

9.1.7

BUILDING TRADES

CONTENTS

9.1.7 – BUILDING TRADES

	<u>Page</u>
9.1.7.1 GENERAL	155
9.1.7.1.1 Work Included	155
9.1.7.1.2 Related Work not Included in this Section	155
9.1.7.1.3 Co-ordination and Co-operation	155
9.1.7.1.4 Submittals	155
9.1.7.1.5 Sample Panels	155
9.1.7.2 MATERIALS FOR BUILDING TRADES	156
9.1.7.2.1 Delivery and Protection of Materials	156
9.1.7.2.2 Roofing	156
9.1.7.2.3 Bricks	156
9.1.7.2.4 Cement	156
9.1.7.2.5 Fine Aggregate and Coarse Aggregate	156
9.1.7.2.6 Water	157
9.1.7.2.7 Reinforcement :	157
9.1.7.2.8 Steel for Hollow Metal Doors and Frames	157
9.1.7.3 FABRICATION AND ERECTION	157
9.1.7.3.1 Brick Masonry Erection :	157
9.1.7.3.2 Roofing	159
9.1.7.3.4 Floor and Wall Finishes :	160
9.1.7.4 PLASTERING	162
9.1.7.4.1 Material	162
9.1.7.4.2 Mortar	163
9.1.7.5 GLASS AND GLAZING	169
9.1.7.5.1 Workmanship	169
9.1.7.5.2 Materials	169
9.1.7.5.3 Protection and Replacement	170
9.1.7.6 MISCELLANEOUS METALS	170
9.1.7.6.1 General	170
9.1.7.6.2 Welding	170
9.1.7.6.3 Materials	170
9.1.7.6.4 General Requirements	171
9.1.7.7 CARPENTRY	171
9.1.7.7.1 Materials	171
9.1.7.7.2 Structural Timber and Timber Roof Work	175
9.1.7.7.3 Joinery	177
9.1.7.7.4 Door and Window Frames (wooden)	179
9.1.7.7.5 Sashes for Doors, Windows, Fanlights etc. (wooden)	180
9.1.7.7.6 Shelving (Timber)	183
9.1.7.7.7 Trellis Work (Timber)	183
9.1.7.7.8 Pelmet (Timber)	183
9.1.7.7.9 Mild Steel Bars or Grills in Wooden Frames	183
9.1.7.8 SHEET METAL	184

9.1.7.8.1	General Requirements.....	184
9.1.7.8.2	Materials.....	184
9.1.7.8.3	Fabrication.....	185
9.1.7.8.4	Installation.....	185
9.1.7.8.5	Special Requirements.....	186
9.1.7.8.6	Painting.....	186
9.1.7.9	PAINTING.....	186
9.1.7.9.1	Preparation of Surfaces.....	186
9.1.7.10	CAULKING.....	187
9.1.7.10.1	General.....	187
9.1.7.10.2	Submittals.....	187
9.1.7.10.3	Materials.....	188
9.1.7.10.4	Application.....	188
9.1.7.10.5	Quality Control.....	189
9.1.7.11	CEILINGS.....	189
9.1.7.11.1	Framing.....	189
9.1.7.11.2	Ceiling Boards Generally.....	189
9.1.7.12	SANITARY AND WATER SUPPLY SERVICES.....	190
9.1.7.12.1	General.....	190
9.1.7.12.2	Sanitary Fittings and Plumbing.....	191
9.1.7.12.3	Water Supply.....	192
9.1.7.12.4	Water Service.....	192
9.1.7.12.5	Soil and Waste Plumbing.....	193
9.1.7.12.6	Rainwater Drainage.....	193
9.1.7.13	MASONRY.....	193
9.1.7.14	DRAINAGE.....	194
9.1.7.14.1	General.....	194
9.1.7.14.2	uPVC Pipes and Fittings.....	194
9.1.7.14.3	Pipe Bedding.....	194
9.1.7.14.4	Laying Pipes for Drainage.....	194
9.1.7.14.5	Construction of Chambers and Headwalls.....	194
9.1.7.14.6	Testing Drains, Chambers etc.....	194
9.1.7.14.7	Covers and Surface Boxes.....	195
9.1.7.14.8	Septic Tanks.....	195
9.1.7.15	PATHS AND PAVED AREAS.....	195
9.1.7.16	DOORS & WINDOWS (ALUMINIUM).....	195
9.1.7.16.1	Description of Work.....	195
9.1.7.16.2	Authentication & Certification.....	195
9.1.7.16.3	Samples.....	196
9.1.7.16.4	Material (Alloys).....	196
9.1.7.16.5	Anodizing.....	196
9.1.7.16.6	Aluminium Windows.....	196
9.1.7.16.7	Aluminium Doors and Screens.....	197
9.1.7.16.8	Aluminium Louvers.....	197
9.1.7.16.9	Appearance and Detailing.....	197
9.1.7.16.10	Execution of the Works.....	198
9.1.7.16.11	Installation.....	198
9.1.7.16.12	Shop Drawings.....	199

9.1.7.17	INSULATION TO RESERVOIR ROOFING.....	199
9.1.7.18	WATERPROOFING TO RESERVOIR ROOFS.....	199
9.1.7.19	CERAMIC FLOOR & WALL TILING.....	200
9.1.7.19.1	Ceramic / Floor Tiles.....	200
9.1.7.19.2	Ceramic Tile Skirting	200
9.1.7.19.3	Wall tiles (Internal).....	200
9.1.7.19.4	Application of Wall Tiles	200

9.1.7 BUILDING TRADE

9.1.7.1 GENERAL

Work in this section consists of furnishing of all labour, materials, apparatus and appurtenant work in connection with building trade work.

In general, all building trade work shall comply with the "Specification for Building Works - Sri Lanka (Volume 1) -1985", (ICTAD publication No. SCA/4 - Volume 1) and for sanitary installation, the same specification Volume II - 1989 or their subsequent revisions if any.

9.1.7.1.1 Work Included

The work includes, but is not limited to the following:

- (a) Brick Masonry Construction
- (b) Roof Construction
- (c) Floor and Wall Finishes
- (d) Glass and Glazing
- (e) Miscellaneous Metal
- (f) Carpentry
- (g) Ceiling
- (h) Any other Work shown on the Drawings or specified herein.

9.1.7.1.2 Related Work not Included in this Section

- (a) Miscellaneous Structural Work.
- (b) Field Painting.

9.1.7.1.3 Co-ordination and Co-operation

Work of this section shall be fully co-ordinated with related work of other trades. Particular attention is required for items embedded in concrete or masonry.

9.1.7.1.4 Submittals

Shop drawings shall be submitted prior to fabrication of any work. Shop drawings shall be based on the Drawings, specification, and field measurements and shall present complete information as to fabrication, installation and proper fitting with other construction.

9.1.7.1.5 Sample Panels

Prior to commencing construction, a sample panel shall be erected, 1 metre square showing brick, bonding, jointing and mortar. Materials intended for use in the construction shall be displayed and method demonstrated and Engineer's approval shall be obtained. Completed work shall uniformly

match selected and approved sample. Samples of the following work for approval of the Engineer shall also be submitted.

- Plastering

- Flooring
- Joinery
- Tiling
- Door & window where requested
- Painting

9.1.7.2 MATERIALS FOR BUILDING TRADES

9.1.7.2.1 Delivery and Protection of Materials

The Contractor shall deliver all materials to the job site in manufacturer's original containers, properly labelled for identification. The Contractor shall provide raised platform and waterproof covers to protect the materials from the weather and from contamination from loose dirt, and debris.

9.1.7.2.2 Roofing

First quality corrugated asbestos cement sheeting shall conform to BS 690:1953.

9.1.7.2.3 Bricks

First quality properly pressed bricks, and regular and uniform to colour. Brick dimensions shall conform with B.S.3921 Pt. 2 and shall be of nominal depth 60 mm. Samples shall be submitted to the Engineer for his approval.

Common bricks of the internal quality shall be the solid type. Facing bricks shall be selected special quality bricks of the solid type. Independent Tests shall be carried out on samples of bricks. The Sampling Procedure and Testing Methods shall be in accordance with the requirements of BS 3921 Part 3.

9.1.7.2.4 Cement

Cement shall be Portland Cement BS 12. Cement brand shall be subject to the approval of the Engineer.

9.1.7.2.5 Fine Aggregate and Coarse Aggregate

For concrete works

As specified in Section 9.1.2.1.6(2), 9.1.2.1.6(3) in this specification.

For building works

The sand may be naturally occurring like river sand, pit sand or crushed stone sand. It shall generally conform to BS 1198, BS 1193 and BS 1200. It shall be hard, durable, clean and free from adherent coatings such as clay. It shall not contain harmful materials like pyrites, salts, coal or other organic impurities mica, shale or similar laminated materials, or flaky or elongated particles in such a form or in sufficient quantity to affect adversely the hardening, strength or durability of the mortar. In addition to the above, the sand when used for reinforced brick work shall not contain any material which may attack the reinforcement.

The quantity of clay, silt and dust shall not exceed the following unless there is satisfactory evidence to the contrary.

- In natural sand - 3% by mass when determined by the decantation method given in BS 812.
- In crushed stone sand - 15% by mass when determined by the sedimentation method given in BS 812

Sand for brickwork/stone work/block work and external plastering shall pass completely through a sieve of 2.36 mm and sand for second and third coats of plastering, pointing and fine work shall completely pass through a 1.18 mm test sieve.

9.1.7.2.6 Water

Potable water.

9.1.7.2.7 Reinforcement :

As specified in 9.1.2.2 of this specification.

9.1.7.2.8 Steel for Hollow Metal Doors and Frames

Cold rolled stretcher levelled carbon steel with hot-dip galvanised G-90 type zinc coating conforming to ASTM A525.

9.1.7.3 FABRICATION AND ERECTION

9.1.7.3.1 Brick Masonry Erection :

(1) General

Except as herein specified, brickwork shall conform to the requirements of C.P. 121:101 and various Standards referred to herein.

All materials for brickwork shall be handled and stored on site in such a manner as to avoid damage or contamination. Bricks straight from the kiln shall not be used in walling and brick deliveries shall be arranged to ensure that natural weathering takes place for a minimum period of 4 weeks before use.

(2) Mortar

Mortar shall be composed of cement and sand and the constituents shall be mixed in small batches in a mechanical mixer and used fresh. Cement shall be ordinary Portland Cement stored and handled as described in these Specifications. Mortar mixes for brick joints shall be measured by volume and be composed of 1 part of Portland Cement to 3 parts of sand, or 1 part of "Walcrete" Cement to 5 parts of sand for brickwork laid above the level of damp-proof course unless specified otherwise in the drawings. Prior approval shall be obtained from the Engineer to the use of any admixture in mortar. Mortar shall be used within an hour of adding water to the mix and no softening or reviving of the mortar will be allowed in any circumstances.

(3) *Brickwork*

Brickwork shall be jointed and pointed with mortar unless otherwise instructed by the Engineer. All brickwork is to be built with horizontal courses and vertical perpend and in vertical planes. The finished surface must be true to line and level. Window and door openings are to be furnished accurately to size, and finished solid against metal or wood frames. Unless the sides of the brickwork are to be plastered or rendered, the brickwork is to have fair faced sides. Walls with fair face both sides shall have a Weathered Joint externally and a Flush Joint internally both as shown in C.P.121. 101, Page 144, Figure 2. All jointing shall be completed with pointing as the brick laying proceeds. External wall faces or other wall faces which are to be rendered or plastered respectively, shall have their joints raked out as the brick laying proceeds. The cross joints in any course shall not be less than a quarter of a brick from those of the course below; or in the case of stretcher bond, half a brick. Expansion joints where required shall be of expanded Polystyrene or as detailed on the Drawings. Joints shall be painted with approved polysulphide filler. Brickwork of 230 mm and 115 mm (9 inches and 4 1/2 inches) thick shall be built in English and Stretcher Bond respectively. Snap headers will not be permitted, and bats shall be used only as closers to obtain a true bond. Particular care shall be taken to ensure that the vertical joints of the header courses are completely filled with mortar.

(4) *Miscellaneous*

All bricks shall be kept damp during building and shall be and carefully bedded on mortar and all vertical and horizontal joints being completely filled with mortar. The brickwork shall be built approximately in courses of 1 metre to the approval of the Engineer. Every third course shall be truly levelled and laid fair and level by line and all quoins, perpendiculars etc., kept true and square. The whole of the work shall be built straight and plumb and properly bonded together and neatly pointed, all to the satisfaction of the Engineer. No one section being raised more than 1 metre above another at one time. Facework shall not be built overhand. All unfinished brickwork shall be left toothed and projecting headers to form a bond with succeeding work. The Contractor is to cut all holes, form all chases for service pipes and conduits for all other trades as required. No wall shall be built up more than 1.5 metres in height on any working day.

(5) *Protection*

Architectural features and finished surfaces shall be protected against damage during the progress of the works. Newly laid brickwork shall be protected from the harmful effects of sunshine, rain, drying wind, running and surface water and shocks. Any work that is damaged shall be taken down and re-built or the joints raked out and pointed as directed by the Engineer. Any cost incurred in carrying out such remedial work shall be borne by the Contractor.

(6) *Damp-Proof Course*

Damp-proof course shall consist of 1 layer of hessian based bituminous sheeting complying with the requirements for Type D (Table 1) in B.S.745. The damp-proof course shall be bedded and covered with 13 mm thick cement mortar (1:3 mix) and shall be continuous throughout and stepped down where floor level changes. Lapping shall be 230 mm at joints and 115 mm minimum at intersections.

(7) *Cleaning*

The whole of the exposed faces of brickwork shall on completion be cleaned of all mortar drops and other markings and left in a perfect condition, and shall be properly protected against possible damage during execution of the works, all to the satisfaction of the Engineer.

9.1.7.3.2 Roofing

Install corrugated asbestos cement roof sheets to all roof surfaces of buildings as shown on the drawings. Sheets shall overlap at least 300 mm down the slope of the roof and adjoining sheets shall be laid with a lap of at least 150 mm. All AC roof panels shall be securely fastened to the hardwood bearers by drilling and self tapping coach screw along the ridges of the corrugated sheets. Eaves shall overhang the fascia by 50 mm.

The ridge of roof shall be sealed with standard asbestos cement ridge cap sections laid with at-least 150 mm overlap. Valance and barge board shall be fixed as shown in the drawings.

The supporting structure for the roof will be constructed using reinforced cement concrete beams. C purlings of the roof will be fixed over the concrete beams. Zinc aluminum roofing sheets will be used with 25mm thick glass wool and aluminum foil insulation. There is 1800mm eave to protect the windows. A specialist contractor will carry out installation of Zinc aluminum roofing. The gutters and down pipes shall be machine pressed Zinc Aluminum.

9.1.7.3.4 Water proofing reservoir roofs.

The concrete roofs of reservoirs shall be provided with a prefabricated water proofing membrane of following characteristics.

It should be a Atactic Polypropylene (APP) modified bitumen membrane consists of nonwoven polyester reinforcement impregnated and coated on both sides with APP modified bitumen and applied with the help of a heating torch according to manufacturer's specifications. The membrane after proper installation shall be covered with a 20 mm layer of cement sand mortar. The vertical surfaces shall be covered with cement sand block work as shown on drawings. Provide 75 mm side laps and 150 mm end laps.

The thickness – not less than 4.0 mm

Softening point not less than 150 deg C.

Penetration at 25 deg C in the order of 25 mm.

Tensile strength – Longitudinal = 700 N/50 mm
- Transverse = 550 N/50 mm.

Percentage of elongation -Longitudinal = 45
-Transverse = 50

Tear resistance -Longitudinal = 150 N
-Transverse = 150 N

Lap joint strength -Longitudinal = 650 N/50 mm

- Transverse = 550 N/50 mm

Resistance to aging & Ultra Violet light should have values equivalent to 10 years of exposure to the element

9.1.7.3.4 Floor and Wall Finishes :

(1) *General*

In general erection of all Plant and Equipment shall have priority over all the finishing work of every description and inclusive of plastering, painting, cement finish, floor tiles, ceilings etc. Prices quoted in the Bills of Quantities are to include for all difficulties, delays and inconveniences encountered and for any interference that may be caused by other Contractors.

(2) *Cement Finishes.*

(i) Steel Trowel

Screed interior slabs to elevations shown on drawings. Tamp with grid tamper enough to rise a bed of mortar to surface. No "dusting" on wet surface will be permitted. Level and compact with motor-driven disk type compactor float. Immediately thereafter the surface shall be further levelled and compacted with motor-driven trowel with flat-pitched blades. Final troweling shall be done with steel hand trowels after surfaces become hard enough to produce a hard, dense, smooth burnished finish. Provide for exposed interior concrete flat-work, except as otherwise indicated or specified.

(ii) Steel Float

Same as steel trowel, except that final burnishing shall be omitted. Provide where resilient flooring is indicated or scheduled.

(iii) Curing

- (a) Water Curing, maintain all concrete including slabs, in continuously wet condition for not less than seven (7) consecutive days after pouring, except where membrane curing is permitted.
- (b) Fabric Covering. Cover flat surfaces immediately after finish has hardened enough so that it will not be marred. Use Sisalkraft curing paper or approved equal polyethylene curing-and-protective tape-seal joints as recommended by manufacturer; also seal edges.
- (c) Sprayed Membrane. May be used for both flat and vertical surfaces of concrete, except where paint or other incompatible finish is to be subsequently applied. Apply with a power sprayer with nozzle equipped with a wind guard. Apply in conformance with manufacturer's printed directions. Protect surfaces that have been membrane cured during entire curing period from all forms of abrasion.
- (d) Weather Conditions. If weather conditions are severe enough to unduly dry out concrete surface, the surface shall be kept moist with a fine fog spray until protected by one of the above specified cures.

9.1.7.3.5 Cast Insitu Terrazo Floor Finishes

Specification shall be according to the ICTAD SPECIFICATION FOR THE BUILDING WORKS - 1985 PUBLICATION NO. SCA/4 (VOL1)

Cement: Black Portland cement conforming to B.S. 12

Facing aggregates : The aggregates shall consist of good quality marble in black, white and brown colours. Aggregate size shall be no 2 and No 3 as specified in the table 11.1 of ICTAD Specification for building works 1985.

Aggregate shall be washed before using Dividing Strips: Dividing strips shall be 2 mm thick 25 mm wide Aluminium .

Thickness of the top Terrazzo layer shall be 8 mm.

Sample panels shall be forwarded to the Engineer for his approval.

9.1.7.3.6 Water Proofing Coating

All new concrete surfaces including columns and baffle walls in contact with potable water of water retaining structures (such as water sumps, water reservoirs and elevated water towers) shall be coated with elastomeric cementitious coating approved by the Water Research Council (WRC) of UK for the use of potable water.

The water proofing coating shall be an two component polymer modified elastomeric cementitious compound.

Coating shall be approved by the Water Research Council (WRC) of UK for the use of potable water.

The product should be able to mix on site using a slow speed drill fitted with a mixing paddle and then applied to the substrate using brush, towel or spray.

The mixed density shall be not less than 1800 kg/m^3

It should have excellent bond to concrete specially bonding to green or damp concrete.

It should be suitable for soft water of "Langelier Saturation Index" of -2.6 and pH value of 6.6 to 9.0 .

The cured coating after immersion, shall be capable of withstanding cracked substrate cyclic movement from $0300-0$ microns at $15-35 \text{ deg. C}$ for 6000 cycles without failure.

It should have the capability to resist a positive water pressure of 7 bar and a negative water pressure of 3 bar when tested to DIN 108.

The coating shall be applied in two coats with a total minimum coverage of 3.6 g/m^2)

It should have a abrasion resistance - water Index 1 or more (ASTM D 4060)

9.1.7.3.7 Capillary Water Proofing for External Concrete Walls

The external concrete faces of pump house walls, valve house walls and reservoir walls which come in contact with soil backfill shall be applied with a water resistant barrier.

The water resistant barrier should be a cementitious, two-part, polymer-modified, elastomeric water proofing and protective membrane which has excellent adhesion properties and high flexural and tensile strength and can be easily applied to both horizontal and vertical surfaces.

Specifications

Physical properties	Compound A	Compound B	Mixture
Solids by volume	100%	not less than 50%	not less than 80 %
Colour			Cement gray or any other light colour.
Curing time between coats			not more than 3 hours
Minimum application temperature			20 deg. C
Consumption			not less than 5 kg/m ²
Resistance to water pressure			no penetration at 3.0 kg/m ²
% elongation at break			not less than 20

9.1.7.4 PLASTERING

9.1.7.4.1 Material

(1) *Lime*

Lime shall be obtained from an approved source;
It shall be one of the following types, as per SLS 552 depending on the raw material from which manufactured,

- Type 1 Dolomitic Lime
- Type 2 Burnt Miocene lime stone

Lime which has perished, or which has been damaged by damp, rain or intermixture or dirt, or which has become partially airslaked shall on no account be used on the works and shall be removed from the site within 24 hours of notice to remove. Lime which gives a residue of more than 10 percent by weight when tested with hydrochloric acid shall be rejected.

The lime stored at the work site shall be protected from weather action, by being kept in a weather proof shed with impervious floor and sides.

(2) *Quick Lime*

This shall be freshly burnt from limestone broken to a uniform size not exceeding 40 mm and carefully freed from earth and other impurities.

The lime shall be delivered at the site of the mortar mill quite fresh i.e. within 15 days of the date on which it was drawn fresh from the kiln. In cases where compliance herewith is not possible due to seasonal closure of kilns, written permission of the Engineer is necessary before stored slaked lime can be used.

(3) *Hydrated / Slaked Lime*

All impurities, ashes, or pieces improperly or carelessly burnt shall be screened or picked out before slaking. Quick lime shall be slaked with sufficient water; slaking shall be done neither earlier than three weeks nor later than one week before being put into the mill.

The lime after slaking shall be screened through a sieve of such size as the Engineer may direct and all stuff that does not pass through the sieve shall be rejected. For plastering second and third coat or for any fine work, unless otherwise specified, the lime shall pass through a 1.18mm BS Test sieve: for all other work, unless otherwise specified the lime shall pass through a 2.36mm BS Test sieve wire screen.

(4) *Lime Putty*

Lime putty shall be obtained by treated either quicklime or hydrated lime with sufficient water so as to produce a plastic, sound product.

It shall be sieved to be entirely free from coarse particles and shall be thoroughly matured for not less than 16 hours before use.

9.1.7.4.2 Mortar

(1) *Lime Mortar*

The mortar shall consist of slaked lime and sand, each complying with the respective standards and mixed in the proportions specified.

Lime and sand shall be mixed dry three times on an approved platform or masonry, stone, or wood, then sprinkled with the necessary quantity of water and ground in a mortar mill. The sand and lime shall be mixed only in sufficient quantities for a day's requirements. The mortar shall be raked up continuously during the grinding process, particularly in the angles of the mill. Water may be added as required during grinding, care being taken not to add more water than what is required to bring the mixed materials to the consistency of a stiff paste. The sides of the mill shall be maintained in good order. A satisfactory method of counting the revolutions shall be followed:

All mortar shall be used as soon as possible after grinding. As a rule it shall be used on the day on which it is made, but in no case shall mortar made 72 hours previously be permitted to be used or remain at the site of the work except mortar which is to be ground a second time for plastering work (see below). If hydraulic lime is used, the ground mortar shall not be kept unused for more than 25 hours after grinding. In all cases, the mortar shall be kept damp and on no account be allowed to dry. It shall always be protected from the sun and rain. All mortar more than 72 hours old or mortar hardened or set before being used shall be removed from the work site within 24 hours or order to do so, and no second mixing will be permitted.

Mortar for plastering shall be ground a second time after storing in a damp condition for an interval of two days in the case of stone lime, and one week in the case of fat lime so as to ensure thorough slaking. The mortar shall then be used at once.

(2) *Cement Mortar*

The mortar shall consist of Portland cement and sand, each complying with the respective standard and mixed in the proportions specified.

<u>Item of work</u>	<u>Cement</u>	<u>Sand</u>
Mortar for masonry	1	5 up to 8 as may be specified
Mortar for plastering	1	3 up to 4 as may be specified
Mortar for pointing	1	3 up to 4 as may be specified
Mortar for floor screws	1	3 up to 4 as may be specified

The Portland cement shall be measured by weight, a bag weighing 50 kg. Being taken as 0.035 cum and the sand in suitable measuring boxes. Where gauge boxed are used for measurement of cement by volume the gauge box shall be 400 mm x 350 mm x 290 mm high while the gauge box for sand shall be 400 mm x 350 mm x 250 mm high. The sand shall be measured on the basis of its dry volume. In the case of damp sand, its quantity shall be increased suitably to allow for bulkage.

The mixing of mortar shall be done in mechanical mixers unless the Engineer permits hand mixing taking into account the nature magnitude and location of the work.

Machine Mixing

The cement and sand shall be fed into the mixer in the specified proportions and shall be mixed dry. Water shall then be added gradually and wet mixing continued for at least one minute. Care shall be taken not to add more water than will bring the mortar to the consistency of a wet paste. Mixing shall be restricted to such quantities as could be utilised on the work within 30 minutes of mixing.

Hand Mixing

In the case of hand mixing, the measured quantity of sand shall be spread level on a clean dry platform and the cement spread over it. The cement and sand shall be mixed dry three times over. Water shall be added to the mixture only when the mortar is required for use and then only in sufficient quantity to bring the mortar to the consistency of a stiff past.

Cement mortars shall be used on the works within two hours after mixing. Mortar remaining unused for more than two hours shall be rejected and removed from the work site.

(3) *Lime - Cement - Sand Mortar (i.e. Composite Mortar)*

Proportioning

Cement, lime putty/dry hydrated lime and sand shall be taken in the proportions specified.

Mixing

Lime putty and sand shall be mixed and ground in the manner described in 9.1.8.4.2 (1) In case where factory made dry hydrated lime powder is used, prior grinding of lime and sand is not necessary, and mixing may be done in one operation in a mechanical mixer. Only a quantity of this mixture which could be used within two hours of its mixing with cement shall be taken out and mixed thoroughly with the specified quantity of cement in a mechanical mixer.

Hand Mixing

Hand mixing shall be permitted by the Engineer after taking into account the nature, magnitude and location of the work, practicability of the use of mortar mill, mechanical mixer etc. or where items involving small quantities are to be done. Cement and sand shall be mixed dry on clean water tight masonry or wooden platforms or in troughs. Lime putty shall be mixed with water to the consistency of milk of lime, which shall be added to the mixture of cement and sand, and the mixture shall be kneaded back and forth for about 10 minutes with addition of milk of lime to obtain mortar of workable consistency.

Precautions

Mortar shall be used within 2 hours after mixing Mortar unused for more than 2 hours shall be rejected and removed from the work site.

9.1.7.4.3. Types

(1) Lime Plaster - 15mm thick

The plaster shall not exceed 15mm total thickness. This shall consist of a single coat of lime mortar including where necessary the setting coat of pure white lime putty.

Materials

Lime mortar 1:2 or other specified proportion conforming to the requirements of Clause 7.4.2(1)

Surface Preparation

New brickwork or stone masonry shall have been finished with recessed joints to receive plastering. In the case of stone masonry, the bushings on the wall to be plastered, shall be removed to within 12 mm projection.

Where so specified for dense and smooth surfaces a suitable bonding treatment shall be applied to manufacturer's instructions before plastering.

All soft joints in old stone masonry or brick work shall be raked out to a depth of not less than 12 mm. The walls shall be brushed clean of all dust, thoroughly wetted and surface dried before plaster is applied.

Application

Plastering of walls commence after completion of ceiling plastering if any. The plastering shall be started from the top and worked down towards the floor. All put-log holes (i.e. holes left for scaffolding) shall be properly filled in advance of the plastering.

To ensure an even thickness and a true surface, gauges of plaster 15 mm x 15 mm, or broken clay tiles set in mortar shall be first established on the entire surface at about 2 meter intervals both vertically and horizontally.

The thickness of the plaster over any portion of the surface shall not vary from the specified thickness by more than 3 mm.

Mortar shall be applied between the gauges to slightly more than the required thickness i.e. slightly proud of the gauges. The plaster shall be well pressed into the joints, levelled and brought to a true surface by working a wooden straight edge reaching across the gauges, with small upward and sideways movement. Finally the surface shall be finished true with a wood float or trowel according to the type of finish required.

If a sandy granular texture is needed, the surface shall be wood floated. If a smooth finish is needed, trowelling shall be done to the extent required. During this process the setting coat of pure white lime putty shall be applied on the surface to facilities finishing.

All moulded work, apart from the coves shall be formed and run in lime cement mortar 1:1:15 all ornaments mitres etc. neatly formed. These shall be finished with lime putty as described above.

All arrises shall be plastered in lime cement mortar 1:1:1.5 and finished with lime putty for widths of not less than 25mm along each face of the arris.

All necessary dubbing behind, rounding of corners at the junctions of the walls plastering of cornices etc. shall be done.

In suspending work at the end of the day, the plaster shall be left cut clean to line both horizontally and vertically. When recommencing the plastering, the edge of the old work shall be scraped, cleaned and wetted with lime putty before plaster is applied to the adjacent areas, to enable the two to be properly jointed together. Plastering work shall be closed at the end of the day on the body of the wall and not nearer than 150mm to any corners or arrises. It shall not be closed on the body of features such as plaster bands and cornices, nor at corners or arrises.

Horizontal joints in plaster work shall not be formed on parapet tops and copings, as these invariably lead to leakage.

No portion of the surface shall be left out initially to be patched up later on.

Any cracks which appear on the surface, and all portions which sound hollow when tapped, or are found to be soft or otherwise defective shall be cut out in rectangular shapes and redone as directed by the Engineer.

Finish

The plaster shall be finished a true and plumb surface and to the degree of smoothness required. The work shall be tested frequently as the work proceeds with a true straight edge not less than 2.5m long and with plumb bobs. The gap between the straight edge and any point on the plastered surface shall not exceed 3 mm. All horizontal lines and surface shall be tested with a level and all jambs and corners with a plumb bob as the work proceeds.

Curing

Curing shall be started 24 hours after finishing the plaster. The plaster shall be kept wet for a period of seven days. During this period it shall be suitably protected from all damages, at the contractor's expense by such means as the Engineer may approve.

(2) *Lime Cement Plaster - 15mm Thick*

The plaster shall not exceed 15mm in total thickness. It shall consist of a single coat of lime cement mortar including where necessary the setting coat of pure white lime putty.

Material

Lime cement mortar 1:1:5 or other specified proportion conforming by the requirements of Clause 9.1.7.4.2.(3).

Surface Preparation and Application

Preparation of surface of the masonry/brickwork, and the application and curing shall be as specified in Clause 9.1.7.4.3.(1).

Surface finish

Unless otherwise specified all surface of lime cement plaster for external rendering shall be wood floated; internal plastering shall be trowelled and finished with a setting coat of lime putty

(3) *15mm Thick Cement Plaster on Masonry / Brick Work*

The plaster shall not exceed 15mm total thickness comprising a single coat of cement mortar and the setting coat of near cement slurry.

Materials

The cement mortar 1:3 or other specified proportion confirming to the requirements of Clause 9.1.7.4.2.(2).

Surface Preparation and Application

The surface preparation, application and curing shall be similar to the procedures specified in Clause 9.1.7.4.3.(1) taking account of the following details:

The setting coat of near cement slurry shall be applied within an hour of the completion of plastering.

It shall be trowelled smooth without showing signs of trowel marks or waviness of folds. Where a smooth finish is not specified, the surface shall be finished off with a rough wood float to the texture approved by the Engineer.

(4) *18mm Thick Coloured Cement Plaster - 2 Coat Work*

This shall consist of 2 coats. The base coat shall be cement mortar 12mm thick with a surface coat of coloured cement mortar 6mm thick.

Materials

Cement mortar 1:3 or other specified proportion conforming to the requirement of Clause 9.1.7.4.2.(2).

An approved water proofing additive shall be used where specified.

Surface Preparation and Application

Surface preparation, application and curing shall be similar to the procedures in Clause 9.1.7.4.3.(1) taking account of the following details.

The base coat of cement mortar shall where specified include 3% by weight of an approved water proof additive. The base coat shall be left roughened with a wire brush to provide a key for the surface coat. The surface coat shall consist of a mortar of coloured cement and sand mix as specified applied to a thickness of 6mm. It shall be applied not earlier than 24 hours of applying the base coat. It shall be finished with a rough texture to accord with the approval sample area or as directed by the officer-in-charge.

(5) *Cement Plaster on Concrete Surface*

Cement plaster for concrete surface shall be of cement mortar of minimum thickness 6mm in the case of single coat work and of maximum thickness 10mm in the case of 2 coat work.

The thickness of the plaster on the soffit of suspended floor shall be the minimum possible.

Materials

Cement mortar 1:3 or other specified proportion conforming to the requirements of Clause 9.1.7.4.2.(2).

Surface Preparation

Projecting burrs of formed surfaces shall be removed and the surface scrubbed clean with a wire brush. The surface shall then be prepared as follows:-

- (a) A first coat of spatter dash shall be applied over smooth clean concrete surfaces if so directed by the Engineer. The dashing shall consist of 1 part of cement and 2 parts of clean fairly coarse sand mixed to a thick slurry and kept well stirred. It shall be applied using a strong whipping motion normal to the face of wall. On setting and hardening, the spatter dash shall give a good key for the subsequent coat to be applied.

- (b) Where directed by the Engineer, the surface shall be hacked with a pointed tool at spacing of not more than 50mm, the hacks being not less than 3mm deep. The surface shall then be cleaned of all mould oil, grease etc. by scrubbing with water containing detergent and washing off with plenty of clean water. The surface shall be allowed to dry before application of plaster.

Application

- (a) Soft Plaster

Floor rendering and finishing of a suspended floor shall have been completed before commencing plaster its soffit. In the case of flat roofs, the weather proofing and other work shall have been completed so that the soffits plaster is not disturbed by subsequent operations on the floor or the roof. The concrete surfaces shall be wetted in advance and allowed to dry before application of plaster. To ensure an even thickness and a true surface, suitable gauges shall be established at about 1.5 metre intervals in both directions as described in Clause 9.1.7.4.3.(1) and the plaster applied and finished smooth as described therein with a floating coat of lime putty. The finished soffit shall not show trowel marks, waves or folds and shall be true and plane. The mortar shall be used within an hour of adding water to the dry mix.

- (b) In the case of concrete surface other than soffits of suspended floors, the plaster shall be finished to a true and plumb surface and to the proper degree of smoothness required. All horizontal surfaces shall be tested with a levelling instrument and all jambs and corners with a plumb bob as the work proceeds. All internal surfaces shall be finished smooth with a floating coat of lime putty and external surfaces wood floated rough to the texture desired, all to the satisfaction of the Engineer.

9.1.7.5 GLASS AND GLAZING

The Contractor shall furnish all labour, materials, and equipment to complete the glass and glazing work as indicated on the Drawings and specified herein.

9.1.7.5.1 Workmanship

Experienced glaziers shall be used to perform glazing . Glass shall be set tight and true with metal and/or extruded glazing beds, on glazing compound, as required. All excess compound shall be struck flush and neat, to leave work clean. All glazing shall be performed in strict accordance with applicable provisions of C.P. 152 and as herein specified.

9.1.7.5.2 Materials

Glass shall be labelled and labels shall not be removed until so directed by the Engineer. Thickness of glass are nominal with a permissible tolerance of plus-or-minus 0.8 mm. Actual glass sizes shall be obtained at job site or from manufacturers of windows. Conform to C.P. 152 and applicable Code requirements for maximum glass size and thickness required to meet a wind pressure of 950 Pa. Types of glass to be used are defined as follows:

(1) *Tempered Glass*

Pittsburgh Plate Glass Company 6.4 mm tempered plate glass or approved equal.

(2) *Clear Sheet Glass*

Pittsburgh Pennvernon Sheet Glass B quality 5.6 mm thickness or approved equal.

(3) *Clear Plate*

Pittsburgh 6.4 mm Polished Plate Glass (wire where indicated) or approved equal.

9.1.7.5.3 Protection and Replacement

All glass shall be protected against damage. At completion of work, all cracked, broken or imperfect glass and glass which cannot be properly cleaned shall be replaced. Immediately prior to final acceptance of the project, all glass shall be thoroughly cleaned.

9.1.7.6 MISCELLANEOUS METALS

The Contractor shall provide all labour and materials to complete the miscellaneous metals work as indicated on the Drawings and specified herein, but not limited to the following:

- a) Miscellaneous Metal Work.
- b) Metal Corner Guards and Sills.
- c) Steel Supports for Crane and Hoists.

9.1.7.6.1 General

The Contractor shall verify all dimensions in the field, report all discrepancies for correction to the Engineer before fabricating work. Shop drawings shall be submitted to the Engineer for approval.

9.1.7.6.2 Welding

All welding shall be performed in a licensed shop by certified welders.

9.1.7.6.3 Materials

- a) Miscellaneous Steel ASTM A7, ASTM A 36
- b) Machine Bolts and Nuts ASTM A 307
- c) Galvanising Hot-dip process, ASTM A 123
- d) Metal Primer Red lead; Federal Specifications TT-P-86, Type I or II; or zinc chromate Military Specifications MIL-P-8585, 85 percent zinc quality.

9.1.7.6.4 General Requirements.

(1) *Workmanship*

Contractor shall conform to accepted shop practice. Form work shall be true to detail, with clean straight, sharply defined profiles. Unless otherwise shown or specified, exposed metal surfaces shall be finished smooth and face of exposed welds shall be made flush and smooth.

(2) *Provisions for Attachment to Structure*

Miscellaneous metal items shall be furnished complete with supports, anchors, and other devices shown, specified or necessary for reinforcement and proper, secure setting or attachment to building construction.

(3) *Painting*

After fabrication, all exposed steel items shall be thoroughly cleaned and given a coat of specified metal primer. All aluminium surfaces placed in contact with concrete, plaster, masonry or dissimilar metals shall be given two heavy coats of the specified protective paint.

9.1.7.6.5 Installation

(1) *Embedded Items*

Embedded items shall be delivered with setting drawings or instructions to other trades for setting. Contractor shall verify grade and line position of items so set; report errors or deviations in order that corrective adjustment may be made before placement of concrete or masonry.

9.1.7.7 CARPENTRY

Contractor shall provide all labour, material, equipment and appliances to complete the carpentry work as indicated on the Drawings and specified herein, including but not limited to the following:

- a) Rough Carpentry, including Rough Hardware.
- b) Millwork
- c) Wood Furring and Grounds
- d) Roof Framing
- e) Installation of Hardware
- f) Door. & window

9.1.7.7.1 Materials

Timber

(1) *General*

Timber for constructional purposes shall be of the specified species and of the best quality, thoroughly well seasoned, sawn square, and free from sap, shakes, cracks and waney edges. It shall be free from decay and insect attack. It shall not contain loose or dead knots and other defects.

Sound knots if they exist, shall be of such size and location as will be permissible for the relevant structural or joinery work.

Where a choice of more than one species is allowed, only one variety shall be used for any particular class of work.

The density of timber used for building purposes should not, in general, be less than 640 kg/m³ (40 lb/ft³) at 12% moisture content.

In general, the quality of building timber shall conform to SLS 263. The size of structural and non-structural timber components shall be as specified.

Any timber brought to the site, which in the opinion of the Engineer does not conform to the required standard shall be rejected and shall then be removed from the site by the Contractor at his own cost within 24 hours of notice to do so.

Tolerances

The tolerance for dimensions of timber both sawn (unplanned) and finished (planed) shall conform to Clause 4 of SLS 263 (1974) which is reproduced below:-

Sawn (unplanned)

Nominal dimension mm	Maximum permissible variation	
		mm
p to 25	-0	+2
Over 25 to 50	-2	+3
Over 50 to 150	-3	+6
Over 150	-6	+6

Finished (planed)

Nominal dimension mm	Maximum permissible variation	
		mm
p to 25	-0	+1
Over 25 to 50	-1	+2
Over 50 to 150	-2	+3
Over 150	-3	+3

Grain Slope

In structural timber, the slope of the grain shall not exceed 1 in 8. Slope shall be measured over the worst face and over a distance of not less than 200mm.

For timer to be used for door and window frames and shutters, the slopes shall not exceed 1 In 8. In panelling however, sloping grain may be permitted to any extent.

(1) *Moisture Content and Seasoning of Timber*

Timber seasoned under controlled conditions shall be used, as green timber is liable to shrinkage and warping and is easily affected by wood destroying and sap-staining fungi. The moisture content of the timber at the time of fabrication shall be within 3% of the moisture content likely to be attained by the timber in service.

Seasoning of green timber in air, kiln or both, shall conform in all respects to CS 159. Seasoning techniques shall be such that seasoning defects like end splits, surface cracks warping etc. are minimised. The moisture content of air seasoned timber shall be not more than 15% and that kiln seasoned timber not more than 12%.

(2) *Preservative Treatment*

Special Preservative treatment such as Pressure Diffusion, vacuum or immersion treatment shall be carried out where necessary in consultation with the Forest Department. Guidance may be obtained from BS 5628: Part 5 for structural timbers and BS 5589 for joinery work.

Unless otherwise specified, all parts of wood work resting on or set in masonry, shall be painted with two coats of hot tar which shall be applied without disfiguring exposed faces. 40mm wide recesses shall be left for free circulation of air around the ends of all beams, and the recesses protected with perforated zinc sheet.

Timber buried in the ground shall be tarred. No timber shall be tarred, oiled or painted before inspection and approval by the Engineer.

Adhesives

Adhesives used for joinery work shall conform to one of the following:

B.S. 745 Animal glues for wood

B.S. 1444 cold setting casein glue for wood

B.S. 1203 synthetic resin adhesive (Phenolic and Amino plastic) for plywood

B.S. 1204 Synthetic resin adhesive (Phenolic and Amino/plastic) for wood

For structural gluing one of the latter three glues shall be used as specified.

Regarding storage, mixing and use of adhesive, the instructions of the manufacturer shall be followed.

Fasteners

Wire Nails

Wire nails (oval, chequered head, lost head, round or panel pins) shall conform to the following standards.

Steel nails - CS 8

Copper nails - BS 120% Part II

Where not specified, the gauge of the nails shall be suited to the woods being used and their length shall give a sound and secure fixing. Nails or screws used with reactive timbers shall be of non-ferrous metal.

Nails used in wood work likely to be subjected to moist conditions (as in the case of external work) shall have the specified protective coating.

Wood Screws

These shall be made of steel wire or brass wire and shall conform to CS 6 or BS 1210. The finish whether oxidised, anodised, galvanised etc., shall be specified.

Coach Screws

These shall conform to BS 1494 Part 2. The finish shall be as specified.

Black Bolts, Screws and Nuts

These shall conform to CS 97 with the specified finish.

Washers

These shall be made of steel or brass and shall conform to CS 238 or BS 4320.

Steel Gussets

These shall be manufactured to the profiles shown on the drawings and made from steel plates conforming to BS 4360. Thickness of plates and the finish shall be as specified.

Mild Steel Connectors

These shall conform to BS 1579.

Other Fixing Devices

Expanding bolts and nuts, joist hangers, framing anchors, tie down straps, anchor bolts etc. shall be as specified in respect of materials, size, gauges and the finish.

Plugs

These shall be of durable timber like teak of specified sizes.

Dowels

These shall be Mild Steel rods of 16mm diameter and of adequate length.

Holdfasts

These shall be of Mild Steel flats 25mm x 6mm x 250mm long, turned up and with 2 Nos. 3mm holes drilled one end, and finish tailed at the other end.

Plywood, Hard Board, Block Board, Chip Board, etc.

These shall conform to the relevant Sri Lanka or British standards as noted below.

1. Plywood for general purpose - SLS 261
2. Plywood for exterior use – BS 1455 bonding
W.B.P. (Grade 1 - where varnished,
Grade 2 - where painted,
Grade 3 - where hidden.
3. Block Board - BS 3444
4. Wood chipboard - BS 5669
5. Hard Board - BS 1142

9.1.7.7.2 Structural Timber and Timber Roof Work

General

Structural timber and timber roof work shall be fabricated in accordance with detailed drawings and shall generally conform to BSCP 112: Part 2 in regard to workmanship.

The Contractor shall provide details of the work as necessary to help ensure co-ordination with related building elements and services. He shall provide fabrication/installation drawings and obtain approval before starting fabrication. Where directed, he shall provide samples for intended connection before commencing actual fabrication.

Proprietary products shall be used to manufacturers recommendations.

Fabrication

The size of timber sections unless otherwise stated are basic (nominal) sizes. Tolerance on sizes shall be as per Clause 9.1.7.7.1.

All timber shall be sawn, planed, drilled or otherwise machined to the correct size and shape in accordance with drawings and specifications. Dimensions and spacing shall not be scaled from the drawings. Pieces damaged by splitting or bruising shall be rejected.

Mating and bearing surfaces shall be finished to ensure close contact over the whole area. These surfaces shall have a good sawn or planed finish and treated with the specified preservative. Bearing surfaces of notches and other cuttings shall be true and smooth and in appropriate relation to the other surfaces of the piece.

9.1.7.7.2.1 Joints

(1) Nailed Joints

Wire nails shall be of the gauge shown in the drawings and at least 20mm longer than the full thickness of the assembly to be secured the projecting portion shall be clinched over at right angles to the grain to resist withdrawal.

All nails shall be soaked in hot boiled linseed oil and allowed to drain immediately before fitting. All nails shall be driven, unless the nails are of large gauge or the timbers are likely to be split in which case holes shall be drilled in one operation through all the members held in position. The holes shall be approximately 20 percent smaller in diameter than the nails.

(2) Screwed Joints

Lead holes shall be used in making screwed joints; the diameter of the hole for the shank shall be equal to the diameter of the shank; for the threaded portion, the diameter of the hole shall not exceed 0.9 of the diameter of the root of the screw thread adjacent to the shank. Care shall be taken to avoid placing screws in an end split.

(3) Bolted Joints

Bolt holes shall be drilled to diameters as close as possible to the nominal diameter of the bolt but not more than 1.6mm larger than the bolt diameter. Care shall be taken to avoid placing a bolt in an end split. At least one complete thread shall protrude from the nut.

A washer shall be fitted under the head of each bolt and under each nut. The minimum sizes of washers are given in the table 9.1.7.1 below.

Diameter of bolt	Minimum thickness of washer	Minimum side of square washed or dia of washer
MM	MM	MM
(9.5)		
(12.7)	3	51
(15.9)		
(19.0)	5	64
(22.2)		
(25.4)		
(28.6)		
(31.8)	6	76

Structural connections using steel plates split rings etc. shall be as per BS CP 112: Part 2.

Note - Laminated Roof Trusses

Unless otherwise specified all members of laminated roof trusses shall be connected with wire nails with a washer at each end of the nails.

9.1.7.7.2.2 Preservative Treatment of Cut Surfaces

Cutting of timber after preservative treatment shall be avoided. However, when it is unavoidable, a liberal application of preservative shall be made to the cut surfaces.

9.1.7.7.2.3 Assembly of Structural Units

Assembly of structural units shall be done on a level bed and in such a way as to avoid damage to any of the members. The finished structural units shall conform to drawings and specifications. Twisted or damaged members shall be replaced before erection on the site.

Before proceeding with bulk production, a complete assembly of each type of framed truss or other structural unit shall be checked for accuracy. A similar check shall be carried out from time to time to control the wear and tear on templates and gauges.

Timber members of built up units shall be marked in accordance with a marking diagram.

9.1.7.7.2.4 Storage

Timber components shall not be exposed to high humidity and all materials and assemblies shall be protected against exposure to the weather, wetting, damage, decay and insect attack.

9.1.7.7.2.5 Painting

Where painting of the timber is specified, all parts of assemblies or individual pieces shall be protected with a priming paint complying with BS 2521 or BS 2522 and one undercoat before leaving the factory.

Steel components other than bolts, connectors and washers shall be thoroughly cleaned to remove all loose scale and rust and painted with one coat of genuine red lead paint before despatch to site.

9.1.7.7.2.6 Transport

All materials and assemblies shall be protected from the weather, and suitable measures shall be taken to protect the surfaces during hoisting and fixing.

9.1.7.7.2.7 Handling Hoisting and Fixing

The over-stressing of members during handling shall be avoided. In the case of framed arches, portal frames, trusses etc., special care shall be taken to avoid distortion in hoisting from the horizontal to the vertical position. Where lifting points or methods of lifting are not indicated on the drawing guidance shall be sought from the Engineer. On completion of erection, all joints shall be inspected and care taken to ensure that all bolts are tightened without crushing the wood under the washers.

9.1.7.7.2.8 Testing and Acceptance

When testing of a timber structure or component becomes necessary due to doubt about the adequacy in design, quality of material, etc., the test and acceptance criteria shall be as per clause 6 of BS CP 112 Part 2.

9.1.7.7.3 Joinery

General

Joinery work shall consist of the manufacture, delivery to the site and fixing in the building of all joinery described in the specification and shown on the drawings including the supply and fixing of-

- (a) Metal straps, lugs and dowels
- (b) Priming and application of preservative
- (c) All iron mongery specified or shown in the drawing

The joinery work shall be of the best workmanship conforming generally to BS 1186: Part 2. The joinery work shall be completed ready for the respective finishes.

9.1.7.7.3.1 Dimensions

All wrot timber is to be sawn, planed, drilled or otherwise machined or worked to the correct sizes and shapes shown in the drawings or specified. Tolerance on timber sizes shall be as per Clause 9.1.7.7.1.1.

9.1.7.7.3.2 Exposed Faces

All timber that is to be exposed in the finished surfaces of joinery works shall be written on the appropriate faces unless otherwise specified.

9.1.7.7.3.3 Natural Finish

When natural finish or finish for staining, clear polishing, or varnishing is specified, the timber in adjacent pieces shall be matched for colour and grain. The surface finish shall be as specified.

9.1.7.7.3.4 Shrinkage

The arrangement, jointing and fixing of joinery works shall be such that shrinkage in any part and in any direction shall not impair the strength and appearance of the finished work, and shall not cause damage to contiguous materials or structures.

9.1.7.7.3.5 Fabrication

All necessary mortising, tenoning, grooving, matching, tonguing, housing, rebating, and all other works necessary for correction jointing, shall be in conformity with BS 1186. All metal plates, screws, nails and other fixing that may be directed by the Engineer or that may be necessary for the proper execution of the joinery works specified, shall be the responsibility of the Contractor. All works necessary for the proper construction of all framing, linings, etc. and for their support and fixing in the building shall be carried out to approval.

9.1.7.7.3.6 Joints

The joinery shall be constructed as shown in the detail drawings. Where joints are not specifically indicated they shall be the recognised forms of joints for each position. The joints shall be made so as to comply with BS 1186; Part 2.

Glued joints shall be used where provision need not be made for shrinkage or other movements in the connections, and where sealed joints are required. All glued joints shall be cross-tongued or otherwise reinforced. All nails, springs, etc. shall be punched and puttied. Surfaces in contact shall have a good sawn or planed finish. All cutting edges of tools shall be shape to avoid burnishing. The surface of plywood to be glued shall be lightly dressed with sand or glass paper. The sand or glass paper must not be allowed to clog and cause burnishing.

Members to be joined by gluing are to be of similar conversion. All surfaces to be glued shall be kept clean, free from dirt, dust, sawdust, oil and any other contamination. Adequate pressure shall be applied and maintained whilst the glue is setting.

9.1.7.7.3.7 Moulding

All moulded work shall be accurately worked to the full size details shown in drawings. All mouldings shall be worked on the solid timber except where otherwise stated.

9.1.7.7.3.8 Bent Work

Where bending is specified, it shall be built up with an appropriate number of pieces out to the required shapes. The pieces shall be put together in two (or three) thickness so that they break joint, and shall be secured with hardwood keys and wedges or with hardwood pins (whichever is more appropriate).

9.1.7.7.3.9 Circular Work

When circular work is specified, it shall be built up with an appropriate number of pieces out to the required shapes. The pieces shall be put together in two (or three) thickness so that they break joint, and shall be secured with hardwood keys and wedges or with hardwood pins (whichever is more appropriate).

9.1.7.7.3.10 Veneering

This shall be carried out in an approved manner, and to the entire satisfaction of the Engineer.

9.1.7.7.3.11 Scribing

All skirting, architrave, plates and other joinery works shall be accurately scribed to fit the contour of any irregular surface against which they may be required to form a close but connection.

9.1.7.7.3.12 Weathering

All weathering surfaces, throatings, grooves and joints, etc., and all open connections in external joinery works shall be properly executed so as to provide a reasonable degree of weather resistance.

All reasonable measures shall be taken to check or prevent capillary penetration of water in the joints and open connections of external joinery works, and in all other positions where joinery works may be exposed to water.

9.1.7.7.4 Door and Window Frames (wooden)

General

The frames shall be wrote, framed and fixed in position as specified in drawings. The scantling of specified timber, shall be planed smooth and accurate to the dimensions shown in drawings. Rebates, rounding, and mouldings shall be made before assembly. Patching or plugging of any kind shall not be permitted except as specified. Tolerance on sectional dimensions of timber shall conform to Clause

9.1.7.7.4.1 General

In general joinery work shall conform to requirements of Clause 9.1.7.7.3.

9.1.7.7.4.2 Joints

These shall be of mortice and tenon type, simple neat and strong. Tenons shall be formed on the posts of frames. Mortice and tenon joints shall fit in fully and accurately without wedging or fitting. The joints shall be glad and the frames put together and kept pressed in position by mean of a press pinned with hardwood pins of at least 10mm dia.

9.1.7.7.4.3 Surface Treatment

Wood work shall not be painted, oiled or otherwise treated before it has been approved by the Engineer. All portions of timber abutting against masonry or concrete or embedded in ground shall be painted with approved wood primer or preservative.

9.1.7.7.4.4 Fixing in Position

Before fixing, the backs and ends of frames shall be coated with 2 coats of good quality wood preservative. When frames are to be built into masonry these shall be braced and protected as necessary to prevent distortion and damage during construction of the brick-work.

The frame shall be positioned accurately plumbed, levelled and aligned as necessary. The timber frames unless otherwise specified shall be fixed at centres not exceeding 600mm with at least one fixing located 150mm from each end of jambs and one adjacent to each hanging point of doors/window shutters. Generally at least 3 fixing per side of each door frame and 2 fixing per side of each window frame shall be provided. The fixing device shall consist of a hold fast as described in Clause 9.1.7.6.1.3 embedded in concrete, or stout steel screws driven into hard wood plugs embedded in the walls, or other approved clamps of a suitable design

The feet of all door frames and posts shall not be buried into the concrete floor but shall be fitted to specially cast cement spur block projecting above the floor. 16mm dia iron dowels shall be provided connecting the spur stone and the frame. The spur stone shall be such that the architraves if any and the coved floor finishes shall be accommodated producing a neat clean finish with no corners which can hold dust or vermin.

9.1.7.7.5 Sashes for Doors, Windows, Fanlights etc. (wooden)

General

The specified timber shall be planed smooth and accurate to the full dimensions rebates, roundings mouldings shall be made before assembly. Patching or plugging of any kind shall not be permitted except as specified.

The sashes shall be wrot, framed and fixed in position as per detailed drawing and as directed by the Engineer.

Note :-Joinery work for doors and windows etc. shall be started immediately after commencement of the building work. The components shall be stored clear off the

floor in a dry and covered area allowing for free circulation of air. Pressing and securing of joints shall be carried out at the time of fixing frames or shutters.

(a) Joinery Work

All members of the door sashes shall be straight without any warp or bow, and shall have smooth well planed faces at right angles to each other.

The corners and edges of panels shall be finished as shown in drawings, and these shall be feather tongued into stiles and rails. Sash bars shall have mitred joints with the stiles. Stiles and rails shall be properly and accurately mortised and tenoned. Rails which are more than 180mm in width shall have to tenons. The thickness of each tenon shall be approximately one third the finished thickness of the members and the width of each tenon shall not exceed five times its thickness. The tenons shall pass through stiles for at least 3/4th of the width of the stile. Muntins and glazing bars shall be stubtenoned to the maximum depth which the size of the member would permit or to a depth of 25mm, whichever is less. When assembling a leaf, stiles shall be left projecting as horn.. The stiles and rails shall have 12mm grooves in the panelled portion for the panel to fit in.

The depth of rebate in the frames for housing the sashes shall in all cases be 12.5 mm; the rebate in the sashes, for closing in double sash doors or windows shall be less than 20mm. In the case of double leaved sashes the meeting of the stiles shall be rebated 20mm and the rebate shall be splayed.

In general, the joinery work shall conform to the requirements of Clause 9.1.7.7.3.

The joinery work shall be assembled and approved by the Engineer before the joints are pressed, and secured by hard wood or bamboo pins of about 6 - 10mm diameter. The horns of stiles shall be sawn off.

(b) Gluing of Joints

The contact surfaces of tenon and mortice joints shall be treated before putting together with bulk type synthetic resin adhesive of a make approved by the Engineer. Sashes shall not be painted, oiled or otherwise treated before they are fixed in position and approved by the Engineer.

(c) Beading

Timber, plywood, hard board and particle board panels shall be fixed only with grooves but additional beading may be provided either on one side or on both sides.

In so far as glass panels are concerned, beading shall always be provided without grooves. Where beading is provided without grooves, the beading shall be only on one side, the other side being supported by a rebate from the stiles.

For external doors and windows beading shall be fixed on the outside.

(d) Fittings

Fittings shall conform to the requirements of elsewhere. Details of fittings shall be as specified.

(e) Wooden Cleats and Blocks

Wooden cleats and blocks shall be fixed to doors and windows as specified or as directed by the Engineer. The size and shape of cleats and blocks shall be as approved by the Engineer.

(f) Tolerance

A “tolerance of ± 1.5 mm shall be allowed on heights and widths of sashes.

9.1.7.7.5.1 Ledge, Braced and Battened Sashes

The thickness of the doors shall be the thickness of the battens only and not the combined thickness of battens and braces.

Planks for battens shall be 75mm to 100mm wide and 20mm thick unless otherwise specified. These shall be planed smooth and provided with rebated joints rebated at least 12mm. The tolerance on sized of battens, ledges and braces shall conform to Clause 9.1.7.7.1.

Ledges and Braces

The battens shall be fixed together by 25mm thick ledges and braces fixed to the inside face of the door shutters with screws. The ledge shall be 175mm wide and brace 125mm wide unless otherwise specified. The braces shall incline downwards towards the side on which the door is hung. Edges and ends of ledges and braces shall be chamfered. Tee hinges shall be provided for these doors.

Wooden cleats, blocks and fittings shall be as specified.

9.1.7.7.5.2 Panelled, Glazed or Panelled and Glazed Sashes

Panelling

The following types of panelling shall be used for door/window sashes as specified.

- (a) Plywood
- (b) Hardboard
- (c) Block board
- (d) Sheet glass

These shall conform to the relevant SLS/BS.

The panels shall be framed into grooves to the full depth of the groove, leaving an air space of 1.5mm and the faces shall be closely fitted to the sides of the groove. Mouldings to the edges of panel openings shall be scribed at the joints.

9.1.7.7.6 Shelving (Timber)

All shelving shall be of the widths and thickness specified. Timber shelving shall normally consist of 25mm thick boarding screwed to 100 x 50mm timber brackets fixed to the wall at approximately 1.2m centre.

Note: The Contractor's rate shall provide for treating both the top and bottom with two coats of approved wood preservative.

9.1.7.7.7 Trellis Work (Timber)

9.1.7.7.7.1 Plain Trellis

The shall consist of wooden strips or laths 35 x 10mm section unless otherwise specified, planed and nailed together at every alternate crossing. The strips shall be spaced 35mm apart so as to form 35 x 35mm openings, or as shown in the drawing. These shall be fixed with nails to the frame. To cover the ends of strips, 50 x 12mm beading shall be fixed to the frame with screws. Finished work with a tolerance of ± 1 mm may be accepted.

9.1.7.7.7.2 Trellis Door and Window Sashes

The sash frame shall consist of two styles and the top, lock and bottom rails, each of section 75 x 35mm unless otherwise specified. The styles and rails shall be properly mortised and tenoned. The tenons shall pass through the styles for at least 3/4th of the width of the style. The sash and frame shall be assembled and passed by the Engineer before jointing. The joints shall be pressed and secured by hard wood pins of about 6mm diameter. To this frame, plain trellis work as described in Clause 9.1.7.7.1 shall be fixed as shown in the drawings, wooden cleats and blocks shall be provided as specified.

9.1.7.7.8 Pelmets (Timber)

The sides, front and top of the pelmets shall be of 12mm thick, planks or boards of specified width unless otherwise stated.

These shall project from the wall face by 150mm or as specified, and shall be securely fixed to walls with wood screws by means of wooden plugs and 100mm long x 25 x 3mm mild steel flats bent in the form of an angle or by any other device approved by the Engineer. The pelmets shall be provided with curtain rods and brackets or curtain rails with rollers, stop ends and brackets as specified. Intermediate wooden brackets shall be provided if the front length of pelmets exceeds 1.5 metres.

9.1.7.7.9 Mild Steel Bars or Grills in Wooden Frames

These shall be of the pattern and details specified.

9.1.7.7.9.1 Fixing of Mild Steel Bars in Wooden Frames

Through holes shall be drilled in one frame, and 50mm deep in the other frame. The bars shall be passed into the frame from one side and shall be of the correct length to fit in at one end and to end flush with outside of the fame at the other side.

Where there are mild steel flats provided along with the bars, these shall be fixed to the wooden frame with wood screws. Holes for passing M.S. bars shall be punched in the flats at proper positions.

9.1.7.7.2 Fixing of Steel Grills

The grills shall be fabricated as per design and fixed to the frame using round screw nails.

9.1.7.8 SHEET METAL

Provide all labour, material, equipment and appliances to complete the sheet metal work as indicated on the Drawings and indicated herein including but not limited to the following:

- A. Sheet Metal Flashings
- B. Gravel Stopes and Scuppers
- C. Louvers and Frames

9.1.7.8.1 General Requirements

Submit shop drawings for approval showing materials, profiles, layout, jointing, and method of attachment to adjacent construction. Take such field measurements as may be required for fabrication of work.

9.1.7.8.2 Materials

(1) *Galvanised Iron or Sheet Metal*

ASTM 193 "Commercial" coating. Where gauge is not shown or specified, use gauge suitable for specific use, but in no case lighter than 24-gauge (or metric equivalent).

(2) *Bolts, Screws, Nails, Rivets, Clips and Accessories*

Iron or steel, galvanised, sherardized or cadmium-plated.

(3) *Solder*

ASTM B32, 50 percent pig lead and 70 percent block tin (new metals).

(4) *Soldering Flux*

Non-corrosive type which will not discolour metal.

(5) *Caulking Compound*

Polysulfide Sealant. See Caulking paragraph.

(6) *Plastic Cement*

As recommended by roof material manufacturer.

(7) *White Lead Paste*

Basic lead carbonate, ASTM D81, and eight percent boiled linseed oil, mixed into smooth paste of putty-like consistency.

(8) *Hot-dip Galvanising*

ASTM A 123

(9) *Flashing and Counter flashings*

Shall be as manufactured by Fry Reglet Corporation or Lane-Air Manufacturing Corp. Metcoa Company types as detailed on the plans or approved equal.

9.1.7.8.3 Fabrication

(1) *Workmanship*

Work shall conform to first class commercial practice. Work shall be neat, strong, weather tight and serviceable with adequate provisions for expansion and contraction.

(2) *Seams and Joints*

Unless other type joints are shown, specified or approved for particular conditions, soldered lock seams shall be used where subject to stress and soldered lap seams shall be used where not subject to stress. Where soldered seams are impracticable, lock seams caulked with white lead past shall be used. Where necessary for strength or stiffness, parts shall be joined with rivets or sheet metal screws.

(3) *Tinning and Soldering*

Both sides of all sheet metal to be soldered shall be tinned with pure tin or solder; use specified soldering flux. Soldering shall be performed slowly, thoroughly heating seams and completely sweating solder through full width of seams.

(4) *Exposed Edges*

Unless otherwise approved, sheet shall be doubled back 12 mm to conceal and stiffen raw edges.

(5) *Provisions for Attachment to Structure*

Sheet metal items shall be complete with anchors and other devices shown, specified or necessary for reinforcement and proper, secure, attachment to building construction.

9.1.7.8.4 Installation

(1) *Items to be Installed by Others*

Sheet metal items which are to be installed by others shall be delivered to other trades as required in sufficient time to avoid delays to construction progress.

(2) *General*

Surfaces to which sheet metal is to be applied shall be thoroughly clean and dry, smooth, free of projections and depressions, and shall be properly prepared.

(3) *Attachment*

Except as otherwise shown or specified, nails, rivets, or screws shall be used at spacing not to exceed 200 mm. Lead washers shall be used where exposed to weather. Barbed roofing nails 11-gauge, 6 mm long shall be used for attachment to masonry or concrete.

(4) *Expansion and Contraction*

Work shall be installed with adequate provisions to prevent distortion and over stressing from expansion and contraction. Expansion joints shall be constructed to be weather tight with specified sealing compound.

9.1.7.8.5 Special Requirements.

(1) *Flashing and Counter flashings*

Counter flashing shall be furnished for flashings at vertical surfaces. Counter flashing shall be installed by securely fastening upper portion in accordance with approved manufacturer's directions. Transverse joints shall be 75 mm and laps cemented with plastic cement. Open ends shall be completely filled and made weather tight with specified sealing compound.

9.1.7.8.6 Painting

All surfaces of all galvanised sheet metal work concealed after installation shall be cleaned and primed with one coat of a good quality priming paint approved by the Engineer. Priming of exposed surfaces and finish coats is provided under Painting Specifications.

9.1.7.9 PAINTING

Contractor shall furnish all labour, materials, equipment, and appliances to complete the painting work as indicated on the Drawings and specified elsewhere in these specifications and as specified in this section including all exterior and interior faces of the buildings except as specifically excluded. Any work not specified in detail shall be given customary finish for such work.

9.1.7.9.1 Preparation of Surfaces

(1) *General*

All dirt, dust, loose plaster, and other deleterious matter which would prevent good paint adhesion shall be removed. All holes, cracks, and depressions shall be filled with patching plaster, mixed and applied to properly key with and match existing plaster. Patches shall be sand papered when dry so that flush, smooth, and properly sealed surface is available before applying prime coat. After priming surfaces, suction spots shall be touched up again with additional prime coat material until entire surfaces evidence uniform coating. For enamel finishes on smooth plaster, all undercoats shall be sand papered by hand with No.00 sandpaper and dusted clean before applying succeeding coat.

(2) *Metal*

All dirt, scale, and rust shall be removed by scraping, wire brushing and/or sanding as required. Oil, grease shall be removed with mineral spirits or appropriate solvent. Before painting, ferrous metal surfaces, including galvanised ferrous metal surfaces shall be pre-treated with approved phosphoric acid etching cleaner, in accordance with manufacture's directions, to produce chemically clean surfaces to ensure good paint adhesion. Unless already properly performed in accordance with specifications of other sections, touch up abraded and bare spots in shop primed coatings with metal primer matching shop coating. For enamel finishes, sand-paper smooth by hand (with No.00 sandpaper) all undercoats. When dry, dust clean before applying succeeding coat.

(3) *Hardware*

Remove all hardware including plated butts before painting doors.

(4) *Woodwork*

Unless already properly hand-sanded and wood work shall be sand papered smooth by hand and dusted clean. Before priming surfaces, thoroughly clean knots, pitch pockets and sap steaks therein of residue, and touch up with shellac varnish coating. After priming surfaces neatly fill nail holes, cracks, and depressions therein with putty or other approved filler coloured to match required finish. When dry sand paper flush, smooth.

(5) *Masonry and Concrete*

Remove dirt, dust, oil, grease, efflorescence and other deleterious matter and roughen when necessary to ensure good paint adhesion : method of surface preparation will be left to discretion of the Contractor, provided results obtained are satisfactory to the Engineer. Before application of resin emulsion paint, prepare surfaces in accordance with manufacturers directions. Before application of oil-base, test surfaces for presence of alkali. If alkali is present, neutralise as recommended by the manufacturer of the materials to be applied.

9.1.7.10 CAULKING

The Contractor shall provide all materials, labour, equipment and appliances to complete the caulking work as indicated on the drawings and specified herein.

9.1.7.10.1. General

This Specification is intended to be general in scope as to location of caulking. The Contractor shall examine all drawings and details, thoroughly familiarise himself with the extent of the caulking and sealing involved. Only a complete and absolutely watertight and weather tight job will be accepted.

Additional Information pertaining to sealing and/or caulking will be found in the various specific trade sections and shall be co-ordinated with the work of this section.

9.1.7.10.2 Submittals

Submit for approval a list of sealants and priming materials, with colour selection for each condition prior to application of sealant.

9.1.7.10.3 Materials

(1) Sealant

Sealant shall conform to or exceed the applicable requirements of Federal Specification TT-S-227b, Sealing Compound; Rubber base, Two Component (for Caulking, Sealing and Glazing in Building Construction) or an equivalent or superior sealing materials approved by the Engineer. Oil-based caulking compounds shall be used. The following construction sealants are acceptable to the Engineer for this project.

1. Chem Seal 2400 synthetic rubber compound manufactured by Chem Seal Corporation of America, Los Angeles, California.
2. Dow Corning 780 Building Sealant, manufactured by Dow Corning Corporation, Midland, Michigan.
3. G-E Silicone Construction Sealant, manufactured by Silicone Products Department, General Electric Company, Waterford, New York.
4. Hornflex Thiokol LP-32 Sealant, manufactured by Grace Construction Materials of W.R. Grace and Company, Cambridge, Massachusetts.
5. Lasto-Metric or Mono-Lasto-Metric, manufactured by the Tremco Manufacturing Company, Cleveland, Ohio.
6. Rubber Caulk 150 Sealant, Rubber Caulk 210 Sealant, Rubber Caulk 220 Sealant, Rubber Caulk 250 Sealant or Rubber Caulk 5000 Sealant, manufactured by Products Research and Chemical Corporation, Burbank, California.
7. Sonolastic Sealant as manufactured by Sonneborn Building Products, Inc. Des Planies, Illinois.

(2) Joint Filler

Joint filler used as a backing for the caulking compound may be vinyl tubing of a slightly greater diameter than the width of the joint to be caulked, a soft glass fibre rope or strip, an open-cell polyurethane rod or a closed-cell neoprene or butyl rod. The compressible joint filler shall be of a type acceptable to the manufacturer of the weather sealing compound being used on this project.

9.1.7.10.4 Application

The Joints indicated on the drawings to be caulked or customarily required to be caulked or required by the Engineer to be caulked shall be thoroughly cleaned of dust, dirt, scale, corrosion, grease or anything that might interfere with the adhesion of the sealant. Non-porous surfaces such as metal or glass may be cleaned either mechanically or chemically. When solvent is used to clean non-porous surfaces, the solvent shall be wiped off with clean cloths before it dries and re-deposits the contaminants.

If the Joints are deeper than 10 mm., they shall be packed to within 10 mm of the face surface with one of the compressible joint fillers specified; the final 10 mm shall be filled with the sealing

compound. If possible, the joints to be caulked shall be built up or be cut square down the sides so as not to be vee shaped.

The Surfaces to be caulked shall be primed with the primer recommended by the manufacturer of the sealant being used in accordance with the sealant manufacturers application instructions with respect to the various types of materials to which the sealant is to be applied.

The Joint Filler, the primer or any other material used in conjunction with the sealant shall be of such composition that will not cause staining of the sealant or the materials to which it is applied.

The Sealant shall be applied before the final coat of paint is applied to adjacent work. The sealing compound shall be applied with a hand gun with the gun nozzle of the proper size to fit the joints. The materials shall be driven in with sufficient pressure to solidly fill the joints: superficial pointing of the joints with a skin bead will not be acceptable. The finish of the weather sealing on flush surfaces shall be neatly pointed flush or be tooled with a beading tool. Excess material shall be removed according to the job conditions or as directed.

The Weather sealing materials shall be applied by experienced workmen in meticulous accordance with the sealant manufacturer's recommendations.

9.1.7.10.5 Quality Control

The weather sealing shall be uniformly smooth, free of wrinkles, flush with adjacent surfaces and absolutely watertight. Adjacent surfaces which have been soiled by the application of the sealing compound shall be wiped clean and be left neat. The work will be adjudged defective due to the sealant's hardening, cracking, crumbling, melting, shrinking, leaking or running.

9.1.7.11 CEILINGS

9.1.7.11.1 Framing

Framing for ceiling shall be constructed with medium hardwood. Ceiling joints shall be of 100 mm by 50 mm size at 1200 mm centres and spacers shall be 50 mm by 50 mm size at 600 mm centres. The joists shall be hung by metal straps secured to the reinforced concrete beams and shall be set out to enable ceiling sheets to be fixed symmetrically from the centre of the ceiling.

9.1.7.11.2 Ceiling Boards Generally

Asbestos ceilings shall have ceiling boards of 3 mm thick asbestos cement flat sheets of approved quality. The finished surface shall be painted with two coats of paint, the colour of which shall be approved by the Engineer.

Timber ceilings shall be of 20mm thick, 125mm wide timber planks of approved type in appropriate lengths. The planks shall have decorative groves of approved design, and shall have a smooth surface. The timber work shall be applied with an approved wood preservative before installation. The underside of the ceiling shall be applied with an approved colour wood stain in order to obtain a uniform colour, and finished with two coats of varnish.

9.1.7.11.3 Mineral Fibre Ceiling

Mineral fiber ceiling with 600 mm x 600 mm panels with class 1 fire rating (surfaces on which not more than 150 mm mean spread of flames occurs under the relevant test conditions)

The manufacturer shall offer a 10 year warranty against visible deformity of the ceiling tile for conditions upto 90⁰ RH and 104 F temperature. The surface pattern of the tile shall be sand finish with tapered edge type.

The ceiling shall be suspended using galvanized "T" bar grid system At 600 mm x 600 mm centers. The main tee bar shall be 38 mm high and 24 mm wide. The intermediate tee shall be 24 mm height and 24 mm wide.

The "T" bar and the ceiling tiles shall be manufacture by the same manufacturer and the entire system shall be covered under a 15 year comprehensive warranty.

The "T" bar system shall incorporate a fire break and shall be suspended from the soffit above using adjusting clips and hanger rods.

The frame work shall be installed level to the satisfaction of the Engineer.

9.1.7.12 Sanitary and Water Supply Services

9.1.7.12.1 GENERAL

The work comprises of labour and materials necessary to all appliances and fittings and joining them to the respective mains in a manner directed by the Engineer.

The Contractor shall :

- 1) Supply a certificate stating that each item supplied has been subjected to the tests laid down in the specifications and conforms to the specifications and regulations of all the statutory authorities, in all respects.
- 2) Obtain approval and compliance from the Colombo Municipal Council before commencement of the installation, during and after completion of the installation, during and after completion of the installation.
- 3) Comply with the relevant American , British, Sri Lankan or any other standard as given under the specifications and with the regulations of the Colombo Municipal Council
- 4) Ensure that all fittings and accessories indicated in the drawings and specifications include all pipe fittings & attachments, valves, gauges, switches, pumps and all such accessories as per the relevant American , British, Sri Lanka or other standards for the proper functioning of the system and should not be limited to those given and indicated in the Plumbing drawings.

- 5) Supply and fix vitreous imported sanitary appliances as shown on Drawings completed with suitable traps and other fixtures viz. : seat covers, cisterns, etc. completed.
- 6) Fix sanitary fixtures completed in position and connect to cisterns, taps, vents, waste and soil pipes.
- 7) Ensure that accessories and fittings identified in this Bills of Quantities shall be from one manufacturer wherever possible, similar design range and matched. The fittings and specials shall also be suitable in all respects to the pipe line to which these fittings and specials are fixed.
- 8) Prepare three sets of “as built drawings” and “Operations & maintenance manuals of equipment “with two sets for the client and one set for the Engineer”
- 9) The above items should all be accompanied in the quoted rates and no additional payments would be made for above.

9.1.7.12.2 Sanitary Fittings and Plumbing

The whole of the sanitary works shall be carried out by a licensed sanitary plumber according to the layout and as specified and as directed at site. It should be noted that the positions shown on plans are approximate. Exact positions would be indicated at site.

All plumbing fixtures and fittings should be approved by the Engineer prior to ordering same for installation.

All items of pipes, specials and fittings shall be suitable for sewerage works purposes and for use with raw domestic sewage and installation and operation in a damp tropical climate with temperature between 20 °C to 40 °C and relative humidity of 80 %

Rates for sanitary fittings shall include for

- a) Fittings such as taps, waste water outlets, flushing cisterns, flush valves, internal overflows etc. the supporting brackets and incidental materials for fixing.
- b) Assembling, jointing together, fixing components and jointing to pipes inclusive of necessary couplings and for leaving perfectly clean undamaged and in perfect working order as on completion.
- c) Jointing and connecting pipes to sanitary fittings
- d) Testing and commissioning of installation
- e) Making good the work disturbed.

Rates for Drainage work shall include for :

- a) Excavation, backfilling, planking & strutting, dewatering and disposal for surplus spoil
- b) Laying of pipe to falls and gradients and all jointing and other incidental materials
- c) All pipe specials such as bends, tees, junctions, elbows, etc.
- d) Connection to sides of manholes etc.
- e) Providing sleeves etc., when pipes pass through walls. Foundations etc.
- f) Giving notices, obtaining permits, paying fees etc.

- g) Testing installation as specified in specifications and/or American, British or Sri Lankan Standards.

9.1.7.12.3 Water Supply

The Contractor is to pressure test pipes after fixing taps and stop cocks and fittings prior to concealing, under the supervision of the engineer.

The Contractor shall provide the Engineer with the manufacturer's certificates of the standards, quality of the materials before commencing the works.

All water pumps should be mounted on inertia bases fitted with anti-vibration mountings. Flexible connections should be provided on connections between pump units and pipework.

Where pipes pass through walls or slabs these shall be wrapped with a layer of inert material. For pipes exceeding 50 mm dia, sleeve pipes shall be used for the full thickness of the slab walls, beams, retaining walls through which the pipe passes.

All taps, shower appliances, cocks and floor waste covers, used in the plumbing installation shall be chromium plated brass (CP brass) or stainless steel items unless otherwise stated.

Water Supply plumbing work shall include:

- a) Cuttings and waste of pipes etc. and jointing of pipes.
- b) All specials such as elbows, bends, tees, junctions, plugs, reducers and similar pipe fittings except for valves which would be measured separately (Separate rates should be indicated for valves inclusive of the associated pipe fittings.)
- c) Connecting pipes to sanitary fixtures and appliances.
- d) Chasing to brick or concrete walls, columns, beams etc. and necessary racks, hangers and clips for fixing to soffits etc. and making good all works disturbed
- e) Necessary screws, nails, sockets, connection backnuts, standard pipe fixing or supporting clips, saddles, brackets, racks, straps etc.
- f) Connecting different types of pipes
- g) Testing and disinfecting after completion
- h) Preparing and making applications and giving notices to the relevant authorities to obtain service connections to the building inclusive of any statutory payments to relevant statutory authorities.

All cold water piping should be provided with flexible connections in pipe work and provided with the required pipe supports & anchoring as per the manufacturer's specifications.

9.1.7.12.4 Water Service

All pipe work for internal potable cold water supply shall be uPVC to SLS 147 with solvent joints. Joints and fittings for uPVC pressure pipes shall be to SLS 659.

Stop valves are to be screw down type gate valves and shall conform to B.S. 1010.

Unless otherwise specified or instructed by the Engineer, in case of pipelines taken along the walls of buildings, all pipe work of diameter 32mm and below shall be embedded within the walls,

and all pipe work of diameter 40mm and above shall be mounted externally to finishes and shall be supported by means of brackets, at intervals not exceeding 1.5 meters.

Pipelines when laid along the floor, shall be installed sufficiently under the surface of the floor. Contractor shall make necessary provisions in floor slabs, concrete members, and foundation etc. For laying necessary pipelines, in order to avoid any subsequent breakages.

The whole of the water service plumbing installation shall be tested prior to any embedding at a pressure of 5 bar for a period of not less than 2 hours in the presence of the Engineer's Representative. Any defect noted shall be made good and the test repeated to the satisfaction of the Engineer. The Contractor shall be responsible for the provision of all necessary equipment, appliances and labour for the testing of plumbing installations. Upon completion the Contractor shall leave all in perfect working order.

9.1.7.12.5 Soil and Waste Plumbing

Soil and waste plumbing work shall comprise all internal and external soil and waste pipework, as necessary, to the buildings. Adequate access doors and cleaning eyes shall be provided. All parts of the work shall meet the requirements of the local regulations in every respect.

Building drains running to first or nearest manholes shall be uPVC of type 600, conforming to SLS 147:1993 or equivalent. The pipes shall be 90 mm diameter, with an approved bedding. All lines shall have approved solvent cement joints.

Contractor shall make necessary provisions in floor slabs, concrete members, foundations etc. for installing necessary pipes, in order to avoid any subsequent breakages.

9.1.7.12.6 Rainwater Drainage

Approved uPVC guttering shall be supplied and fixed where shown on the Drawings. uPVC supports shall be provided at spacing not exceeding 1.2 metres. The guttering shall be fixed so that it falls at a gradient not less than 1 in 100 to the nearest down pipe.

Rainwater down pipes, fittings and fixings shall be of an approved manufacture in uPVC and shall be fixed in the locations and to the dimensions indicated on the Drawings. Down pipes shall discharge into a channel in in-situ concrete around the buildings.

9.1.7.13 MASONRY

Masonry shall be constructed from approved hard durable stone laid to bond. The stones shall be rough dressed so that the beds and sides are roughly perpendicular to the exposed face of the wall. The joints shall be 12 mm thick on the average and completely filled with mortar. The face of the work shall be true to profile and the joints shall be neatly pointed in mortar.

Where the walls are to be rendered the joints shall be raked out to a depth of 12 mm to form a key.

9.1.7.14 DRAINAGE

9.1.7.14.1 General

Foul drains and sewers shall be constructed of uPVC or asbestos cement pipes unless otherwise stated.

Surface water and overflow drains shall be constructed of pre-cast concrete pipes unless otherwise stated.

9.1.7.14.2 uPVC Pipes and Fittings

Unplasticised Polyvinyl Chloride (uPVC) pipes and fittings for sewerage and drainage shall comply generally with SLS 147, Type 600 or equivalent and shall be obtained from an approved manufacturer. Joints shall comply with SLS 659 or equivalent.

9.1.7.14.3 Pipe Bedding

Pipes shall be laid on a bedding similar to those specified for water pipes under similar ground conditions, as specified in the drawings.

Above the bedding the trench shall be backfilled with suitable material similar to that specified for water pipes, under similar ground conditions.

9.1.7.14.4 Laying Pipes for Drainage

Pipes shall be laid straight and at constant gradient between manholes and chambers.

The width of the trench at the crown of the pipe shall not exceed the outside diameter of the pipe plus 300 mm.

9.1.7.14.5 Construction of Chambers and Headwalls

Chambers and Headwalls shall be constructed as shown on the detail Drawings in the locations indicated by the Drawings or as directed by the Engineer. Benching shall be provided with channels to conduct flow between the incoming and out going pipes.

9.1.7.14.6 Testing Drains, Chambers etc.

All drains and chambers shall be watertight and clean throughout. Drains shall be tested by the Contractor under a minimum head of 1 m in the presence of the Engineer's Representative. Should the pressure fall during a test the Contractor shall locate the leaks and make them good after which the pressure shall be reapplied and the process shall be repeated until the drains are satisfactory.

No drain or other work shall be covered up until it has been seen and approved by the Engineer.

In every case the water used for testing the pipes shall be left in the pipes until they are covered with earth to the top of the trench or a depth of at least 1.2 m over the top of the pipes and

until permission is given by the Engineer for the water to be released. If after the Engineer has approved the pipes and has given permission for the trenches to be refilled the pipes become damaged and loose water from any cause and/or admit subsoil water the pipes shall be uncovered and the defect made good and the pipe re-tested as before to the satisfaction of the Engineer.

9.1.7.14.7 Covers and Surface Boxes

Chambers shall be completed with access covers and frames as indicated on the Drawings.

All chamber covers shall be set in cement mortar or built into concrete slabs as shown on Drawings to the correct levels, cambers or falls.

9.1.7.14.8 Septic Tanks

Septic tanks shall be constructed in concrete with reinforced concrete roof slab as shown on the drawings.

9.1.7.15 PATHS AND PAVED AREAS

Paths and paved areas shall comprise pre-cast concrete paving slabs bedded in 1:5 cement/sand mortar and laid on a 150 mm layer of compacted hard-core.

Paving slabs shall be 600 mm square and 50 mm thick, joints shall be grouted up with cement mortar.

The Contractor shall lift and relay at his own expense any slabs which have sunk as a result of consolidation of the underlying fill or sub-base.

9.1.7.16 DOORS & WINDOWS (ALUMINIUM)

9.1.7.16.1 Description of Work

This drawings are only a schematic presentation of the Aluminium Doors & windows. Shop drawings showing details of composite profiles for frames and sashes (with Aluminium profile be done by the fabricator for approval prior to Manufacturer profile reference Nos.) shall be provided prior to Fabrication.

9.1.7.16.2 Authentication & Certification

All components of the Door/Window System/Assembly shall be from a Aluminium Glazed window/door manufacturer of international repute. All component parts of the Window/Door System offered shall be compatible with one another and be tropicalised and as recommended by such reputed manufacturer.

A - Minimum metal wall thickness shall be 1.2 ± 0.15 mm and section of 100 x 50 mm (Or closest standard)

All Bidders shall provide adequate proof and confirmation in writing so as to satisfy the Engineer that their offer confirms with specification herein.

Where the Engineer is dissatisfied with the proof provided they may reject such offers or request for adequate and more specific proof from the manufacturer or principal as the case may warrant in order to obtain a durable and reliable and safe product for their client.

9.1.7.16.3 Samples

Samples sections of all mullions transforms complete with gaskets weather stripping bedding, screws, anchors and all components that comprise the various types of door/window assemblies shall be submitted to the Engineer with the Tender so as to enable them to examine the quality offered.

9.1.7.16.4 Material (Alloys)

All extrusions shall be of AlMgSi, designation 6060, or 6063, temper T5, heat treatable, and shall be in accordance with BS 1474 : 1987.

Panels, if not extruded and sheets, plate and strip shall conform to BS 1470 : 1987, shall be of AlMgSi designation 5005, 5050 or 3003; temper and condition to suit conditions of environment and use.

The average roughness of the surface shall not exceed $R_a = 5$ microns.

The radius of corners shall be 1.5 mm minimum.

9.1.7.16.5 Anodizing

Prior to anodizing, the extrusions, panels and sheets shall be etched or pickled in an even manner, to achieve a chemical satin finish.

Bronze anodizing, in an Anolok color to be selected by the Architect, shall be carried out preferably by means of the Sulphuric Acid direct current method, but otherwise in accordance with BS 3987 with an average film thickness of not less than 20 microns (Grade AA25 as set out in BS 1615)

Said average implies the mean film thickness of 10 Nos. measurements with an eddy-current film thickness meter taken over the total surface, all in accordance with ISO 2360; no measurement shall show less than 80% of the specified film thickness.

The surface shall then be sealed. Sealed is to be in compliance with testing through the "admittance measuring" method of ISO 2931/2 or the solvent-method of ISO 3210; "admittance" shall be a maximum of 20 micro Siemens, and with the solvent-method the maximum permitted weight loss shall be 30 mg/sq.dm.

9.1.7.16.6 Aluminium Windows

The windows shall be delivered to site complete with all fittings. Care shall be taken to protect all units during handling, storing and fixing in.

All windows and their components shall conform to B.S.4873 and shall be designed to resist the severe (b) exposure test pressure of 2800 N/m^2 when tested in accordance with B.S.4315: 4315: Part 1, and test certificates shall be submitted to the supervising Engineer confirming this requirements.

All frames and casements shall be fully weather stripped with continuous neoprene strips and shall be designed for internal glazing with snap-on Aluminium beads. Those windows shown on the schedules or drawings to be openable shall open inwards and shall be secured in the closed position by means of budget locks.

All aluminium surfaces in contact with steel, concrete, masonry or mortar shall be protected by painting with bituminous paint or taping with PVC before fixing in position.

The windows shall be fixed-in with stainless steel lugs, or with screws supplied by the manufacturer, in accordance with the details shown on the Drawings.

After fixing and where shown on the Drawings, the frames shall be pointed in polysulphide or equal and approved non-hardening pointing sealant recommended by the window manufacturer.

9.1.7.16.7 Aluminium Doors and Screens

The Aluminium doors and partitions are to be constructed of box section aluminium as detailed, with single action floor closers.

Meeting stiles and the back edges of stiles adjoining the frame of double doors shall be fitted with woven pile or neoprene draught strip.

Each outer pair of double doors shall have fitted in one leaf a flush bolt top and bottom, and in the other a mortice deadlock, mastered with the other locks in the part of the building which it serves.

9.1.7.16.8 Aluminium Louvers

the louvres shall be of 18 gauge aluminium, of fixed pitch at 45°, complete with frames, sills, and mullions as detailed on the Drawings. The louvres shall be preformed for site assembly, and shall be anodised to match the windows in accordance with B.S 3987. The back of the louvres shall be fitted with bird mesh screens or blank sheet aluminium panels where indicated on the Drawings.

Care shall be taken to protect the louvres during handling, storing and fixing. All aluminium surfaces in contact with steel, concrete, masonry or mortar shall be protected by painting with bituminous paint or taping with PVC before fixing.

9.1.7.16.9 Appearance and Detailing

The details of anodized aluminium windows on the Tender drawings show certain types of sections, which have not been calculated for strength, together with the relevant vertical and horizontal connections to builders work. The Contractor may submit alternative sections which he proposes to use with his Tender, for approval by the Architect, although a box-section is preferred and the width of 50 mm for external window frames should be adhered to.

9.1.7.16.10 Execution of the Works

(1) General

The works shall be executed in a first class workmanlike manner including all work and materials in accordance with this Specification and Schedules, the drawings referred to therein and the shop drawings, to be prepared by or on behalf of the Contractor and approved by the Architect.

In all cases where a component or part of the installation is referred to in the singular, it is intended that such reference shall apply to as many such items as are required to complete the whole installation.

The Contractor shall refer drg.nos.AR/DW/41 to AR/DW/55 for information on glazing, fixing details, size and materials of frames and sashes, iron-mongery etc., which information which generally take precedence over that shown on the detail drawings.

(2) Responsibility of the Contractor

The Tender drawings, showing aluminium windows and details, have been prepared on the basis of a type of section from a particular manufacturer and have not been calculated for their respective strengths; details serve only to show requirements as to dimensioning water and weatherproofing etc. It is therefore the responsibility of the Contractor:

- to calculate and provide on the basis of approved calculations, sections and glazing of material, strengths and thicknesses suitable and adequate for their purposes and locations in the building;
- to check joints and clearances available and, if necessary, to provide extra expansion joints in composite windows. Details and, consequently, interim dimensions of doors and windows may therefore be subject to change, all such changes in co-ordination with and to the approval of the Architect.

9.1.7.16.11 Installation

The Contractor shall be responsible for setting all units straight, plumb and level, and for their satisfactory operation after fixing is complete.

The Contractor shall ensure that he has sufficient support on site from the manufacturer and/or supplier to guarantee a first class installation procedure and flawless operation of the units installed.

All units shall be fixed into prepared openings. Frames shall not be forced into openings which are out of square or too small. The openings must show at least 2.5 mm tolerance all round. The frames shall be secured at head, jambs and sill; care should be taken to ensure that the frames are not distorted when screwing up lugs or fixing screws, etc.

All external doors, door frames, windows and window frames when installed, shall be completely watertight.

All opening lights, pivoted or sliding, and all doors shall open as indicated on drawings and schedules.

All windows and door units shall be protected from damage by being wrapped in plastic film or by other approved means until shortly before handling over of the building.

All glass shall be as specified in Section 9.1.7.5.5 of the Specification.

All glass shall be sized, cut, finished and fixed in accordance with specifications and requirements of the manufacturer.

9.1.7.16.12 Shop Drawings

Fully detailed shop drawings must be submitted as soon as possible after the commencement of the works, showing complete scale elevations and full-size details of all doors, windows, etc. required; the relations of all the sections to the exterior and interior work, the points to which all dimensions are taken and the locations of all ventilators and opening light.

The type and positioning of all fixing devices shall be shown, the work to be done by other trades shall be indicated, and the size, type and thicknesses of glass and all infill panels, doors, hatches etc. shall be shown.

Shop drawings must be approved by the Engineer before any of the required units are manufactured or assembled; in programming the works, the Contractor shall allow adequate time for the Architect to inspect and approve these drawings

9.1.7.17 INSULATION TO RESERVOIR ROOFING

Insulation to reservoir roofs shall be pebbles or gravel which have been washed and screened so as to eliminate all dust and particles which will pass through a 6 mm sieve.

The material shall be distributed evenly and ranked true to falls and to a uniform finished thickness of 150 mm. Under no circumstances will dumpers or other mechanical plant be permitted on the roof to place, distribute or spread the material.

9.1.7.18 WATERPROOFING TO RESERVOIR ROOFS

Waterproofing membrane shall be Bitu-Thene 1200 HC as manufactured by Serviced Ltd. of London, England or equivalent self-adhesive waterproof sheeting.

The Contractor shall apply waterproofing in strict accordance with the manufacturer's instructions and recommendations.

Waterproof roof slabs shall be tested for water tightness as specified for water retaining structures elsewhere in the specification.

The Engineer's approval to the use of any water proofing materials shall not relieve the Contractor of his responsibilities as to watertight performance of any roof slab. Any defects detected in waterproofed roofs shall be repaired and made good to the satisfaction of the Engineer at the Contractor's sole expense.

9.1.7.19 CERAMIC FLOOR & WALL TILING

9.1.7.19.1 Ceramic / Floor Tiles

Tiles shall be 200 x 100 x 7 mm thick fully vitrified ceramic tiles of approved make. The tiles shall conform to EN 87 (BS 6431 PG1) and shall have a water absorption not exceeding 3–6%.

Tiles shall be installed with straight joints 4 mm wide, and shall be bedded in an approved floor tile adhesive, in strict accordance with the manufacturer's instructions. Against wall tiles shall be cut to the proper size in order to obtain joints no wider than the regular joints. The installed tile work shall give a full sound when tested with a hammer.

Tile joints shall be filled with Bal-Grout Flooring or equal and approved grouting applied in strict accordance with the manufacturer's instructions.

9.1.7.19.2 Ceramic Tile Skirting

Ceramic tile skirting shall be 200 x 100 x 7mm thick with a bullnosed top to plastered walls, the skirting standing 5mm proud of the walls finish and with a square top to tiled walls, the skirting finishing flush with the tiling, the cove radius not less than 15mm. The bases shall be of the same quality as the above specified ceramic tiles.

9.1.7.19.3 Wall tiles (Internal)

The tiles shall be eggshell ceramic glazed tiles nominally 100 x 200 x 4mm thick as supplied by an approved manufacturer. Tiles shall conform to EN 87 and shall have water absorption not exceeding 3 – 10%.

9.1.7.19.4 Application of Wall Tiles

The walling shall be plastered in cement and sand to give a true and level surface which before hardening shall be combed and scratched. Tiles shall not be laid until 24 hours after application of the render backing.

Wall tiling is to be carried out in accordance with the recommendation of BS 5385 and BS 6431, the tiles spaced at least 1.5mm apart and the overall thickness of plaster and tiling not exceeding 20mm.

The tiles shall be soaked in clean water before use and shall be straight jointed and set in an approved tiling adhesive and pointed in white grouting compound both. Proprietary adhesives shall be used in strict accordance with the manufacturer's instructions.

The areas to be tiled shall be set out to avoid unnecessary cutting and the whole work shall be carried out to the Supervising Engineer's satisfaction.

On all walls tile work shall be checked for deviation from the plumb line which shall not exceed 0.3 mm per meter of height.

