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TECHNICAL

SPECIFICATION

FOR

MEDUPI POWER STATION

STANDARD PREAMBLES AND DESCRIPTIONS OF MATERIALS AND WORKMANSHIP TO ALL TRADES

1. GENERAL

1.1 SABS: The abbreviation SABS refers to the South African Bureau of Standards. All work shall be executed in accordance with the relevant SABS Code of Practice whether specifically mentioned in these Preambles or not.

1.2 MATERIALS AND WORKMANSHIP GENERALLY: The Contractor shall provide materials and workmanship to the best of their respective kinds and to the approval of the Engineer. Unless otherwise described all items include for fixing in the approved manner.

1.3 TRADE NAMES, ETC: All materials, fittings, finishing, etc. specified under a "Trade Name", catalogue number or reference shall be either exactly as described or shall be of equal quality, specification and mass to those described. The Engineer's written approval must be obtained for any departure from the specification.

1.4 NOMINAL SIZES: Where a component is specified as a nominal size the onus is on the Contractor to establish from the manufacturers the exact size or the likely size variation.

1.5 MANUFACTURER'S INSTRUCTIONS: In all cases where the Contractor takes delivery of, handles, stores, uses, applies and/or fixes any proprietary product, he shall do so in strict accordance with the manufacturer's instructions.

1.6 SAMPLES: The Contractor shall furnish without delay such samples as may be called for by the Engineer, who may reject any materials or workmanship not corresponding with the approved sample. Samples of all materials, colours, patterns, etc., shall be submitted for the Engineer's approval before use.

2. EXCAVATIONS

2.1 SITE CLEARANCE

2.1.1 CLEAR SITE: "Clear Site" shall include for digging up and removing all rubbish, vegetable soil and substance from the area of the site shall be built upon, removing all small trees, shrubs, etc. having a circumference of less than 200mm measured at a height of 1 000mm above ground level including grubbing up all roots and roughly leveling and carting away debris to a site as directed by the Engineer.

All shrubs and trees shall be removed shall be physically marked by the Contractor in the presence of the Engineer and no other shrub or tree shall be removed. Where shrubs or trees are removed, the roots shall be entirely grubbed up and the hollow filled back with good selected soil and compacted.

Materials arising from site clearance shall become the property of the Contractor except where otherwise provided and shall be removed from site as work proceeds. Where specified shall be re-used, the Contractor shall protect from damage, clean and overhaul. Burning on site of materials arising from the site clearance shall not be permitted. Brick rubble or other hard materials arising from site clearance may be re-used as hardcore, subject to compliance with the specification for filling.

2.2 EXCAVATIONS

2.2.1 Blasting is not permitted.

2.2.2 The Contractor shall make all necessary enquiries and take all precautions concerning the ground water level on the Site during construction.

2.2.3 The contractor shall keep excavations and all building work free from water, mud, rubble, sand, vegetable matter, etc. by hand or machinery (including day and night attendance if necessary) as no water, mud, etc. shall be allowed to stand or accumulate therein. Furthermore, during the time that the excavations are open the Contractor shall cut all storm trenches, etc. or take sufficient precautions to divert storm water and/or ground water from the excavations and the new building under erection. The contractor shall not disturb material in and around excavations by pumping operations.

The Contractor shall fill in with approved material and properly compact all temporary trenches, sumps, etc. No building work shall commence or continue in trenches which are or have been flooded without the Engineer's permission.

2.3 ANT PROOFING

2.3.1 The poisoning of ground against termites shall be executed with either Aldrin or Chlordane emulsifiable concentrates complying with SABS 1164 and 1165.

2.3.2 The poisoning of filling or ground surfaces under all floors shall be done as soon as practicable so that it may dry out before any work is done above. The treatment of ground with the Pentachlorophenol poison shall be carried out under the supervision of the Engineer and in strict accordance with the South African Bureau of Standards Code of Practice for the use of Pentachlorophenol as a Soil Poisoner, SABS 018.

2.3.3 The Contractor shall take care not to rupture any ground surface which has been treated with the poison, and should the poisoned layer be ruptured at any point it shall be made good and the area affected treated again.

2.3.4 Where the area of ground shall be poisoned abuts against the inner face of walls, or against sleeper walls, sleeper piers, etc. a 50mm deep V-shaped channel shall be raked out, flooded with the Pentalchlorophenol solution, allowed to drain and then filled and compacted.

2.4 EARTH FILLING

2.4.1 Earth filling shall be clean, hard, dry, inert, non-expansive, clay-free earth filling, free from organic or deleterious matter having a Plasticity Index of not more than 12 at a density of 93% Modified AASHTO.

2.4.2 The Engineer shall approve the material shall be used for filling prior to commencement. Any damage incurred by subsidence shall be made good by the Contractor.

2.5 COMPACTION

2.5.1 Unless otherwise specified compaction shall be to at least 93% Modified AASHTO dry density at optimum moisture content.

2.5.2 Compaction shall be carried out by means of grid rollers, sheepsfoot rollers, tamping rollers, flat wheel road rollers, vibratory rollers and pneumatic-tyred rollers, or by such other means as the Engineer may approve. The types of rollers shall be used and the amount of rolling shall be done shall be such as to ensure that specified densities are obtained. During compaction the layer shall be maintained to the required shape and cross section, and all holes, ruts and laminations removed.

2.5.3 Should the Engineer find after carrying out in-situ density tests on any section of the work that the specified compactions have not been achieved or that the specified tolerance on the moisture content has been exceeded, then the Contractor shall take out and re-compact such section. The actual maximum Modified AASHTO dry density or densities (should the density vary from place to place on the Site) and corresponding optimum moisture content shall be determined by the Contractor by an approved soil testing laboratory and shall supply this information to the Engineer.

2.5.4 All surfaces shall be left to a smooth uniform surface to the specified levels, free from humps, hollows, ridges, sudden changes of grade or other irregularities, all to the satisfaction of the Engineer. Depressions developing during the course of the work due to settlement or other causes shall be made up with suitable filling compacted as specified. Broken rock or stones brought up to the surface during blading shall be removed as the work proceeds. During the progress of the works the Contractor shall keep the surface damp to prevent a dust nuisance and erosion by wind. Any re-compacting of the finished surface that may be necessary shall be at the Contractor's expense.

2.5.5 Where required. water shall be added to the material before material is compacted, in successive applications by means of water sprinklers fitted with proper sprinkler bars or by means of pressure distributors all capable of applying the water evenly and uniformly over the area concerned.

2.5.6 The water shall be thoroughly mixed with the material shall be compacted by means of ploughs, disc harrows, rotary mixers, motor graders or other suitable equipment. Mixing shall continue until the required amount of water has been added and until a uniform mixture is obtained before compaction is commenced.

2.5.7 The amount of water shall be added shall be sufficient to bring the material to the proper optimum moisture for the compaction equipment used and the density required, provided always that compaction shall not be attempted and will not be approved with materials which are too wet. Should the material be too wet, due to rain or any other cause, it shall be harrowed and allowed to dry out to a moisture content conforming to the above requirement before compaction proceeds.

2.5.8 The compacted layers shall be adequately drained to prevent free water standing on the finished work. Windrows shall be removed to facilitate drainage of water from the surface.

2.5.9 No material for a succeeding layer shall be placed if the compacted layer is wet or saturated.

2.5.10 After the compaction of a layer has been completed and before proceeding with the next course, the Contractor shall notify the Engineer and shall cause a series of density tests shall be carried out, at the Contractor's expense, to determine whether the course conforms to the Specifications. Records of the Tests carried out for, or by the Contractor shall be kept and shall be produced if and when required by the Engineer.

2.5.11 If the Contractor is satisfied that the layer conforms to the Specifications, the Contractor shall notify the Engineer who may nevertheless cause check tests shall be carried out on the layer.

2.5.12 All check tests shall be carried out at the Employer's expense except check tests on reconstructed layers which shall be paid for by the Contractor.

2.5.13 Density tests shall be carried out by means of the dry sand replacement method or other approved method.

2.6 TOLERANCES

2.6.1 Formation is defined as that plane in the earthworks that is prepared to receive either the selected top of sub-grade, sub-base and/or base course. The finished surface of the top of formation shall be fine graded to a surface such that at least 90%, of spot levels are within a tolerance of 40mm from design level, and to a surface smoothness such that no irregularities greater than 20mm can be seen under a 3 000mm straight edge.

2.7 STABILISATION

2.7.1 Where specified, the formation shall be lime or cement stabilized to a depth as specified and compacted to the required Modified AASHTO density as specified hereinafter, to the full width of the road bed.

2.7.2 The material shall be compacted shall be thoroughly broken up over the full width and depth of the layer by means of scarifiers, disc harrows, hand tools or other suitable equipment. All boulders and lumps of soil with a maximum dimension larger than one half of the specified layer thickness shall be broken down or removed prior to the addition of the stabilizer.

2.7.3 After preparation of the layer of soil, the stabilizer shall be uniformly spread over the full width of the layer by means of an approved type of mechanical spreader at the specified rate of application in a continuous operation. When chip spreaders, suitably adjusted, are used for spreading, a curtain of heavy canvas or other suitable material shall be fitted around the spreader box with the lower edge of the

curtain slightly above ground surface so as to minimize losses of the stabilizer during windy periods.

2.7.4 The Engineer will allow hand spreading under exceptional circumstances. When spreading is done by hand, pockets of bags of the stabilizer shall be accurately spaced at equal intervals along the section shall be stabilized so as to provide the specified rate of application. The pockets shall be spaced in transverse rows across the full specified width of the road bed. A uniform distribution of the stabilizer over the entire area shall be treated shall be obtained.

2.7.5 No traffic, nor any equipment not actually used in the processing of the layer, shall be allowed to pass over the freshly spread stabilizer until it has been mixed into the material shall be stabilized.

2.7.6 Immediately after the stabilizer has been applied, it shall be mixed with the loose soil for the full depth of treatment. The Contractor shall take care not to disturb the compacted road bed underneath, or to mix the stabilizer below the desired depth. Mixing shall be continued for as long a period of time and repeated as often as may be required to ensure a thorough, uniform and intimate mix of soil and the stabilizer over the full depth of material shall be treated and until the resulting mixture is homogeneous and of uniform appearance throughout.

A deviation of one half percent (0,5%) from the specified stabilizer content shall be allowed.

2.7.7 Immediately after the stabilizer has been properly mixed with the soil, the moisture content of the mixture shall be determined and the required amount of water added, in an approved manner to the Engineer's satisfaction. Each application of increment of water shall be particularly incorporated in the mixture by means of the mixers used so as to avoid concentration of water near the surface or flow of water over the surface of the layer.

2.7.8 The Contractor shall ensure satisfactory moisture distribution over the full width and length of the section being stabilized and shall prevent any portion of the work from being saturated after the stabilizing agent has been added.

2.7.9 Any portion of the work that becomes saturated with water after the stabilizer has been added and before the mixture has been compacted will be rejected and such portion must be removed from the site and dumped at such dumping sites as the Engineer may require, new soil shall be brought in to replace the saturated soil and the procedure for stabilization repeated using fresh lime or cement. The water supply and mixing equipment shall be adequate to ensure that all water required is added and mixed with the material being treated within a period of three hours.

2.7.10 Compaction shall be as specified. During compaction the layer shall be continuously bladed by means of a motor grader and loss of moisture through evaporation shall be corrected by further light application of water. Final rolling shall be done with pneumatic tyred rollers and/or flat wheel

road rollers, whichever is specified by the Engineer and the surface shall be lightly bladed in order to eliminate all ridges and other surface irregularities caused by the compaction equipment before final rolling.

2.7.11 A sufficient number of compacting units shall be employed on the work to ensure that after the correct amount of water has been incorporated in the mixture and all compacting and finishing is completed within a period of twelve hours. Any finished portion of the stabilized layer adjacent to the new work and which is used as a turn around area by equipment in constructing the adjoining section shall be provided with a protection cover of soil at least 100mm in thickness over a sufficient length to prevent breaking up work already completed. At the time of final finishing of the adjoining section, such cover shall be removed to permit the making of a smooth joint at the junction of the different sections.

2.7.12 The stabilized work shall be protected against rapid drying out during the first four days after completion by keeping it continuously wet or damp. Thereafter it shall be allowed to dry out over a period of at least three days before the base course is placed. No traffic of any description shall pass over the layer whilst it is curing.

2.7.13 No stabilization shall be done in wet weather.

2.8 HARDCORE

2.8.1 Hardcore shall be in layers of the thickness specified and shall be formed of suitable broken stones, bricks or other hardcore approved by the Engineer, well watered, compacted to 95% Modified AASHTO dry density and rolled to form solid foundations for concrete floors or steps. The Contractor may use crusher run in lieu of hardcore.

2.9 CRUSHER RUN BASE COURSE

2.9.1 Where a crusher run base course is specified it shall be in layers of the thickness specified.

3. PRECAST CONCRETE

3.1 PRECAST CONCRETE PAVINGS

3.1.1 Paving slabs shall be Class 20 quality precast concrete finished on top to match granolithic and, if so specified, rendered non-slip by the addition of 227gm of "Alundum" sprinkled on and rolled into the top surfaces of each slab or by other means to the approval of the Engineer, or brushed to a fine texture.

3.1.2 Slabs shall be even in size and shape, free from cracks, flaws, blemishes or other defects all in accordance with SABS 541 and equal to samples submitted to and approved by the Engineer.

3.1.3 Paving slabs, where so described, shall be solidly bedded in 4:1 cement mortar or bedded with a rubber hammer on and including 50mm bed of clean dry cyanide sand and flush

pointed on all exposed faces with semi-dry cement mortar pressed in. On no account may liquid grout be poured on.

3.1.4 Paving shall be well protected to prevent all possibility of damage or discolouration and thoroughly cleaned off at completion.

3.2 PRESTRESSED LINTELS

3.2.1 Lintels shall be as manufactured and supplied by an approved manufacturer, in the approximate widths and in the lengths to provide a minimum bearing of 225mm each side of opening. The Contractor shall allow for hoisting, bedding in cement mortar, maintaining in position and propping in accordance with the manufacturer's instructions. Care shall be taken to avoid breakages in handling.

3.3 PRECAST CONCRETE, RE-CONSTRUCTED STONE AND TERRAZZO

3.3.1 The requirements of the Concrete Specification shall apply to all the precast concrete work except where specifically modified by the clauses set out below.

3.3.2 Water shall be clean, free from impurities or other materials which may adversely affect the undercoat or finishing coats.

3.3.3 Cement shall be Portland cement equal to the requirements of SABS 471 for Ordinary and Rapid Hardening Portland cements.

3.3.4 All cement must be fresh and dry when used and no cement older than 3 months or which has absorbed moisture to the extent that it becomes at all caked shall be used. Quick setting or rapid hardening cement shall not be used.

3.3.5 Coarse and fine sand aggregates shall not contain shale, dust, salt, lime, bitumen, coal nor animal, vegetable or other organic or deleterious material. The aggregates shall be washed if so required by the Engineer.

3.3.6 Sand aggregates shall contain not more than 5% of material that shall be retained on a No. 4 Tyler sieve, not more than 15% of material that shall pass a No. 100 Tyler sieve and not more than 5% of material that shall pass a No. 200 Tyler sieve, measured by mass, unless otherwise agreed by the Engineer.

3.3.7 The largest grains of sand for white lime putty plaster shall pass a No. 28 Tyler sieve and that for other plasters a No. 8 Tyler sieve and shall exclude crusher sand. It shall be graded from coarse to fine so that its fineness modulus is between the limits 1.1 and 2.1 in the case of sand for white lime putty and 1.1 and 2.4 in the case of sand for other plasters.

3.3.8 Aggregates for finishing coats of precast claddings, etc. shall consist of drippings (granular not flaky) of the specified stone and colour, all of which shall pass a 9,5mm aperture test sieve. They shall be graded from coarse to fine so as to give the greatest possible mass in a given volume.

All aggregates shall be free from animal, vegetable or foreign mineral matter and shall comply with such tests as may be required by the Engineer. Samples of each kind of aggregate it is proposed to use shall be submitted to the Engineer for approval and no aggregate shall be used until it has been passed.

3.3.9 Steel reinforcement shall be mild steel of approved manufacture and rolling, to comply with SABS 920 for concrete reinforcement, and shall be cut to lengths and securely bound at all intersections with a sufficient number of strands of not less than 2mm annealed wire.

3.3.10 PRECAST RE-CONSTRUCTED STONE

3.3.10.1 The backing for a single-faced precast panel shall be a thickness 10mm less than the finished thickness reinforced as specified or with expanded metal lathing or wire netting of stout gauge. The finishing coatsshall be 10mm thick composed of the materials specified.

3.3.11 PRECAST TERRAZZO

3.3.11.1 Terrazzo wall linings, floor tiles, etc. shall be of the specified thickness and shall be of cement concrete having a minimum crushing strength of at least 30MPa at 28 days.

The external finishing coats shall be 25mm thick and composed of 40kg of cement (to which shall be thoroughly mixed a colouring matter complying with the requirements of the current B.S. 1014 - Pigment for Colouring Cement - in such proportions as will give to the surface the colour specified) to 80kg of the specified aggregate. (In no case may the mass of the colouring agent exceed 10% of the mass of cement.) The finishing coat shall be of uniform composition and colour throughout. No dusting on of colouring matter will be permitted. The finishing coat shall be compacted until all superfluous water is expelled and removed from the surface and trowelled to an even surface with approximately 80% aggregate showing.

3.3.11.2 Exposed surfaces of reconstructed stonework and terrazzo shall be kept wet by sponging at regular intervals. Surfaces shall be polished by machine with a very fine abrasive to a perfectly true and smooth surface.

3.3.11.3 Brushed surface shall be lightly brushed to the desired texture with a steel wire brush and an approved solution.

3.3.11.4 Washed shall be washed with a hose to obtain the required texture.

4. BRICKWORK

4.1.1 MATERIALS AND MORTARS

4.1.1.1 Sand shall comply with the requirements for fine aggregate as SABS 1083 washed where necessary and screened through a 2,36mm sieve.

4.1.1.2 Cement shall be Portland Cement complying with the requirements of SABS 471.

4.1.1.3 All lime used for mortar shall conform to SABS 523.

4.1.1.4 Unless otherwise described mortar shall composed of one part by volume of cement and five parts by volume of sand. mortar shall be mixed in small batches as no mortar that has once commenced to set shall be used.

4.1.1.5 Lime mortar with cement added shall be composed of four parts of sand to one part of lime with one part of cement added to nine parts by volume of the lime mortar immediately before use, with the addition of extra water.

4.1.1.6 Mortar mixing shall be done with mortar mixing machines or on clean non-absorbent close jointed platforms. The materials shall be thoroughly mixed dry to a uniform colour and clean water added gradually through a fine rose, the mixture being turned over until the ingredients are thoroughly incorporated. The platforms shall be well cleaned before mixing each batch.

4.1.2 BRICKS AND BLOCKS

4.1.2.1 Stock bricks shall be first quality, good, hard, sound, well burnt clay stocks or wire cuts, nominal size 222 x 106 x 73mm, even in size and shape and equal to samples shall be submitted to and approved by the Engineer and shall comply with the requirements of SABS 227 "General Purpose" class with a "Nil" degree of efflorescence as defined therein. No chipped or damaged bricks will be allowed. Bricks for foundations and similar work shall be specially selected for hardness.

4.1.2.2 Facing bricks shall be selected facings size 222 x 106 x 73mm of the type specified, free from blemishes, square on all faces, uniform in size, shape and colour and equal to samples shall be deposited with and approved by the Engineer and shall comply with the requirements of SABS 227 "Facing" class with a "Nil" degree of efflorescence as defined therein.

4.1.2.3 Sand lime bricks shall comply with the requirements of SABS 285 and shall be of "Stock Brick" class.

4.1.2.4 Cement bricks shall be rectangular faces, free from cracks, chips and other defects. Nominal size of bricks shall be 220 x 105 x 70mm. Bricks shall comply with the following compressive strengths and degrees of efflorescence.

	Usage	Compressive Strength (MPa) (Minimum)		Degree of Efflorescence
		Average for 12 bricks	Individual	
A	General	4	3,5	Moderate
B	Loadbearing (unless described as external loadbearing)	14	11	Nil
C	External loadbearing	21	16,5	Nil

The degree of efflorescence shall be tested in accordance with the principles laid down in paragraph 7.5 of SABS 987.

Drying shrinkage shall not exceed 0,06 per cent.

Bricks shall comply in all respects with the standards and tests laid down in SABS 987 and shall be equal to samples submitted to and approved by the Engineer.

4.1.2.5 Blocks bricks shall be rectangular and even in size, free from cracks, chips and other defects. The sizes and strengths of blocks shall be in accordance with the following table:-

Usage	Size (mm) (Tolerance)			Compressive Strength (MPa) (Minimum)		
	Length	Thickness	Height	Average per 12 blocks	Individual	Drying Shrinkage
A General	390	75	90	2,8	2,2	0,05% max.
	440	108	140			
	590		190			
	(±4)	(±3)	215			
			290			
			(±3)			
B Loadbearing	390	90	90	7	5,5	0,06% max.
(unless described	440	150	140			
as external	590	190	190			
loadbearing)	(±4)	215	215			
		(±3)	290			
			(±3)			
C External loadbearing		(As B above)		21	18	0,06%, max.

Blocks shall comply in all respects with the standards and tests laid down in SABS 527 and shall be equal to samples submitted to and approved by the Engineer.

4.1.2.6 Hollow clay building blocks shall be rectangular, even in size, free from warped sides, cracks, chips, laminations or other defects. The sizes and strengths of blocks shall be in accordance with the following table.

Usage	Size (mm)		Compressive Strength (MPa)			
				(Minimum)		
	Length (Half-block)	Width	Height	Average per 12 blocks	Individual	Water Absorption Shrinkage

A General	230:290 (110:114)	75 100 150 200	140 215 290	5,5	4	5 to 20
B Loadbearing and exposed to weather	(As A above)			9	7	5 to 15

Hollow clay building blocks shall comply in all respects with the standards and tests laid down in SABS 589 and shall be equal to samples shall be submitted to and approved by the Engineer.

4.1.2.7 Unless otherwise stated all brickwork shall be built in stock clay bricks. Wherever practicable, the brickwork shall be built in English bond; no false headers shall be used except where legitimately required for bond.

Bricks shall be soaked in water immediately before being laid and the course of bricks last laid shall be well wetted before laying a fresh course upon it.

Brickwork shall be properly and solidly bedded and all joints flushed up solid at every course. Mortar joints are in no case to exceed 10mm in thickness and all perbes and angles shall be plumb. No wall shall be carried more than 1200mm higher than

the adjoining work except shall be shown on the drawings. Pointing shall be done as the work proceeds. The joints of all walls shall be plastered or tiled shall be raked out 12mm deep as the work proceeds to form key.

Care must be taken to keep cavities free from mortar droppings or other matter and temporary openings must be left at the bottom of walls through which any droppings, etc. can be removed on completion and on completion shall be bricked up.

Weep holes shall be formed, at approximately 900mm centres, in the outside skin of cavity walls by leaving open perpends in the lowest course of brickwork immediately above the damp-proof course.

Brickwork shall be built hard up against all wood frames, steel linings and steel windows and excessively thick mortar beddings will not be permitted.

Brickwork shall be built within normal accepted tolerances being vertical as reflected on a builder's Level and without bowing or bulging. Bowing or bulging in excess of 10mm over any 3000mm length will be rejected as unacceptable.

4.1.2.8 Brickwork shall be aliened with concrete with and including 4 x 32mm galvanized iron ties one end embedded 76mm deep or shot-fired into concrete and other end built 76mm deep into brickwork (No. 8 ties to every square metre).

4.1.2.9 Where brickwork is described as being in two or more skins bricksshall be tied together with wire ties as described (No. 8 ties to every square metre).

4.1.2.10 Cavity walls shall be included for temporary openings to clean cavities, weep holes as described and tying the skins together with

and including wire ties as described with a dip in the centre (No 8 ties to every square metre).

4.1.2.11 Wire ties shall be galvanized iron twisted wire ties not thinner than 3,20mm and equal in all respects to the "Vertical Twists" "Butterfly" or "P.W.D." Type wall tie in accordance with SABS 28.

4.1.2.12 Brick lintels shall be formed of good, sound, well-burnt bricks complying with current SABS 227 for bricks of a grade not inferior to **General Purpose** bricks not containing cavities or perforations and with water absorption not exceeding 14 per cent, properly bonded longitudinally. They are to have a bearing of at least 330mm on each side of the opening. Where two openings are less than 1000mm apart the lintels shall be continuous over all such openings and their dividing piers plus at least 330mm bearing at both extreme ends. At each reveal the end bricks of the bottom course must have a bearing of at least half its face length. The lintels shall be a height of at least the number of courses stated in the table below. In continuous lintels the heights shall be for the widest opening spanned. The space between the brick skins of the bottom two courses of lintels in

cavity walls shall be filled in with fine cement concrete. The bricks shall be bedded and jointed in 3.1 cement mortar. Particular care must be taken to ensure solid bedding particularly where the reinforcement occurs. Each lintel shall be reinforced with lengths of approved mild steel brick reinforcement as set out in the table below in single layers to the full length of the lintel. Half of the reinforcement shall be placed in the soffit and the other half in the first horizontal joint above the soffit except in the case of face brick soffits where all the reinforcement may be placed in the first, horizontal joint. Reinforcement is to have a 3mm cover top and bottom. All brick lintels must be built upon approved rigid temporary supports left in position until removal is sanctioned by the Engineer but not less than 7 days after erection

Width of Opening	Thickness of Walls	No. of Brick courses	Brick Reinforcement
Not exceeding	115mm	4	1 Run 82mm wide in each of 2 joints
1 500mm	230mm or 280mm	4	1 Run 158mm wide in each of 2 joints
1 500mm to	115mm	6	1 Run 82mm wide in each of 4 joints
2 250mm	230mm or 280mm	6	1 Run 158mm wide in each of 4 joints
2 250mm to	115mm	8	1 Run 82mm wide in each of 6 joints
3 000mm	230mm or 280mm	8	1 Run 158mm wide in each of 6 joints

Reinforcement of other diameters and strengths may be used providing the values used are equivalent to those shown in the table.

4.1.2.13 Samples of the bricks and blocks shall be used on site including face bricks, stock bricks and concrete blocks shall be submitted to the Engineers for their approval and after approval of same these

samples shall be retained in the site office for the duration of the contract.

4.1.2.14 Sufficient expansion joints shall be allowed in brick walls to ensure the achievement of controlled movement and minimise cracking in brick walls.
The Contractor shall agree positions and details of expansion joints with the Engineer. Where brickwork crosses expansion joints in the structural frame such expansion joints shall be carried through the brickwork and all finishes whether specifically shown on the drawing or not.

4.1.2.15 Bagging shall be carried out when mortar in joints is still soft by rubbing over with wet rough sacking dipped in a 4.1 cement mortar slurry until all joints and crevices are evenly filled, including additional mortar if necessary to obtain an even surface or, when mortar in joints is set, by rubbing over as described but including cement grout as necessary to fill up the joints and crevices.

4.1.3 BUILDING IN

4.1.3.1 All pipes, conduits shall be built in, chased, where required shall be neatly executed.

4.1.3.2 Where door frames, linings, surrounds, etc. are built into brick or concrete shall be braced up sufficiently to prevent distortion, with lugs cut and pinned, or built into brickwork or block work, grouting up solid all round, pointing both sides in cement mortar and any necessary propping of lintels.

4.1.3.3 Metal window frames shall be grouted solid, pointed both sides in cement mortar and left perfectly watertight all round.

4.1.3.4 Heads and stiles of windows a shall be fixed to the adjoining construction as follows:

4.1.3.5 Build brickwork or block work hard up against window frames and build in the fixing lugs, or plug window frame to concrete or screw window frame to and including dove-tailed hardwood fixing blocks cast into concrete.

4.1.3.6 The Contractor shall ensure that windows are fixed they shall be glazed and prepared so that each window can be tested for water tightness with water sprayed on by means of a 19mm hosepipe Each window section shall be tested under the supervision of the Engineer and approved before final acceptance of the fenestration.

4.1.3.7 DB boards, electrical boards with conduits and cable sleeves shall be built in to the walls.

4.1.4 FACED BRICKWORK

4.1.4.1 Facing bricks shall be sorted to ensure that proper mixing of the bricks within the colour range of each type of facing brick used is obtained. Sudden changes in the general colour of face work in any one type of facing brick will not be acceptable. The various types of facings shall be even in size and shape and equal to samples shall be submitted to and approved by the Engineer before use.

Special care must be taken to preserve arises and faces of these bricks during transit and handling. Any facing bricks on the site not in accordance with the approved samples will be rejected by the Engineer, the delivery and removal of which will be solely at the Contractor·s risk.

4.1.4.2 Faced work, except where otherwise specifically described, shall be built in horizontal stretcher bond in 5:1 cement mortar with 2 mm square recessed pointed vertical and horizontal joints.

All perpendsshall be accurately kept. Scaffold boards against faced work must be turned away from walls during rain. All electrical conduiting shall be built into facings. No chasing will be allowed. Face brick work shall be kept clean during building work and shall be left clean to the Engineer's approval.

4.1.4.3 Cills and copings shall be bedded and jointed solid in 4.1 cement mortar and pointed with a keyed-in joint on all exposed surfaces with semi-dry cement mortar pressed in.

4.1.5 FIBRE REINFORCED CEMENT CILLS

4.1.5.1 Fibre reinforced cement cills shall be pressed stock cills fitted with fixing lugs securely screwed to underside of cill, cut to fit between reveals and bedded solid in 3.1 cement mortar, including cutting pockets for lugs and keeping cills damp until mortar has set hard, all cutting and cleaning down on completion.

4.1.6 PAVINGS

4.1.6.1 Paving shall be laid butt-jointed and solidly bedded in 4.1 cement mortar and flush pointed or. Exposed faces with dry cement mortar broomed in. Pavingshall be well protected to prevent all possibility of damage or discolouration and thoroughly cleaned off at completion.

4.1.6.2 Paving shall be laid to accurate and even falls so that no water ponds at any point and no bulges occur. Special care shall be exercised to ensure that joints are straight and in accordance with the required pattern.

4.1.7 QUARRY TILES

4.1.7.1 Quarry tiles shall be best quality quarry tiles of approved manufacture, even in thickness, truly square, uniform in colour, free from cracks, twists, blemishes or other defects and bedded, jointed and flush pointed in 4.1 cement mortar. Cleaning off and washing with an approved solution and rinsing off with cold water on completion.

4.1.8 SLATE

4.1.8.1 Slate shall be sawn slate from an approved quarry, free from all defects, cross-cut on back to form key, rubbed smooth on exposed faces, bedded, jointed and flush pointed in 4.1 slate tinted cement mortar.

5. RUBBLE WALLING, MASON, MARBLE AND SLATE MASON

5.1 GENERAL

5.1.1.1 Sand shall be as described in Clause 1.01 in brickwork.

5.1.1.2 Cement shall be as described in Clause 1.02 in brickwork.

5.1.1.3 Lime shall be as described in Clause 1.03 in brickwork.

5.1.1.4 Cement mortar shall be as described in Clause 1.04 in brickwork but shall be composed of five parts by volume of sand to one part by volume of cement unless otherwise described.

5.1.1.5 Compo mortar shall be as described in Clause 1.05 in brickwork

5.2 RUBBLEWALLING

5.2.1 Local stone shall be approved by the Engineer and must be free from vents, flaws, sand holes, iron stains and other imperfections.

5.2.2 All stones shall be laid on their natural quarry beds, using as many large flat stones as possible and with through stones or bonders built in one to every square metre.

5.2.3 All stones shall be laid and flushed up solid (unless otherwise described) in lime mortar and well hammered down to their bearings and carefully fitted into position in the strongest manner so as to avoid interstices and where these are unavoidable they shall be hand packed with flat spalls bedded in the mortar. Level up with picked long flat stones for damp proof course and elsewhere where required.

5.3 MASON

5.3.1 Only skilled labour shall be employed in this trade. Otherwise described grouted or flushed up solid in cement mortar.

5.3.2 Allow for the supply and delivery of the stone to the site, for all labour in preparatory work, hacking surfaces where required for plaster, templates, dowels and mortices, for all handling in connection with hoisting, placing in position and setting, removing all mortar or other stains, casing, protecting from injury and cleaning down on completion.

5.3.3 Local stone shall be from an approved quarry and free from all defects.

5.3.4 All freestone shall be the best and most durable of its kind, free from vents, loose beds, sand holes, oxide veins and other imperfections and shall be set on its natural quarry bed.

5.3.5 Granite unless otherwise described shall be best quality Black Bon-Accord, of reasonably uniform colour and fine texture, compact and reasonably constant in grain structure, durable, free from all cracks, chips, blemishes and other

defects, sufficiently hard to take a high polish, and equal to samples shall be submitted to and approved by the Engineer. Granite linings to walls are to have the grain running horizontally andshall be selected for matching of colour and character to the Engineer's approval. A11 granite must be of uniform thickness, cut true to the size and shape required to form close joints and shall be highly and uniformly polished on a11 exposed faces and edges, with all exposed angles neatly arris rounded, all to the satisfaction of the Engineer.

5.3.6 Granite linings, etc. shall be solidly bedded against walls, etc. with 3.1 cement mortar. Slabs shall be secured to brick or concrete walls, etc. with copper cramps at not exceeding 380mm centres both ways andshall be fixed together along all vertical joints with 6mm diameter x 38mm long copper dowels at not exceeding 350m centres, with all necessary slots, sinking and mortices formed in marble, concrete and brickwork and with cramps and dowels set in 1.3 cement mortar.

5.3.7 The Contractor shall submit sample slabs for approval by the Engineer before commencement of the works.

The Contractor shall maintain in every respect a finish equal to that of the approved sample in all work under this contract. Any work which does not conform to the approved sample will be rejected, broken up and replaced at the Contractor's expense.

The whole of the granite work must be cased as necessary and carefully protected from injury during fixing of pre-cast work and all other building operations. Care must be taken to keep all faces free from mortar and other stains. All granite work must be properly cleaned down at completion to the entire satisfaction of the Engineer.

5.4 MARBLE AND SLATE MASON

5.4.1 Sand and cement shall be as described in Clauses 1.01 and 1.02 in brickwork.

5.4.2 Marble shall be best quality Italian or local Travertine as described, free from chips, blemishes and other defects, and to conform strictly to samples shall be submitted to and approved by the Engineer, All marble shall be selected having reasonably constant grain structure, colour and meeting thickness of uniform thickness, cut true to size and shape as required to form close joints, and shall be highly and uniformly polished on all exposed faces and edges with all salient angles neatly arris rounded. All marble shall be free from loose beds, metallic veins, iron stains, sand holes and other defects and to the approval of the Engineer.

5.4.3 All sawn slate shall be obtained from an approved quarry, free from defects and equal to samples shall be submitted to the Engineer.

5.4.4 The slabs shall be rectangular except where otherwise described and sawn die square. The linings, skirtings, paving, etc. shall be properly matched for veining, colour and texture and laid out for inspection and after approval by

the Engineer each slab shall be numbered and kept in the same relative position when fixing, with veinings running in the approved directions.

5.4.5 Artificial patching will be allowed only where approved by the Engineer.all

5.4.6 Polished samples size 150 x 150mm of each different type of material shall be used shall be submitted to the Engineer for his approval before the work is put in hand and the slabs used shall be equal in all respects to the approved samples.

5.4.7 Floor paving, etc. shall be bedded and jointed in 4.1 cement mortar and neatly pointed with a slightly keyed-in joint and cleaned off. Bedding joints are not to exceed 20mm and heading joints 3mm wide.

6. WATERPROOFING

6.1 DAMP-COURSING TO WALLS, ETC.

6.1.1 Sheeting shall be (consisting) of one layer of approved plastic sheeting complying with the requirements of SABS 952, Type B.

6.1.2 Fibre felt shall be consist of one layer of three-ply bituminous fibre felt fabric complying with the requirements of SABS 248, Type GH.

6.1.3 Damp-coursing shall be laid on walls, under sills, etc. and lapped the full thickness of walls at angles and a minimum of 150mm at junctions.

6.2 DAMP-PROOFING TO FLOORS

6.2.1 Sheeting shall be seamless sheeting complying with the requirements of SABS 952, Type C of the thickness specified, laid and sealed in strict accordance with the Manufacturer's instructions. The waterproofing shall be of the number of layers specified each in single sheets of the widest suitable widths and in long lengths without

laps wherever possible. Where laps are necessary these shall be 100mm wide overlap sealed with non-water soluble brush applied adhesive finished off with 50mm wide pressure sensitive tape to give a double seal joint.

6.3 WATERPROOFING TO FLOORS, BASEMENTS, ETC.

6.3.1 Sheeting shall be seamless complying with the requirements of SABS 952, Type C of the thickness specified, laid and sealed in strict accordance with the Manufacturer's instructions.

6.3.2 The waterproofing shall be of the number of layers specified, each layer in widest practical widths lapped 100mm wide and spliced to form continuous membrane using specially formulated adhesive and pressure sensitive strips in accordance with the Manufacturer's instructions.

6.4 SHEET ROOF WATERPROOFING

6.4.1 Derbigum 6 mm thick or similar and approved waterproofing layed on screed to slope. Continuous rolls used with overlapped torched hot sealed joints. No sharp bends allowed. All 90° corners shall be filled with cement or other approved material to make provision for an easy bend of the waterproofing material. End of waterproofing sealed against vertical walls or concrete upstand with hot torched sealed edges. All in a neat straight line to Engineer's approval. Work done to manufacturer's specifications.

6.5 ASPHALT ROOF WATERPROOFING

6.5.1 Roof covering is to consist of a mechanical mixture of selected and properly graded aggregate with approved asphalt cement, to comply in all respects with SABS 297. The mastic shall be applied hot in two 10mm layers with all joints broken at least 75mm, on and including an underlay of an approved sisal fibre based reinforced waterproof building paper; asphalt shall be trowelled to falls and contours as required, with second layer blinded with sand and rubbed to a smooth surface and finished where so specified with one coat aluminium paint.

6.5.2 The mastic is to have a hardness number of between 20 and 40 at 25 degrees and a penetration of between 21 and 25. The mastic asphalt shall be mixed at a temperature of not exceeding 215 degrees C and spread on roof whilst hot and trowelled smooth.

6.6 ROOFING PAINT

6.6.1 The Contractor shall ensure that the surface should be wired brused to remove all dirt and loose particles. Other substances such as oil, grease, waxes, paint, etc. should be removed with suitable solvents. All cracks holes shall be filled with stiff mortar comprising one part "Coprox" and two parts sand.

6.6.2 "Coprox" should be applied to clean masonry surfaces with a fibre brush to ensure that the first coat is well worked into the pores of the surface. The second coat may be applied any time after six hours after the first. The Contractor is to ensure that the application is protected from inclement weather for six hours after the application and that the paint does not dry out too quickly due to high winds, strong sun or excessive heat.

6.7 ROOF INSULATION

6.7.1 One layer of Isover Cavitybatt 14kg/m^3 102 mm thick layed on top of 12.5mm gypsum board ceiling in continuous lengths to fill the total area between the roof purlins and to cover the total roof as indicated on the Engineer's drawings. No gaps allowed.

One layer of Isover Cavitybatt 14kg/m^3 51 mm thick layed above ceiling boards to cover the total area without gaps.

6.7.2 Fibreglass Insulation or other approved under screed insulating sheets shall be free from cracks, chips, or other defects and in strict accordance with the Manufacturer's instructions.

6.7.3 Polyurethane Insulation shall be "Herathon KPF" or other approved insulating sheets. Sheets shall have a density of 32kg/m3 and a k factor of 0,025 W/m deg C, free from cracks, chips or other defects, handled and laid in strict accordance with the Manufacturer's instructions.

6.7.4 Concrete or screeded surfaces shall be dry and free of any standing water when insulation boards are laid.

7. ROOF COVERING

7.1 ROOF SHEETING, CLADDING, GUTTERS, DOWNPIPES AND FLASHINGS.

7.1.1 All roof sheeting shall be HH Robertson Klip-Lok 700 profile 0,58mm thick high yield stress ASTM 446 grade E(3T), heavy industrial Z 275 galvanized and finished on the outside with the following paint specification or similar and approved by the Engineer.

Type:	Global-Duro
Primer:	Beckry Prim 209
Topcoat:	Beckry Duro DJ 284
Film thickness:	55 microns
Application:	Reverse roller coating

This paint finish must have a 10 year guarantee.
Roof sheeting fixed to manufacturers specification. Colour of finish see colour schedule below.

7.1.2 Metal sheet cladding shall be in continuous lengths from top to bottom. If this can't be done in special occasion the overlap visual joint position must line up with the top or bottom of windows or any other Engineer rural element. All cladding shall be IBR 890 (supaclad) profile 0,58 mm thick high yield stress ASTM 446 grade E (3T) heavy industrial Z 275 galvanized and finished on the outside with the following paint specification or similar and approved by the Engineer.

Type:	Global-Duro
Primer:	Beckry Prim 209
Topcoat:	Beckry Duro DJ 284
Film thickness:	55 microns
Application:	Reverse roller coating

Colour of finish see colour schedule below.

7.1.3 All exposed gutters shall be the same colour as the roof sheeting.

Generally roofs don't need gutters or down pipes. If an exposed down pipe or spout is needed a metal rectangular down pipe or spout in the same colour as the cladding must be used.

All roof gutters except for box gutters are manufactured out of 0,8mm thick, mild steel with Z 450 galvanized finish on both sides and finished with Globalcoat Global – PVDF colour to match colour of roof.

Exposed down pipes where required fixed to the above gutters must be rectangular and manufactured out of 0,8 mm thick, mild steel with Z 450 galvanized finish on both sides and finished with Globalcoat Global – PVDF colour to match colour of gutter unless otherwise specified on drawings.

7.1.4 All flashings including ridge and hip flashings constructed shall be the same material as for roofs and finished with the same Globalcoat finish. Colour to match colour of roof.

Colour for all roofs – Aloe green.

8. CARPENTRY AND JOINERY

8.1 CARPENTRY

8.1.1 Timbers shall be well seasoned and free from sap, reasonably free from wavey edges, large, loose or dead knots, splits, shakes or other defects and shall be sawn die square. The scantlings of all timbers are to hold full size when sawn.

8.1.2 Net lengths of timber have been measured as fixed and no allowance has been made for joints in the lengths whether lapped, spliced, halved, scarved or finger-jointed.

8.1.3 All, timber shall be kiln dried to a moisture content of approximately 12 per cent.

8.1.4 Wall plates, ceiling joists, etc. shall be in as long lengths as possible. Except where lapping is possible, timbers up to 75mm depth shall be halved at junctions and angles, and above 75mmshall be splay-scarved at junctions; in all cases the joints shall be arranged over the points of supports and well spiked.

8.1.5 All timber delivered to the site shall be properly stacked above the ground, either on rough bearers or platforms under cover and protected from inclement weather.

8.1.6 The pre-treatment of all timber against possible infection later is described under the following heading, but the Contractor shall nevertheless take every precaution to ensure no infected timber whatsoever is brought on to the site, whether for scaffolding, formwork or for any other purpose. Any infected timber shall be immediately removed by the Contractor and replaced at his own expense to the satisfaction of the Engineer.

8.1.7 All permanent timber installed in the building is, unless otherwise specified, shall be treated against borer, cryptoterms, termites and all wood destroying agencies with an approved preservative all in accordance with SABS 05. Any surface subsequently exposed by cutting or planing must be touched up with the same preservative solution.

8.1.8 The name of the supplier of the timber shall be supplied to the Engineer on request and also a written statement that the timber has been treated in accordance with the abovementioned Standard Regulations.

8.1.9 The Engineer shall be at liberty to select samples of the treated timbers on the site and to have them tested by the Department of Entomology or any other authority; the expense of such tests shall be borne by the Contractor, if the penetrations and absorptions do not comply with the standards laid down above.

8.1.10 All materials which do not comply with the above requirements or which are in any way damaged or discoloured by the pretreatment must be replaced by the Contractor at his own expense, if so directed by the Engineer.

8.2 TIMBERS

8.2.1 All South African pine used in this Contract shall bear the mark of the South African Bureau of Standards. Timbers used for various purposes are to comply with the relevant SABS specifications; constructional timbers, grounds for paneling and shelving are to comply with SABS 563, 653 and 654 respectively. Wood for joinery purposes must comply with SABS 1359. Should S.A. pine in the respective grades be unobtainable, other suitable and approved timber may be substituted.

8.2.2 All hardwoods are to comply with SABS 1099.

8.2.3 Philippine mahogany shall be best quality, specially selected and well seasoned, free from all sapwood to the approval of the Engineer and shall be well kiln dried.

8.2.4 Deal shall be best quality red Baltic deal. Deal for joinery shall be specially selected with a minimum of knots and shall be kiln dried. Should deal be unobtainable Oregon pine or other suitable and approved timber may be substituted.

8.2.5 Oregon pine shall be "Merchantable" quality; Oregon pine for joinery shall be selected from "No. Clear and Better" quality and shall be kiln dried, that for all members except panels shall be sawn "edge grain" and that for panels shall be sawn "flat grain". Should Oregon pine be unobtainable other suitable and approved timber, specially selected with a minimum of knots and free from attack by borer, may be substituted.

8.2.6 Kiaat, Mvuli, Afrormosia and Meranti timbers shall be best quality, specially selected; straight grained, well seasoned, free from sapwood to the approval of the Engineer and shall be well kiln dried.

8.2.7 Sapele mahogany timbers shall be light red, to approval, close textured and weighing about 195kg per m3 when seasoned.

8.2.8 Laminated timber beams shall be glued laminated timber beams manufactured in a factory specially equipped for that purpose to comply with the requirements of SABS 876. The timber used in the manufacture of the glued laminated timber beams shall be "Eucalyptus Grandis" complying with the standard Australian strength group "C" grading, and the definitions, classification, materials, grading, manufacture and testing of the beams shall be in accordance with the "Canadian Standards Association's Specification for Glued Laminated Timber No. 0122-1959". The glues used shall be Casein Glues complying with the Canadian Standards Association Specification 0112.3 Casein glue for "wood" or "American Military Specification MMM-A-125". All finished beams shall be sanded all round or planed all round with misses and treated with one coat of "Weather seal", or other approved compound containing a minimum of 7% pentachloraphenol.

8.2.9 Beams shall be manufactured in a factory specially equipped for the purpose. The timber used shall be kiln-dried S.A. Pine of 30mm laminae; finger jointed, bonded throughout with resorcinol (waterproof) adhesive, finished "off-the-saw" and shall be free from warping and twisting.

8.3 SHEETS, BOARDS, ETC.

8.3.1 All pressed fibre cement sheeting shall be of the thickness specified and smooth both sides, free from chips, twists and blemishes and shall be of South African manufacture complying with SABS 685. Fascias and barge boards shall be pressed strips or cut from sheeting, of the widths described and in convenient long lengths, neatly butted at heading joints and jointed as described.

8.3.2 Plywood shall be best quality, free from all blistering, cracking, twisting and other defects and glued with best waterproof glue under pressure and to comply in all respects to the requirements of SABS 929. Veneers, where specified, shall be matched, kiln-dried of best quality timber, free from knots and other defects, properly selected and correctly jointed, dried and machine-sanded to a smooth finish.

Where type of veneer is not stated, a veneer suitable for painting or staining may be used.

8.3.3 Chipboard shall be "Novobord" as manufactured by Novoboard Ltd., or other approved, free from cracks, chips, and other defects, manufactured under a one year guarantee. Edges shall be treated with approved filling well rubbed in to form hard true surface.

8.3.4 Novo white shall be best quality free from cracks, chips or other defects as manufactured by Novobord Ltd.

8.3.5 Hardboard shall be best quality tempered hardboard, free from cracks, twists or other defects, complying with the requirements of SABS 540, prestretched before fixing, all in accordance with the manufacturer's instructions.

8.3.6 Boards shall be of best quality, free from cracks, chips, twists or other defects and equal to samples shall be submitted to and approved by the Engineer.

8.3.7 Boards shall be manufactured from Kiln-dried South African Pine timber core formed of 76mm to 102mm laminations. All Commercial Hardwood veneers used in the manufacture of boards and shelving shall be treated against insect infestation during manufacture with Boric Acid/Boron in accordance with the recommendations of the Department of Entomology. Bonding throughout shall be by means of heat and hydraulic pressure. All products shall be sanded to a smooth finish.

8.3.8 Boards shall be of the thickness and ply specified, manufactured from kiln-dried South African Pine timber core cross grain veneer underlay and long grain veneers face and back. All Commercial Hardwood veneers used in the manufacture of boards and shelving shall be treated against insect infestation during manufacture with Boric Acid/Boron in accordance with the recommendations of the Department of Entomology. Bonding throughout shall be by means of heat and hydraulic pressure. All products shall be sanded to a smooth finish. Blockboard with decorative veneers on face and back shall be of the thickness and ply specified with timber core and underlay as above and faced with 0,6mm decorative long-grain veneers.

8.3.9 Decorative veneer one-side-only blackboard shall be balanced with 1mm veneer on reverse side. Edge strips to blackboard shall be formed with 9,5mm thick strips to match the face veneer and shall be the full thickness of the board.

8.4 ROOFS

8.4.1 Trusses shall be engineered timber trusses designed by a qualified engineer in accordance with the Standard Building Regulations, Chapter 3, "Loads" and Chapter 7, "Structural Timber" and the joints in accordance with the latest revision of "Design Specification for Light Metal Wood Trusses".

8.4.2 The trusses shall be manufactured in strict accordance with the "Gang-Nail Truss" license requirements, out of Merchantable quality South African Pine, graded in accordance with SABS 563, as amended, and having a density of not less than 481kg/m3, and each truss shall be labeled with the name and address of the licensed "Gang-Nail Truss" manufacturer.

8.4.3 The members shall be connected in one plane by means of commercial class hot-dipped galvanized (650g/m2) 1,25mm and 2mm thick drawing quality steel connector plates pressed simultaneously into each side of all joints by means of a 40 t parallel plated hydraulic press, using a jib. The trusses shall be fabricated by a licensed "Gang-Nail Truss" Manufacturer in accordance with design prepared by a registered professional engineer and the specifications for fabrication issued by Automated Building Components (S.A.) (Pty) Ltd or other approved Specialist. The design and shop drawings as well as the fabrication of the trusses shall be subject to the inspection and approval of the Engineer at all times.

8.4.4 The handling, erection and fixing of the trusses shall be in accordance with the specifications noted on the design drawings of the said trusses. The exposed ends of all rafters shall be of uniform cross-sectional size or be fitted with false sprockets of uniform cross-sectional size.

8.4.5 Roof and floor platesshall be halved at joints, angles and intersections and securely nailed together.

8.4.6 Timbers to have splayed heading joints securely nailed together. Joints shall be staggered and to occur over bearers and sleeper piers respectively.

8.4.7 Unless otherwise detailed all purlins, etc. 50 x 76mm and under must be jointed over the rafter. Larger sized purlins may be dealt with in the same way or by using some other suitable, recognized method.

8.4.8 The Contractor shall ensure that the spacing attention is drawn to the fact that joints in purlins, beams, etc. should be made at the 1/5th point of an internal span. This factor must be borne in mind before the timber is ordered.

8.4.9 All purlins and battens should be fixed to supporting rafters by at least 1 nail skew driven from the direction of the ridge. This is especially necessary on roofs of steep slopes and/or where the purlin is higher than it is broad, the purpose being to prevent tilting or overturning of the member. Where the purlin or batten fixings are at more than 900mm centre to centre, at least two nails should be used at every fixing point.

8.4.10 All head rails, verandah beams, etc. must be jointed as detailed. Where no details are available they should be jointed over a support or at 1/5th span with a suitable joint using bolts, etc.

8.4.11 Sawn brandering shall be butt-jointed at heading joints and angles and wrot-brandering shall be splayed at heading joints and mitred at angles, all over points of support.

8.5 CEILINGS

8.5.1 All ceilings shall be free from cracks, twists, and other defects and equal to samples shall be submitted to and approved by the Engineer. Include for all right-angle cutting and waste.

8.5.2 Ceiling boards shall be in single lengths and 600mm, 900mm or 1 200mm widths, arranged in symmetrical panels around centre of ceiling with narrow panels next to walls and neatly secured in accordance with the manufacturer's instructions.

8.5.3 Ceilings to comply with the requirements of the South African Bureau of Standards Specification for Gypsum Plasterboard, SABS 266 cut where required and neatly and

securely nailed to the brandering with 2,6mm galvanized or cadmium-plated

8.5.4 Clout headed nails 38mm long, spaced at not more than 150mm apart at edges of boards and 150mm apart along intermediate brandering. All depressions and sinking formed by nail headsshall be filled to the Engineer's satisfaction.

8.5.5 Cover strips to gypsum plasterboard ceilingsshall be of plasterboard as for ceilings 50mm wide, with smooth machined edges, neatly butt-jointed and fixed with 2mm galvanized or cadmium clout headed nails, 40mm long, spaced at not more than 150mm centres.

8.5.6 The Engineer shall approves, an alternative to the above cover strip which shall be filling the joint with gypsum plaster filler or when sheets with tapered or rebated edges are used, joints can be taped and filled with filler and finished flush with the sheets.

8.5.7 Cornices shall be in accordance with SABS 622.

8.5.8 Ceilings shall be of fibre cement sheets in accordance with SABS 685. Sheets shall be factory cut to the required sizes and shall be fixed closely butt-jointed. Sheets shall be nailed to the brandering with 40mm stout clout nails at 300mm centres along longitudinal edges and along centre of each sheet.

8.5.9 Gypsum ceiling board shall be 12,5mm thick fixed above 64 mm studding which are fixed in between the studding at 600mm centres and fixed to both sides of the purlins in the same direction as the purlins. Ceiling boards fixed with tight butt joints. All joints which are plastered with gypsum plaster above shall be 100 % air tight.

8.5.10 All patent ceilings are to have main and cross tees of the same strength and capable of supporting light fittings, diffusers and return air grilles at any point in the ceiling area whether supported on main or cross tees.

8.5.11 The maximum deflection permitted in the proprietary suspension system false ceilings will be 1/360th of the span, and in addition the structural stability of these ceilings will be subject to the approval of the Engineer.

8.5.12 The Contractor is to ensure that the correct pins and firing charges are utilized in the shot-nailed or bolting of hangers etc. and must allow for accurate setting out and marking for shot-nailing or bolting.

8.5.13 The Contractor must study the ceiling drawings in conjunction with the electrical drawings and familiarize himself with the correct positions and mass of the various light fittings.

8.5.14 The space between the soffit of the concrete slab or beam and ceiling tiles, boarding etc. may contain obstructions such as air ducts, pipes, etc. and Allow for any additional fixings such as straps, hangers, channels etc. that may be necessary in order to bridge around same and securely

support the ceiling at these positions.

8.5.15 Suspended ceilings shall be capable of providing lateral stability to the head of any demountable partitioning or shop fronts and the Tenderer is to allow accordingly.

8.5.16 Where suspended ceilings pass under major air conditioning ducts they shall be supported on bearers spanning below the ducts and to suit the suspension system and the tenderer is to allow accordingly.

8.5.17 Proprietary suspension system ceilings hall be erected by an approved firm of ceiling specialists all in strict accordance with the manufacturer's instructions.

8.5.18 Ceilings shall be of ceiling tiles of the specified sizes and types, arranged with continuous joints in both directions in symmetrical panels around centre of ceiling with narrow panels next to walls, and unless otherwise described suspended by means of the "DONN DV One Directional Concealed Tee System", as manufactured by "Conresco" or other approved, using continuous galvanized mild steel double web main

8.5.19 Tees with rectangular bulb, stabilizer bars, concealed tee splines and flat steel splines to form a positive interlock, the grid suspended on 1,25mm diameter galvanized annealed wire hangers, one end threaded through holes in and twisted around tees and other end twisted around and including shot-nails to concrete soffit.

8.5.20 Ceilings shall be as for concealed tees but unless otherwise described, suspended by means of the "DONN" or other approved exposed tee system.

8.6 DRYWALL AND METAWALL PARTITIONING

8.6.1 The gypsum drywall partitioning shall be generally in accordance with the materials supplied and the methods of erection and finishing, where applicable, recommended in Gypsum Industries Catalogue Ref DW1-14/1980 entitled Drywall Systems.

8.6.2 The system of Rhino-Drywall Partitioning specified shall be the system as detailed in the abovementioned Gypsum Industries Catalogue, or other approved drywall system, approved by the Engineer before the submitting of Tenders, erected and finished in strict accordance with the manufacturer's instructions. The Contractor will be held responsible for the structural stability of the partitions.

8.6.3 The bottom rail is to receive a coating of black epoxy paint for corrosive protection. All studs shall be power-nailed where adjacent to brickwork or concrete.

8.6.4 Before the erected framework is covered with wallboard, the Contractor is to ensure that all conduits, switchboxes, piping, etc. or electrical, sir conditioning, plumbing or other services that shall be contained within the thickness of the partition are completely installed so as to avoid any subsequent cutting and patching of the plaster-wallboard

coverings.

8.6.5 Unless otherwise described, the partitioning shall be fitted on both sides with 3 x 75mm anodized aluminium skirtings.

8.6.6 Unless otherwise described, shall be semi-solid with veneers suitable for paint both sides as described and fitted with two concealed hardwood edge strips. Doors full height of partition.

8.6.7 Standard natural anodized aluminium door frame profiles for the full height of the partitions with 3 hinges at each door leaf.

8.6.8 Single and double doors shall be fitted with mortice locks and rebated mortice locks respectively as per door schedules. The locks shall be made "en-suite", each having two keys and to differ and pass a master key and shall be engraved with consecutive numbers, the keys shall be numbered to correspond with the locks. The Contractor must allow for their fixing in the price of each door. Butt hinges shall be supplied and fitted to all doors.

8.6.9 Louvres shall be adjustable "NACO" or other approved, for full width of fan lights, with single toggle operator per bank of louvre blades glazed with 6 x 152mm float glass louvres polished all round, unless otherwise specified constructed to suit and match finish of aluminium in partitioning.

8.6.10 Doors, unless otherwise described, shall be 44mm thick semi-solid with veneer both sides as described and fitted with two concealed hardwood edge strips.

8.6.11 Doors shall be fitted with locks, latches, bolts, door closes, etc. as separately measured and per door schedules. The locks shall be made "en-suite", each having two keys and to differ and shall be sub-mastered and pass the grading master key, and shall be engraved with consecutive numbers; the keys shall be numbered to correspond with the locks. One-and-a-half pairs of butt-hinges shall be supplied and fitted to all doors and shall be included in the price of the doors.

8.6.12 All exposed screws shall be cadmium-plated dome-headed with recessed "Phillips" slots.

8.6.13 Materials and workmanship shall be in accordance with best practice and veneers shall be matched throughout and matched with doors, all to the approval of the Engineer.

8.7 DOORS

8.7.1 Doors and panels to comply with SABS Specification 545 for flush doors and shall be of best quality material and workmanship, manufactured under a two-year guarantee and equal to doors and panels manufactured by Messrs Bruply Limited. Any work which is warped, twisted, chipped or in any way defective will be rejected.

8.7.2 The doors shall be specified thickness with vertical edge strips not less than 10mm thick of timber similar to face

veneer, tongued and grooved and glued on to vertical edges flush with and to conceal cross-banding and face veneer.

8.7.3 All timbers shall be treated against borer and the manufacturer's certificate for guarantee lodged with the Engineer.

8.7.4 Semi-solid or solid core flush doors shall be guaranteed against twisting or warping for a period of one year and the manufacturer's guarantee shall be lodged with the Engineer.

8.7.5 Cross-banding on both sides shall be well sanded and faced with best quality veneers of the respective timbers on both sides free from knots and other defects, properly selected and correctly jointed and glued, dried and machine-sanded to a smooth finish.

8.7.6 Veneers shall be matched and selected from flitches having reasonably constant colour depths. Where type of veneer is not stated any approved
veneer suitable for painting or staining may be used. All flush doors are to have hardwood edge strips.

8.7.7 All glue used for flush doors shall be waterproof. Top and bottom edges of flush doors shall be sealed with suitable lacquer before leaving the factory.

8.7.8 All timbers and veneers used in the construction of flush doors and panels shall be pre-treated against borer, cryptoterms, termites and all wood-destroying agencies in accordance with the Engineer's instructions. Any work which is warped, twisted, dented or chipped will be rejected. Thickness described is net. Sizes given are approximate and are not shall be used for ordering purposes, but reference must be made to detailed drawings for exact sizes.

8.7.9 All face veneers to flush doors, etc. shall be kiln-dried of best quality of the respective timbers, free from knots, cracks, patchwork, sapwood and other defects properly selected and correctly jointed and glued, dried and machine-sanded to a smooth finish. All glue shall be waterproof of the best quality and veneers shall be applied under hydraulic pressure. Where exterior quality veneer doors are specified the adhesives shall be weather and boil proof as SABS 1349.

8.7.10 Doors and panels shall be formed with 44 x 108mm stiles and top rail, 22 x 108mm ledges and braces and 22 x 220mm bottom ledges, all framed together and filled with 22mm tongued, grooved V-jointed boarding in narrow widths; the boarding rebated on outer edges and fixed flush with outer face of door to grooves in stiles and top rail and twice countersunk screwed at each intersection with middle and bottom ledges and braces, and with inner edges of stiles and top rail and outer edges of boarding chamfered to form V-joints. Framed and ledged doors or framed, ledged and braced doors shall be guaranteed against twisting or warping for a period of one year and the manufacturer's guarantee shall be lodged with the Engineer.

8.7.11 Doors with grooved and tongued battens are to have the tongues and grooves well primed before assembling.

8.7.12 Doors with plywood panels on the internal face are to have the inner edges of stiles, edge, top and bottom rails rebated for the plywood panel to finish flush on the internal face.

8.8 JOINERY

8.8.1 All joinery shall be purpose-made to detail under the climatic conditions similar to those prevailing in the area of the works.

8.8.2 No joinery shall be primed until it has been inspected and approved by the Engineer.

8.8.3 Skirtings, cornices and rails of all kinds shall be in long lengths wherever possible and to have splayed heading joints and whether described or not shall be ploughed at back.

8.8.4 Work shall be framed up but not glued or wedged immediately the order is given to commence work. All external woodwork shall be put together in, and all external cills and thresholds shall be bedded in thick white lead.

8.8.5 Allow for sinking and pelleting heads of all nails and screws where exposed in hardwood joinery and for cross-tonguing all solid wood sections unobtainable in single widths. The pelleting and cross-tonguing are indicated where possible.

8.8.6 Except where otherwise described, sizes of wrot woodwork are given "nett". All exposed angles of wrot work shall be arris rounded unless otherwise described.

8.8.7 All horns of door frames shall be checked and splayed back where frames are fixed projecting or flush with surface and built in.

8.8.8 All joinery liable to injury must be covered with temporary casing to the entire satisfaction of the Engineer. All exposed faces of joinery which are eventually shall be stained, oiled or varnished must be oiled to preserve them during building operations. Great care must be taken to protect these surfaces from damage or discolouration.

8.8.9 Where joiner's work is described as fixed to walls, etc. except where specifically stated, no particular method of fixing is specified, but the Contractor may employ any approved method of fixing, e.g. plugging, steel-nailing, power-nailing or power-bolting provided that the method used is suitable for the requirements of the specific member shall be fixed. Allow for all such fixing whatever method is employed.

8.8.10 Include for mitres, stopped and returned ends of cornices, cover strips, skirtings, beads, plinths, cappings, edge strips, surrounds, etc.

9. FLOOR COVERINGS AND PLASTIC LININGS

9.1.1 The Contractor shall ensure that the surface to receive the floor coverings is laid level and suitable to take the floor covering.

9.1.2 Linoleum floors in roll form shall be made of colours specified and layed to manufacturer's specifications.

9.1.3 The laying of floor finishing such as thermoplastic asphalt tiles, semi-flexible vinyl asbestos tiles, polyvinyl chloride tiles or sheeting shall be carried out by skilled workmen experienced in laying the particular type of floor finish and in strict accordance with the manufacturer's instructions. The adhesive used for cementing down tiles and sheeting shall be supplied or recommended by the manufacturer's of the flooring material. Tiles and sheeting shall be neatly cut and fitted against margins, thresholds, walls, projections, etc. where exposed and shall finish perfectly flush with adjoining floors, margins, etc. Proper rollers shall be used in laying sheet flooring.

1. Thermoplastic floor tiles with a bituminous or resinous binder shall be in accordance with SABS 586.
2. Semi-flexible vinyl asbestos tiles or sheeting shall be in accordance with SABS 581.
3. Fully-flexible vinyl floor tiles or sheeting shall be in accordance with SABS 786.

9.1.4 Flooring shall be laid in accordance with SABS 070 Code of Practice for the prevention of explosive and electrical hazards in hospitals and laid by specialists strictly in accordance with the manufacturer's instructions on an approved type of 0,8mm thick bitumen saturated felt laid with special adhesive, two-part epoxy resin type loaded with conductive carbon; the tilesshall be welded at all joints and insulating PVC separation pieces using a PVC strip which is heat welded with a hot air gun.

9.1.5 Vinyl skirtings shall be of the height specified, fitted in direct contact to the wall/floor junction using a contact adhesive and butted tightly against floor edges.

9.2 CARPETING

9.2.1 Carpeting shall be of approved colour, free from all defects and equal to samples shall be submitted to and approved by the Engineer, supplied and fixed under guarantee by an approved firm of Specialists on a clean swept cement screed (screed elsewhere measured) to floors, all in strict accordance with the manufacturer's instructions.

10. IRONMONGERY

10.1 All ironmongery shall be of the best quality and shall be approved by the Engineer prior to fixing. All chromium plating shall be chrome on brass in accordance with SABS 728. All locks and furniture shall be in accordance with SABS 4. Allow for screws of corresponding material and for fixing complete including all mortices and for oiling and easing and protecting on completion. All damaged or scratched or defective ironmongery shall be replaced without charge.

10.2 Where a provisional sum is allowed for supply of ironmongery, "take delivery and fix only" shall mean take delivery, check all invoices against quantity and quality of

goods as ordered, check goods for damage, report any short-fall or damage, get in, store, open up, assemble as required and fix only to soft or hardwood with screws of corresponding metal. No scratched or damaged ironmongery will be accepted in the works.

10.3 Locks under the heading "en-suite"shall be made with each lock differing, each to pass a master and grand master key and shall be engraved with consecutive numbers, the keys shall be numbered to correspond with the locks, and each lock having two keys.

10.4 No two locks are to have interchangeable keys and all locks or night latches to have at least two keys.

10.5 Allow for stamping all locks with a distinctive consecutive number and with keys with a corresponding number to the lock which it controls.

11. CAST IRON AND WROUGHT IRON

11.1 Cast Iron shall be the best quality and approved before fixing; wrought iron shall be forged clean from the anvil and shall be sound and to have full threads to all screw work. All loose scale rust, dust, oil or coatings shall be removed before fixing.

11.2 MILD STEEL

11.2.1 Steel shall be mild steel of approved manufacture and rolling.

11.2.2 Welding may be done either in the workshop or on site, at the Contractor's convenience and discretion, by an approved method in accordance with SABS 044 Code of Practice.

11.2.3 Welding shall be done with 6mm fillet welds and shall be continuous unless otherwise described.

11.2.4 Wherever welding is carried out, the Contractor must make due allowance for rectifying any distortion of the steel and sheet iron members involved and for leaving all welds neat and smooth.

11.3 GALVANISED ARTICLES

11.3.1 Metalwork specified shall be galvanized shall, after fabrication and before leaving the manufacturer's works, be galvanized by the hot dip process in accordance with SABS 763.

11.3.2 Before being galvanized all surfaces of the metalwork shall be thoroughly cleaned in accordance with SABS 064 of all scale, rust, grease, oil and foreign matter by shot blasting or by pickling, and then fluxed ready for galvanizing.

11.3.3 The spelter, unless otherwise described, shall have a zinc content of not less than 98 percent and the mass of coating per 0,1m2 of surface area of the metal shall be not less than 53,4g (0,082mm).

11.3.4 The zinc coating shall be even and continuous over all surfaces including site welds, entirely free from bare spots, dull rough patches, blisters and other imperfections, shall show no signs of peeling and shall be uniform in thickness.

11.3.5 Any steelwork which requires site welding after galvanizing is to have welds touched up with an approved cold galvanizing paint.

11.3.6 If requested by the Engineer, the manufacturer shall carry out tests to prove that the requisite mass/thickness of zinc coating is applied and that it is of uniform thickness.

11.4 PRIMED ARTICLES

11.4.1 Steel windows, doors, door frames and other manufactured articles where not specified as- hot dip galvanized are to dip or spray primed with red oxide zinc chromate in accordance with SABS 909 before leaving the manufacturer's works.

11.5 STRUCTURAL STEELWORK

11.5.1 The structural steelwork, etc. shall be fabricated in accordance with the Structural Engineer's drawings and specifications. Any defective work shall be taken out and replaced at the Contractor's expense.

11.5.2 All materials and workmanship shall comply with SABS 1200 and SABS 0120 Code of Practice, the latest amendments thereto and all the relevant specifications therein.

11.5.3 The Contractor shall adhere strictly to the drawings supplied by the Engineers and Engineers and from these he shall prepare his shop details and other necessary drawings, which are to conform to the requirements of the British Standards Institution and shall be submitted to the Engineer for his written approval at least seven days prior to such approval being required. The Engineer shall have the right to call for additional revised details if they are of the opinion that the details submitted are inadequate. The Contractor shall be responsible for all dimensions and details on his shop drawings and must ensure the perfect fitting of all materials supplied. The approval of any details by the Engineer shall not relieve the Contractor from his responsibility for the correct fitting of all materials or strength of the materials.

11.5.4 The Engineer's written approval must be obtained before fabrication of the structural steelwork is commenced.

11.5.5 All steel, including rolled sections, plates, rivets and bolts shall be mild steel of approved manufacture and rolling and shall, as regards quality, method of manufacture, fabrication and workmanship, conform to the requirements of SABS 15 and SABS 449.

11.5.6 The material shall be of the best quality throughout, free from loose rust or milscale, true to thickness and profile throughout and of the section and mass specified subject to a 2,5%, tolerance of rolling margin.

11.5.7 The Engineer shall at all reasonable times have free access to the works where steel is being fabricated and to all places where materials for the work are being supplied and

shall be at liberty to inspect the work at all stages of manufacture and fabrication.

11.5.8 The standard of workmanship at the site and in the workshop shall be of the highest quality and shall comply with the best accepted practice in the industry.

11.5.9 The edges of all rolled sections shall be true and fair and full profile throughout. The edges of all plates, gussets and similar small parts where sheared shall be perfectly straight and fair. The whole surfaces of all faces which are riveted or bolted together shall be in close contact. The ends of all joists and beams shall be truly square. The stanchion bases shall be machine square for welding to base plates with full fillet welds. Contact surfaces shall be clean and free from burrs, rusts, grease, paints or other forms of foreign material.

11.5.10 Holes shall be accurately drilled to a template. Burrs and arises shall be removed from the edges of holes before the work is assembled.

Wherever possible holes shall be drilled through all thickness in one operation. The diameter of holes for bolts shall not exceed the diameter of the bolt by more than 1,5mm.

11.5.11 The accuracy of all holes shall be such that when the work is assembled, the steel gauge of 0,8mm less diameter than the hole can be passed through irrespective of the number of plates. Drift pins shall only be used for bringing the work together and no drifting enlargement of any holes will be allowed.

11.5.12 Bolts shall have well-formed heads forged from the solid. Nuts shall closely fit the bolts so that they can only just be turned by hand and at least one clear thread shall project beyond the nut when fully tightened. All bolts shall have one washer under the nuts and shall be so tightened that the threaded portion does not bear on the members connected. Where bolt beads or nuts bear upon beveled surfaces they shall be provided with tapered washers of 2,3mm mean thickness to provide a seating square with the axis of the bolt.

11.5.13 Where holding down bolts, etc.shall be embedded in concrete theyshall be fixed in their individual exact positions. Any costs incurred by subsequent repositioning of bolts, etc. resulting from the incorrect setting will be for the Contractor's account.

11.5.14 Where high strength friction grip bolts are specified the Contractor shall submit to the Engineer, for his approval, details of the systems he proposes to use to check the achievement of the specified tensile load in the bolt, together with the name of the manufacturer of the bolts.

11.5.15 Studs of an approved manufacturer shall be used as shear connectors. Studs shall be automatically end welded in the shop or site to centres as shown on the drawings. All stud welds shall be made in strict accordance with the recommendations of the manufacturer.

11.5.16 All riveted componentsshall be thoroughly primed and tightly drawn together with bolts before any riveting is commenced. Only drilled holes will be permitted for rivets and under no circumstances may holes be punched.

11.5.17 All welding shall comply with the requirements of SABS 044. The length and the size of all welds shall be in accordance with the approved shop drawings or as specified by the Engineer. Only skilled operators shall be employed on welding, and welded samples shall be submitted for testing if required.

11.5.18 The surfaces shall be welded and the surrounding metal for a distance of at least 12,5mm shall be cleaned and free from rust, scale, paint or other forms of foreign material. Fusion faces may be cut by shearing, clipping, machining or machine gas cutting. If the fusion face is rough, it shall be ground smooth before welding.

11.5.19 The Engineer shall be at liberty to select test pieces from steelwork in the workshop or on the site and to have them tested; the expense of such tests shall be borne by the Contractor if the steelwork does not comply with standards laid down above.

11.5.20 The Engineer will specify the structural sections shall be used. No substitution of the structural sections shown on the working drawings may be made without the Engineer's approval.

11.5.21 All steelwork shall be fabricated to an accuracy so as to enable erection to the specified tolerances to take place without introducing permanent erection stresses into the structure.

The following fabrication tolerances shall apply:-

Deviation from line of any edge or surface	1 in 1 000 but not more than 6mm
Length of member	± 3mm
Distance between bolt or rivet holes and/or	± 1mm between any holes or
Welded connection	connections in the member
Machined surfaces	± 0,025mm

11.5.22 The Contractor shall ensure that all precautions of safety and stabililty of the steelwork during erection and is to ensure that all steelwork is set in the exact position both horizontally and vertically as indicated on the Engineer's drawings.

11.5.23 The Contractor shall expedient to erect any of the individual structural units in section, he must obtain the Engineer's written approval of the position of the joints in the unit and the details of the splicing, etc. he intends using.

11.5.24 Steelwork shall be fireproof or encased in concrete. shall not be

11.5.25 Steelwork shall be painted, before leaving the works of the manufacturer. The steelwork shall be thoroughly cleaned, free from scale, rust, oil, grease or other deleterious matter and all surfaces, including concealed surfaces, shall be given one coat of primer complying with SABS 312, Type II Grade I, brushed on to a minimum thickness of 0,025mm. After erection has been completed all unpainted steelwork at site connections shall be primed as specified above, and thereafter the steelwork shall be carefully examined and any paintwork that has been damaged during delivery and erection shall be touched up with primer as specified above.

11.6 PRESSED STEEL DOOR FRAMES

11.6.1 Pressed steel door frames shall be in accordance with SABS 1129 and shall be manufactured from mild steel sheet, 1,6mm thick, for single rebated and 1,2mm for double rebated. Rebate sizes shall be suitable for standard timber doors 40mm or 45mm thick unless otherwise described.

11.6.2 Head and jamb members shall be accurately bent to form the profile. Corners shall be mitred and welded and also reinforced with l,6mm steel angles. Transoms for fanlights shall be let into the jambs and all joints welded solid. Welds shall be cleaned off flush, leaving a perfect outside finish. Each frame shall be provided with a pair of sturdy channel section tie bars, welded below the frame. Where required for additional strength, cross struts of the same section shall be welded between and at right angles to the main ties. Adjustable 230mm corrugated lugs shall be supplied with every frame. All frames shall be thoroughly cleaned, free from rust, scale, grease, etc. and painted one coat oxide primer before dispatch and shall be carefully protected in transit and during erection from twisting, dents and distortion.

Fittings: - Each frame for single side-hung doors shall be provided with the following:-

(a) One pair 102mm 5-Knuckle loose pin steel hinges, with 3-Knuckle leaf welded securely into the frame.
(b) One adjustable strike plate with mortar guard, suitable for mortise locks of approved manufacture.
(c) Three rubber shock absorbers in rebate of lock jamb.

Each frame for double doors shall be provided with the following:-

Two pairs 102mm 5-Knuckle loose pin steel hinges, with 3-Knuckle leaf welded securely into the frame.

11.7 PRESSED STEEL CUPBOARD FRAMES

11.7.1 Pressed steel cupboard frames shall be as above described for door frames of 1,6mm mild steel sheet, having rebate for doors and fitted with transom and/or mullions where required and unequal threshold channels providing dust resisting rebates and allowing doors shall be taken down to general floor level with floor level of cupboards not less than 12mm above general floor level. Jambs shall be 216mm girth, mullions and transoms 209mm girth. Three corrugated offset building-in lugs shall be provided to each jamb of

frames without transoms and four to each jamb of frames with transoms. One pair of 102mm steel hinges shall be provided for each door or each leaf of each double door and one pair of 76mm steel hinges to upper doors. Frames shall be prepared for locks and for bolts to and all first closing leaves. Frames shall be cleaned and primed one coat red oxide primer before leaving the manufacturer's works unless described as hot dipped galvanized.

11.8 STEEL WINDOWS AND DOORS

11.8.1 Steel windows and steel doors shall be in accordance with SABS 727 and in addition shall comply with the following requirements:-

11.8.2 Side hung and vertically pivot hung sashes shall open to at least 90 degrees, horizontally pivot hung sashes to at least 80 degrees and bottom hung sashes to 30 degrees.

11.8.3 Sashes hung at side to open out in windows above ground floors and not accessible externally shall be hung on cleaning hinges.

11.8.4 Industrial type windows shall be glazed from the inside and all other windows from the outside.

11.8.5 Suitable weather bars shall be provided where necessary to render the windows and doors perfectly watertight.

11.8.6 Frames of windows and doors where fixed to concrete shall be provided with suitable lugs or screw holes for screwing to plugs at the same intervals as the standard fixing lugs.

11.8.7 Windows, doors and components shall be primed with red oxide before leaving the manufacturer's works, unless described as hot dipped galvanized. Windows and doors, unless otherwise specified, shall be of "One Piece" construction; those which shall be in more than one unit shall be joined with standard mullion/s and/or transoms and Allow for same. After the windows and doors have been built in and before glazing they shall be overhauled, adjusted and left in good working order.

11.8.8 Windows and school type windows of residential sections shall be constructed of standard 25mm steel sections not less than 3mm thick. Side top and bottom hung sashes shall be hung on steel hinges with brass pins and washers. Side hung open out casements to have brass two-point handle engaging with brass striking plate and brass sliding stay. Side hung open in casements to have brass single point handle engaging with steel hook striking plate and brass sliding stay. Top hung open out vents to have brass peg stay, steel peg and locking bracket.

11.8.9 Bottom hung open in vents to have brass spring catch, steel spring catch plate and steel concealed side arms with brass guides. Horizontally pivot hung vents to have brass adjustable friction ring centers, brass spring catch for long arm or hand operation, steel spring catch plate. Projected out vents to have spring loaded brass shoes at head sliding in brass guides, steel concealed balance side arms and brass casement handle at cill engaging with brass striking

plate. If so specified, ring handles for long arm operation shall be fitted.

11.8.10 Windows shall be constructed with main frames of 35mm steel sections not less than 3mm thick and supplied with separate lugs, clips, bolts and nuts as required for fixing to brickwork, concrete or steelwork. Sashes shall be of standard 25mm sections with metal not less than 3mm thick. Hinges, friction pivots, spring catches and keeps and concealed friction slide arms shall be as before described.

11.8.11 Windows constructed of Universal Sections shall be not less than 33mm wide (measured over one opening section only) and not less than 4mm thick with all sight lines maintained (whether sashes are fixed or opening) and with all glass in the same plane and with outside legs of frames longer than inside legs. Side, top and bottom hung sashes shall be of steel hinges with brass pins and washers and horizontally pivot hung sashes shall be hung on brass adjustable friction ring centers and have brass spring catch for long arm or hand operation and steel spring catch plates. Vertically pivot hung sashes shall be hung on locking friction pivots.

Fittings shall be of brass with casement fasteners to outward opening sashes having two point noses engaging on a bevel plate on fixed frame and approved sliding stays. Casement fasteners to inward opening sashes having single nose engaging in staple on fixed frame and approved spring catches and keeps and fanlights stays and fasteners.

11.8.12 Stock and purpose made doors, side lights and fanlights shall be constructed with doors of Universal Steel sections not less than 29mm wide and not less than 4mm thick and side lights and fanlights of 25mm steel sections not less than 3mm thick. Each leaf of double door and each single door shall be hung on three steel hinges with brass pins and washers and shall be of parliament type where frames are set back from wall face and doors are shown to fold back against wall face.

11.8.13 Fittings shall be brass with three lever mortise locks and heavy lever handles and bolts. Fanlights and side lights shall be hung and fitted as described for windows.

11.8.14 Bottom openings in doors and side lights shall be fitted with kicking plates of 1,6mm mild steel sheet fixed with metal beads.

Frames of outward opening doors shall be fitted at bottom with sills of door framing section (stepped sills) and of inward opening doors with metal ties, welded to frames, for embedding in thresholds.

11.8.15 Where windows are described as fitted with burglar bars, unless otherwise described these shall be standard pattern formed of 5 x 19mm flat section bars, spaced vertically and horizontally to follow the line of the glazing bars, riveted together at all intersections and to window frames.

11.8.16 Where so required shall be of approved design constructed with frames of rolled steel or other approved material. shall

be detachable and fitted with 0,315 x 1mm aperture (or finer mesh) bronze cloth and shall be complete with all necessary fittings. The wire shall be secured with steel split tube, designed so that the mesh may be easily replaced. Frames of windows shall be prepared for fixing the screens.

11.8.17 Built-up windows shall be procurable in one piece construction coupled with standard type coupling mullions and transoms to conform to the windows sections used and to the Engineer's details.

11.8.18 The sizes given are approximate and not shall be used for ordering purposes, but reference must be made to detailed drawings for exact sizes. All dimensions should be checked before any work is put in hand and the Engineer's attention should be drawn to any discrepancies. Any errors in these respects will be at the Contractor's expense.

11.8.19 Windows, where so specified, shall be hot dipped galvanized with a minimum coating of zinc with a mass not less than 650g/m2 complying with SABS 763 and to the Engineer's satisfaction.

11.9 BRASS

11.9.1 Brass work shall be constructed of solid sections to the size and profile indicated.

11.9.2 All brass sections shall be brazed together where required.

11.9.3 All brass surfaces shall be cleaned free of blemishes, semi-polished by bolt-sanding, and the corners disc-ground.

11.10 ALUMINIUM AND ANODISED ALUMINIUM

11.10.1 Sections shall be manufactured by an approved manufacturer in accordance with SABS 1476/HE 9 and of required standard sizes and profiles. Unless otherwise described all sections shall be mill finished.

11.10.2 Sheets and strips shall be of 2S, ½H or M575 alloys in accordance with SABS 1470/SIC and 1470/NS4.

11.10.3 All surfaces, specified as anodized shall be treated with a 180 (maximum) grit emery abrasive to give a soft, uniform surface.

11.10.4 The frames, etc., together with any exposed screws shall be anodized by the sulphuric process to a minimum average thickness of 25 microns in strict accordance with SABS 999 for Grade AA25 anodic coating to a natural colour. Samples showing the colour of the anodizing proposed shall be used shall be submitted to the Engineer for approval prior to the work being commenced. Before leaving the manufacturer's works, all surfaces shall be treated with a coat of clear "Methacrylic" lacquer and suitably packed and protected for safe transportation.

11.10.5 The Contractor shall provide all samples required for testing in accordance with the aforesaid Specification. If required, tests on the anodic coatings shall be carried out at the works of the anodize to verify that the work conforms to SABS 999.

11.10.6 Joints shall be mechanically joined in accordance with the best practice. Assembly screws and bolts shall be stainless steel and fixing screws cadmium plated.

11.10.7 Anodized aluminium work must be erected as near to the end of the contract period as possible, to minimize the danger of damage or deterioration. Where ends of aluminium are built in, they shall be coated with one coat zinc chromate primer.

11.10.8 All anodized aluminium must be protected against damage by covering with temporary casings (masking tape, plastic coatings, etc.) and against deterioration or discolouration caused by mortar droppings, wax, paint, etc. all to the entire satisfaction of the Engineer. On completion all such protection shall be removed and work cleaned down and left in proper working order. All aluminium so damaged, deteriorated or discoloured must be replaced at the Contractor's expense.

11.11 ALUMINIUM DOOR FRAMES

11.11.1 Frames shall be manufactured of extruded aluminium sections in No. 50 SWP alloy anodizing quality or epoxy powder coated finish to approved colour.

11.11.2 The frames shall be of approved single or double rebated profile of appropriate width to suit the thickness of the particular walls and of sizes to suit the dimensions of doors required in accordance with SABS 1202.

11.11.3 Each frame is to consist of head, hinged jamb, lock jamb and base ties, the whole rigidly fixed by mechanical means into a complete and truly square unit.

11.11.4 The base ties are to consist of two flat bars fixed within the limits of the profile and flush with the bottom edge of jambs, which are to project not more than 40mm below the finished floor level.

11.11.5 The workmanship shall be of first quality and the profiles shall be perfectly straight and free from twists, hammer marks, scratches and other imperfections.

11.11.6 Three long stainless steel lugs each drilled and tap screwed with non-magnetic stainless steel screws to back of frames shall be provided to each jamb of frames.

11.11.7 All hinges shall be of extruded anodized aluminium alloy with non-magnetic stainless steel hinge pins and anti-friction nylon bushes.

11.11.8 The one leaf of the hinge must be inserted into the frame and securely screwed with countersunk-headed non-magnetic stainless steel set screws.

11.11.9 Two hinges shall be provided for doors not exceeding 1 000mm wide and three hinges for doors exceeding 1 000mm wide.

11.12 ALUMINIUM WINDOWS

11.12.1 Windows shall be first quality and of approved make and design, properly straightened, free from hammer marks, rolling flaws or other imperfections, truly squared and prepared to receive putty glazing from the outside in accordance with SABS 1202. Joints between similar extruded sections shall be welded by electric butt welding. Joints between dissimilar extruded sections, sheets and strips shall be welded by argon tungsten arc welding. Welding shall be executed in such a manner as not to affect the colour of the material. Screw or bolt fixing shall be kept to a minimum and will be permitted only where welding is impractical. Where screws or bolts are required, fixing shall be with stainless steel screws or bolts with raised heads.

11.12.2 All opening portions must fit perfectly on all faces and be so hung as to open and close freely without binding at any point. All corners shall be solidly welded by argon tungsten arc welding and neatly cleaned off.

11.12.3 The fittings for all opening parts shall be substantial and of solid material to match the windows or doors in all respects.

11.12.4 All opening casements shall be hung on a pair of stainless steel butts with stainless steel pins, nylon bushes and stainless steel washers. Side hung casements are to have fasteners and sliding stays and top hung ventilators to have peg stays.

11.12.5 All leaves of doors shall be hung on one-and-a-half pairs of 102mm stainless steel butts with non-magnetic stainless steel pins, anti-friction nylon bushes and stainless steel washers. Single doors shall be fitted with approved 76mm 3-lever upright or sash mortise lock with pressed steel case finished baked enamel, flat stainless steel fore-end and striker size 152 x 25mm and set cast brass lever furniture of approved design with satin chrome finish; double doors shall be fitted with 76mm 3-lever rebated mortise lock set and set lever furniture as above and one pair of 150mm chromium plated barrel bolts and keeps. Locks shall be supplied with two keys and each key provided with a stamped brass or plastic identification disc and split ring.

11.12.6 Unless otherwise described frames shall be suitable for brick or concrete reveals and shall be fitted with manufacturer's standard type stainless steel fixing lugs, not less than 3 x 19 x 150mm long, screwed to frame with set screws, placed one near each corner and intermediately not more than 750mm apart to sides, top and bottom, and where to concrete reveals or wood sub-frames shall be countersunk holed for wood screws, one near each corner and intermediately not more than 750mm apart to sides, top and bottom.

11.12.7 After windows and doors have been delivered to the site, they shall be thoroughly overhauled and all necessary adjustments or repairs made before they are fixed in position. Windows and doors shall be placed in their positions for building in and adjusted to open and close properly and shall be securely strutted to prevent distortion whilst the brickwork and lintels etc. are being built.

11.12.8 After fabrication all exposed surfaces shall be treated with a 180 (maximum) grit emery abrasive to give a soft, uniform surface.
The units, fittings, etc. together with any exposed screws shall be anodized by the sulphuric process to a minimum average thickness of 25 microns in strict accordance with SABS 999 for Grade AA25 anodic coating to a natural colour. Samples showing the colour of the anodizing proposed shall be usedshall be submitted to the Engineer for approval prior to the work being commenced. Before leaving the manufacturer's works, all surfacesshall be treated with a coat of clear "Methacrylic" lacquer and suitably packed and protected for safe transportation.

11.12.9 On completion of all other works, windows and doors shall be adjusted as necessary and rendered in a complete and satisfactory state of repair and in working order and left perfectly clean and free from all plaster, putty or other marks.

11.12.10 Windows shall be manufactured of approved aluminium sections measured 25mm over one opening section and not less than 3mm thick.

11.12.11 Doors shall be manufactured of approved aluminium sections measured 33mm over one opening section and not less than 5mm thick.

11.13 ALUMINIUM HOLLOW SECTION WINDOWS

11.13.1 Main frame and sash members shall be of hollow (tubular) sections suitable for weather-stripping.

11.13.2 All corners of frames and sashes shall be mitred and electrically flash-welded, electronically controlled to provide integral frame sections of uniform strength.

11.13.3 Mullions and transoms shall be argon-arc welded (concealed) at their intersections and their joints to the frames.

11.13.4 Sashes shall be weather-stripped with water-repellent silicone treated woven pile or approved stripping around perimeter of sash.

11.13.5 Hinges and fittings shall be as previously specified for Residential, Industrial and Medium Universal Windows.

11.14 ALUMINIUM SINGLE SASH HORIZONTAL SLIDING WINDOWS

11.14.1 Main frame and sash members shall be of extruded aluminium sections.

11.14.2 Frame and sash members shall have corners neatly fitted to hairline joints, weather tight and securely connected with 18/8 stainless steel self tapping screws into integral parts. Provision shall be made in the sill members for exterior drainage of water. Sashes shall be weather-stripped with water-repellent silicone treated woven pile or other approved stripping around perimeter of sash. Sashes shall

have night ventilation lock position and shall not be removable from the outside when locked in the closed or night ventilation positions. Additional arrangements for ventilation shall be provided to give full protection against inclement weather when the sashes are closed.

11.14.3 All sliding sashes shall be fitted with catches, finger pulls and nylon ball-bearing rollers.

11.15 ALUMINIUM HORIZONTAL SLIDING DOORS AND FIXED LIGHTS

11.15.1 Main frame and leaf members shall be of extruded aluminium alloy sections.

11.15.2 Where required transom and mullions shall be furnished in conformity with the design and construction of the frame members.

11.15.3 Frame shall be mechanically joined by means of two wide connectors at each corner so as to form rigid joins. Provision shall be made in sill for exterior drainage of water.

11.15.4 Leaf members shall be securely and rigidly joined at corners by means of special spigots and 18/8 stainless steel self tapping screws. Sliding leaves shall not be removable from the outside when in a closed and locked position.

11.15.5 The frame members and meeting stiles shall be weather-stripped with water repellent-silicone treated woven pile weather seal strips, so as to form weather-tight joints around the sash perimeter.

11.15.6 All sliding leaves and fixed lights shall be designed for clip-on beads glazing to receive glass up to 10,5mm maximum thickness.

11.15.7 All door leaves shall be fitted with door pulls, tamper-proof cylinder locks and nylon ball-bearing rollers. The lock bolts shall automatically retract on contract with jamb if door is closed with bolt in locked position, thus incorporating a safety factor for the prevention of damage or accidental lock out.

11.16 ALUMINIUM ENTRANCE DOORS AND FIXED LIGHTS

11.16.1 Main frames shall be of extruded sections and mullions and transom shall be of hollow (tubular) sections in conformity with the design and construction of frame members.

11.16.2 Door framing shall be of hollow (tubular) sections and bottom rails shall be not less than 150mm high to provide integral kicking plates and matching hollow sections kicking plates shall be continued to fixed side lights.

11.16.3 Where doors are hung to floor springs the locking and hanging stiles shall be slightly rounded and the framing shall have appropriate concave faces to accommodate same.

11.16.4 Frame shall be mechanically joined or welded and corners of door leaves shall be of concealed welded construction.

11.16.5 The mullions and transoms shall be welded at their intersections and their joints to the frames.

11.16.6 Door leaves shall be hung on heavy aluminium butt hinges incorporating ball bearings and nylon bushed stainless steel pins or they must be fitted with single or double-action concealed overhead spring hinges and bottom pivots if so specified.

11.16.7 The meeting stiles shall be weather-stripped with water-repellent silicone treated woven pile or other approved weather seal strips.

11.16.8 All doors shall be fitted with heavy door pulls of modern design not less than 300mm long on both faces of doors. Double doors shall be fitted with concealed flush bolts to one leaf and double cylinder master key mortise deadlock.

11.17 ALUMINIUM ADJUSTABLE LOUVRES

11.17.1 Adjustable louvers shall be of the manufacture specified with aluminium framing, aluminium glazing beads, operating gear and neoprene seals, etc.

11.17.2 Adjustable louvres to have toggle operators operating banks of not more than 12 blades per operator. Blades shall be clear float, obscure or Georgian-wired rough cast glass as described, polished all round.

12. PLASTERING

12.1 MATERIALS

12.1.1 Shall be Portland Cement complying with the requirements of SABS 471. No blast-furnace cement will be permitted for any work under this Trade.

12.1.2 SAND. Sand is to comply with the requirements for fine aggregate as SABS 1083, washed when necessary and screened through a 1,18 to 2,36mm sieve.

12.1.3 Water shall not contain impurities or be used in detrimental proportions to the type of work being executed.

12.1.4 Lime shall be best quality plasterer's lime and shall be slaked and run at least four weeks before being used.

12.1.5 Plaster or paving described as waterproofed shall have "Drikon" liquid, "Blue Circle" or other approved, waterproofing compound added in strict accordance with the manufacturer's instructions.

12.1.6 Before any plastering or paving is commenced, the surfaces shall be cleaned down to remove grease spots, concrete laitance, etc. wire brushed and well watered. Joints of brickwork shall be raked out.

12.1.7 Each coat of plaster shall be approved by the Engineer before the next is applied. All plaster shall be finished to even surfaces, in accordance with the sample approved by the Engineer, and free from tool-marks. Unless otherwise described, all external plaster shall be finished with a wood

float and all internal plaster shall be finished with a steel trowel.

All salient angles shall be rounded to 6mm radius. Finished surfaces shall be protected from injury and cement plaster shall be kept damp until properly set. Cement plaster shall be mixed in small batches and used within 30 minutes after mixing.

12.1.8 Where the plastering is on concrete the surfaces must be steel brushed pure cement washed and slushed with 2.1 cement grout before plastering to ensure a good key.

Where plastering is on soffits of composite slabs, Allow for any dubbing out necessary to eliminate unevenness.

12.1.9 If steel or other forms of smooth shuttering and formwork is used by the Contractor for concrete and the finished surface becomes excessively smooth and, in the opinion of the Engineer not able to provide sufficient "key" when treated as above prescribed, the Contractor will be required to apply an approved "Plasterkey adhesive", or other patent solution to such surfaces at his own expense in order to ensure that the plaster finish will not separate from the concrete.

12.1.10 Tolerances for finished surfaces of screeds and granolithic shall be 3mm in 3 000mm and of plaster to walls 6mm in 3 000mm.

12.1.11 Thickness of plaster shall be not less than 13mm or more than 20mm in thickness; on concrete ceilings and beams not less than 10mm or more than 15mm in thickness, unless otherwise directed.

12.1.12 Mouldings, weathering, etc. shall be run to full size details and allowance shall be made for mouldings, etc. for dubbing out forming templates, runners, etc. for forming mitres and clean and sharp arises. Where sizes of mouldings, etc. are given the projections refer to the distance beyond the general plaster face.

12.1.13 All cracks, blisters and other defects shall be carefully cut out and made good and the whole of the plaster work shall be left in perfect and clean condition on completion.

12.1.14 Allow for all square and coved internal angles at junctions of plaster at walls and ceilings.

12.1.15 All plaster, etc. shall be temporarily but properly protected where necessary against damage.

12.1.16 Screeds shall be composed of one part cement and four parts fine river sand of dolerite or other approved origin, steel floated to true, even, level and fine-textured finish suitable to receive finish specified.

12.1.17 All screeds to receive vinyl or other similar floors, to have semi-granolithic finish, (cement sprinkle and steel floating) in accordance with instructions of and to the entire satisfaction of the flooring specialists.

12.1.18 Screeds shall be laid without air holes, and shall be level, smooth and free from trowel marks and shall be sufficiently hard to withstand the lifting and relaying of tiles without deterioration. The greatest care shall be exercised in laying of the screeds to avoid the use of old cement, incorrect proportioning of ingredients, excessive water, sand other than that specifically approved by the Engineer, bad trowelling, insufficient during, etc. and the Engineer may insist upon samples of the screeds being laid for testing and approval before the floor screeding is commenced.

12.1.19 Adequate temporary lighting must be provided when necessary to ensure that workmen avoid the appearance of trowel marks on the surface of the screeds.

12.1.20 The cement-sand mix must be fresh; the water content at a minimum and all laying except for successive trowelling or floating must be completed within 30 minutes of adding water to the dry mix.

12.1.21 Initial leveling and successive working of the top surface shall be by wood float, but the final surface must be formed by steel trowelling. The finished screed shall be level and have just sufficient roughness to ensure the bonding of the adhesive to both tile and screed.

Note: The screeding to floors shall be done as early as possible in order shall be perfectly dry before the floor finishes are put down, and shall be protected with 25mm thickness of sand until the floor finishes shall be laid.

12.2 GRANOLITHIC FINISH

12.2.1 The granolithic work shall be carried out by experienced workmen and shall be laid in panels not exceeding 9m2 in areas with a small V-joint between panels and lined out into smaller panels as directed with sunk V-joint. Thin strips of wood, bituminous sheeting or other suitable material shall be laid between the panels to break contact. The consistency of the granolithic shall be kept as dry as practicable.

12.2.2 Float up to within 6mm of finished surface with concrete composed of one part cement, one and a half parts approved clean sharp sand (as described in paragraph 10)and three parts clean granite chippings or other approved hard stone of maximum size of 12mm.

12.2.3 Form finished surface with one and a half parts fine granite chippings or other approved hard stone or coarse washed sand (as described in

12.2.4 Paragraph 10) graded up to particles which will pass a 5mm mesh to one

12.2.5 Part cement brought up to a true smooth and even surface with a steel float.

12.2.6 If practicable the floating coat shall be laid before the concrete floor is allowed to set. The floating and finishing coats of granolithic shall be performed in one operation.

12.2.7 All granolithic work shall be protected from injury from rain or other extreme weather for 72 hours after being laid and against too rapid drying whilst hardening by being covered with wet sacks and protected from injury and discolouration during the progress of the work.

Edges of margins, etc., shall be protected by fixing temporary wood strips, which are to remain in position until the commencement of the laying of the adjoining flooring material.

12.2.8 Where described as hardened, the lower coat shall be floated up to within 13mm of the finished surface and the topping coat shall be 13mm thick and have "Durogran" mixed in at the rate of 9,5kg of "Durogran" per 50kg of cement used and trowelled up to a smooth hard surface, all in accordance with the manufacturer's instructions.

12.2.9 Where granolithic is described shall be tinted, the requisite quantity of approved colouring pigment shall be mixed with the finishing coat. No dusting on of colouring material will be allowed.

12.3 LIME PLASTERS

12.3.1 Lime plaster for one coat work shall be in the proportion of three parts sand to one part plaster lime. For two coat work the rendering coat of plaster shall be in the same proportion and the setting coat shall be white lime putty run through a fine sieve into a clean receptacle where it is to remain until of a correct consistency for use and shall be mixed for use in the following proportions:

0,03m^3	of white lime putty
0,03m^3	of fine washed sand of approved quality
0,50kg	of Plaster of Paris

12.3.2 The Plaster of Paris is not shall be added to the mixture until immediately before the setting coat shall be applied and is then shall be thoroughly incorporated in the mixture.

12.3.3 The rendering coat shall be in the proportion of three parts of sand to one part of white lime mixed with sisal in the proportion of 0,50kg of sisal to 0,06m3 of mixture. Before being used the lime plaster is to have 10% cement thoroughly mixed in with it and shall be mixed in such quantities that can be used before commencing to set. No lime plaster mixed with cement that has once commenced to set will be allowed shall be used. The floating coat shall be in the same proportion of sand, lime and cement as the rendering coat.

12.3.4 Expanded metal lathing for plaster work shall be of 0,63mm thick steel of 10mm mesh and 3mm strands and shall be fixed with the long way of mesh across bearers. The metal lathing to comply with British Standard Specification No 405 of 1930. Ends of sheets shall be lapped and the joints staggered.

12.4 CEMENT PLASTER

12.4.1 Cement plaster to walls shall be in the proportion of four parts sand to one part cement for external work and five parts sand to one part cement for internal work, unless otherwise described. Cement plaster to concrete ceilings and beams, etc., shall be a rendering coat in the proportion of three parts to one part cement. Where a setting coat is described for internal work it shall be composed of one part cement, two parts white lime putty and one part fine washed sand.

12.5 COMPO PLASTER (LIME PLASTER WITH CEMENT ADDED)

12.5.1 Compo plaster shall be composed of five parts of sand to one part of plaster lime, mixed as before described. One part of cement shall be added to ten parts of the mortar immediately before use, with the addition of extra water. This plaster mortar shall be prepared in small batches and no mortar which has once commenced to set will be allowed shall be used.

12.6 FINE ROUGH CAST PLASTER

12.6.1 Fine rough cast plaster formed with an undercoating of five parts sand to one part cement brought to a smooth and even finish with a wood float and finishing coat composed of three parts sand to one part cement with fine 6mm stone chippings mixed in and dashed against the undercoating before the latter has finally hardened with a "Tyrolean type" machine to produce a fine rough cast surface of uniform texture.

12.6.2 Special plaster shall be composed of backing coat of 4.1 cement plaster finished with a wood float and a setting coat 3mm thick of "Glastone" finishing plaster mixed in accordance with manufacturer's instructions and finished smooth and free from trowel marks and all blemishes. The backing coat is to take up its set and dry out before the setting coat is applied and only sufficient water shall be added to induce suction.

12.6.3 Cretestone plaster shall be applied in two layers in strict accordance with manufacturer's instructions to a total thickness of approximately 6mm, the second layer shall be applied when the first layer has stiffened, but before it has set and steel trowelled to a fine, smooth, hard and almost glossy surface.

12.7 VERMICULITE PLASTERS

12.7.1 The vermiculite content of the aggregate shall conform in all respects to SABS 794. The aggregate shall be delivered to the site in sealed bags marked with the manufacturer's name, the name of the product and the SABS mark.

12.7.2 Where plaster shall be applied by spraying, all areas not shall be plastered must be properly masked using polythene and masking tape, or other approved means of protection.

12.7.3 On new board ceilings constructed of asbestos, plasterboard or other ceiling board material, cover the joints with a 50mm wide strip of copper mesh securely tacked on each side of the joints. If the ceiling shall be sprayed, apply one coat of plaster by hand over the joints ensuring that scrim is covered, and feather the edges of the plaster flush with the ceiling material.

12.7.4 Where a spray application of plaster is required, two classes of finish may be obtained, either "off-shutter" or "smooth".

12.7.5 In "off-shutter" finish no preparation other than the treatment of oil with approved bonding material and filling of holes as above described is necessary.

12.7.6 In "smooth" finish, in addition to the treatment of oil and holes, remove any ridges in the concrete that may occur at joints in shuttering and fill any indentations and unevenness in the concrete surface by applying one coat of plaster by hand, trowelled to a smooth and even surface.

12.7.7 Acoustic vermiculite plaster shall be supplied by Mandoval Vermiculite (Pty) Ltd, or any other firm specializing in pre-mixed pigmented vermiculite plaster aggregates. The plaster shall be mixed in batches to a proportion of 23 litres of pure clean water to each 14kg bag of aggregate. The amount mixed shall not exceed that which may be applied within a period of 45 minutes. Any plaster mixed and not used within this period shall be discarded. The application of plaster by spraying shall be carried out by approved Specialists using a spray gun operating at a pre-determined pressure. In the spraying of surfaces a minimum of 5 coats shall be applied as follows: First coat evenly over the whole surface to give coverage of 75%. The remaining coats shall be applied when the plaster from the preceding coat has set.

12.8 IN-SITU TERRAZZO – FLOORS

12.8.1 Terrazzo shall be of the thickness required to finish flush with adjoining floor finishing and shall be executed in the following manner:-

12.8.2 The paving shall be divided into panels of shapes and sizes shown on drawings with dividing strips set into the screed whilst still in a semi-plastic state. Unless otherwise specified, the dividing strips shall be of brass, not less than 1,6mm thick and of width to suit the thickness of the floor finish and shall be of approved pattern to bond with the screed or holed and fitted with galvanized wire dowels 25mm long at 305mm centres.

12.8.3 The terrazzo finish shall be 16mm thick, composed of South African marble chippings in sizes from 1,5mm to 10mm of approved colours, graded to obtain the greatest weight in a given volume and mixed in the proportions of 1kg of chippings to 0,5kg of Snowcrete, Medusa or other approved white cement tinted to approval, first mixed dry and then water added to make a plastic mixture, which shall be applied to the floors trowelled and rolled until all superfluous water has been extracted.

The procedure of rolling shall be continued until approximately 85% of free marble aggregate will show after polishing.

12.8.4 The floors shall then be cured for a period of at least six days by being covered with a 25mm thick layer of clean sand which shall be kept moist during this period.

12.8.5 After curing, the sand shall be removed and the floor washed and traversed with abrasive machines with the various grades of abrasive, by means of the wet process, and then given a light grouting of neat cement, of the same colour as the matrix, to fill all voids. The grout shall remain until the time of final polishing.

12.8.6 Terrazzo floors specified shall be rendered non-slip shall have an approved abrasive aggregate incorporated in the finish at the rate of 1,63kg per 1m2 of floor area. The aggregate shall be of the requisite colour and type and shall be evenly sprinkled on the floor and worked in.

12.8.7 The terrazzo shall be of the colour specified and to match a sample piece submitted to and approved by the Engineer before the work is put in hand. The marble chips shall be of the appropriate colour and the cement shall be white, black or tinted as required to produce the correct colour of terrazzo.

12.8.8 The floors shall be covered up and protected from injury, stains, etc. until all other work is completed.

12.9 POLISHED IN-SITU TERRAZZO – WALLS

12.9.1 Terrazzo shall, unless otherwise specified, be of a total thickness of not less than 13mm or more than 19mm and shall be carried out in the following manner:-

12.9.2 The walls shall be well wetted and provided with a suitable key by means of galvanized wire nails driven in at maximum 300mm centres both ways and screeded up to within 7mm of the finished surface with one to three cement plaster finished to a true and even surface and well scratched over to form a key for the terrazzo finishing.

12.9.3 Where described as "on concrete surfaces" Allow for providing a suitable key by means of bush hammering and the use of galvanized wire nails driven into the concrete at maximum 300mm centres both ways or other approved method.

12.9.4 The walls shall be divided into panels with dividing strips set into the screed as described for floors and finished with a 7mm thickness of terrazzo composed of South African marble chippings in sizes from 1,5mm to 10mm of approved colours, graded to obtain the greatest weight in a given volume and mixed in the proportions of 1kg of chippings to 0,5kg of Snowcrete, Medusa or other approved white cement tinted to approval, first mixed dry and then water added to make a plastic mixture, which shall be applied to the walls, trowelled and rolled until all superfluous water has been extracted.

The procedure of rolling shall be continued until approximately 85% of free marble aggregate will show after polishing.

12.9.5 The terrazzo shall be protected against too rapid drying and, when sufficiently hardened, shall be ground or rubbed down with abrasives by hand or machine by the wet process and given a light grouting of neat cement to fill any voids as described for floors and, after the grouting coat has set, finally polished until the finish is in a condition acceptable to the Engineer.

12.9.6 The terrazzo shall be of the colour specified and to match a sample piece submitted to and approved by the Engineer before the work is put in hand. The marble chips and cement shall be of colour required to produce the correct colour of terrazzo.

12.9.7 The terrazzo shall be covered up, protected and washed down at completion with soft soap and warm water.

12.10 SCRUBBED IN-SITU TERRAZZO – WALLS

12.10.1 Terrazzo shall, unless otherwise specified, be of a total thickness of not less than 13mm or more than 19mm and shall be carried out in the following manner:-

12.10.2 The wall shall be prepared as before described for polished terrazzo finish to walls and finished with a 7mm thickness of terrazzo composed of granular chippings of marble with other aggregates and glass chippings added as required mixed with cement in the proportion of one part cement to one-and-a-half parts of the mixed aggregate and the water added to make a plastic mixture and applied to the wall surfaces and trowelled to an even surface.

12.10.3 After the cement has set the facings shall be scrubbed with a brush to remove the cement and expose the aggregate.

12.10.4 The aggregate shall be of such granules and colour and the cement shall be white or tinted as required to provide a finish similar in texture and colour to the sample submitted to and approved by the Engineer before the work is put in hand.

12.10.5 The terrazzo shall be covered up, protected and washed down at completion with soft soap and warm water.

13. TILING

13.1 MATERIALS

13.1.1 Shall be Portland Cement complying with the requirements of SABS 471. No blast-furnace cement will be permitted for any work under this Trade.

13.1.2 Sand is to comply with the requirements for fine aggregate as SABS 1083, washed when necessary and screened through a 1,18 to 2,36mm sieve.

13.1.3 Water shall not contain impurities or be used in detrimental proportions to the type of work being executed.

13.2 WALL TILING

13.2.1 Tiles shall be first grade glazed porcelain wall tiles complying with the SABS 22, true and regular in shape and free from cracks, chips, blemishes and other defects. All tiles shall be dipped in water before fixing and bedded in 3.1 cement mortar to true and even surfaces or fixed to plaster backing with an approved adhesive in accordance with the manufacturer's instructions. Horizontal and vertical joints shall be absolutely straight and continuous and all joints shall be rubbed in solid with neat cement grout tinted to match the colour of the tiles and flushed off. Tiles must be set out from the top and only the bottom tiles may be cut.

13.2.2 Mosaic tiles shall be best quality coloured glass tesselae, size approximately 19 x 19 x 5mm thick. All mosaics shall be bedded on screeded surfaces (screeds measured elsewhere) in a fixing mortar composed of one part cement, three parts pit sand and one part pure white lime putty applied by the "buttering" method, and the paper backing removed and surface of mosaics thoroughly cleaned with a wire brush, before grouting in joints with a 50/50 cement-lime mortar tinted to approval.

13.3 FLOOR TILING

13.3.1 Tiles shall be best quality of their respective types, true and regular in shape, free from cracks, chips, blemishes and other defects, uniform in colour and equal to samples shall be submitted to and approved by the Engineer. Special care must be taken to preserve arises and faces during transit and handling.

13.3.2 Tiles shall be well soaked in water before laying and solidly bedded in cement mortar on concrete floor and flush pointed on all exposed faces with semi-dry cement mortar pressed in.

14. PLUMBING AND DRAINLAYING

14.1.1 All drainage and sanitary work shall be executed in accordance with Municipal and/or Local Authority Regulations. None but licensed Plumbers and Drain layers shall be employed on any plumbing and drainage work in this Contract.

14.1.2 Unless otherwise described all diameters of pipes are internal diameter (nominal size). O.D. designates normal outside diameter.

14.2 UNPLASTICISED POLYVINYL CHLORIDE (PVC)

14.2.1 Guttering and downpipes shall comply with the requirements of SABS 11.

14.2.2 Black polythene pipes for cold water service lines and for low pressure drainage systems shall comply with the requirements of SABS 533.

14.2.3 Pipes shall be unplasticised PVC piping free from all defects, with uniform thickness walls, straight and smooth inside and out and truly circular in section. Soil pipes shall comply with the requirements of SABS 791 and shall be jointed with rubber ring joints. Waste and vent pipes shall comply with the requirements of SABS 967 and shall be jointed with solvent welded joints, all strictly in accordance with the manufacturer's instructions.

14.2.4 Pipes and fittings shall comply with SABS 966. Unless otherwise described all pipes must withstand a working pressure of 16 Bars.

14.2.5 Pitch fibre pipes and couplings shall comply with the requirements of SABS 921.

14.3 GALVANISED MILD STEEL

14.3.1 Mild steel water piping shall be in accordance with SABS 62 galvanized inside and outside and with screwed ends, and unless otherwise specified shall be of Medium Class, and shall be provided with sockets, bends, elbows, tees, long screws, back nuts, and other fittings, as may be required, all complying with the requirements of SABS 509. The screwed joints shall be made with lead paint and hemp to cold water piping, and with graphite and hemp to hot water piping.

Cut ends of pipes shall be reamed out to remove burrs.

14.3.2 All pipes shall be firmly and neatly fixed to walls, with galvanized malleable iron brackets (School Board pattern) for pipes up to and including 80mm diameter, and with galvanized cast iron hinged holder bats, fastened with pins or bolts, for pipes over 80mm diameter, all built into walls in 3.1 cement mortar. Pipes shall be fixed to timber work with galvanized mild steel pipe clips screwed on.

14.3.3 Mild steel waste, ventilation and anti-syphon pipes shall be all as described above including jointing, fixing, etc. but fitted at angles and intersections with brass or galvanized malleable cast-iron bends and junctions, respectively.
The bends and junctions to waste pipes where accessible, and to other pipes wherever necessary, shall have inspection eyes.

14.4 COPPER

14.4.1 All copper sheets shall be hot rolled and of the thickness as specified. Copper nails or brass screws shall be used for fixing copper where required. Allow for all labour, nails, screws, wedges, dressing, welting, soldering and all cutting.

14.4.2 Copper pipes for water, gas supplies and sanitation purposes, shall comply with the requirements of SABS 460.

14.4.3 Pipes shall be firmly and neatly fixed to walls, with brass or copper School Board pattern pipe bands or brackets for

pipes up to and including 65mm diameter and with approved holder bats for pipes over 65mm diameter, all built into walls in 3.1 cement mortar, and to timber work with brass or copper pipe clips screwed on.

14.4.4 Unless otherwise specified, all copper pipes shall be jointed with approved dezincification resistant brass or gun-metal compression fittings, of the expanded tube and cone type with coupling nuts and rotary sleeve pieces.

14.4.5 Copper pipes specified shall be jointed with capillary fittings shall be jointed with approved capillary type fittings, each joint being formed by cutting end of pipe square, cleaning the bore of fitting and end of pipe in the bore with sand paper or steel wool, covering surface of pipe and inner surface of bore in fitting with flux supplied by the manufacturer of the fittings, and inserting pipe into the fitting and heating same with a blow lamp until complete ring of solder appears around the mouth of the fitting. Fittings and pipes shall be wiped clean after jointing.

14.4.6 Compression and capillary type fittings used in jointing copper pipes must be of such bore as will correctly fit the pipes, to ensure satisfactory jointing.

14.5 CAST IRON

14.5.1 Pipes and fittings shall comply with the requirements of SABS 746, shall have spigots and sockets and be of spun-cast or sand-cast type, coated inside and outside with bituminous solution, jointed with gaskin and blue lead properly caulked, and fixed to walls with cast iron hinge holder bats complying with the above specification, fastened with brass bolts and built into walls in cement mortar, or bolted to wood framing through ears cast onto pipes.

14.5.2 Unless otherwise described all cast iron pipes and fittings shall be "Standard Pattern".
Bends, junctions, W.C. connectors, etc. shall be provided wherever necessary with cast iron cleaning eyes, bedded in putty and bolted on.

14.5.3 Pipes and fittings shall be coated spigot and socket drainpipes and fittings in accordance with SABS 437 and SABS 1130.

14.5.4 Covers and frames shall comply with the requirements of SABS 558 and be coated with preservative solution before leaving the manufacturer's works. The frame must be bedded in 3.1 cement mortar and the cover in tallow.

14.6 CONCRETE

14.6.1 Concrete non-pressure pipes shall comply with the requirements of SABS 677. Concrete pressure pipes shall comply with the requirements of SABS 676. Pipes must be accurately laid, and jointed in accordance with SABS Code of Practice 058 with rigid jointing.

14.6.2 Unless otherwise described, concrete channels or shoes shall be cement concrete (15MPa) of the specified size, laid to falls and finished on exposed faces with 20mm untinted

granolithic with angles rounded and include excavation, filling in and compacting, striking off and curing and all necessary formwork.

14.7 VITRIFIED CLAY

14.7.1 All clay pipes, channels and fittings for drainsshall be first quality vitrified clay complying with SABS 559. Pipes must be accurately laid, closely fitted together and jointed in accordance with the South African Bureau of Standards Code of Practice for Sewer and Drain Jointing SABS 058 with gaskin and 1.1 cement mortar, well pressed in and finished with smooth, well trowelled fillets and all joints must be wiped clean inside.

14.7.2 Barrels of pipes must rest on solid ground and holes must be cut around joints of sufficient size to enable the jointing and filleting shall be properly performed. Alternatively at the Contractor's choice pipes at his own expense may be bedded full length on and including concrete (15MPa) laid in semi-dry state immediately before pipes are laid.

14.8 LEAD

14.8.1 Sheet lead shall be best milled sheet of the full weight as stated of equal thickness throughout. Copper nails or brass screwsshall be used for lead where required.

14.8.2 Lead pipes shall be hydraulically drawn, of equal substance and of full bore throughout, of the minimum mass stated in the following table:-

DESCRIPTION	DIAMETER mm	MASS IN kg/m (lineal)
Service pipe	15	3,3
Service pipe	20	4,3
Overflow pipe	20	2,4
Waste and ventilating pipe	32	3,3
Ditto	40	4,3
Ditto	50	5,8
Soil pipe	100	11,6 (or 39kg/m²)

Lead pipes shall be jointed with wiped soldered joints and pipes shall be supported by strong lead tacks to prevent bulging or sagging, soldered to pipes and screwed to wall plugs or to wood framing. Pipes shall be provided wherever necessary with brass screw cap inspection eyes wiped on.

14.8.3 Connections between pipes of different materials and between pipes and fittings, shall be formed as described below:-

CONNECTION	METHOD OF JOINTING
Between socketed cast iron and galvanized mild steel pipes.	Gaskin and blue lead well caulked in.

Between socketed cast iron and lead pipes.	Brass ferrule wiped solder jointed to lead pipe and caulked into cast iron socket with gaskin and blue lead.
Between socketed cast iron and stoneware pipes and vice versa	Semi-dry caulking cement and 2.1 cement mortar fillet.
Between lead and stoneware pipes	Brass ferrule wiped on to lead pipe and caulked into stoneware pipe socket with bitumen or cement.
Between mild steel and copper pipes	Straight or bent female or male fittings as described under "Jointing of Copper Pipes".
Between lead pipe and W.C. anti-syphone horn	Brass thimble wiped to lead and jointed to anti-syphon horn with bitumen.
Between mild steel pipe and W.C. anti-syphon.	Bitumen.
Between water closet pan outlet and cast iron connector	Bitumen or with an approved flexible plastic pan connector provided with internal ribs at each end to ensure water- tight seal at upper end over outlet of pan and at lower end in spigot end of cast iron soil pipe.
Between water closet pan and flush pipe	Lead cone and putty or approved efficient rubber flush pipe connector.
Between sink or basin waste fitting and lead trap	Brass cap and lining with wiped solder joint to lead trap.
Between bath waste fitting and lead trap	Lead flange and back nut wiped on, bedded in putty and screwed up to waste fitting.
Between sink, bath or basin waste fitting and mild steel pipe	Screwed.
Between pillar tap and supply pipe	On basins: Lead connector with brass caps and linings and wiped soldered joints, or copper connector. On baths: As above or with mild steel pipe with sockets and lock nuts.
Between flushing cistern and supply pipe	Lead connector with brass caps and linings and wiped soldered joints, or copper connector.

14.8.4 Lead traps shall be hydraulically drawn with the mass stamped on and heavy brass screw cap inspection eyes wiped on, and in accordance with the British Standard Specification for drawn lead traps.

The mass of lead shall be not less than that stated in the following table.

SIZE OF TRAP, mm	MASS OF LEAD, kg/m²
32	28
40	28
50	34

Allow for sockets and couplings in running lengths and all short lengths and cutting.

14.8.5 All water taps, other than those for special hospital and similar fittings, and stop taps shall comply with the requirements of SABS 226.

14.8.6 Shall comply with the requirements of SABS 752.

14.8.7 Non-swinging rotary fire hose reels shall comply with the requirements of SABS 543 solid side discs and 25mm waterway at brackets incorporating Jenkins's type control valve and rotary pressure joint at hub to hose connection. Valve hand wheel shall be clearly marked with an arrow and the words "Open" - "Oop" in red. Reels shall be fitted in addition with specified length of 19mm internal diameter first quality 4-ply canvas reinforced red rubber hose having smooth black rubber core or other equal type to the approval of the Engineer and the local Firemaster firmly fixed at one end to reel hub connection which must be so arranged that the hose coils without kinking at the joints and fitted at the other end with chromium plated 19mm metal shut-off cock and 8mm detachable nozzle. A suitable chromium plated flexible hose guide through which hose shall be permanently threaded shall be provided for securely fixing to wall and shall be so designed that the hose may be run out in any direction. A suitable chromium plated bracket shall be provided for supporting nozzle when hose is not in use and screwed to wall plugs.

14.8.8 The reel and hose guides shall be securely fixed to wall with suitable bolts with plate washers, built into wall in 5.1 cement mortar.

14.9 HYDRANTS

14.9.1 Fire hydrants shall be of the wheel valve pattern with instantaneous coupling outlets, size 65mm or 70mm as stated on the drawings. Hydrants fixed in a horizontal position shall have oblique angle outlets and those fixed in a vertical or inclined position shall have right angle outlets.

14.9.2 The materials used in the manufacture of the hydrants shall be as laid down for the manufacture of couplings, branch, pipes, etc. in SABS 1128 and the various requirements of instantaneous coupling, and dimensions for 64mm outlets, shall be as laid down therein; dimensions for 70mm outlets shall comply with the requirements for Morris instantaneous pattern couplings.

14.9.3 The valve spindle shall have a minimum diameter of 22mm with swiveling clack at one end fitted with first quality dexine or other approved washer, bedding on to a raised seat not less than 6mm wide, and the other end shall be machined to form a square shank of 15mm minimum thickness and of a length corresponding with the thickness of the boss of the handwheel; the portion protruding from the boss shall be threaded and fitted with a washer and nut to hold the handwheel firmly in place.

14.9.4 Valve inlet shall be male screwed 80mm Whitworth pipe thread, and outlet shall be fitted with approved India-rubber coupling gasket.

The internal diameter of the valve body shall be not less than 95mm in the case of 64mm outlets or 100mm in the case of 70mm outlets.

14.9.5 The valve handwheel shall have an overall diameter of 165mm and the rim shall be of oval cross-section and shall have the words "OPEN" and "OOP" together with direction arrows embossed on the face.

14.9.6 All hexagonal faces shall be machined and all exposed surfaces of the valve and the wheel periphery shall be buffed and polished. Parts of the wheel not polished shall be painted two coats bright red high gloss paint.

14.9.7 The completed hydrant valve shall be guaranteed hydraulically tested by the manufacturer to a pressure of 3 500 KPa and shall be badged or stamped accordingly with the manufacturer's name or symbol and the words "TESTED 3 500 KPa".

14.10 FIRE EXTINGUISHERS

14.10.1 Extinguishers shall be approved Cylindrical type water /C02 plunger type fire extinguishers of specified capacity with CO^2 cartridge and brackets fixed to and including 22 x 230 x 760mm chamfered oiled hardwood backboard bolted with and including four 9mm diameter bolts with plate washers cut and pinned to brick or concrete wall in 3.1 cement mortar.

14.10.2 Soda-acid fire Extinguishers shall be of specified capacity and charge complete, painted red and with bracket fixed to and including 22 x 230 x 760mm chamfered oiled hardwood backboard bolted with and including four 9mm diameter bolts with plate washers cut and pinned to brick or concrete wall in 3.1 cement mortar.

14.11 DRAINAGE

14.11.1 Trenches shall be in straight lines and to falls as shown on drawings or directed with pockets cut in trench bottom for pipe collars so that pipe barrel is firmly supported and joints can be properly made and caulked (unless the pipes are laid on a concrete bed).

14.11.2 The first backfilling of pipe trenches shall be of approved material, imported if necessary, free from rock or stone and shall be watered and carefully tamped over and around pipes until they are covered to a depth of 300mm. Subsequent filling shall be in 300mm layers, watered and rammed and to at least 93% Modified AASHO dry density at optimum moisture content.

14.11.3 Mechanical rammers shall not be used until the pipes have been covered to a depth of 1 000mm.

14.11.4 Any disturbance or damage to the pipes during backfilling must be made good by the Contractor at his own expense.

14.11.5 Surplus material shall be laid over the trench to allow for settlement of filling, and any depressions or subsidence below the level of the adjacent ground shall be filled up, as and when necessary, until the end of the maintenance period.

14.11.6 Earth shall be understood to mean all kinds of ground met with, excepting only soft or hard rock as hereinafter defined and shall include made ground, black turf, gravel, clay, running sand and ground interspersed with boulders not exceeding 0,3m3 each. Tenderers are strongly advised to inspect the ground shall be excavated.

14.11.7 Soft rock shall be understood to mean all rock other than that described as hard rock and shall include:
Ouklip, Hard Shale, mudstone, soapstone, etc.

14.11.8 Hard rock shall be understood to mean granite, quartzitic sandstone or rock of similar hardness and refers to rock of igneous type and similar rock boulders exceeding 0,3m3, which in the opinion of the Engineer has shall be blasted or broken up by means of jack-hammers and chisels, etc.

14.11.9 All pipe laying shall be carried out in accordance with the procedure described in SABS 058.
Laying shall be commenced at points of junction with existing drains or at points of discharge.
Each line of drain shall be laid in a perfectly straight line to even gradients.
Before each pipe is laid, it shall be examined to ensure that the ball is clean and any foreign material removed. Each pipe shall be struck with a wooden mallet to test for soundness, and any crack or damaged pipes rejected. Ends of all pipes must be clean before jointing.

Immediately after jointing a tight fitting wad or scraper shall be drawn several times through the bore of the pipe to ensure that it is left clean and free from obstructions. The pipe jointsshall be protected from injury by rain, soil, water, etc. until they have set hard.

14.11.10 Plug open pipes and junctions, whenever work is suspended, to prevent the entrance of rubbish during construction.

14.11.11 All pipes, vitrified clay and others, laid within 350mm of the finished ground level and all pipes under the buildingsshall be encased in cement concrete (15MPa) of a minimum thickness of 100mm.

Form or leave openings for pipes passing through foundation walls where required and build in and make good in cement mortar. Build ends of pipes into walls of inspection chambers in 2.1 cement mortar. The drainsshall be suitably protected until they have been tested and covered in. Open pipe endsshall be plugged or stopped to prevent the entry of soil or mud during wet weather.

14.11.12 When pipes are bedded on concrete the bed shall be first laid to correct falls and levels with recesses formed in same for the pipe sockets so that the whole of the soffits of the pipe barrel bears evenly on the bed.

14.11.13 When the concrete has set a thin layer of cement mortar 2.1 shall be spread on the bed to receive the pipe barrel, sufficient to ensure that a surplus is squeezed out when the pipe is laid, and finally adjusted to level.

After jointing, the recesses around the sockets shall be filled with concrete of the same mix as the bed and the haunching or surrounding completed.

14.11.14 Gulley trapsshall be as described with outlet jointed to drain and with hopper head fitted with grating as described, the whole set on and encased in cement concrete (15MPa) carried up 75mm high as kerb size 460 x 460mm with splayed edges and finished on exposed surfaces with 20mm untinted granolithic with angles rounded including excavation and casing.

14.11.15 Grease trapsshall be first quality vitrified clay with 100mm outlet to drain, 50mm vertical inlet, 100mm outlet connected to and including 100mm junction with socketed arm flush with top and with cast iron stopper with raised letter "C.E." on same set in bitumen therein, bottom end jointed to drain, trap fitted with galvanized steel hinged grating and frame with purpose made brass locking fitting the frame set in bitumen; the whole set on and encased in cement concrete (15MPa) carried up 100mm above ground as kerb, splayed on edges dished down to grating and finishing on exposed surfaces with 25mm untinted granolithic with angles rounded, the trap fitted with 1,25mm thick galvanized steel perforated container 75mm deep with strong handle riveted on and stayed to sides, including excavation and casing.

14.11.16 Cleaning eye covers shall be cast iron A.B.C. cleaning eye covers and frames, jointed to top of drain with gaskin and T.O.K, strip and grooved for and including stopper with raised letter "C.E." cast on same, bedded in tallow and secured to frame with gunmetal set screws and the frame encased in cement concrete 1:3:6 finished on top with untinted granolithic including excavation and casting.

14.11.17 Manholes, unless otherwise described, to have 150mm thick cement concrete (15MPA) bottom and one brick sides in extra hard burnt bricks in 6:1 cement mortar, plastered smooth internally in 5:1 cement plaster and with 150mm cement concrete (20MPa) slab over including necessary reinforcement and casing and holed for cover the bottom benched up from and including necessary channels, etc. in cement concrete (15MPa) at angle of 45 degrees and finished smooth in 2-1 cement, including filling and ramming around outside walls as required and carting away surplus earth.

Where double seal covers are specified they shall be of two piece (cover and frame) and of the following types, weights and sizes:

Double Seal:	450 x 600mm	Type	8A	72kg
	600 x 600mm	Type	8B	124kg
	600 x 760mm	Type	10B	154kg
Circular Road Manholes:	550mm diameter	Type	1	136kg
	550mm diameter	Type	2A	190kg
	550mm diameter	Type	2B	183kg
	550mm diameter	Type	4A	71kg

550mm diameter	Type	4	82kg
650mm diameter	Type	1A	204kg
650mm diameter	Type	1B	135kg

14.11.18 This shall mean "allow for all apparatus necessary for and including testing the whole of the plumbing and drainage to the satisfaction of the Engineer and Local Authorities, including replacing and making good any defective work free of charge".

14.12 SANITARY FITTINGS

14.12.1 Pedestal water closet pans, wash hand basins and sinks shall be of white glazed fire clay or vitreous china complying with the requirements of SABS 497.

Stall urinals shall be of single stall or in ranges of two or more stalls as specified, of white glazed fire clay complying with the requirements of SABS 497.

14.12.2 Sinks shall comply with the requirements of SABS 907 and constructed of type 304 stainless steel for general use.

14.12.3 Stainless steel stall urinals shall comply with the requirements of SABS 924. Stainless steel straight and curved back slab urinals shall be of approved manufacture constructed of 1,2mm thick materials, type 18/8; or type 316 for special hospital use.

14.12.4 Basins and troughs shall comply with the requirements of SABS 906.

14.12.5 Sinks and draining boards shall comply with the requirements of SABS 242. Fittings shall be polished on exposed surfaces and all welding cleaned off perfectly flush and smooth and polished.

14.12.6 Sanitary fittings shall be firmly and properly fixed in position, connected and jointed to all pipes including the following:

a) Brackets, etc., fixed to wall with and including 6 x 150mm bolts but bent to right angle and cut and pinned to brickwork in cement mortar.

b) Pans, pedestals, etc., bedded on concrete floor in cement mortar.

c) Urinals bedded securely against wall and floor in cement mortar, with treads bedded in waterproof mastic and left watertight.

d) Basins, troughs and the like shall be fitted with waste unions, chain and plug. Unless otherwise described basins shall be fixed on and including Vaal 8118 semi-concealed brackets.

e) W.C, suites, squat pans, etc., complete with ball valves, unions, integral overflows, lever handles, flush pipes (white but chromium plated for coloured fittings) rubber connectors, etc.

14.12.7 CP shall mean "chromium plated" on exposed surfaces. ECCP: shall mean "easy clean, chromium plated, on all exposed surfaces.

15. GLAZING

15.1 GLASS

15.1.1 All glass shall be equal to CKS 55 "Glass for glazing".

15.1.2 All glass shall be cut to suit openings, with sufficient clearance all round to prevent cracking by expansion or contraction, vibration, etc.

15.1.3 Unless otherwise described the whole of the glass in steel frames shall be well back puttied, sprigged as necessary and puttied,

15.1.4 Sashes with glazing beads shall be built in with beads fixed in position and the Contractor must allow for unscrewing the heads and refixing after glazing.

15.1.5 Clear glass shall, unless otherwise described, be clear flat glass of "Float" quality, free from stains, scratches or other imperfections and of South African manufacture.
Unless otherwise described, float glass shall be of the following thickness:-

i) Panes not exceeding 0,75m2 surface area shall be of 3mm thickness.
ii) Panes exceeding 0,75m2 and not exceeding 1,50m2 surface area, shall be of 4mm thickness.
iii) Panes exceeding 1,5Om2 surface area shall be of 5mm thickness.

15.1.6 Obscure glass for glazing shall be patterned glass of South African manufacture of the pattern and thickness specified.

15.1.7 Glass used in laminated safety glazing shall be clear flat glass of "Float" quality of South African manufacture, free from imperfections as described above and of minimum 6mm thickness, unless otherwise specified.

15.1.8 High impact strength laminated glass shall be of minimum 7,5mm thickness unless otherwise specified. Toughened safety glass of clear float quality, roughcast quality, or patterned glass quality, shall be of South African manufacture.

15.1.9 All special laminated glassesshall be glazed in strict accordance with the manufacturer's recommendations and allow for all gaskets, setting blocks, etc.

15.1.10 All laminated and toughened safety glass shall comply with the requirements of SABS 1263.

15.1.11 Louvre blades, unless otherwise described, shall have edges polished all round.

15.2 GLAZING

15.2.1 All glazing shall be carried out in accordance with SANS 10137, National Building Regulations and South African Glass Institute.

15.2.2 At completion clean all glass and replace all damaged panes. All glass broken before the premises are handed over for occupation shall be replaced and surfaces made good by the Contractor at his own expense.

15.3 PUTTY

15.3.1 All putty used for glazing is to comply with SABS 680, of Type I for glazing in wood and Type II for glazing in steel.

15.3.2 Putty used for glazing in unpainted hardwood shall be tinted to match the colour of the wood.

15.3.3 No soft or oily putty shall be covered by paintwork until rectified. All putty should form a surface crust and have a smooth finish before any paint is applied. A priming coat must be applied to the putty within seven days of putty being applied.

15.3.4 Glass fixed with glazing beads in unpainted hardwood doors shall be bedded on strips of rubber, velvet, leather or felt turned over on to both sides of glass in the rebates to form a soft packing between the glass and the woodwork. In all other cases the glass shall be well bedded in back putty in the rebates.

15.3.5 Putty shall be carefully trimmed and cleaned off with front putty worked to within 3mm of the sight lines.

15.4 Mirrors shall comply with the requirements of SABS Specification 1236.

16. PAINTING

16.1 GENERAL PREPARATION

16.1.1 All walls and ceilings, etc. shall be thoroughly cleaned prior to commencement of painting and the premises shall be kept clean and free from dust during painting operations. Protect all surfaces not shall be painted against spotting and spilling and clean down and make good as necessary. Locks, door handles and similar fittings or fixtures shall be removed (or masked) and refitted on completion of painting.

16.2 PREPARATION OF PLASTER SURFACES

16.2.1 All surfaces, cills, ceilings, etc. shall be thoroughly dry before painting operations are started (an exception may be made in the case of certain emulsion type coatings which may be applied with advantage to damp plaster).

(i) Exterior Surfaces. Any cracks shall be scraped out and filled with an approved stopper or patching plaster and rubbed down flush. The whole surface shall be well brushed down to remove all loose dust and powdery material before applying the first coat of the specified paint system

(ii) Interior Surfaces. All cracks, blow holes, etc. shall be filled with hard stopper and rubbed down flush. The whole surface smoothed to an even finish and dusted down. Any grease marks, crayon marks, etc. shall be cleaned off with a strong detergent

and thoroughly rinsed with clean water. The surface shall be thoroughly dry before painting operations are started.

(iii) Ceilings. Ceilings shall be brushed down and free of all dust and powdery materials. Cover strips and cornices shall be stopped where necessary and rubbed down smooth. All nail heads shall be primed and also stopped, rubbed down flush. The surface shall then be wiped or brushed free of all loose or powdery materials before applying the recommended paint system.

(iv) Asbestos Cement. Asbestos cement surfaces shall be brushed down with a stiff brush until free of all dust. If there is any possibility that the cement is "green", a good alkali resistant primer should be applied before any subsequent coats which are not, in themselves, alkali resistant.

16.2.2 Painted plaster surfaces being redecorated shall be washed down, filled where necessary with suitable stopping or patching plaster, spot primed and rubbed down ready to receive new paint.

16.2.3 Distempered plaster surfaces being redecorated shall be rubbed down ready to receive new distemper but where the distemper is in poor condition or where a finish other than distemper shall be applied, old distemper shall be completely removed by wetting and scraping, the surfaces filled as above where necessary and rubbed down ready to receive the new finishing.

16.2.4 Surfaces previously painted with lime wash shall be recoated with lime wash, must be well rubbed down with a brush to remove all loose material. If it is required to recoat with any type of paint other than lime wash, the surface must be completely stripped down to the plaster and given a coat of approved bonding liquid.

16.3 PREPARATION OF METALWORK

16.3.1 NEW WORK :

(i) Iron and Steel. New metalwork of iron and steel shall be cleaned by the most effective method available (shot or sand blasting, flame cleaning, mechanical wire brushing, chipping, hand wire brushing) and all rust scale shall be removed in this way. An endeavour should be made to bring the surface to a bright metallic condition. All trace of surface oil and grease shall be removed and any salt deposits arising from a marine or industrial environment shall be removed by washing with water prior to priming.

(ii) Galvanized Surfaces. New galvanized surfaces shall be well cleaned to remove all traces of dirt. When painting new galvanized sheets, the paint manufacturer's instructions regarding the removal of the protective coating shall be strictly adhered to.

(iii) Other Non-Ferrous Metals (Aluminium, Zinc, Etc.) . If convenient, non-ferrous metal surfaces shall be left to weather for six to eight months before cleaning down and priming.

Otherwise, all milling oils and temporary protective coatings shall be removed by degreasing with solvents or detergents, and thereafter the surface shall be cleaned with an abrasive paste cleaner or lightly rubbed with fine emery paper and washed down. A suitable non-ferrous metal primer shall then be applied.

16.3.2 the paint film is in good condition and there are no signs of blistering or peeling, the surface shall be well cleaned down and lightly abraded prior to painting.

16.3.3 If the paint film has blistered or broken down or where rusting is evident, the surface shall be completely stripped of paint and well abraded with steel wire brushes (or by some other accepted method, such as sand blasting). After cleaning off rust, affected areas shall be primed with a suitable anti-corrosive primer.

16.4 PREPARATION OF WOODWORK

16.4.1 New woodwork shall be brushed down and the surface prepared as follows:-
Knots and knotting shall receive a coat of knotting, the surface shall be primed overall, and all holes shall be stopped and filled.

16.4.2 The surface shall then be rubbed down with glass paper until smooth and even.
Woodwork shall be oiled, stained or varnished shall be free of all stains, pencil marks and other surface discolourations and blemishes and shall be stopped with tinted stopping and rubbed down.

(i) Paint Film in Good Condition (i.e. free of peeling, flaking, crazing, cracking, or other signs of failure) shall be dusted and wiped down. All traces of oil and grease shall be removed with a solvent rinse, particular attention being given to areas around door handles. All cracks, crevices, and holes shall be scraped out and patch primed; and when dry, shall be made good with hard stopper, faced up and rubbed down to an even smooth surface. The whole of the woodwork shall then be lightly abraded with fine glass paper and finally wiped down in preparation for application of the primer.

(ii) Paint Film in Generally Good Condition but exhibiting occasional blisters, shall be prepared by removing the blisters, chamfering the edges smooth with glass paper, rubbing immediate area down to bare wood, spot priming and rubbing down.

(iii) Paint Film in Poor Condition (exhibiting failure through checking, cracking, flaking, peeling, crazing, etc.) shall be completely removed by use of a blow lamp or paint remover. Care must be taken to avoid charring of wood when burning off; if slight

charring should occur the area shall be primed with a good quality aluminium wood primer.
Paint removers shall be free of wax and caustic substances and shall preferably be of water rinsable grade.

The whole area subject to treatment by paint remover shall be well washed with water to ensure complete removal of old paint and paint remover.
Painting shall then proceed as with new woodwork.

(iv) Oiled Hardwood being redecorated shall be thoroughly cleaned down, stopped with tinted stopping and rubbed down.

16.4.3 Primers shall be supplied only by the paint manufacturer approved by the Engineer. No deviation from the approval shall be permitted.

16.4.4 The primer shall be brought onto the site in unopened containers. Adulteration or thinning of primers shall not be permitted unless recommended by the manufacturer. All prime coats shall be applied by clean brushes of good quality and shall be well brushed in to obtain maximum penetration.

16.4.5 Wood, metal and other surfaces normally primed before being painted, shall be prepared and primed as before described in readiness to receive the specified paint system.

16.4.6 Backs of wood doors and similar frames and surfaces of other new or refixed joinery in contact with brickwork, etc. and built in as the work proceeds, shall be primed before building in, whether the article shall be painted or not, to prevent moisture seeping into the wood from the mortar bedding.

16.4.7 Wood surfaces shall be knotted, primed and stopped before being coated with emulsion paint or distemper.

16.4.8 Tongued and grooved and rebated edges of boards in batten doors and other such like inaccessible parts of new joinery shall, before the joinery is to receive a finish other than paint, be given one coat of such other finishing material.

16.4.9 Priming to new external structural timbers shall be applied before the timbers are fixed in position, and shall include all surfaces such as backs of fascias, and barge boards.

16.4.10 All colours and tints shall be submitted to the Engineers for approval. Each coat of paint shall be of a distinctive colour. Sample be prepared in all cases for the final coat and all work must be finished to colours approved by the Engineer. Colours shall

16.4.11 An item of "cutting in" will be measured where two different paint finishes or colours adjoin on a flat surface. Where different finishes meet at internal or external angles, rails, V-joint, etc. or where dado lines occur "cutting in" will not be

measured. "Cutting in" will not be measured on paint to narrow rails and surrounds, steel windows, etc.

16.4.12 Paints shall be used exactly as supplied and in strict accordance with the manufacturer's labeled instructions. All undercoats, etc. shall correspond with their finishing coats and thinners or other mediums must not be used except with the approval of the manufacturer.
Manufacturer's representatives must be given access to the work.
All materials, if and when required by the Engineer, will be subject to tests by the South African Bureau of Standards at the Contractor's expense if found deficient.

Ready mixed paints must bear the SABS mark if there is a mark holder for the type of paint specified or comply with the relevant SABS Specifications as set out below:-

Type of Paint	SABS Specification No
Distemper	322
Zinc chromate primer	679 Type I
Wash primer	723
Undercoat for high gloss enamel	681 Type II
Undercoat for oil gloss paint	681 Type I
Eggshell	515
High gloss enamel	630 Grade I
Oil gloss paint	631
PVA Exterior quality	634
PVA Interior quality	633 Grade I
Wax polish	15

Where no SABS specification exists for the prescribed material, the material used shall be of best quality to the Engineer's approval.

16.4.13 All surfaces shall be thoroughly cleaned down before painting and prepared to receive the type of paints specified, all in accordance with the manufacturer's recommendations. All woodwork shall be stained, varnished, oiled, polished or painted shall be glass papered to a smooth finish. All steelwork shall be painted shall be scraped and cleaned free of dirt, grease and rust, well rubbed down with glass paper and washed down with turpentine. All plaster, brick and concrete work shall be painted must be thoroughly washed down three times at intervals of 24 hours and brushed down to remove all traces of efflorescence. All asbestos cement and PVC piping, etc. shall be painted must be thoroughly cleaned down.

16.4.14 No undercoat of lime wash will be allowed on plaster under ready mixed paints.

16.4.15 No painting shall be done on damp surfaces or in damp conditions. All areas shall be cleared of rubbish and dust before commencement of painting.

16.4.16 All doors and opening sections of windows must be left ajar after painting or varnishing until paint is perfectly dry.

16.4.17 All necessary precautions shall be taken for the protection of all finished work and other trades during painting, and all

ironmongery shall be removed, where possible, prior to the commencement of painting and refixed after completion. All paint spots, stains, etc. shall be cleaned off floors, walls, glass, etc. at completion.

17. PAPERHANGING

17.1 VINYL OR PAPER WALL COVERINGS

17.1.1 Coverings shall be of approved colours and patterns, free from all defects and equal to samples shall be submitted to and approved by the Engineer, supplied under guarantee and fixed with neat butt-joints, including sealing the whole surface of the wall and abutting edges of sheets with adhesive, all in strict accordance with the manufacturer's instructions. Coverings shall be hung by an approved firm of Specialists in strict accordance with manufacturer's instructions, hung truly vertical and free from bubbles, wrinkles, etc. No horizontal joints will be permitted.