

- 12.1.9 Prior to import and / or purchase of the Aluminium Doors and Windows, the relevant specification of the manufacturer, along with samples has to be submitted to the Consultant for approval. This clause shall not be contravened on any account.
- 12.1.10 The fitting shall be done with utmost care not to spoil the finishes given by the manufactures, and any cleaning done shall be done with cleaners etc. as specified by the Manufactures.
- 11.1.11 The Contractor shall provide all items, articles, materials, operations, mentioned, or scheduled on the drawings, including all the labour materials, including fixing devices, equipment and incidentals necessary as required for their completion.
- 12.1.12 The Contractor shall submit shop drawings and/or samples of each type of doors, windows, railings and other items of metal work to the Consultant for approval. The shop drawings shall show full size sections of doors and windows etc. thickness of metal, details of construction hardware as well as connection of windows, doors and other metal work to adjacent work.
- 12.1.13 Aluminium doors and shutters shall be manufactured by an approved manufacturer and shall be of sections, sizes combination and details shown on the drawings. The frame member shall be one piece, corners shall be electrically welded, ground smooth and true and glazing bare shall be threaded or interlocked as approved by the Consultant.
- 12.1.14 Glazing for doors and windows shall be of specified thickness and of approved quality and shall conform to specification of glazing. Fixing for glazing shall be done with aluminium Snap-On beading as per detail drawing and instructions. Necessary continuous rubber gaskets of approved make shall be provided.
- 12.1.15 Colour for doors and windows shall be approved by the Consultant.

12.2 Aluminium louvres

- 12.2.1 Samples shall be submitted for approval.
- 12.2.2 All metal louvres shall be installed according to manufacturer's instructions.
- 12.2.3 All units shall be installed plum, well fitted and securely attached to supporting frames.

12.3 Top hung windows, ventilators and side hung doors

All windows and doors should be weather stripped. The weather protection should be achieved by a positive compressive action against the section and should not depend on external contact. At every contact between two profiles two weather stripping sections should be provided to complete weather protection.

The bottom section for hinges must be capable of being adjusted vertically if necessary. The gap between section and the floor should be covered with a pair of special splay-tube sections.

The shutter sections for both windows as well as doors shall be hollow section type and shall be overall size 57 x 45 mm and the door sections shall be overall size 81 x 45 mm (including flanges).

The shutters of the windows and doors should be assembled with stainless steel pins and nylon washers. Handles shall be anodised aluminium finished to match the aluminium sections and mounted with self lubricating nylon washers.

A mortice cylinder rim automatic deadlock of high quality with double pin tumbler shall be used. Windows shall have anodised aluminium handles, colour as framing and a latching mechanism securing the shutter to the frame both at the top and bottom.

Required fittings;

- 12.3.7.1 single action door closer concealed in the head bar of the outer frame and mounted on an adjacent pivot at the threshold and deadlock fitted.

the left hand leaf of double doors with flush bolts at head and sill with deadlock fitted to the

right hand leaf.

escape doors to have panic bolts assembly with vertical elements concealed in the sill and door closer as in 13.3.7.1.

12.4 Installtion

Aluminium work shall be installed adjusted and glazed by experienced workmen all in accordance with the manufacturer's installation instructions and in full conformity with the approved shop drawings, samples and other submitted data. Under no circumstances shall materials be installed on surfaces that contain condensation, dirt, grease or other foreign encountered materials that would hinder or prevent proper installation and functioning for the use intended.

Aluminium work shall be carefully and accurately assembled with proper and approved provision for contraction and expansion and set in correct locations as per approved detailed shop drawings, all level, square, plumb and aligned with other work. All joints between framing and structural building shall be sealed in order to be watertight and weatherproof and to satisfy all other requirements of the Consultant.

Frames shall be designed and manufactured with a maximum 2.5mm tolerance around the opening in the structure. These joints are to be finished by applying an approved sealant into a polystyrene foam backing strip.

All aluminium works are to be fully protected for the duration of the contract from damage by other trades. The Consultant shall approve the method of protection.

If for any reason final finishes become scratched, abraded or damaged during transport, delivery, storage or erection, it shall be the Contractor's responsibility to remove or repair those defective areas or components as directed and to the complete satisfaction of the Consultant.

Repair work shall be identical to the manufacturer's applied finish with regard to gloss, finish and visual appearance. Field touch up of painted aluminium is permitted only with the written permission of the Consultant. Where touch up is not an authorised means of repair the damaged materials must be replaced by new.

Upon completion of work all protective coverings from all exposed surfaces shall be removed. All surfaces shall be cleaned using soap or detergents as recommended by the aluminium manufacturers to remove sealants, discolouration and any other foreign material. Defection of any type determined by the Consultant shall be repaired at the Contractor's expense.

Extreme care shall be taken when cleaning the exterior portion to protect all other adjacent works.

12.5 Sealing joints

The Contractor shall ensure that joints are dry and remove all loose material, dust and grease.

Joints shall be prepared in accordance with sealant manufacturer's recommendations using recommended solvents and primers where necessary.

Adjoining surfaces which would be impossible to clean if smeared with sealant shall be masked.

Backing strips shall be inserted in all joints to be pointed with sealant. When using backing strips, the Contractor shall not leave gaps and shall not reduce depth of joint for sealant to less than the minimum recommended by the manufacturer.

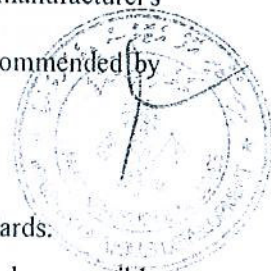
Cavities shall be filled and jointed with sealant in accordance with the manufacturer's recommendations. Sealant shall be tooled to form a smooth flat bead.

Excess sealant shall be removed from adjoining surfaces using cleaning materials recommended by the sealant manufacturer, and shall be left clean.

12.6 Glass installation

Workmanship shall generally be in accordance with CP 152 and respective British Standards.

The glass is to be delivered to the site with adequate protection to prevent damage and where possible it is to be fixed in position immediately after delivery. When fixed the Contractor is to take all necessary precautions to prevent damage during succeeding building operations and will be entirely responsible for the replacement of any broken or damaged glass at his own cost.



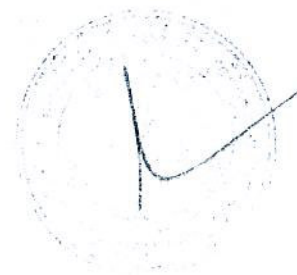
The Contractor is to be solely responsible for determining the exact sizes of glass required, including a tolerance of 2mm to each edge and he is recommended to check the necessary dimensions on site.

No glazing is to be carried out until rebates have been painted with primer. Glazing beads as applicable are also to be primed before fixing.

All mastic is to be neatly struck off to agree exactly with site lines inside and out.

Rates are to include for all necessary springs, clips, setting blocks, location blocks and distance pieces and for taking off and later re-fixing loose beads

Glass apertures in timber doors are to be bedded in chamois leather glazing strip, black ribbon velvet or P.V.C. glazing strip to the approval of the Consultant.



13. ROOFING

13.1 Scope

13.1.1 This Section deals with steel profiled sheeting used as external weatherproof cladding of roofs.

13.2 Roof Cladding

13.2.1 Sheet type: Spandek hiten roofing sheets manufactured by John Lysaght, No.18 Benoi Sector, Jurong, Singapore 2262 or equivalent.

13.2.2 Structural support: timber sections as per drawings.

13.2.3 Fastening: No. 12-14x45mm hexagonal head self drilling and tapping screw seal.

13.2.4 End laps: 200mm and should be sealed with a recommend sealant for pitches below 7 degrees.

13.2.5 Side laps: as per manufacturer's recommendations.

13.3 Products

13.3.1 The profiled sheeting shall be in galvanized sheet steel with a factory per finished protective PVC film with colour to approval.

13.4 Workmanship

13.4.1 Accessories: Flashing, trims, filler pieces, spacers, tapes, sealant, etc. where not specified to be the types recommended by the sheet manufacturer.

13.4.2 Fastening: Select types and location of fastenings to meet the following requirements.

13.4.2.1 Wind suction loaded: Calculate in accordance with CP 3: Chapter5 : Part2 , making due allowance for any internal pressure.

- Basic wind speed : 45 m/sec.
- Topography factory S1 : 1.0
- Ground roughness, building size and height Factory (S2) : as determined from CP3:Chapter5 : Part 2, Table 3
- Statistical factor (S3) : 1.0

13.4.3.2 Imposed loads other than wind and maintenance load, 1.5 KN/m² concentrated on a 300mm² which ever produces the greater stress. Maintenance point load : 0.9 KN concentrated on any 125mm².

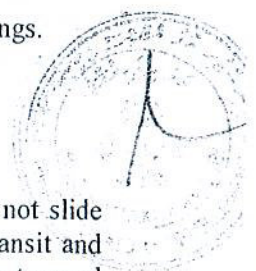
13.4.3.3 Dead load: allow for self weight of sheeting.

13.4.3.4 Roof pitch: as indicated on drawings.

13.4.3.5 Distance between not less than 900mm or as indicated on the drawings.

13.5 Fixing

13.5.1 Quality of Work: Handle and store to preserve surface using clean dry gloves. Do not slide sheets over rough surface or each other . Packs of all sheet must be kept dry in transit and stored clear of the ground under cover to prevent water and /or condensation being trapped between adjacent surfaces. If packs become wet, sheets should be separated, wiped with a clean cloth without delay and placed so that air calculation completes the drying process.



- 13.5.2 Structure: Check that structure is in a suitable state to receive sheets before commencing fixing. Contractor must confirm acceptance to consultant
- 13.5.3 Structure: Do not fix profiled sheeting until final coats of paints have been applied to outer surfaces of supporting structure.
- 13.5.4 Isolating Tape: Apply to those surfaces of supports which would otherwise be in contact with sheeting or accessories after fixing.
- 13.5.5 Cutting and drilling :
- 13.5.5.1 Cuts sheets accurately with clean, true lines and no distortion with a power saw with abrasive cutting disc.
 - 13.5.5.2 Cut openings in sheet for out lets, vent pipes , flues etc. to the minimum size necessary . Reinforce edges of openings with structural members.
 - 13.5.5.3 Drill all holes. Position at regular intervals in straight lines. Holes for primary fastenings to be 1.5mm larger than the diameter of fastening unless self drilling type is used.
 - 13.5.5.4 Remove burrs, drilling swarf, lubricant , dust and any other foreign matter before finally fixing sheets into position.
- 13.5.6 Direction of Laying: Lay sheets with exposed joints of side lap away from prevailing wind.
- 13.5.7 End Laps: to be fully supported.
- 13.5.8 Sealant:
- 13.5.8.1 Install to manufactures recommendation.
 - 13.5.8.2 Position in straight, unbroken lines parallel to edges of sheets. Placed into corrugations. Do not allow to sag into position.
 - 13.5.8.3 Ensure continuity and effectiveness of seal , especially at corners of sheets.
 - 13.5.8.4 Do not over compress.

13.6 Fittings and Features

- 13.6.1 Profile Fillers : use where specified and wherever necessary to close off corrugation cavities from the outside and inside of the building. Position on the line of, or above, fastening and ensuring a tight fit and leaving no gaps. Where sealed laps are specified bed profile fillers in sealant on top and bottom surface, but do not obstruct channels for ventilation or condensation drainage.
- 13.6.2 Flashing Trims: All fittings for flashing / trim shall be as per manufacturers recommendation and lapped at joints as follows:
- 13.6.2.1 Vertical and sloping flashing / trims : end lap to be the same as for adjacent sheeting.
 - 13.6.2.2 Horizontal flashing / trims: end laps to be 150mm and sealed.
- 13.6.3 Gutter: Ensure that gutters are fully supported at each joint and at intermediate position not more than 900mm apart. Fix with spigot ends up the slope and make all the joints fully watertight. Position sheeting to leave a clear width across the gutter of not less than 230mm.
- 13.6.4 Insulation :
- 75mm thick Rock Wool insulation blanket with aluminium foil backing on both sides, laid between purlins at 1000 centres, including wire mesh. Manufacturer and reference - to approval.

14. FINISHES

14.1 General

Glazed Ceramic Tile shall comply with British Standard specification No. 1281 and shall be approved sizes as shown on Drawings and the product of a reputable manufacturers approved by the Consultant.

Unglazed Ceramic Tile shall comply with the requirements of British Standard No.1286 and shall be of approved sizes as shown on the drawings and the product of a reputable manufacturer.

14.2 Manufacturers

All tiles, ceramic or homogenous, for the project shall be manufactured by one of the following manufacturers.

1. Guocera Cermiche of Spain
2. Horse brand Ceramic of Malaysia
3. R.A.K Ceramic of United Arab Emirates

Tiles from manufacturers not listed above shall only be used with prior written approval of the Consultant.

14.3 Ceramic and Vitreous Tile Materials

14.3.1 Ceramic and Vitreous clay Wall Tiles:

- 14.3.1.1 All tiles for wall installation shall have cushion edge, impervious porcelain and highly glazed surface. Colours shall be as selected by the Consultant and shall include trimmers, corner pieces, bullnose and all other special shapes indicated or required. All this shall be free from flaws, cracks and crazing.

14.3.2 Floor Ceramic and Vitreous Tiles

- 14.3.2.1 Non-slip ceramic tile for shall be used on all floor locations. Floor tiles shall be specially prepared for floor use but shall have all the qualities of ceramic tiles listed above for wall use.

14.4 Mortar Materials

14.4.1 Standard brand of light gray or white Portland Cement as specified in drawings, conforming to current British Standard specifications shall be used.

14.4.2 Sand: shall be clean, sharp, river sand, conforming to British Standard Specifications and graded fine to coarse within the following limits: 100% passing 8 sieve, 90% to 100% passing 16 sieve, 60% to 90% passing 30 sieve, 25% to 55% passing 50 sieve and 0% to 15% passing 100 sieve.

14.5 Cement Colour

14.5.1 Dry cement colour, chemically inert, non fading, alkalifast, mineral pigment, as approved shall be used wherever refinished.

14.6 Waterproofing

14.6.1 Floors of toilet areas, corridors and planter boxes shall be treated with an appropriate water proofing coating, approved by the Consultant

14.6 Installation Requirements

As far as possible, tile lay out work should be in such a way that no tile less than half size occurs.

Align joints in wall tile vertically and horizontally except where other patterns are shown or specified,
Align joints in floor tiles at right angles to each other straight with walls to conform to the patterns selected.

Verify locations of accessories before installing tiles. Work shall be coordinated with plumbing and other trades before starting of tile work.

Installation of ceramic and vitreous tile shall be in accordance with manufacturer's instructions.

14.7 Floor Tile Installation

All ceramic and vitreous clay tile floors shall be in Portland cement setting beds. Concrete surfaces shall be cleaned and surface of concrete shall be wetted prior to placing of setting bed mortar. Tiles shall be immersed in water for minimum of 4 hours before laying.

Setting Bed Mortar Mix: shall consist of one (1) part Portland cement and two (2) parts dry sand, by volume, to which not more than 1/10 part of hydrated lime may be added.

When mixed with water, the mortar mix shall be of such consistency and workability as to produce maximum density. Determine consistency by stroking the mortar surface with a trowel. Whereof correct consistency, the trowelled surface readily assumes a smoothed, slickened appearance.

Spread setting bed mortar and screed to provide smooth, dense beds with true planes pitched to drains. The thickness of bed shall be such that the floor tile will finish flush with adjacent finished flooring, but bedding shall have average thickness of 38mm.

After bed has set sufficiently to be worked over, trowel or brush a thin layer, 3mm in thickness, of neat Portland cement paste over the surface of the back of tile.

Do not prepare larger setting bed than can be covered with tile before the mortar sets.

Press tile firmly into the bed tapping with wood blocks to obtain firm bedding of total tile area and a smooth top surface.

All tile shall be properly aligned with straight joints in even widths. Joints width shall be determined by spacers on ceramic tiles. Tamping shall be completed within one (1) hour after placing tile. Adjust work out of line within this period.

Tiles shall be fitted closely around pipes running through walls and floors. Pitch floors to drains.

14.8 Wall Tile Installation

14.8.1 Base Plaster 13mm thick applied to masonry wall shall be one-part Portland cement, three-parts of river sand by volume. Where additional thickness build-up is required to conform to indicated lines, apply as separate coat at no cost to employer.

14.8.2 Setting bed of tiles shall be done with cement slurry. The thickness of slurry bed shall be 3mm thick minimum for setting tiles and walls.

Installation of tiles shall be in accordance with standards and applicable requirements previously specified for floor tile.

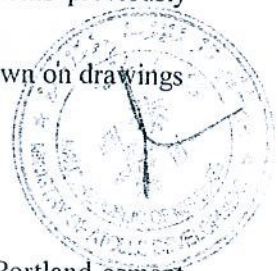
Tiles shall be installed in perfect vertical plumb and as per the pattern and joints if shown on drawings

14.9 Grouting

Grouting shall not commence for at least 24 hours after placing of tiles.

Grout for floor and wall ceramic and vitreous tiles shall be waterproof, neat white Portland cement with dry cement colour added as directed by the Consultant. If white grout is selected, cement shall be white.

Grout mixed to a creamy consistency in accordance with manufacturer's directions shall be used for joint filling. Maximum width of joints shall be 3mm.



Force maximum grout into the joints with trowel. Before grout sets, strike or tool joints to base of cushion and fill all skips and gaps. Do not permit setting bed materials to show through grouted joints.

Cure grout joints by maintaining damp condition for three (3) days by sponging down, or other methods approved by the Consultant. Allow floors to set 48 hours before permitting ordinary foot traffic.

14.10 Defects in Tiles and Tile Laying

The surface of all tiled floors shall be perfectly in level and shall be executed by experienced workers in the field of tile laying.

A sample panel of laid tiles of each type shall be approved by the Consultant before commencement of tile laying.

Mismatches of colour, chipped or damaged tiles installed by the Contractor shall be rejected and shall have to be replaced by the Contractor at his own cost and risk.

14.10.4 Mismatches of colour in tiles installed by the Contractor shall be rejected and shall have to be replaced by the Contractor at his own cost and risk.

14.11 Guarantees

14.11.1 Manufacturer shall be provide his standard guarantees for work under this section. However, such guarantees shall be in addition to not in lieu of all other liabilities which manufacturers and Contractor may have by other provisions of the Contract Documents.

[Faint, illegible text, likely bleed-through from the reverse side of the page]

[Handwritten mark, possibly a signature or initials]



15. PLUMBING

15.1 General

The materials used and workmanship shall be of highest quality and grade unless otherwise specified shall conform to the latest specifications of British Standards and Codes of Practice for "Water Supply "Sanitary, Pipe Work "Building Drainage " Surface Water and Sub- Soil Drainage" and applicable to details and work indicated on the Drawing and Bill of Quantities. In case of any discrepancy / ambiguity the decision of the Consultants shall be final, and the contractor will act and perform accordingly.

The work shall be executed strictly in accordance with the rules and regulations set by the relevant local authority of the Maldives.

The Contractor shall be responsible for obtaining the necessary approvals and test certificates from the concerned departments of Maldives.

Plumbing work shall be carried out by licensed plumbers and shall produce the copy of the license along with the tenders, or approved by the Consultant.

Any damage done by the Contractor to any existing work during the course of execution of his work, shall be made good by him at his own cost. Failing which it shall be get done by the Consultants at Contractor's risk and cost.

The Contractor shall be responsible to connect the drainage and water supply to the mains and to obtain the necessary approvals and certificates from the relevant authorities of the Maldives.

All connections to mains and meter installation shall be arranged by the Contractor and payment of fees thereof, if any, shall also be made by him.

The Contractor shall be responsible for the watch and ward of all fittings until the Works is fully completed and handed over to the owner.

The levels, measurements and other information concerning the existing site as shown on the drawings or as described as are supposed to be correct. The Contractor shall, however, verify them by himself and no extra claim whatsoever shall be entertained on account of the errors or omissions in such matters or on account of the descriptions turning out to be different from what was expected.

The Consultant shall instruct the Contractor to purchase and use such materials of particular make or from particular source as may in his opinion be necessary for proper and reasonable compliance with the specification and execution of the Works.

After all plumbing fixtures and equipment have been set ready for use, and before the Contractor leaves the job, he shall thoroughly clean all fixtures installed by him, removing all plaster, stickers, rust stains and other foreign matter of discolouration on fixtures, leaving every part in acceptable condition and ready for use to the satisfaction of the Consultants.

15.2 Drawings and Information Required

The Contractor shall submit shop drawing for the entire installation including installation details for all items required or asked for approval of the Consultant.

Approved by the Consultant of shop drawing for any material, apparatus, devices and layout, shall not relieve the Contractor from the responsibility of furnishing same of proper dimension, size, quantity and all performance characteristic to efficiently perform the requirements and intent of the Contract Documents. Such approval shall not relieve the Contractor from responsibility for errors of any sort in the shop drawing.

If the shop drawings deviate from the contract Documents the Contractor shall advise the Consultants of the deviations in writing accompanying the shop drawings including the reasons for the deviations. At the start of the Project the Contractor shall periodically and thereafter submit to the Consultants list of all shop drawings which will be submitted in the course of the project. The list shall show the disposition of each item including date of submission approval etc. The list shall be kept upto date through the entire course of construction.

94

15.3 Record Drawing

During Construction the Contractor shall keep an accurate record of all deviations between the work as shown on the Contract Drawings and that which is actually installed.

The Contractor shall secure from the Consultants after approval of his Shop Drawing a complete set of drawing and note changes thereon in ink.

The Contractor shall make a complete record of all changes and revisions in the original design which exist in the completed work.

The cost of furnishing above prints and preparing these for record " shall be deemed to be include in the tendered cost and its effects spread over other items of work, and as such item shall not be a subject to payment". When all revisions showing the work as finally installed the corrected Original Transparencies shall be submitted to the Consultants before final payment for the completed work will be made.

15.4 Operating and Maintenance Instructions

15.4.1 Three sets of operating and maintenance instruction covering completely the operation and maintenance of all plumbing equipment, controls, heaters, pumps and the like shall be furnished to the Owner, by the Contractor.

15.5 Tests

The entire system of drains, waste and vent piping inside and outside the building shall be tested by the Contractor under a water test, which shall include the entire system from the lowest point to the highest pipes above the roof.

The water test shall be made in accordance with all local requirement. Every portion of the system shall be tested to a hydrostatic pressure equilent to latest 15 feet head of water. After filling, the Contractor shall shut off water supply and shall allow it to stand 2 hours under test during which time there shall be no loss or leakage.

The Contractor shall furnish and pay for device, material supplies, labour and power require for all tests. All tests shall be made in the presence and to the satisfaction of Consultant.

Defects disclosed by the test shall be repaired or if required by the Consultant defective work shall be replaced with new work without any extra charge to the Owner. Test shall be operated as directed until the work is proved satisfactory.

Fixture shall be tested for soundness, stability of support and satisfactory operation.

The Contractor shall notify the Consultant at least one week in advance of making the required test, so that arrangements may be made for their presence to witness the test.

Equipment shall be tested in service and the Contractor shall demonstrate that the equipment performs the work intended for it and that it complies with the requirement of these specification for such equipment, to the satisfaction of Consultants.

The rates shall include for all costs associated with tests.

15.6 Work in Common Piping

15.6.1 Material

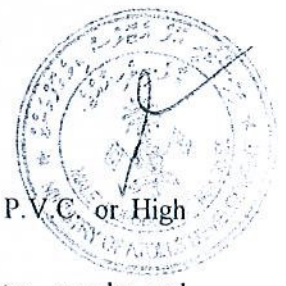
15.6.1.1 Piping and fitting material shall be uP.V.C, Hard Impact P.V.C. or High Temperature P.V.C. and approved by the Consultant.

15.6.1.2 Piping material shall comply with requirements of water supply and sewerage and other relevant authorities.

15.6.1.3 Materials for the piping and service requirements shall basically conform to the service pressures encountered.

15.6.2 Providing Drawings and Manuals

15.6.2.1 The Contractor shall submit one set of originals and further two copies of



layout drawings to the Consultant after completion of the Works. These drawings must give the following information:

- (a) Run of all piping and diameter on all floors and the vertical stacks.
- (b) Location and sizes of all control valves, access panels and other equipment.
- (c) Location of all manholes and their sizes.

15.6.2.2 No completion certificate will be issued until the drawings are submitted.

15.6.2.3 The Contractor shall submit to the Consultant for approval, samples, shop drawings, manufacturer's drawings, equipment characteristics and capacity data etc. of all equipment, accessories devices etc. that he proposes to use in the installation.

15.6.3 Samples

15.6.3.1 The Contractor shall provide samples of all sanitary fittings, pipes and specials man-hole cover and frames, gratings and water supply pipes and fittings etc. and shall be deposited with the Consultant (which will be returned to the Contractor at the completion of the Works) and shall obtain approval from the Consultant before using in the Works. Any material rejected by the Consultant shall be removed from the site within 24 hours of rejection.

15.6.4 Drawings

15.6.4.1 The works shall be done in conformity with the plans and within the requirements of the general architectural, electrical and structural plans. This work shall be properly coordinated with the work of the other trades. Hangers and sleeves shall be furnished in time for their installation as other work proceeds.

15.6.4.2 The plumbing drawings are diagrammatic, but shall be followed as closely as actual construction. All deviations from drawings required to conform to the building construction shall be made by the Contractor at his own expense.

15.6.4.3 The architectural drawings shall take precedence over the plumbing drawings as to all dimensions.

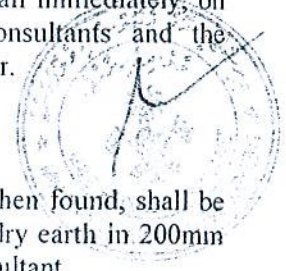
15.6.4.4 Large size details shall take precedence over small size drawings. The special dimensions in the specifications or schedule of quantities or instructions of the Consultant shall supersede the drawings. The Contractor shall verify all dimensions at site.

15.6.4.5 The recommend position of the fittings, fixtures, control valves, tanks etc. as shown on the drawings will be adhered to as far as practicable.

15.6.4.6 Should there be any discrepancy due to incomplete description ambiguity or omission in the drawings and other documents, whether original or supplementary, forming the contract, either found on completion or during the currency of the installations work, the Contractor shall immediately on discovering the same, draw the attention of the Consultants and the Consultants decision in final and binding on the Contractor.

15.6.5 Existing pipes

15.6.5.1 The site shall be examined for field drains and those, when found, shall be either entirely removed or diverted, trenches filled with dry earth in 200mm to 300mm layers and consolidated as directed by the Consultant.



15.6.6 Spare Parts

15.6.6.1 Necessary spare parts of the plumbing equipment for the one (1) year operation shall be supplied by the Contractor.

15.6.7 Excavation

15.6.7.1 All excavations shall be timbered to the satisfaction of the Consultant and the type of timber shall be suitable to the kind of earth encountered. Fixing of timber and removal after completion of work shall be done as directed by the Consultant.

15.6.7.2 Should any water accumulated in the trenches, headings or other excavation, the Contractor shall do such work as may be necessary to drain away the accumulated water and shall install pumps as may be required to keep the excavation and trenches dry. The Contractor shall ensure that the flow water in trenches or excavation does not injure or remove cement or aggregate of any concrete that has not set. No subsoil water shall be discharged into open drains or sewer at the site.

15.6.7.3 In refilling trenches after excavation this should be done in layers of 150mm after consolidating each layer. Special care shall be to see that the earth is packed uniformly and no injury to the pipe.

15.6.7.4 Rates for excavation should include for backfilling in consolidated layers where necessary and as directed by the Consultant.

15.6.8 Piping

15.6.8.1 The Contractor shall, as soon as possible after the award of the contract, prepare and submit to the Consultant for approval, working drawings showing exact locations and pipe runs for all pipework, the layout and setting up of equipment and the connection of piping to the equipment. Such drawings shall include details and methods of supports, anchors and sleeves etc.

15.6.8.2 Pipe runs shown in the drawings are approximate and intended to indicate the general run and locations only. The exact locations of all pipework shall be determined on Site.

15.6.8.3 All pipes, fittings etc. shall be kept closed against moisture and foreign matters when stored at site and during installation.

15.6.8.4 All pipes shall be fixed clear of one another and be so arranged as to provide easy access for maintenance and repair.

15.6.8.5 All plumbing work shall be carried out by suitably qualified plumbers in accordance with the British Code of Practice and Regulations and requirements of related Authorities.

15.6.8.6 Materials for the piping and service requirements shall basically conform to the service pressures encountered.

15.6.8.7 Each part of the installation of the plumbing work shall be completed in all details as shown in the drawings or as specified and provided with all necessary control valves, etc. that will be necessary for their satisfactory operation.

15.6.8.8 All piping shall be run plumb, and straight and parallel to walls, except drain line which shall pitch 6mm per 300mm in the direction of flow.

15.6.8.9 Pockets, unnecessary traps, turns and off-sets shall be avoided. When traps or pockets are unavoidable they shall be valved drains.

15.6.8.10 Piping installed on the concrete slab shall be firmly fixed or anchored to the

- floor with packing to prevent damage to pipes. Pipes shall not be bent with bender where cross with other pipe or change to upward.
- 15.6.8.11 Where pipes are to be laid directly in the ground, bed shall be sufficiently compacted, necessary protection for piping shall be taken.
- 15.6.8.12 Backfill shall be done after the approval of the Consultant in such a manner not to damage the pipe line and shall be restored to the original stage.
- 15.6.8.13 Where pipes penetrate through waterproof part or fire partition or fire wall, pipe sleeves shall be provided and clearance between pipe sleeve and pipe shall be filled with caulking material approved by the Consultant.
- 15.6.8.14 Pipes, fittings, valves and accessories shall be thoroughly cleaned, both internally and externally before installation and shall be cleaned before putting into service.
- 15.6.8.15 Plumbing work shall be completed in accordance with the details shown on the Drawings or as specified and provided with all necessary control valves, etc. that will be necessary for their satisfactory operation.
- 15.6.8.16 All pipes shall be cut square and true to the pipe axis by means of suitable tools without reducing pipe diameter and cut ends shall be finished smooth. Before making connections, chips, dirt and other foreign matter shall be removed from inside interior of each pipe. Fixing of hangars and embedding of pipe sleeves shall be carried out without delay along with the progress of the work where required.
- 15.6.8.17 Pipe connections for the water supply system shall be by uP.V.C high pressure. Jointing shall be generally by means of solvent cement according to manufacturer's instructions
- 15.6.8.18 Vertical pipe shall be braced at more than 2 point in every story.

15.7 Water Supply Work

15.7.1 Materials

Pipes, joints and fittings for water supply work shall be high pressure uP.V.C.

Materials and workmanship shall comply with the local water supply authority requirements.

15.8 Water Pumps

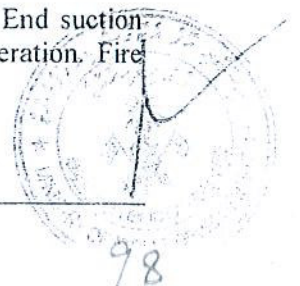
The specification herein stated are basic guides only. Other items not so indicated but which are obviously necessary for the proper operation of the system as intended shall be supplied and installed, in accordance with accepted Consulting standard.

Manuals of operation and maintenance and list of spare parts shall be supplied together with the equipment.

The contractor shall submit at least four copies of pump performance curves showing among others, the pump rating and efficiency, properly marked out.

A metal name plate indication in indelible letters for the correct specification of the pump and motor shall be properly attached to the assembly at a location such that the information written thereon can be conveniently read by all concerned.

Well water pump and Fresh water pump: Flow rate = 60L/min, Head = 70m, Type : End suction
Hydro pneumatic pump, 220/440V, 3-Phase, 50 Hz. Alternate and parallel operation. Fire
pump: 50L/min, 70m head, Vertical multistage pump with alternative operations.



15.9 Spacing of supports

15.9.1 Support spacing for uP.V.C pipes shall be as follows

Nominal Dia.	upto 40	more than 50
Space (m)	1.2	1.5

15.10 Drainage Work

15.10.1 General

15.10.1.1 High Pressure uP.V.C pipe and fittings shall be used for all drainage work including vent pipes.

15.10.1.2 Joints shall be made by the cold-jointing method, and the pipe interior shall have not offset at the joint interfering with the flow. Joint adhesive shall be good quality and shall not be affected by heat and shock.

15.10.1.3 Where horizontal drain branch joints the main, such branch shall be connected to the main in a substantially horizontal position and at an acute angle of not more than 45 degree to the main in all cases.

15.10.2 Vent stack pipes

15.10.2.1 Vent pipe shall be vertically branched out upward from a horizontal drain branch pipe or other appropriate point. Horizontal branching of the vent pipe shall be done on approval of the Consultant.

15.10.2.2 Where vent pipes on each floor are to be connected to the vent stack, all connections shall be made at least 150mm above the respective overflow edges of fixture on that floor.

15.10.2.3 The provision of the preceding item shall also apply to the connection of vent stack vent pipe.

15.10.2.4 Vent stack shall be connected to the waste stack or soil stack at the lowest part to stack pipe.

15.10.2.5 Where vent pipe is to be connected to the horizontal drain pipe, such angle shall be more than 45 degree to upward.

15.10.2.6 Vent stack shall be extended 600 mm from the top of the roof or lead to the wall and top of pipe shall be covered with vent cap.

15.11 Laying of Pipes

15.11.1 The pipes shall be laid to proper lines and levels as shown in the plans and directed by the Consultant, as the main is laid, the front pipes in the trench shall always be closed with a plug either of iron or wood and security fastened. The plug shall not be removed except when pipe laying is resumed or for purposes of testing.

15.12 Laying of sewer water Mains

15.12.1 All mains shall be laid on a good solid, bottom to prevent subsidence and consequent fracture.

15.12.2 Mains running under buildings, if unavoidable, shall be completely surrounded by 150mm of concrete.

15.12.3 In case of mains passing through a well, the weight of the latter shall be carried by a lintel or a suitable relieving arches.

All rising mains shall be properly plugged to all wall brackets at regular intervals as given in the

drawings.

All mains shall be concealed inside wall as far as possible except for vertical sewer mains, cleaning doors shall be provided in the walls whenever necessary and as directed by the Consultant.

15.13 Sewers

After the cement has had time to set, the pipes shall be tested in length between manholes in following manner.

In the lowest manhole/intercepting trap as the case may be, a plug shall be inserted in the pipe. The disc in the pipe at the upper manhole shall be fitted with a filling pipe with a right angle bend and an air cock.

The pipe line shall then be filled with water by means of the pipe connection on the upper disc. The air cock on the upper disc shall be kept open while the pipe line is being filled to permit the escape of air.

When the pipes are filled with water and air excluded, the air cock shall be shut and the water shall be poured into conical filler, attached to the filling pipe until the water remains in the filter.

The filling pipe shall then be raised and fastened so that the height of surface of the water in the filler above the invert of the pipe is 1828 mm which will be usual test pressure for S.W pipes.

If the water level does not fall more than 16mm (12mm) in a length of 91.4 metre the test may be considered satisfactory.

The Contractor shall make good all defective work at his own expense

15.14 U.P.V.C Pipes

15.14.1 Manufacturer's instruction should be followed in pipes to be used for water mains. Where specified, pipes shall have integral rubber ring joints and where solvent cement joints are specified, a sufficient number of expansion/contraction joints shall be incorporated in the length of mains to allow for variation of temperature to the recommendation of the pipe manufacturers.

15.14.2 These pipes shall be effectively protected from the direct rays of sun immediately after they are laid and until permission is given for the trenches to be refilled by the Consultant. Subject to such permission being obtained, trenches shall be refilled without delay. Final connection at a fixed point shall be deemed unto the majority of the length of the pipe line has been covered by backfill in order to reduce the effect of expansion and contraction caused by temperature variations .

15.15 Bends and other Specials

15.15.1 In fixing bends care shall be taken to see that the axis of the bend is truly vertical or horizontal as the case may be and the spigot of the bend is well in the socket of the pipe with which a joint has to be formed. The Contractor shall be called on to replace any faulty work at his own expense.

15.16 Flanged Joints

15.16.1 All flanged joints shall be made by painting the faces of the flanged with red lead freely and bolting the flanges evenly on all sides. A thin fiber of lead wool may be used in making the joints water tight when facing of the flanges is not true. Rubber insertions may be used with approval. Sewage resistant rubber insertion is to be used for sewer lines.



15.17 Support for U.P.V.C Pipes

15.17.1 When U.P.V.C pipe lines incorporate metal valves or other heavy fittings, it is essential to support the valves directly rather than allowing their weight to be carried by the uP.V.C pipe and support shall be placed on either side of the fittings mentioned above. Moulded plastic fitting also should be supported.

15.17.2 Maximum allowable horizontal support distance for uP.V.C are given below.

Nominal bore	12 mm (1/2")	18 mm (3/8")	25 mm (1")	32 mm (1 1/4")	38 mm (1 1/2")	50 mm (2")
Support distance	533 mm (1'9")	616 mm (2'0")	686 mm (2'3")	764mm (2'6")	840 mm (2'9")	915 mm (3'0")
Nominal bore	75 mm (3")	100 mm (4")				
Support distance	1220 mm (4'0")	1290 mm (4'6")				

15.17.3 For vertical installation supports, distances shall be doubled.

15.18 Sewer pipes

15.18.1 All 'P', 'S', 'T' junctions bends etc. required shall be furnished and set without extra charge and shall conform to the pipe specifications as to quality

15.19 Air Valves

These valves to be fitted as per drawings and Bill of Quantities shall be tested and accompanied by a certifying their efficiency.

The floating ball in the valve shall be suitable metal or vulcanite or rubber specially manufactured for tropical conditions.

15.20 Scour Washout Valve

These shall be provided at portions shown in place and shall contain in one unit a flanged scour valve with short connection pieces, cast iron bend and T pieces for connection to main pipe.

The rate shall also provide for short length of straight pipe to a convenient as per details complete with covers and surface boxes

15.21 Foot valves and Strainers

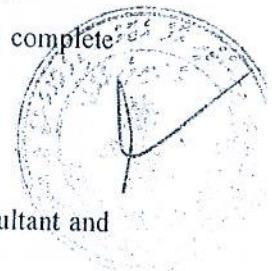
15.21.1 Foot valve and strainers should be of reputable manufacture approved by the Consultant and shall be fitted with flushing lever attachment where specified.

15.22 Pressure Reducers

15.22.1 Pressure reducing valves shall be of the equilibrium type of approved manufacture and capable of reducing the pressure to the valve required as per plan and Bill of Quantities.

15.23 Water Meter

15.23.1 The water meters shall be from a reputed manufacture and shall be approved by the



consultant before installation.

15.24 Equilibrium Ball Valves

15.24.1 These should be of reputable manufacture approved by the Consultant and be of the angle pattern with gun metal valve seats guide bush, copper float with wrought iron lever and links with bronze pins.

15.25 Fittings

All sanitary pipes, gullies, water closets/bidets, squatting basins, sinks bath tubs etc. to be of approved design and to be obtained from approved Manufacture and to be of the best stoneware, glazed inside and outside, with burnt hard and sound, free from flaws, blisters, cracks and other imperfections and best quality commonly called 'Firsts'.

Rates should include for all bends, junctions, traps, cleaning, painting, fixing clear of wall etc. complete as specified as per Bill of Quantities.

All pipes, fittings, flushing cisterns, valves, stop cocks, taps, tanks, surface boxes etc. to be of the best of their kinds and in addition to complying with previous clauses to be from approved Manufacturers and all taps, cocks, valves etc. to be screwed down pipe. Taps to be of brass/nickel coated and valves to be of gun metal. All tanks to be made fly-proof and to the complete satisfaction of the Consultant.

Rates should include for all cutting and waste, bends, taps junctures, cleaning eyes, tees.

15.26 Manholes, Manhole covers and Frames

Concrete cover slabs or top rings of manholes shall provide a suitable seating for a rectangular cover.

The frame shall have a clear opening of 0.61m x 0.61m or alternatively a circular or double triangular cover depending on the type of cast iron manhole cover to be used. The rate for manholes shall allow for such provision.

Where the supply of cast iron manhole cover and frames is payable separately the cost of setting, surrounding, painting and materials for same shall be allowed for in the rate for manholes.

Suitable lifting rings, hooks or brackets shall be provided in the precast manhole sections. Box holes shall be separately grouted with 1:2 cement mortar.

The contractor shall supply two manhole keys for each pattern of cover without additional charge over the rate for covers (or manholes).

Heavy duty (grade a) cast iron manhole cover and frames shall be of the double triangular type to bs and having a clear opening of 550mm dia.

Medium duty (grade b) cast iron manhole covers and frames shall be of the circular type having a clear opening of 550mm dia or the rectangular type having a clear opening of 0.61m x 0.61m and conform to bs. They shall be of the single seal type, the weight of cover frame being approximately 127.00 kgs.

Light duty (grade c) cast iron manhole cover and frames shall be of the doubles seal flat type having a clear opening of 0.61m x 0.61m conforming to bs. Weight of cover and frame approximately 50.75kgs.

All manhole covers and frames shall be supplied, coated with a black bituminous composition and be given two coats of bituminous paint after bedding.

No extra rate is payable for drop and/or junction manholes but piping in and surrounds of drop lines are payable at that relevant rates for s.w piping and manholes.

In drop manholes where the difference in level between the incoming drains and the sewer does not exceed 0.610m in 75mm and there is sufficient room in the manhole, the connecting pipe may be brought directly through the manhole wall, and the fall accommodated by constructing a

ramp in the benching of the manhole. The ramp shall be of concrete and finished equal to that of the benches. No extra rate is payable.

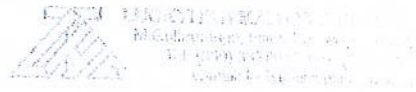
15.27 Interceptor Manhole

15.27.1 All gravity sewer lines should be, connected through an intercepting inspection chamber before connecting to the main sewer line, and the dimensions of the manhole and trap to be in conformity with the Maldives Water and Sanitation Authority.

15.28 Fixtures and Accessories

15.28.1 All sanitarywares shall be manufactured by one of the following manufacturers.

1. American Standard
2. Ideal Standard
3. American Briggs
4. Armitage Shanks
5. Cotto
6. Star sanitaryware



Sanitary ware from manufacturers not listed above shall only be used with prior written approval of the Consultant

15.29 As built Drawings

The Plumbing Contractor, shall mark down with red pencil on two sets of plumbing plans all the revisions, omissions and/or additions to the various plumbing installation drawings as the construction progress. One set of the plans as marked shall be submitted to the Consultant after completion of the work.

Before the final payment is made to the Contractor, he shall submit to the Owner through the consultant, all As-Built Drawings incorporating the changes made and noted in the marked plans retained by him. The As-Built Drawing incorporating all the changes made and noted in the marked plans retained by him. The As-Built Drawings shall be prepared on reproducible form

The Plumbing contractor shall prepare and submit the As-Built Drawings without extra cost to the Owner.

15.30 Miscellaneous

Throughout the construction period, open ends of all installed pipelines shall be kept closed by temporary plugs. Drainage lines shall not be used to conduct dirty construction wash-washer, especially, those with cement, to avoid possible clogging.

A temporary fire protection system at each building shall be provided by the Contractor during the construction period. This shall be of sufficient capacity to put out any fire that may break out at any of the building floors due to construction period. This in addition to temporary fire extinguishers required.

A temporary potable water supply shall be available to construction workers at each building floor as construction work progresses.

A temporary human Excrete Disposal System shall be provided by the Contractor to serve the workers during the construction period.

15.31 Height of Fixture Installation

Height of fixture shall be as follows unless otherwise specified on the Drawings

