent welders. Submit evidence that all welders have passed training tests in BS 1295. Obtain approval from Architect regarding welding procedure prior to commencement.

(4) Welding of aluminium shall be to BS 3571 : Pt 1.

(5) Testing of welds shall be of BS 3451.

(6) The type, size and spacing of welds shall be as shown on the approved shop drawings. Welding materials and methods shall be such as not to cause distortion, discoloration, or result in any other adverse effect on the required profiles and finishes.

(7) Weld spatter and welding oxides on exposed surfaces shall be removed. All exposed welds shall be finished to match and blend with adjacent parent metal prior to application of the finish.

(ix) Glazing

(1) Glazing shall be carried out to BS 6262 and in accordance with the manufacturer's recommendations.

9.0 STEEL AND METAL WORKER (Cont'd)

(2) Glazing shall be carried out to BS 6262 and in accordance with the manufacturer's recommendations.

(3) Glazing shall be carried out form inside the building wherever possible.

(4) Glass and glazing materials shall be compatible with each other and the glass shall be protected from damage and staining of any kind.

(x) Application's Sealant and Gaskets

(1) Sealant and gaskets shall be as shown on the approved shop drawings which shall indicate the sealing mechanism for each location.

(2) The design of all sealed joints shall be in accordance with the recommendation of the sealant and/or gasket manufacturer.

(3) Protecting all adjoining surfaces to sealants and gaskets against staining.

(4) Joints, Joint surfaces and glazing rebates shall be clean, dry, and the free of any material that have an adverse effect on the bonding or sealing of the sealant and gasket materials or on the proper drainage of the glazing rebates.

(5) Apply sealants and gaskets under the conditions and in the manner recommended by the Manufacturer. No sealant that has started to set in its container or has exceeded its self life shall be used.

(6) Where printed instructions are indefinite on the use of a primer, a primer shall be used. Unless printed instructions state to the contrary, sealant shall not be applied when substrates are wet or when the temperature is below 4.5°C.

(7) Fill all joints continuously and completely with sealant, forming a neat, uniform, concave or flat bead. Finish flush with adjoining surface unless otherwise shown on the drawings. All sealant surfaces shall be tooled smooth.

(8) Exposed sealants shall be installed so that top surfaces of the horizontal sealant beads are sloped to drain water away.

(9) Glazing gaskets shall be of the profile, dimension and diameter required to support the glass and resist water penetration.

(xi) Cleaning

The Contractor is responsible to clean all windows/doors/louvers upon the completion of the project and subsequent the removal of protective tapes and strippings and ensure that all exposed surfaces of all work cleaned and left free of smears, dirts, scratches, tape markings, adhesive stains abrasions and residues to the satisfaction of the Architect. Any damages to finishes shall be replaced.

(xii) General

Exposed metal surface shall be finished to match the appearance, colour and texture of the samples approved by the Architect.

9.0 STEEL AND METAL WORKER (Cont'd)

(j) Finishes

(i) Anodic Coating to Aluminium

(1) All aluminium surfaces shall be thoroughly cleaned and given a coating of clear or non-fading coloured anodizing of the hard coat inorganic type specified and be compatible with the alloy used. The coating shall be applied over a caustic etched finish and be sealed effectively. The coating shall have a minimum film thickness of 0.025mm when tested in accordance BS 1615 : 1972 or equivalent standard. Protect surfaces from handling marks until sealers and protective coatings are applied. A certificate of guarantee shall be submitted by the manufacturer verifying the thickness of the anodized coat.

(2) After cleaning and finishing, a clear, non-yellowing colourless coating shall be applied to all surfaces of aluminium. The coating shall be of sufficient thickness to resist damage from alkaline mortar and plaster throughout the period for the Contract.

(3) Delivery to site shall be scheduled for the latest possible date in the course of the construction to shorten the time that the materials will be subject to the hazards of on-site storage and handling. Protective tapes and strippings shall be supplied on all aluminium surfaces and shall not be removed until the final cleaning down of the building. If the design of the window is such that removal of the tape protection is necessary to install the glass, the aluminium surfaces are to be completely re-taped and such tapes shall be maintained until the final cleaning of the window. Where aluminium comes into contact with concrete, brickwork or plaster, it should be coated with an insulating lacquer paint or bituminous paint or tape, etc., to ensure that electric chemical corrosion is avoided.

(4) Repair of damage of finished surfaces by mechanical means (other than those specified) or by painting is strictly forbidden unless authorized in writing by the Architect.

(ii) Fluorocarbon Coating

All aluminium doors have to be treated with 4 coats of PVDF coating with the following performance to achieve the metallic finish:

Properties	Standard	Performance
Specular Gloss	ASTM D 523	Medium Gloss
Dry Film Hardness	ASTM D 3363	Meets or Exceeds Specification
Dry Film Adhesion	ASTM D 3359	No Adhesion Loss
Wet Film Adhesion	ASTM D 3359	No Adhesion Loss
Boiling Water Adhesion	ASTM D 3359	No Adhesion Loss
Impact Resistance	ASTM D 2794	No Cracking or Adhesion Loss
Abrasion Resistance	ASTM D 968	Meets or Exceeds Specification
Muriatic Acid Resistance	ASTM D 1308	No Effect
Mortar Resistance	ASTM D 1308	No Effect
Nitric Acid Resistance	ASTM D 1308	Meets or Exceeds Specification
Detergent Resistance	ASTM D 2248	No Effect
Humidity Resistance	ASTM D 2247	Meets or Exceeds Specification
	ASTM D4585	Meets or Exceeds Specification
Salt Spray Resistance	ASTM B 117	Meets or Exceeds Specification
South Florida Weathering Conditions	ASTM D 2244	Meets or Exceeds Specification
Colour Retention	ASTM D 2244	Meets or Exceeds Specification
Chalk Resistance	ASTM D 4214	Method D659 Meets or Exceed Specification
Gloss Retention	ASTM D 523	Meets or Exceeds Specification
Erosion Resistance	ASTM B 244	Meets or Exceeds Specification

9.0 STEEL AND METAL WORKER (Cont'd)

Colour of the coating shall match that of adjoining finishes, and shall be determined by the Architect.

Alloy grade 3003 or 3004, conform to BS N3 or N4.

(k) Testing

The Contractor will be required to demonstrate that the proposed windows comply with the requirements of this specification in terms of mechanical strength, air-tightness and water resistance. The performance test should be carried out by an independent testing laboratory. Calculations and result must be acceptable to the Architect.

The Contractor will also be required to carry out on site performance test to sample windows of each type with methods to be approved by the Architect.

(i) Laboratory Testing

The Contractor is required to propose the name of an approved laboratory to test on sample panels of any window members and materials to be selected by the Architect to demonstrate that the window installation, including all pointing, caulking and grouting, will meet the performance requirements listed above and elsewhere in this specification. The Contractor is required to submit proposed test regime upon confirmation of laboratory.

(ii) On-Site Watertightness Test

Carry out 100% watertightness tests by spraying water on windows and glazing properly fixed in place on site. All joints between window frames and the concrete surrounds/frames of casements or fixed panels, transoms, millions and sashes are to be tested in accordance with the procedures set out.

Watertightness tests are to be witnessed by the Architect's representative and the Contractor's representative. Test results are to be endorsed by those present.

The joints of windows are deemed to have failed if signs of water seeping through the joints are observed during the tests and within the subsequent two hours after the tests. Those joints which fail to meet the testing requirements shall be reminded and retested again in accordance with the testing methods and procedures set out herein until all criteria specified by the tests have been satisfied all at the Contractor's own expense. Any method for remedial work on the joints is subject to approval.

Submit three (3) copies of the testing reports to the Architect for approval/record.

Testing Method and Procedures shall be as follows :

(1) After the window is glazed, conduct watertightness test as early as practicable before the scaffolding is removed.

(2) 100% watertightness test shall be applied to all windows.

(3) Carry out the test with the waterjet from the outside with the window in a closed position.

9.0 STEEL AND METAL WORKER (Cont'd)

(4) The water shall be applied a nozzle with 1/2" FPT. The nozzle shall be used with a 3/4" hose and shall be provided with a control valve and a pressure gauge between the valve and the nozzle. The water flow to the nozzle shall be adjusted to produce 30 to 35 p.s.i. water pressure at the nozzle inlet.

(5) A continuous jet of water is to be sprayed from the above specified spraying device and at the specified pressure at 300mm form an perpendicular to the window joints. The nozzle of the spraying device is moved manually to and fro along the joints, starting from the lowest horizontal joint at the cill, then the middle horizontal joints, then the vertical joints and lastly the topmost horizontal joint at window head.

(6) Joints between window frame and concrete surround should be tested for a period of 1min in every 2m of joint length, whilst the others shall be tested for a minimum period for 1 min in every 2m of joint length.

9.20 Glass Lift Shaft

The lift tower is composed of partly glass walls and partly concrete walls, with different finishing materials clad on the latter. The Contractor is responsible for design and construction of the lift shaft.

(a) Scope of Work

(i) The Project Structural Engineer has designed the steel structure of the lift shaft. The Contractor shall develop further the details and complete the design to show how the glass and concrete components are fixed to the steel frame, to indicate how the cladding materials are anchored to the wall, to verify the size and thickness of all materials, and to design the junction and interfacing details. In this regard, the Contractor has to engage a Hong Kong Registered Structural Engineer to check and endorse the design before submission to Project Structural Engineer.

(ii) The Contractor shall also coordinate with the Nominated Lift Sub-contractor on the design and construction of the lift shaft, particularly to accommodate lift equipment loads that may apply onto the lift shaft structure.

(iii) The Contractor shall provide the glass portion of the lift shaft including framing, glazing, glazing channel and other accessories, that have been designed, produced, fabricated and installed to withstand the loading criteria as specified by the Project Structural Engineer, without failure including structural defects, deterioration of finishes, and delaminating or deterioration of glass and interlayer.

(iv) The Contractor shall carry out watertightness test and submit as-built drawings, maintenance manuals and material certificates on completion of work.

(b) Code and Standards

The work shall conform to the following codes and standards :

BS476-7:1997	Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products
BS5950-1:2000	Structural use of steel in buildings
BD5655-6:2002	Lifts and service lifts. Code of Practice for selection and installation

9.0 STEEL AND METAL WORKER (Cont'd)

BSEN81-2:1998	Safety rules of construction and installation of lifts and service lifts. Type of Glass : Toughened and Laminated
EMSD Code	Code of Practice on Design and Construction of Lifts and Escalators
BD Code	Code of Practice on Design and Construction of Buildings and Building Works for Installation and Safe Use of Lifts and Escalators

(c) Submittals

Within six (6) weeks after the award of the Contract, the Contractor shall submit the following for Architect's and Structural Engineer's approval :

(i) Programme of Works, Plan of Delivery and Erection
Refer to Section 9.19(e) of this Particular Specification

(ii) Shop Drawings

Shop drawings shall show the fabrication, construction, assembly and fixing details of each element of the lift shaft. The shop drawings shall contain but not limited to the following information :

(1) Plans indicating extent and location of each type of system
(2) Setting out and configuration dimensions
(3) Details for fabrication and erection including fixings, member intersections and interfaces with related materials
(4) Material, finishing and colour designations
(5) Interfacing arrangement with glass lift car, machinery space and lift

(iii) Calculation

Calculations shall be certified by a Hong Kong Registered Structural Engineer, confirming that the lift shaft has been designed to satisfy the requirements of specified loading criteria and maximum deflection limits. Calculations shall include but not limited to the following information :

(1) Factors of safety
(2) Section property computations for framing members
(3) Analysis for applicable loads, pull-out resistance, load factor and shear resistance capacity on anchorage and fixings
(4) Stress and deflection for laminated tempered glass
(5) Stress and movement allowances for glazing channel and joints

(iv) Sample
Submit for approval 2 sets of samples of glass (600 x 600mm), fixing spiders, and sealants for Architect's approval.

(d) Project Closeout Submission

On completion of the construction works, the Contractor shall submit the following documents, in both hard and soft copies, to the Architect :

(i) Maintenance Manual

The manual shall describe methods for proper inspection and maintenance of the complete systems, including the maintenance frequency, types of sealant and agents to be used for cleaning, inspection, dismantling and reinstatement of lift shaft.

9.0 STEEL AND METAL WORKER (Cont'd)

(ii) As-built Drawings

(iii) Certification

Certification shall confirm that products and support systems furnished comply with all applicable standards and specified requirements. Certifications shall include :

(1) Test certificates (including heat soaked test reports and fire resistance test reports) prepared by an Accredited Testing Laboratory previously reviewed without objection by Project Structural Engineer indicating the testing standards used and the testing results.
(2) Product data including construction details, material descriptions, dimensions, mounting methods, performances, and testing recommendations.
(3) Manufacturer's in-house quality inspection records for each production batch.

(e) Performance

The Contractor shall design, provide and install materials and products in accordance with the following requirements :

(i) Loading Criteria

Refer to structural drawings and specifications

(ii) Performance Requirements

The glass lift shafts completed by the Contractor shall satisfy the following performance requirements :

Performance	Description	Unit	Requirement
Flame spread	Resistance to propagation of fire	Index	Min Class 1
Deflection	Acceptable deflection under specified load	mm	As required for lift operation, not to exceed 20mm
Vibration	Resistance to movement under specified load		No vibration, ratting or dislodgement under applied load
Deformation	Resistance to deformation under specified load		No warp-age, oil-canning or permanent deformation
Equipotential Bonding	Electrical safety		In accordance with referenced standard

(iii) Low-E Laminated Tempered Glass

(1) Low-E clear laminated glass shall be provided to vertical shaft walls. Laminated glass at lift shaft wall intersected with ceiling, floor and roof shall receive laminated glass with ceramic silk screening to glass at interlayer.

The glass shall be 2 layers of clear tempered glass and laminated using cast-in place resin interlayer in accordance with manufacturer's recommendations.

9.0 STEEL AND METAL WORKER (Cont'd)

(2) Glass thickness shall be verified by calculation based on the specified loading criteria and deflection limit. All the glass for the glass lift shafts shall be of one thickness. The minimum laminated glass thickness shall not be less than 12 + 12 mm.

(3) Low-E solar function shall be achieved using a proprietary PVB interlayer consisting of architectural grade PVB with an interlayer of low-emissivity coated solar control film. Total thickness shall be not less than 1.52mm.

The PVB interlayer shall have the following solar performance :

- Shading Coefficient less than or equal to 0.45
- Solar heat gain coefficient : less than 0.40
- Day light Transmittance : 70% minimum
- External / internal daylight reflectance 8% maximum
- U-value : 5.7 maximum

The laminated glass with this low-E PVB interlayer shall be fabricated by an approved licensee by the PVB manufacturer.

(f) Installation and Workmanship

The Contractor shall install materials, products and support systems in accordance with the following requirements.

(i) Co-ordination

The Contractor shall furnish sufficient information and details to other nominated sub-contractors, in particular lift-sub-contractor, so that they can prepare their works properly. The Contractor shall verify and coordinate openings and installations on the lift shaft as allowed for the works of the nominated sub-contractors.

The Contractor shall incorporate the calculated deflection and tolerance for operation of the lifts in the detailed design of components for lift shaft.

(ii) Storage

The Contractor shall protect materials and products during storage and handling complying with manufacturer's directions and to prevent damage to materials from effects of moisture, condensation, temperature changes, direct exposure to sun, exposure to subsequent construction activities and from any other causes.

(iii) Preparation

The Contractor shall verify site conditions, locations, and dimensions prior to shop fabrication.

(iv) Examination

The Contractor shall measure and inspect substrates for areas to receive this Work, and shall Inform the Project Structural Engineer of deficiencies that will interfere with the proper installation of the Work, and shall not proceed with installation until deficiencies have been satisfactorily corrected.

9.0 STEEL AND METAL WORKER (Cont'd)

(v) Installation tolerances

The Contractor shall comply with the tolerances required by the lift sub-contractor with regard to size as well as horizontal and vertical alignments.

(vi) Remedial

The Contractor shall restore cladding, glass panel and other exposed components damaged during installation and construction period, so that no evidence remains of correction work.

If results of restoration are unsuccessful, as judged by the Architect and Structural Engineer, the Contractor shall remove damaged units. The new units shall be identical to the other panels and components of the Work to eliminate evidence of replacement.

(vii) Protection and Cleaning

The Contractor shall retain temporary protective coverings and strippable firms, if any, after installation of the Work. The Contractor shall provide additional protective coverings if the installed Work would possibly be damaged by other work trades nearby. The Contractor shall also allow for temporary removal and subsequent reinstatement of the temporary protective coverings for the Engineer's inspections.

Upon completion of the Work, the Contractor shall remove all temporary protections and clean finished surfaces as recommended by manufacturer.

(g) Testing

The Contractor has to carry out on site performance test in accordance with Section 9.19(k) of this Particular Specification.

9.21 Fall Arrest System

The Contractor has to provide a proprietary fall arrest system on roof. Shop drawings and structural calculations are required for submission to Architect and Structural Engineer for approval. On completion of the system, the Contractor has to provide training courses and an Operation and Maintenance Manual, and has also to provide certificate on strength and safety of the system.

9.22 Outdoor Bench

The Contractor should supply and install proprietary outdoor bench in accordance with Drawings and the following requirements :

(a) The dimension of bench is 1200mm (L) x 650mm (W) x 800mm (overall height).

(b) The bench is made of recycled plastic slats on GMS RHS supporting frame. Slate and GMS frame colour are walnut brown and grey respectively.

(c) The slats should be at least 60mm x 45mm in size. At least 13 nos. of slats should be evenly distributed along the bench top and the gaps in between slats should not be greater than 100mm.

9.0 STEEL AND METAL WORKER (Cont'd)

(d) All frame of the bench should be galvanized metal applied with sand blasting and zinc sprayed anti-corrosive treatment. Any on-site welding of the steel members are strictly prohibited.

(e) 2-component polyurethane spray paint finish has to be applied on all metal frame in factory. On-site painting is not allowed.

(f) Concealed type fixing should be used.

(g) The bench has to be tightly fixed to ground with no exposed and protruded fixing accessories.

(h) The proposed bench should have job reference in Government Park or recreational projects in the past 2 years.

The Contractor has to submit shop drawings, ground fixing details and calculations, material samples, product images and job references of the proposed bench for Architect's approval.

9.23 Outdoor Litter Bin and Recycled Bin

The Contractor should supply and install proprietary outdoor litter bins and recycled bin in accordance with Drawings and the following requirements :

(a) The dimension of the litter bin is 430mm dia. x 1125mm (overall height).

(b) The dimension of the recycled bin is 1630mm (L) x 430mm (W) x 1060mm (overall height).

(c) The body of litter bin is made of recycled plastic slats on GMS supporting frame with side opening door provided with lock. The cover shall be made of 3mm thick GMS plate. Inner bin is of 3mm thick GMS plate and is to be chained to the GMS frame. Slate and GMS frame / plate colour are walnut brown and grey respectively.

(d) The body of recycled bin is made of recycled plastic slats on GMS supporting frame with 3 side opening doors provided with lock. 230 x 350mm x 2mm s.s. plate with acid etched graphic shall be mounted one ach opening door. The cover shall be made of 3mm thick GMS steel plate. 3 nos. of independent inner bin shall be provided, each built of 3mm thick GMS plate, and is to be chained to the GMS frame. Slate and GMS frame / plate colour are walnut brown and grey respectively.

(e) The slats should be at least 75mm x 25mm in size. At least 12 nos. and 49 nos. of slats should be evenly distributed along the litter bin and recycled bin body respectively, all at close joint.

(f) All frame and plate of the bench should be galvanized metal applied with sand blasting and zinc sprayed anti-corrosive treatment. Any on site welding of the steel members are strictly prohibited.

(g) 2-component polyurethane spray paint finish has to be applied on all metal frame in factory. On-site painting is not allowed.

(h) Concealed type fixing should be used.

(i) The bin has to be tightly fixed to ground with no exposed and protruded fixing accessories.

9.0 STEEL AND METAL WORKER (Cont'd)

(j) The proposed litter bin and recycled bin should have job reference in Government park or recreational projects in the past 2 years.

The Contractor has to submit shop drawings, ground fixing details and calculations, material samples, product images and job references of the proposed litter bin and recycled bin for Architect's approval.

10.0 PLASTERER, PAVIOR & TILER

10.1 External Plaster Finish

The degree of smoothness for external plaster must be steel trowelled finish. A sample plaster panel together with tile finishes shall be prepared for Architect's inspection prior to the commencement of the plastering work.

10.2 Rendering

All rendering and spatterdash mix shall be added with render improver in accordance with the manufacturer's recommendation. The render improver shall have the following performance:

(1) High porous substrate: cohesive failure within aerated concrete block after 7 days cure.
(2) Euro Norm standard concrete block

(i) No treatment, mean 0.3N/mm² after 14 days

(j) NRI/water/cement, keycoat achieved 1.95 N/mm² after 28 days cure and 2. N/mm² after 56 days cure.

(k) NRI/cement, keycoat achieved 2.16 N/mm² after 28 days cure and 2.29 N/mm² after 56 days cure.

All rendering shall be steel trowelled finish to smooth and level surface prior to the application of sprayed textured polyurethane coating.

10.3 Tile Adhesive

All external wall tiles and homogenous tiles, if specified, shall be fixed with an approved proprietary adhesive, complying with BS 5980 and in strict accordance with manufacturer's specification for its application.

Tile joint shall be grouted with an approved proprietary coloured grout material. A written guarantee for the materials to be free from breaking down and deterioration is required for five (5) years from Practical Completion.

10.4 Waterproof Cement Rendering

Where waterproof cement rendering is specified, the additive shall conform to AS 1479-A3 standard, and shall be used in strict accordance with the Manufacturer's instructions and under the supervision by the Specialist Supplier.

Technical data for waterproof cement rendering should be as follows:

Test (Units)	Method*	Mean Results
Water pressure (6 metres)	MOAT 27:5.14	No penetration
Low temperature flexibility (at -25 °C)	MOAT 27:5.4.2	
-unaged		No cracking
-180 days heat aged at 80 °C		No cracking
-UV aged		No cracking
Static indentation	MOAT 27:5.1.9	
-concrete sybstrate		L4
expanded polystyrene		L4
Dynamic Indentation	MOAT 27:5.1.10	
-chipboard substrate		I4
-expanded polystyrene		I3
Unrolling ar low temperatures/0 °C	MOAT 27:5.4.3	Satisfactory
Tests on joints Air pressure at 10kPa	MOAT 27:5.2.1	
-hot air weld		No penetration
-solvent weld		No penetration
Tensile strength (N)	MOAT 27:5.2.2/4	
hot air weld		
-unaged		944
-28 days heat aged at 80 °C		910
-7 days water soak at 60 °C		822

10.0 PLASTERER, PAVIOR & TILER (Cont'd)

solvent weld		
-unaged		851
-28 days heat aged at 80 °C		913
-7 days water soak at 60 °C		855
Weldability (Nmm^{-1})	MOAT 29:4.17.2	
-hot air weld		2.94
-solvent weld		2.88
Test (Units)	Method*	Mean Results
Water pressure (6 metres)	MOAT 27:5.14	No penetration

10.5 Waterproof Cement Grouting

Where waterproof cement grouting is specified, the additive shall conform to AS 1479-A3 standard, and shall be used in strict accordance with the Manufacturer's instructions and under the supervision by the Specialist Supplier.

Whether or not mentioned on the drawings, waterproof cement grouting shall be applied to all external work, including grouting around window frames and doors frames.

10.6 Surface Hardener

(a) All granolithic flooring and cement/sand screed finish as shown on Drawings and finishes schedule shall be coated with an approved surface hardener.
(b) The floors shall be cleaned and dry before the application of two coats of surface hardener/dust-proofer in strict accordance with Manufacturer's instruction.

10.7 Recessed Joints

Recessed joints or groove lines shall be formed on large panels of cement screed/rendering/tiling to a maximum length of 5m or in accordance with the existing details or as specified by the Architect. Such joints shall be sealed with polysulphide sealant.

10.8 Dividing Strips

3 mm thick stainless steel dividing strips shall be provided, set between different floor finishings, wherever applicable.

10.9 Sealant and Pointing

(a) Unless otherwise specified or shown on the drawings, the sealant for expansion joints shall comply with the following standard and have the following properties:

(i) ISO 11600:1993
(ii) British Standard BS 4254:1983
(iii) British Standard BS 6920:1988 (gun grade grey)
(iv) U.S. Federal specification TT-S-00227E November 1969 (amended 1970)
(v) ATSM C920-87: Type M, Grade NS, Class 25

Form	:	Multi-part, paste compound
Movement Accommodation Factor (BS 6093)	:	25% butt joints 50% lap joints
Physical or Chemical Change	:	Chemical cure
Pot Life	:	2 hours @ 25°C
Setting time	:	72 hours at 5°C 36 hours at 15°C 18 hours at 25°C
Cure Time	:	Grey, Black, mahogany, Brick Red: 4 weeks at 5°C 2 weeks at 15°C 1 week at 25°C Off white, Stone: 8 weeks at 5°C 4 weeks at 15°C 2 weeks at 25°C
Application Temperature	:	5°C to 50°C

10.0 PLASTERER, PAVIOR & TILER (Cont'd)

Operation Temperature	:	-20°C to +60°C	
Hardness Shore "A" 25°C	:	Pouring Grade: 15 to 23	
		Gun Grade: grey, black mahogany, brick red: 20 to 25; Stone, off white: 28 to 23	
Water Immersion	:	Must be Cured before permanent immersion in water	
Chemical Resistance to Occasional Spillage	:	Dilute Acids	Resistant
		Dilute Alkalis	Resistant
		Petrol	Resistant
		Aviation Fuels	Resistant
		Diesel Fuel	Resistant
		Kerosene	Resistant
		Lubricating Oil	Resistant
		Skydrol	Resistant
		White Spirit	Resistant
		Chorinated Solvents	Not Resistant
		Aromatic Solvents	Not Resistant
		Dilute Oxidizing Acids	Not Resistant
Biological Resistance	:	Should be evaluated in microbiologically active situations and shown to have resistance to aerobic conditions	
Solids Content	:	100%	
Density	:	1.62 to 1.73kg/litre according to colour	
Flash Point	:	Over 65°C	
Flammability	:	Burns but does not readily support combustion	

The sealant shall be based on a liquid polysulphide polymer, which when mixed and applied, cores to form a tough, rubber-like seal.

Joints shall be prepared and the sealant mixed and applied in accordance with the manufacturer's current data sheet.

(b) Sanitary sealant shall be used for joints between sanitary fixtures and wall/floor/counter top finishes where applicable. The sanitary sealant shall have the following properties:

As supplied – tested at 25°C, 50% relative humidity		
Flow, Sag or Slump	:	Nil
Approximate Working Time	:	10 Minutes
Tack Free Time	:	15 Minutes
In-depth cure at 25°C	:	2 mm
As Cured – after 7 days at 25°C, 50% relative humidity		
Durometer hardness, Shore A	:	17 Points
Ulitmate Tensile Strength	:	1.35Mpa
Temperature Stability	:	- 45 to + 150 °C
Movement Capability	:	± 25 %

All sanitary fixtures are to be properly pointed accordingly (where applicable), colour of which shall match with wall/floor finishes and subject to the Architect's approval.

(c) Polysulfide sealant where specified shall comply with British Standard BS 5215:1986 and have the following properties:

Form	:	Paste	
Movement Accommodation Factor (BS 6093)	:	Total joint movement for cured sealants: 20% for butt joints	
Physical or Chemical Change	:	Chemical cure	
Cure Rate	:	Should form a surface skin within 24 hours. Though cure gradually proceeds over a period of weeks depending upon temperature, humidity, substrates and sealant depth.	
Application Temperature	:	5°C to 50°C	
Hardness Shore "A" 25°C	:	25 to 30	
Water Immersion	:	Not suitable for use in submerged joints	
Chemical Resistance to Occasional Spillage	:	Dilute Acids	Resistant
		Dilute Alkali	Resistant
		Lubricating Oil	Resistant
		Petrol	Resistant
UV Resistance	:	Good	
Solids Content	:	95%	
Density	:	1.6 kg/litre	
Flash Point	:	Over 65°C	
Flammability	:	Burns but does not readily support combustion	

Joints shall be prepared and the sealant applied in accordance with the manufacturer's current data sheet.

10.0 PLASTERER, PAVIOR & TILER (Cont'd)

(d) Silicone glazing sealant shall be conform to the following or equivalent standard and have the following properties:

(i) Federal Specification TT-S-001543 Class A
(ii) Federal Specification TT-S-00230 Class A
(iii) Canadian Specification CAN2-19.13-M82
(iv) ASTM C920 Specification Class 25
(v) Chemically acceptable for application to surface and equipment that may contact edible products in establishments operating under the USDA federal meat and poultry inspection programme.

Method	Test	Unit	Result
As Supplied			
ASTM C 679	Tack-Free Time	minutes	10-20
Skin formation Test	Tooling Time	minutes	5-10
ASTM C 639	Flow, Sag or Slump	inches	Nil
EPA method 24	VOC content, all colours, max	g/L	40
ASTM C 603	Extrusion Rate	g/minutes	350
As Cured – 7 days at 25°C (77°F), 50%RH			
ASTM D2240	Durometer Hardness	Shore A	25
ASTM D 412	Ultimate Tensile Strength	psi(Mpa)	325(2.1)
ASTM D 624	Tear Strength	ppi (kN/m)	25 (4.4)
ASTM C 794	Peel Strength	ppi (kN/m)	20 (3.5)

(e) All surfaces on which sealant to be applied shall be cleaned with trichloroethylene prior to application of sealant pointing.

(f) The Contractor shall submit sample and catalogue for the proposed sealant for Architect's approval.

10.10 Plastering Tape

Plastering tape shall be provided to joints of plywood ceiling and samples of which shall be submitted for the Architect's approval prior to ordering.

10.11 Cracks in Plaster

Cracks occurring in plaster work during the Defects Liability Period shall be dealt with as follows:-

- Hair cracks which are not normally visible at a distance of 1m away will not require attention.
- Cracks around the edge of wall areas will be filled and repainted to match the existing paint as closely as possible.
- Cracks which are in a wall or ceiling area away from the edges will be dealt with as above provided that when the appearance is still unsightly, the whole wall or ceiling may be required to be repainted at the discretion of the Architect.

10.12 Defects in Tiling Works

Any tilework which does not dry to an even colour, or which has joints of differing widths, whether due to the tiles not being thoroughly square or to bad workmanship, or which show cracks, uneven edges or other flaws, will be replaced. Clean all mortar or paint drippings from tiles surfaces prior to handing over completed works.

10.0 PLASTERER, PAVIOR & TILER (Cont'd)

10.13 Ceramic Tiles

Glazed ceramic mosaic wall tiles, where specified, shall be to BS 6431 and sized approximately 45 x 45 x 7mm cushion-edged and with metallic finish. Corner tiles or jolly-edge treatment are required for internal and external corners. Colour range shall be provided for Architect's approval and be in accordance with finishes schedule and Drawings. The tiles have to fulfil the following standards :

Water absorption	:	ENISO 10545-3, >10%
Moduls of rupture	:	ENISO 10545-4, 20N/mm^2
Thermal expansion coefficient	:	ENISO 10545-8, 7MK^{-1}
Resistance to acid and alkali	:	ENISO 10545-13, no alteration

Tiles have to be bedded and jointed solid in cement and sand (1:3) bedding to the stated thickness and pointed with a neat flush joint in coloured grout.

10.14 Homogeneous Tiles

Homogeneous tiles, if specified, shall be 150 x 150 x 8 mm matt finish for wall and 300 x 300 x 8 non slip finish (R11) for floor as specified. Tread tiles are required for steps, corner tiles are required for walls, and coved tiles are required for skirting. Jolly-edge cutting may be accepted as an alternative to corner tile subject to presentation of samples to and approval by Architect. Sizes and colour range shall be provided for Architect's approval and be in accordance with finishes schedule and Drawing. An approved proprietary adhesive complying with BS 5980 is required to fix the tiles to wall. The tiles shall also stand the following tests :

Water absorption	:	ASTM C-373 (impervious)
Size	:	ASTM C-499 (warpage ± 1% on any edge, ± 0.75% on diagonal, wedging ± 1%)
Bond strength		ASTM C-482 (50 PSI or greater)
Abrasive hardness	:	ASTM C-501 (100)
Thermal shock resistance	:	ASTM C484-66
Frost resistance	:	ASTM C-1026, C-1028, C-674
Chemical resistance	:	ASTM C-650
Break strength	:	ASTM C-648 (250 PSI or greater)
Colour resistance to light	:	DIN 51094
Impact resistance	:	ASTM C-368
Skid resistance	:	ASTM C-1028

10.15 Homogeneous Court Tile

Homogeneous court tiles shall be 600 x 600 x 12 mm non-slip (R11) plain finish with lustrous quartz look. Tread tiles are required for level drops. Colour range shall be provided for Architect's approval. The tiles shall stand the following tests :

Water absorption	:	ISO 10545-3 (0.04% max.)
Frost resistance	:	ISO 10545-12 (frost proof)
Bending strength	:	ISO 10545-4 (50 N/mm^2 max.)
Breaking strength	:	ISO 10545-4 (compliant)
Thermal expansion	:	ISO 10545-8 (7 x 10^{-6} ℃$^{-1}$ max.)
Thermal shock resistance	:	ISO 10545-9 (resistant)
Chemical resistance	:	ISO 10545-13 (resistant)
Stain resistance	:	ISO 10545-14 (resistant)
Slip resistance	:	DIN 51130 (R11)
Dynamic friction coefficient	:	B.C.R. (>0.40)
Coefficient attrito statico	:	ASTM C1028 (wet/dry>0.60)
Surface resistance	:	EN101 (mohs 6)

10.0 PLASTERER, PAVIOR & TILER (Cont'd)

10.16 Homogeneous Roof Tile

Homogeneous roof tiles shall be 300 x 300 x 10mm thick unglazed and non-slip finish (R12) as specified.

The concrete slabs are to be swept and well washed before the tile is laid, and laying is by semi-dry mix method, with cement and sand 1:4 semi-dry mix bedding compacted to required thickness (minimum 20mm) and cement and sand 1:1 slurry over bedding. All joints should be even and grouted up with coloured cement.

10.17 Granite Tile

External granite wall tiles shall be to BS 6431 and sized approximately 227 x 60 x 13mm. Purpose-made external corner tiles shall be provided to all external right angle corners. If corner tiles are not available, jolly edge may be accepted as alternative subject to presentation of samples and approval by Architect. Colour range shall be provided for Architect's approval and be in accordance with finishes schedule and Drawings. The tiles shall also stand the following tests :

Water absorption	:	JISA5209-1994 (under 1.0%)
Abrasion test	:	JISA5209-1994 (under 0.1g)
Bending strength Chemical resistance	:	JISA5209-1994 (100N/cm or over)
Acid (3% Hcl.)	:	JISA5209-1994 (no deterioration)
Alkali (3% NaOH)	:	JISA5209-1994 (no deterioration)

10.18 Reconstituted Stone

Reconstituted stone, if specified, shall be 150mm wide x 12mm thick honed finish as specified. Colour range shall be provided for Architect's approval and be in accordance with finishes schedule and Drawings. The stone shall also attain the following tests :

Density	DIN 52102, ASTM C 97
Water absorption	DIN 52103, ASTM C 97
Flexural strength (Modulus of rupture)	DIN 52112, ASTM C99
Compressive strength	ASTM C 170
Surface scratch hardness	EN 101
Resistance to deep abrasion	DIN 52108, ASTM C241, EN 102
Coefficient of linear thermal expansion	DIN 53752
Dimensional stability	Mapei Method
Resistance to chemicals (acids)	ASTM C 650
Frost resistance	DIN 52104-B, Teil 1
Combustion reaction	DIN 4102 Teil 1
Suitability for use in wet area	EMPFEHLUNG XII, BGW, DIN 68930

10.19 External Granite Cladding

External granite cladding is to be provided to walls in accordance with Drawings.

All granite claddings for lift tower are to be dry-fixed, and all surfaces of the granite claddings have to be applied with sealer.

The concrete surface has to be applied with cementitious waterproofing paint before fixing of granite cladding. Catalogue of the paint should be submitted for approval, and application shall be in strict accordance with manufacturer's instruction.

10.0 PLASTERER, PAVIOR & TILER (Cont'd)

The Contractor has to submit full-size samples, shop drawings and structural calculations of granite cladding for approval.

A written guarantee for integrity and watertightness of the material (including joints) is required for three (3) years from Practical Completion.

10.20 Tactile Markers

Proprietary steel markers with anti-slip (R13) crystal colour carborondum grit filled with spigot 96mm diameter, 15mm long) shall be provided at guided paths for the disabled. Samples of applicable sizes and profiles shall be provided for Architect's approval and be in accordance with finishes schedule and Drawings.

Proprietary plastic markers with embossed slip resistant surface (R13) and spigot at a size of 35mm diameter and 5mm protrusion height may be accepted as alternative subject to presentation of decent colour meeting luminance – contrast requirements and treatment against damage and vandalism to Architect's approval.

10.21 Washed Grano

Washed grano finishes are to consist of one part by volume of Portland Cement to one part of granite fines and two parts of either grey granite or white stone aggregate graded from 3mm to 10mm and free from dust and decomposed or coloured stone. They are applied and trowelled to a plane surface to the substrate, well washed and scrubbed down just prior to setting in order to remove superfluous cement.

10.22 Access Panels

The Contractor shall supply and install access panel for inspection and maintenance to all concealed drainage works and other services inside bulkhead and duct enclosure. The access panel shall be an approved proprietary product of flush access door. The access doors for plaster construction should have 22 gauge expansion casing bead with galvanized lath between frame and plaster. The door panel finishes flush with the plaster surface and is held in place by continuous concealed piano hinge. Frame shall be 16 gauge steel and door at 14 gauge steel.

Locks shall be provided for all access panels and shall be key operated cylinder lock with automatic dust shutter.

Finish shall be prime coat of rust inhibitive electrostatic powder baked enamel. Colour to be submitted for the Architect's approval.

The Contractor shall coordinate with drainage works and other services for details and locations of access panels. Installation of the access doors shall be in strict compliance with manufacturer's specification.

10.23 Submission for Approval

All finishing materials, including tiles, mats, panels, etc. have to be proposed by Contractor with a comprehensive submission of sample board, colour chart, catalogue and relevant technical data for the Architect's approval within six (6) weeks after award of Contract. Those materials should have at least 10 local job reference in Government and recreation projects in last 2 years.

10.0 PLASTERER, PAVIOR & TILER (Cont'd)

10.24 Setting Out of Wall and Floor Finishes

Whether or not shown on drawings, the setting out lines of wall and floor tiles, stones, etc. have to be presented to and confirmed acceptance by Architect on site prior to cutting and laying of those finishes.

10.25 Colour and Luminous Contrast

Floors of level drops should be provided with tread tiles at the raised portion in contrasting colour. Treads and walls of steps should also be in contrasting colour.

In addition, luminous contrast should be provided in accordance with the following minimum standards :

Step nosing and adjoining surfaces — ≥30%
Step tread and adjoining wall — ≥30%
Tactile marker and adjoining surface —≥50%

Similar colour and luminous contrast in accordance with the latest Design Manual for Barrier Free Access as issued by Building Authority has to be complied with.

Floor finishing supplier's confirmation to achieve the above standards sould be submitted together with material sample submission.

10.26 Selected Material Colour

The Contractor shall provide and apply materials in accordance with selected colour and texture for various areas as tabulated below :

Location		Material	
		Material	Colour
Exterior of Service Block	Wall	Artificial granite tile (60 x 227 x 13mm, rough surface)	Beige (Pantone 4525C, with shiny white dots)
			Light Grey (Pantone 422C, with shiny white dots)
	Court Floor	Homogeneous tile (600 x 600 x 12mm, non-slip plain surface)	Ivory (Pantone 454C, quartz)
	Roof	Homogeneous tile (300 x 300mm x 10mm, non-slip)	Brown (Pantone 451C)
Interior of Service Block	Wall Band & Accent	Ceramic tile, (45 x 45 x 7mm, metallic finish)	Bluish green (Pantone 5487C)
			Pink (Pantone 694C)
	Wall	Homogeneous tile (150 x 150 x 8mm, with coved tile, matt finish)	Green (Pantone 442C)
			Pink (Pantone 4655C)
			Biege (Pantone 454C)
	Floor	Reconstituted stone (150mm wide, 12mm thick, honed finish)	Off-white with glass chips
		Homogeneous tile (300 x 300 x 8mm, non-slip matt finish)	Ivory (Pantone 454C)
	Counter Top	Solid surfacing material	Quartz

10.0 PLASTERER, PAVIOR & TILER (Cont'd)

10.27 Proprietary Material

The Contractor shall provide and install selected proprietary grates for surface channels and pits as tabulated below:

Location		Proprietary Material		
		Material	Colour	Brand Name and Serial / Model No.
Exterior Area	Channel and Pit	Reinforced stone grating and cover	Match paving colour	'Jonite', pedestrian grate B125 (heavy duty), C2-292H35 HD/C3-355H35HD for straight alignment, 90^{o}C2-H35 HD/90^{o}C3-H35HD for corner, custom curve grate 292W/355W for curved alignment

11.0 GLAZING WORK

11.1 Quality of Glass

All glass shall be of the qualities specified in B.S. 952, and free from bubbles, smoke vanes, air holes, scratches, or other defects, but nevertheless complying fully with the weights and thicknesses given below.

In addition to the descriptions below, also refer to Section 9.19 for glass specification.

11.2 Clear Sheet Glass

Clear sheet glass shall be of ordinary glazing quality and of the following approximate thickness and weight:

Type	Thickness	Max. Area	Max. Width
24 oz.	2.75 - 3.1 mm	0.25 m^2	300 mm
26 oz.	3.10 - 3.4 mm	0.45 m^2	457 mm
32 oz.	3.80 - 4.2 mm	0.90 m^2	610 mm
48 oz.	6 mm	1.85 m^2	1215 mm

11.3 Polished Plate Glass

Polished plate glass shall be of "Glazing Glass" quality with both surfaces ground, smoothened and polished to provide clear, undistorted vision and of the following thicknesses and weights :

Type	Weight	Max. Area
6 mm.	16.80 kg/m^2	4.5 m^2
9 mm	24.75 kg/m^2	9 m^2
12 mm.	31.74 kg/m^2	exceeding 9 m^2

11.4 Float Glass

Float glass shall be manufactured in continuous ribbon form, floated in molten condition upon liquid metal at controlled temperatures. The finished product shall be completely transparent, both surfaces of the glass being flat, parallel and fire-polished, giving clear undistorted vision.

11.5 Wired Glass

Polished wired glass shall be standard quality 6mm clear polished Georgian wired glass with a 2mm square electrically welded mesh with an actual thickness of 6-7mm and a weight of 17kg/m^2.

Wired glass of the same thickness and weights, but with a 22mm hexagonal mesh may be used in place of the above only when the particular specification so states.

11.0 GLAZING WORK (Cont'd)

11.6 Obscured Glass

Obscured glass shall be of the types and weights specified and equal in all respects to samples approved by the Architect. The maximum permitted glazing areas shall be as for clear sheet. The same glass type shall be used throughout the building.

Obscured glass shall be the same type being used throughout the building.

Obscured glass shall generally be used for windows to lavatories.

11.7 Tempered Glass

(a) Provide approved heat strengthened glass and fully tempered glass, manufactured using the "roller hearth", or an equivalent approved process in accordance with AS 2208, ASTM 1048 and/or ANSI Z97.1. Submit details.

Base material shall be an approved selected quality float glass.

Relevant Standards :

- ASTM C1048 – Standard specification for heat-treated flat glass – Kind HS, kind FT coated and uncoated glass.
- ASTM C1087 – Standard test method for determining compatibility of liquid-applied sealants with accessories used in structural glazing techniques.

(b) All toughened glass shall have belt arrised edges.

All heat strengthened glass shall have clean cut edges.

Do not cut, work, or permanently mark after toughening. Use installation methods which prevent the glass making direct contact with metals or other non-resilient materials.

(c) Surface compression stress of toughened glass shall be not less than 96.8 Mpa (14,000 psi) in accordance with ASTM 1048.

(d) Submit production and test records to AS 2208 and/or ASTM 1048. Indicate test procedures, acceptance criteria and pass and/or fail rate.

(e) All toughened glass in single pane applications shall be warranted for the warranty period.

(f) Roller wave distortion shall not exceed requirements for toughened glass.

(g) 100% heat soak testing will be required for all glass with edge stress exceeding 7500 psi. Submit Heat Soak method, temperature (not less than 280^0C), and duration (not less than 1 hour) for approval, prior to commencement.

(h) Submit shop drawings and structural calculations for fixing of tempered glass railing.

(i) Submit certificates to statutory requirements as per PNAP APP-13 issued by the Buildings Department.

11.0 GLAZING WORK (Cont'd)

11.8 Laminated Glass

(a) Provide all required laminated glass in accordance with AS 2208 and FGMA Glazing Manual. Submit details.

The base material shall be an approved selected quality float glass.

Relevant Standards:

- FGMA – Glazing Manual
- ANSI Z97.1 – Glazing materials used in building – Safety performance specifications and methods of test.

(b) Provide an approved polyvinylbutyral (PVB) interlayer with properties conform to the requirements set in ISO, CEN, ASTM, JIS etc.

Submit details.

(c) All laminated glass shall have clean cut edges, or polished edges if required, to eliminate thermal stress breakage risk.

(d) Submit production and test records to AS 2208, ANSI Z97.1 and/or ASTM 0148. Indicate test procedures, acceptance criteria and pass and/or fail rate. Include records for interlayer.

Provide daily records of maximum factory temperature and humidity and weekly records of water quality used for washing glass. In the event that Interlayer Supplier application requirements are not satisfied, batches of non-complying glass shall be rejected.

(e) All laminated glass in single pane applications shall be warranted for the warranty period.

(f) Use glazing materials which do not cause deterioration or discolouration of the interlayer.

Submit test results in accordance with an approved test programme to confirm the compatibility of laminated glass with adjacent glazing materials.

11.9 Frit Glass

All frit glass shall be with frit pattern etched on glass. Pattern and size is in accordance with Drawings. Samples are required for submission to and approval by Architect.

11.10 Polycarbonate

Polycarbonate where specified shall be proprietary solid polycarbonate sheets, clear in colour, minimum 6mm thick minimum, with polished surfaces and enhanced UV and abrasion resistant properties and to the following standards :

Property	Standard	Units	Test Method
General			
Specific Gravity	1.2	-	ASTM D-792
Water Absorption after 24 hrs.	0.15	%	ASTM D-570
Refractive Index	1.586	-	ASTM D-542

11.0 GLAZING WORK (Cont'd)

Property	Standard	Units	Test Method
Mechanical			
Tensile Strength, Yield, .125"	9,000	psi	ASTM D-638
Tensile Strength, Ultimate	9,500	psi	ASTM D-638
Tensile Modulus	345,000	psi	ASTM D-638
Shear Strength	6,000	psi	ASTM D-732
Compressive Strength	12,500	psi	ASTM D-695
Flexural Strength .125"	13,500	psi	ASTM D-790
Flexural Modulus .125"	345,000	psi	ASTM D-790
Izod Impact Notched .125"	12-16	ft-lbs/in	ASTM D-256
Rockwell Hardness	R118/M70	-	ASTM D-785
Gardner Impact 1/2" Diameter DArt. 125"	>320	in-lbs	ASTM D-5420
Instrumented Impact .125"	>45	ft-lbs	ASTM D-3763
Poisson's Ratio	.38	-	
Thermal			
Heat Deflection Temperature @264 psi	270	ºF	ASTM D-648
Heat Deflection Temperature @ 66 psi	280	ºF	ASTM D-648
Coefficient of Thermal Expansion	3.75×10^{-5}	In/in/ ºF	ASTM D-696
Coefficient of Thermal Conductivity	1.35	BTU/hr/ft^2/ ºF	ASTM C-177
Smoke Density .125"	68	-	ASTM D-2843
Shading Coefficient Clear .125"	1.02	-	ASHRAE
Shading Coefficient Gray/Bronze .125"	.70	-	ASHRAE
Shading Coefficient Dark Gray .125"	.58	-	ASHRAE
Brittle Temperature	-200	ºF	ASTM D-746
U Value .236" (summer gain, winter loss)	.90, .96	BTU/hr-sq/ºF	
Flammability			
Horizontal Burn, AEB .125"	<1	In	ASTM D-635
Horizontal Burn, ATB .125"	<1	min	ASTM D-635
Ignition Temperature, Self	1,070	ºF	ASTM D-1929
Ignition Temperature, Flash	870	ºF	ASTM D-1929
UL94* ≥.060"	V-2	-	UL94
UL94 Clear ≥.236"	V-0	-	UL94
Optical			
Light Transmission, Clear 125"	86	%	ASTM D-1003
Haze, Clear .125"	<1	%	ASTM D-1003
Light Trans. 7130 Gray, 5109 Bronze	50	%	ASTM D-1003
Electrical			
Dielectric Constant 10 Hz	2.96	-	ASTM D-150
Dielectric Constant 60 Hz	3.17	-	ASTM D-150
Volume Resistivity	8.2×10^{16}	Ohm-cm	ASTM D-257
Dissipation Factor 60 Hz	0.0009	-	ASTM D-150
Dissipation Factor 1 MHz	0.010	-	ASTM D-150
Arc Resistance			
Stainless Steel Strip Electrodes	10-11	sec	ASTM D-495
Tungsten Electrodes	120	sec	ASTM D-495
Dielectric Strength, in air, 125 miles	380	V/mil	ASTM D-149

UL 94 applies to MAKROLON GP & SL Only

11.0 GLAZING WORK (Cont'd)

11.10 Putty

Putty for glazing shall be in accordance with B.S. 544, prepared from best washed whiting and boiled linseed oil, well kneaded together, and with a proportion of not less than 10% white lead ground in oil worked into it during preparation.

11.11 Mastic Compound

Mastic compound for glazing shall be specially manufactured suitable for tropical conditions as approved by the Architect and provided as follows :

- 100% mastic compound for exterior and interior glazing with beading.
- 70% mastic compound for exterior glazing without beading.

11.12 Glazing Sealants

Glazing Sealants shall meet with the requirements as stated in Section 9.19.

11.13 Fixing of Glass

Rebates are to be primed and painted with one coat of undercoat before glazing. Fixing lugs for hardware that cannot be painted after glazing shall all be painted with two finishing coats of a black or dark grey colour.

11.14 Mirrors

All mirrors shall be plate glass of "Silvering" quality, 6mm thick, with edges bevelled, backed with an even coating of silver and two coats of shell varnish or other approved treatment to resist moisture.

11.15 Glass Louvres

Glass blades to fixed and adjustable louvres shall be 6 mm thick with exact widths and lengths required with edges truly parallel and ground to remove sharp arises.

11.16 Cleaning Down

Glass is to be cleaned both sides and left clean and perfect on completion. Any cracked or broken panes are to be replaced.

12.0 PAINTER

12.1 Painting of Metal Work

All galvanized or hot-dipped galvanized metal works shall be painted with an approved proprietary product of industrial coating as following:-

Priming coat - 1 coat Galvinoleum Primer

Finishing - 2 coats polyurethane finish coat

All mild steel metal works shall be painted with industrial coating as following:-

Priming Coat - 1 coat epoxy primer

Finishing Coat - 2 coats polyurethane finish coat

The proprietary industrial coating shall be proposed for Architect's approval, and shall comply with the following requirements :

Galvinoleum Primer

Physical properties

Recoat Time@ 70^0-80^0F (21^0C-27^0C) and 50% RH	:	Recoat after 1 hour but within 24 hours to avoid dirt accumulation on the tacky surface
Dry Heat Resistance	:	212^0F
Shelf Life	:	5 years
Lead Content	:	No lead has been deliberately added.
Specification Performance	:	USDA Acceptable.

Polyurethan finish coat

(i) Appearance	:	High gloss
(ii) Physical properties		
Pot life @ 70^0-80^0F (21^0 -27^0C) and 50% RH	:	8-16 hours
Dry Times @ 70-80^0F (21^0-27^0C) and 50%RH	:	Tack Free 2-4 hours Handle 4-6 hours Recoat after 16 hours

12.0 PAINTER (Cont'd)

Dry Heat Resistance	:	300^{U}F (149^{U}C)
Shelf Life	:	2years
Lead Content	:	No lead has been deliberately added.
Specification Performance	:	(i) USDA Acceptable (ii) Federal Specification TT-C-550C, Class A (iii) Federal Specification MIL-C-46168B (iv) Federal Specification MIL-C-81773C (v) Federal Specification MIL-C-83286B

Epoxy Primer

(i) Appearance	:	Flat Gray
(ii) Physical properties		
Pot life @ 70^{0}-80^{0}F (21^{0}-27^{0}C)	:	8-16 hours
Dry Times @ 70^{0}-80^{0}F (21^{0}-27^{0}C) and 50%RH	:	Track Free 1-2 hours Handle 3-4 hours Recoat Anytime after 1 hour
Dry Heat Resistance	:	300^{0}F (149^{0}C)
Shelf Life	:	5 years
Lead Content	:	No lead has been deliberately added.
Specification Performance	:	(i) USDA Acceptable (ii) Federal Specification MIL-C-38427A Type III, Class II

The coating system for the steel and metal work for this Contract shall be a proprietary polyurethane paint system. The surface preparation method, primer and finishing coat shall be part of a paint system from the paint manufacturer and shall be applied strictly in accordance with the Manufacturer's specifications and data sheets. The colour of the finish coats shall be prepared to the requirements and approved before ordering. The painting shall be carried out by a qualified applicator approved by the Manufacturer. The Contractor shall provide a ten (10) year warranty on the material and workmanship of the paint system to guarantee against the deterioration of the coating system and the protected steel and metal work. The warranty shall be effective from the date of issue of the certificate of practical Completion for the Works.

Submit manufacturer's data sheets and specifications with a method statement for the surface preparation and paint application to the Architect for approval at least three (3) weeks before ordering. Carry out trials with the approved paint system and colours on site to produce samples based on the approved application method for the review and approval by the Architect before ordering of the paint material. The Contractor shall allow sufficient time for approval and ordering of the paint material. The Contractor shall not be entitled to any claims for delay because of disapproval of the Contractor's submissions by the Architect. Acceptance of the completed painting work shall be based on the colour, texture and finish of the approved sample.

12.0 PAINTER (Cont'd)

12.2 Painting of Pipe Work

(a) Prepare prime and paint two coats of epoxy primer one coat of polyurethane finish coat on all metal water pipes, cistern overflows, flush pipes, electrical conduits, switch boxes ext. where exposed to view.

(b) Where pipes inside pipe ducts shall be primed and painted with three coats of black bitumastic paint and shall comply generally with the requirement of B.S. 1070.

12.3 Preparation of Plastered and Rendered Surfaces

(a) All plastered and rendered surfaces are to be thoroughly washed as necessary broomed down and stopped.

(b) "Wash down" shall mean either:

(i) The removal with clean water of all dirt, etc. not absorbed into the surface of a material not previously decorated, or

(ii) The removal with clean water of existing limewash, non-washable distemper or similar material not absorbed into the decorated surfaces, or

(iii) The removal of dirt, etc. from, and cleaning down of, existing washable distempered, cement painted, synthetic painted and similarly decorated surfaces with sugar soap powder mixed with water, followed by further applications of clean water.

(c) "Broom down" shall mean the thorough dry brushing of any surface with a stiff broom or brush so as to remove all cobwebs, dust or loose particles or previous finishes.

(d) "Scrape" shall mean the removal of all existing coats of paint, limewash, colourwash, distemper, etc. by scraping tools with or without the use of chemical solvents or heat and without damage to the underlying material. Any damage so caused shall be made good at the Contractor's expense.

(e) "Wire brush" shall mean the thorough brushing of the surface with a stiff wire brush.

(f) 'Strip" shall mean the complete removal, without damage to the underlying surface, of all existing coats of limewash, distemper, paint or other decorative material by means of washing and scraping together with the use of chemical solvents or heat, if necessary.

(g) "Stop" to plaster shall mean carefully trimming the edges of all holes, cracks or crevices of any description and filling with an approved proprietary brand of filler or with Plaster of Paris to produce an even, flat surface, and touching up all patches with a coat of sealer prior to repainting.

(h) 'Stop" to woodwork shall mean the cleaning out and filling of all holes, cracks and crevices, etc.

(i) "Knot" to metal pipes shall mean the application of one coat of patent "knotting" to surface of any bitumen or "Dr. Angus Smith's solution" coated pipe.

12.0 PAINTER (Cont'd)

(j) "Knot" to woodwork shall mean the application of a sufficient number of coats of "knotting" over all knots in the wood to prevent the bleeding of resin, etc. through the subsequent decoration.

(k) "Rub down" shall mean the rubbing of newly prepared surfaces, or surfaces of existing paint remaining after preparation for redecoration, with approved waterproof glass paper, pumice stone or similar, to give a flush, slightly roughened surface as key for new paint.

(l) "Fill" shall mean filling of grain with approved surface filler.

12.4 Priming Coats to Woodwork

The primer for woodwork is to be an approved aluminium primer.

12.5 Preparation of Woodwork

Wood surfaces to be painted are to be knotted, primed, stopped the grain filled in with an approved filler and rubbed down with waterproof glass-paper.

12.6 Treatment of Woodwork

(a) All internal wood surfaces which are shown or indicated on drawings to be painted are to be prepared as described above and painted with two coats of synthetic paint.

(b) External woodwork is to be similarly painted but with the addition of an extra coat of synthetic paint.

(c) Waterproof glass paper is to be used in rubbing down between coats. The grain of the wood is not to be visible after the lasting rubbing down.

12.7 Limewash

Limewash to walls, ceilings, etc. is to be composed of quick-lime and tallow in the proportions of 16kg of tallow to 1 cubic metre of lime. The lime is to be broken into small lumps and the tallow shredded and placed on top of the heap. Sufficient cold water is to be added so that the heat developed in slaking is sufficient to melt and disperse the tallow within the mas without becoming charred. When slaking is completed, water is to be added to enable the mass to be worked into a stiff cream and screened to remove lumps if necessary. The limewash is to be applied in a thin film which appears dark in colour on application but dries white.

12.8 Painting of Plastered or Off-Form Surfaces

Surfaces to be limewashed are to be prepared and finished with two coats of limewash applied by brush or spray.

12.9 Sprayed-On Polyurethane Paint

Sprayed-on polyurethane paint with or without texture, where specified, shall be proprietary product having the following properties when conducted with the following or equivalent test methods :

12.0 PAINTER (Cont'd)

Test	Result	Test Method
Hardness	Good surface hardness and scratch resistance	ASTMD3363
Gloss	High Gloss	BS 3900, Part D5 (60^0)
Flexibility	Good	ASTMD522
Resistance to weathering and UV exposure	No apparent change, good gloss retention No signs of blistering, peeling or cracking	BS 3900, Part F3 (1000 hours) Part D5 Gloss and yellowing
Resistance to water vapour	Low moisture vapour permeability. Good waterproofness	BS 3177
Resistance to humidity	No apparent change	BS 3900, Part F2 (500 hours)
Resistance to chemicals	No visible effect : Sodium hydroxide (20%), Hydrochloric acid (20%), Sulphuric acid (20%), water, lime solution (14%)	24 hours immersion at 20℃ 100 hours immersion at 20℃
Resistance to salt spray	No apparent change No apparent change	BS 3900, Part F4 (500 hours)
Resistance to cold check	Excellent check resistance	30 cycles of : 1 hour at 50℃ 1 hour at –20℃ 1/2 hour at 25℃
Resistance to impact	No obvious visible defects Good impact resistance	BS 3900 Part E3 2mm indetation
Resistance to abrasion	No apparent change. No damage or penetration of coating.	Taber abrasion U.S. Fed. Spec. 141a

Sample board of the paint with test reports should be submitted to the Architect for approval.

12.10 Emulsion Paint

Emulsion paint shall be proprietary product having the following performance conforming to all relevant standards:

- no residual odour
- fast drying
- smooth and fine surface
- opacity
- ease of application and brushability
- free from Lead and Mercury
- dry film allows evaporation of moseture without causing blistering and peeling
- environmental friendly
- matt finish

12.0 PAINTER (Cont'd)

Test report/data shall be submitted, to substantiate compliance of the standard and the performance criteria as specified above.

Sample board of the paint shall be submitted to the Architect for approval.

12.11 Synthetic Paint

Synthetic paint shall be a proprietary product having the following performance conforming to all relevant standards :

- gloss retention
- colour retention
- adhesion
- opacity
- levelling and application properties gloss finish

The synthetic paint shall be combined with drying oils and pigments and mixed ready for use.

Test reports/data shall be submitted, to substantiates compliance of the standard and the performance criteria as specified above.

Sample board of the paint shall be submitted to the Architect for approval.

12.12 Sprayed-on Coating

Sprayed-on coating shall be composed of ceramic chips and acrylic resin and in selected colour with natural sand texture, and be suitable for use in humid condition or externally. The manufacturer's instruction on undercoat, texture coat and top coat requirements and application procedure should be strictly followed. Sample board of the paint with test reports should be submitted to the Architect for approval.

12.13 Joinery Fittings

(a) All visible surfaces of open fronted joinery fittings are to be painted or clear finished.

(b) All surfaces of joinery fittings with doors visible when the doors are closed are to be painted or clear finished. The internal surfaces of the fittings are to be painted with one coat of shellac.

Hardwood and door surfaces are to be painted with synthetic paint.

12.14 Cleaning Down

Protect all work, fittings, etc. during the progress of the painting and remove all splashes from floors, skirtings, etc. and leave clean and perfect on completion.

13.0 SANITARY FIXTURES

13.1 Proprietary materials

The Contractor shall supply and install proprietary sanitary fixtures as tabulated below :

Location	Proprietary Material		
	Material	Colour	Brand Name and Serial / Model No.
Male lavatory and female lavatory	Wall hung water closer (WC) bowl (with soft closing toilet seat and cover)	White	'TOTO' CW822JT1 & BU111
Female lavatory	Squatting Water closet (WC)	White	'TOTO', C755CU
Male lavatory and female lavatory	Concealed type WC sensor	Chrome plated cover	'TOTO', TEF75LRV9
Male lavatory and female lavatory	Wall carrier for wall hung WC bowls	-	'VJY', VJY850C
Male lavatory	Back inlet wall hung urinal	White	'TOTO', UW104HJ
Male lavatory	Concealed type urinal sensor	Chrome plate cover	'TOTO', TEA99V33
Disabled lavatory	Disabled toilet (with elbow lever)	White	'TOTO' CW660PJ, SW660JT2
Disabled lavatory	Wall hung basin	White	'TOTO', L34
Male lavatory female lavatory, disabled lavatory, and baby care room	Automatic sensor faucet	Chrome plated	'TOTO', TEN40AWX
Male lavatory female lavatory, and baby care room	Under counter basin	White	'TOTO', LW651JU
Male lavatory female lavatory, and baby care room	Automatic soap dispenser with 3 plugs and including the extension cord	Chrome plate	'TOTO', TES131MV4