



DEPARTMENT OF PUBLIC WORKS

SPECIFICATION OF MATERIALS AND METHODS TO BE USED

All references to South African Bureau of Standards Specifications and Codes of Practice in this Document shall be deemed to refer to the latest issue of such specifications and codes as may be amended from time to time and are to be read in conjunction with the latest issue of the National Building Regulations

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SECTION 1

STANDARD CONDITIONS

1.1 USE OF LOCALLY MANUFACTURED MATERIALS AND PRODUCTS:

Materials and products manufactured in South Africa shall be used in carrying out the work to which this specification refers, unless an imported product is prescribed specifically, or when no suitable locally manufactured product for the specific use is available.

1.2 APPLICATION OF CLAUSES:

All clauses in this specification which describe the materials and methods to be used in carrying out the work specified in the specification of work to be done, or indicated on the drawings, or included in the bills of quantities, or in any detail drawings, or instructions issued by the Representative/Principal Agent to the Contractor during the progress of the work, shall be considered as applying to the performance of the contract.

1.3 SAMPLES:

The Contractor shall furnish without delay, such samples and/or certificates as called for or may be called for by the Representative/Principal Agent. Materials and/or workmanship not corresponding with approved samples may be rejected.

1.4 WATER:

Clean, fresh water free from vegetable or organic matter, earth, clay, acid or alkaline substances either in suspension or in solution, other than those used for purification thereof by the responsible authority, shall be used through-out.

Where there is any reason to suspect the presence of impurities, the Representative/Principal Agent may require the Contractor to obtain a chemical analysis of the water by a competent analyst at his own cost. Should the water prove unsuitable for use the Contractor must procure water of a

1.5 STANDARD DETAIL DRAWINGS

All standard detail drawings applying to a particular service and referred to in this document, in the specification or in the bills of quantities, may be seen by Tenderers at Head Office, Pretoria, and at the office of the relevant Regional Representative, Pretoria, Johannesburg, Bloemfontein, Cape Town, Port Elizabeth and/or Kimberley and will be issued to the Contractor upon request, for the carrying out of the work.

1.6 SCALE:

The scale to which the drawings are prepared is only to be made use of when no figured dimensions are given, either on the drawings or in the specification. Figured dimensions are always to be followed though they may not coincide with the scale of the drawings. Where possible dimensions are to be taken from all relevant existing buildings.

1.7 UNITS OF MEASUREMENTS:

Units of measurements have been standardised in accordance with "Système International d'Unités" (SI).

1.8 INTERPRETATION OF DRAWINGS ETC.:

Should any part of the drawings, specification or bills of quantities not be clearly intelligible to the Contractor or that the materials or articles to be used in the execution of the works be considered insufficiently described, the Representative/Agent shall be requested in writing, to make clear, also in writing, his requirements, failing which the Contractor shall be liable to make, at his own expense, any alterations or substitutions rendered necessary through incorrect interpretation of such drawings, specification or bills of quantities.

1.9 DETAILS:

Upon receipt of detail drawings for any work the Contractor shall, before putting that work in hand, ascertain that the dimensions given on the Detail Drawings correspond with the dimensions of any work already built which governs the sizes of the work for which the detail is given. In the event of the detail drawings not agreeing with the work already built, the drawings shall be at once returned for alterations as no claim for extra work will be entertained in this respect.

1.10 VERTICAL TRANSPORT:

Vertical transport for workmen and materials is entirely the responsibility of the Contractor. Permission is to be obtained shafts by the Contractor on shaft(s), make good and clean Contractor wishes to commence

1.11 SOUTH AFRICAN STANDARD SPECIFICATIONS AND CODES OF PRACTICE:
STANDARD SPECIFICATIONS:

SABS	22	Glazed Ceramic Wall Tiles and Fittings
SABS	28	Metal Ties for Cavity Walls
SABS	38	Metallic Naphthenates for Timber Preservation
SABS	42	Pentachlorophenol for Timber Preservation
SABS	62	Steel Pipes and Pipe Fittings up to 150 mm nominal bore
SABS	82	Bending Dimensions of Bars for Concrete Reinforcement
SABS	92	Bituminous Roofing Felt
SABS	151	Fixed Electric Water Storage Heaters
SABS	226	Water Taps (Metallic)
SABS	227	Burnt Clay Masonry Units
SABS	242	Stainless Steel Sinks with Draining Boards (for Domestic Use)
SABS	248	Bituminous Damp-Proof Courses
SABS	266	Gypsum Plasterboard
SABS	281	Hardwood Block and Strip Floorings
SABS	297	Mastic Asphalt for Roofing
SABS	307 – 309	Bitumen Emulsion
SABS	312	Red Lead Base Primers for Structural Steel
SABS	460	Copper and Copper Alloy Tubing
SABS	471	Portland Cement (ordinary, rapid hardening and sulphate- resisting)
SABS	497	Glazed Ceramic Sanitaryware
SABS	509	Malleable Cast-Iron Pipe Fittings
SABS	515	Decorative Paint with a Non-Aqueous Solvent Base for Interior Use
SABS	523	Limes for Use in Buildings
SABS	540	Woodfibre Building Board
SABS	515	Decorative Paint with a Non-Aqueous Solvent Base for Interior Use
SABS	523	Limes for Use in Building
SABS	540	Woodfibre Building Board
SABS	542	Concrete Roofing Tiles
SABS	543	Fire Hose Reels (with hose)
SABS	545	Wooden Doors
SABS	546	Cast Iron Fittings for Fibre Cement Pressure Pipes
SABS	558	Cast Iron Surface Boxes and Manhole and Inspection Covers and Frames
SABS	559	Vitrified Clay Sewer Pipes and Fittings
SABS	563	Stress-graded Softwood: General Structural Timber
SABS	565	Pentachlorophenol-Zinc Naphthenate Timber Preservative
SABS	581	Semi-Flexible Vinyl Floor Tiles
SABS	622	Gypsum Cove Cornice
SABS	626	Portland Blastfurnace Cement
SABS	629	Softwood Flooring Boards
SABS	631	Decorative Oil Gloss Paint for Interior and Exterior Use
SABS	632	Clay Roofing Tiles
SABS	633	Emulsion Paints for Interior Decorative Purposes
SABS	634	Emulsion Paints for Exterior Use

SABS	653	Softwood Brandering and Battens
SABS	675	Zinc-coated Fencing Wire (plain and barbed)
SABS	677	Concrete Non-Pressure Pipes
SABS	678	Primers for Wood for Interior and Exterior Use
SABS	680	Glazing Putty for Wood and Steel Sashes
SABS	681	Undercoats for Paints
SABS	682	Finishing Paint, Aluminium-type
SABS	683	Roof Paints
SABS	684	Structural Steel Paint
SABS	685	Fibre-Cement Sheets: Profiled and Flat
SABS	723	Wash Primer (Metal Etch Primer)
SABS	727	Windows and Doors made from rolled mild steel sections
SABS	746	Cast-Iron pipes and pipe fittings for use above ground in drainage installations
SABS	752	Float Valves: Part I and Part II
SABS	763	Hot-dip (Galvanised) Zinc Coatings other than on continuously zinc-coated sheet and wire
SABS	786	Flexible Vinyl Flooring
SABS	801	Epoxy-tar Paints
SABS	802	Bituminous Aluminium Paint
SABS	803	Fibre-Cement Boards
SABS	821	WC Flushing Cisterns
SABS	831	Portland Cement 15 (Ordinary and Rapid Hardening)
SABS	887	Varnish for Interior Use
SABS	903	Aluminium Alloy Corrugated and Troughed Sheets
SABS	906	Stainless Steel Wash Hand Basins and Wash Troughs
SABS	907	Stainless Steel Sinks for Institutional Use
SABS	909	Red Oxide Zinc Chromate Primer for use on Steel Windows and Doors
SABS	912	Calcium Plumbate Primer
SABS	920	Steel Bars for Concrete Reinforcement
SABS	926	Two pack zinc-rich epoxy primer
SABS	929	Plywood and Composite Board
SABS	934	Hot-dip (Galvanised) Zinc Coatings on Steel Sheet and Strip
SABS	949	Strongroom Doors
SABS	952	Polyolefin film for damp-proofing and waterproofing in buildings
SABS	978	Wood Mosaic Flooring
SABS	1024	Welded Steel Fabric for Concrete Reinforcement
SABS	1039	Wooden Ceilings and Panelling Boards
SABS	1083	Aggregates from Natural Sources
SABS	1090	Sand for Plaster and Mortar
SABS	1099	Hardwood Furniture Timber
SABS	1128	Fire Fighting Equipment'
SABS	1200	Standardized Specifications for Civil Engineering Construction
SABS	1223	Fibre-cement Pressure Pipes and Couplings
SABS	1227	Textured wall coatings, emulsion base, for interior and exterior use
SABS	1236	Silvered Glass Mirrors for General Use
SABS	1245	Stress-graded Softwood Engineering Timber
SABS	1263	Safety and security glazing materials for buildings
SABS	1288	Preservative-Treated Timber
SABS	1300	Particle board: Exterior and Flooring Type
SABS	1301	Particle board: Interior Type
SABS	1359	Softwood timber for industrial use
SABS	1373	Chain-Link Fencing and its wire accessories
SABS	1381	Materials for thermal insulation of buildings
SABS	1388	Tributyltin Oxide-Lindane Timber Preservative
SABS	1460	Laminated Timber (Glulam)
SABS	1466	Portland fly ash cement
SABS	1491	Portland cement extenders

CODES OF PRACTICE:

SABS	03	The Protection of Buildings against Lightning
SABS	05	Preservative Treatment of Timber
SABS	021	Waterproofing of Buildings
SABS	043	The laying of Wood Floors
SABS	064	Preparation of Steel Surfaces for coating
SABS	070	The laying of thermoplastic and similar types of flooring
SABS	096	Manufacturing of Finger-Jointed Structural Timbers
SABS	0107	The fixing of Glazed Wall Tiles
SABS	0137	The installation of glazing materials in buildings
SABS	0155	Accuracy in building
SABS	0040	The application of the National Building Regulations

CKS SPECIFICATIONS:

CKS	208	Concrete Flooring Tiles
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STANDARD TEST METHODS:

STM	861	Sampling of freshly mixed concrete
STM	862	Slump of freshly mixed concrete
STM	863	Compressive strength of concrete

(IN ALL CASES THE LATEST PUBLICATION OR REVISION SHALL APPLY.)

1.12 ACCURACY IN BUILDING WORK:

The method of measurement and accuracy of dimensions required for the setting out of structures and for completed building work shall be as described in SABS Code of Practice 0155, unless otherwise specified in this document.

SECTION 2

EARTHWORKS

2.1 CLEARING SITE:

Clear site for the whole area of the ground to be built upon up to a distance of at least 1 m beyond the perimeter of the structure of building(s) and/or extent of steps, pavings, etc. This operation shall be deemed to include the digging up and removal of rubbish, debris, vegetation, hedges, shrubs and small trees (up to 200 mm girth), bush, etc. as well as the digging up of top soil and examining for and removal of all dead roots and other vegetable matter likely to provide food for termites.

2.2 EXCAVATIONS:

2.2.1 Notification by Contractors and Excavators:

In terms of the Factories, Machinery and Building Work Act, 1941, as amended through Act 6 of 1983, every Contractor shall immediately furnish the Divisional Inspector with the following information in writing:

- (a) Name of Builder (Contractor) or Excavator (Earthworks Contractor/Subcontractor).
- (b) Name and style under which his business is carried out.
- (c) His business address.
- (d) The premises or place where building or excavations are to be commenced as well as the expected starting date.

2.2.2 Excavations for basements, foundations and floors:

Excavations for the formation of basements, vaults and the like, shall be of such area and depths shown on drawings, together with any such additional prescribed excavations that may be required for working space (see 2.2.4 hereinafter for scope of working space measured).

Trenches and holes for foundations shall be excavated to the several lengths, widths and depths shown on drawings or to such other depths as may be directed by the Representative/Agent to ensure a good foundation.

Bottoms of trenches and holes shall be level, with sides trimmed vertical for the full width from top to bottom. The bottoms of trenches shall be stepped as shown but if the stoppings are not shown on drawings or are not otherwise directed on site, the stepping shall be of at least the thickness specified for the concrete footings but shall be adjusted downwards to conform with an exact number of brick courses where necessary. Any excavations taken out too deep shall be made up to correct levels with Class A concrete, at the Contractor's expense. Back filling and ramming is not acceptable.

The ground under solid floors shall be excavated where necessary and levelled in readiness for the laying of the surface beds. The ground under suspended wooden floors shall be excavated where necessary so that in no case will the finished ground level be less than 0,75 m below floor joists, where the ground is to be treated against termites, or less than 0,3 m below floor joists where the ground is not to be so treated.

2.2.3 Excavations to reduce levels:

The ground outside the buildings shown to be reduced in levels, shall be excavated and levelled or graded to falls as shown on the drawing(s). Sloping banks shall be of such gradient as will maintain the stability of the ground above, and shall be neatly trimmed. For purposes of landscaping and the planting of grass the gradient must not exceed 30° to the horizontal.

2.2.4 Excavations for working space:

Working space for formwork to sides of all concrete, except columns, has been measured only where the concrete face is less than 750 mm from the face of the measured excavation.

Working space for formwork to sides of columns has been measured for the width of the column face only where both:

the top of the column base is more than 1,5 m below the commencing level of the excavation, and

the column face is less than 500 mm from the face of the measured excavation.

No claim will be considered for any working space for formwork to concrete other than as above described nor for working space beyond the sides of trench excavations for the building of brick or block walls.

Descriptions of excavations for working space shall be deemed to include any additional risk of collapse so incurred and the returning and compacting of the excavated material as described.

2.2.5 Definitions:

Earth shall mean ground that can be removed by hand tools and shall include loose gravel, clay, made up ground, loose or soft shale, loose oukclip and any loose boulders less than 75 mm in diameter.

Soft rock shall mean rock that can be loosened by hand, pick or crowbar and includes hard shale, compact oukclip, stone of a similar hardness and boulders from 75 mm diameter up to 0,03 cubic metres in volume.

Hard rock shall mean granite, quartzitic sandstone, slate and rock of similar or greater hardness and boulders from over 0,03 cubic metres in volume.

2.2.6 Blasting:

No guarantee is given or implied that blasting shall be accepted but should this method of removal be necessary and permitted, the Contractor must take all responsibility and observe all conditions set forth in all Government and Local Authority Regulations and/or bylaws.

2.3 DISPOSAL OF EXCAVATED MATERIAL:

2.3.1 Part return:

Material from the excavations, after testing by the Departmental Laboratory, where suitable and approved by the Representative/Agent, is to be returned, filled in and rammed against foundation walls, under floors, steps, etc. as necessary.

No clay shall be used as filling.

2.3.2 Deposit on site:

The excess material shall be deposited on site, spread and roughly levelled, where permitted.

2.3.3 Cart away:

Surplus material is to be carted away to a suitable dumping site to be found by the Contractor, outside the boundary of the site.

2.4 MAINTENANCE OF EXCAVATIONS:

2.4.1 Planking, strutting, etc.:

Planking, strutting, shoring and temporary sheet piling shall be measured as such only when prescribed.

2.4.2 Risk of collapse:

The Contractor shall maintain all excavated faces exceeding 1,5 m deep in accordance with Government Regulations and all excavated faces not exceeding 1,5 m deep affecting the safety of the work and/or the workmen.

The Contractor shall carry the risk of collapse of excavated faces whether or not he takes any precautions, the nature of which shall be entirely at his own discretion.

2.5 WATER IN EXCAVATIONS:

No water shall be allowed to accumulate in any portion of the excavations.

The excavations shall be protected against any water entering them whether by seepage, rains, storms, floods or any other means. Any water found in the excavations shall immediately be removed by pumping or baling.

It is the Contractor's responsibility to keep foundations and excavations water free and the Contractor must supply all pumps etc. that may be necessary for clearing out the water. Water must be cleared in such a way that it cannot seep or flow back into the excavations.

2.6 COMPLETION OF EXCAVATIONS:

The Contractor shall give notice, in writing, to the Representative/Agent when the excavations are ready to receive the foundations.

The foundations shall not be laid until the excavations have been approved of, in writing, by the Representative/Agent and they shall not be covered until any variation has been measured.

2.7 FILLING:

Filling shall be of approved clean earth in layers not exceeding 150 mm in depth, well watered, rammed and thoroughly consolidated to at least a density of 90% Modified AASHTO (American Associations of State Highway and Transportation Officials), which will be verified by the Representative/Agent having it tested.

All filling material shall be approved beforehand by the Representative/Agent prior to placement. A 60 kg sample of the proposed fill is required for this purpose and fourteen days must be allowed for initial sample testing.

Before filling is placed the virgin soil shall be scarified and compacted to at least 90% Modified AASHTO. Each layer of fill must be tested and approved by the Representative/Agent before the next layer is placed and compacted.

(a) To defined levels:

The ground outside the building shown shall be made up with earth filling as above, finished level or graded to falls as shown on the drawings, or as directed.

Sloping banks of made up ground shall be of such angle as will maintain the stability of the ground above, and shall be neatly trimmed.

(b) To foundations etc:

Filling to foundations etc. shall be of earth filling as above.

The filling of areas under solid floors shall be carried out as soon as the foundations and foundation walls have been completed.

(c) Thicknesses of compacted material:

Given thicknesses are those for compacted material.

The Representative/Agent shall keep notes on all filling supplied by the Contractor.

(d) Descriptions (prices):

Descriptions (prices) of all filling including filling supplied by the Contractor from an off-site source, and separately measured, are to include for any necessary stockpiling and multiple handling.

2.8 SURPLUS EARTH:

All surplus earth, topsoil and/or other materials from the excavations shall be deposited and levelled on the site, or carted away, as directed.

2.9 GRAVEL DRESSING:

Gravel dressing to the ground outside the building shall be of approved clean gravel, well watered and consolidated by rolling with an approved roller to a hard even surface. The dressing shall be of a consolidated 75 mm thickness.

2.10 GARDEN SOIL FILLING:

Garden soil filling in flower boxes shall be rich, selected, well sifted soil containing the proper proportions of loam and leaf mould. The filling is to be placed and lightly consolidated.

2.11 PROTECTION AGAINST TERMITES:

The ground under surface beds and below suspended wood floors shall be poisoned with an approved registered soil poisoning material of the chlordane or aldrin type mixed with water, applied at the rate of not less than 5 litres of solution per m². Great care is to be taken to apply the solution evenly over the whole surface. The concentration of the solution shall be in accordance with the Manufacturer's instructions and to the approval of the Representative/Agent.

Where the ground to be treated is of earth filling, the upper layer of fill shall be levelled by raking, but where of natural ground, it shall be dug up, well loosened to a depth of not less than 50 mm so as to enable the solution to penetrate into the soil and similarly levelled. After the solution has been applied and allowed to soak in, the soil shall be well rammed and consolidated to at least 90% Modified AASHTO.

Before applying the solution to the ground under the floor, 75 mm deep V-shaped channels shall be raked out alongside all walls enclosing the floors and against sleeper walls and piers etc. under floors and the channels flooded with poison solution. After the solution has soaked in, the channels shall be back filled and rammed.

The bottom of all foundation trenches and holes shall be similarly poisoned, but without digging up and loosening the soil.

The poisoned layer of soil under suspended wood floors shall be protected with a 75 mm thick layer of approved clean gravel or broken stone, levelled to an even surface on top, leaving a clearance as specified under Subclause 2.2.2 above.

Where the concrete surface beds are laid above damp course level, the ground at damp course level shall be poisoned as above and a layer of clean earth filling laid on the poisoned ground up to underside of concrete beds, all well consolidated to at least 90% Modified AASHTO.

Great care shall be taken whilst laying the concrete floor beds, protective layers and filling to avoid

rupturing the poisoned layer of soil under the floors. Should the poisoned layer be ruptured at any point it shall be made good and the affected areas treated again.

- NB:** (a) The soil poison shall be delivered to the site in sealed containers, clearly labelled or stamped with the name of the product.
- (b) Contractors are advised that special precautions must be taken to protect the workmen working with the soil poison.
- (c) The poisoning of the ground under floors shall be done as soon as practicable, so that it may dry out before the floors are laid.
- (d) The poisoning of the ground **must be carried out under the supervision of the Representative/Agent.**
- (e) All Government laws and regulations, as well as local authorities' regarding termite poisoning, shall be strictly adhered to.

SECTION 3

CONCRETE, FORMWORK AND REINFORCEMENT

NB: All in situ concrete work (mass and reinforced) shall comply with SABS Specification 1200G ("8. Measurement and Payment" is **not** applicable) supplemented by the clauses in this section. Where SABS Specification 1200G and the clauses in this section are in conflict the clauses in this section shall take precedence.

Where the term "plain concrete" appears in SABS Specification 1200G it shall be read as "mass concrete"

3.1 CEMENT:

Cement shall be Portland cement complying with the requirements of SABS Specification 471 or PC15 complying with SABS Specification 831.

Samples of cement from any one, or from every consignment, may be required by the Representative/Agent for test purposes. Cement in any consignment from which a sample may have been taken for testing shall not be used until it has been approved. Allowance must be made for possible delay in that tests may take 10 days to carry out.

Bags of cement shall be stacked in a waterproof, solidly constructed shed with a central door and a floor rendered damp-proof with a tarpaulin. The bags of cement shall be closely stacked (but not against walls) in order to reduce air circulation in such a manner that the cement is used in the order in which it was received, i.e. first in first out.

Unless otherwise specified in the tender documents the use of ordinary Portland cement blended with ground granulated blast furnace slag complying with SABS Specification 1491, or ordinary Portland Cement blended with Pulverised Fly Ash complying with SABS Specification 1466 will be allowed in certain instances as an alternative, after acceptance of tender, but only with the approval of and at the sole discretion of **the Department**. If not so specified in the tender documents the Contractor must demonstrate a saving in favour of the Department together with his alternative tender. The saving offered will be adjudicated by the Engineer/Quantity Surveyor for the service and acceptance of the alternative will be in accordance with the reasonableness thereof.

3.2 SAND (FINE AGGREGATE):

The fine aggregate shall comply with the requirements of SABS Specification 1083. Other aggregates may be approved if they have a satisfactory history and/or test results.

No aggregate may be used until it has been approved. Samples having a mass of 25 kg (16,5 litre) of the aggregate proposed to be used may be required by the Representative/Agent for test purposes. Samples having a mass of 25 kg shall be forwarded every 3 months during concreting work and also if the source of supply is changed. Allowance must be made for possible delay in that the tests may take 14 days to carry out.

3.3 STONE (COARSE AGGREGATE):

3.3.1 The coarse aggregate shall comply with the requirements requirements of SABS Specification 1083.

No aggregate may be used until it has been approved. Samples having a mass of 25 kg (16,5 litre) of the aggregate it is proposed to use may be required by the Representative/Agent for test purposes. Samples shall be forwarded every three months during concreting work and also if the source of supply is changed. Allowance must be made for possible delay in that the tests may take 14 days to carry out.

NB: Certain fine grained sand and stone originating from the Beaufort Series and Karoo Systems which are known by reputation, local experience or tests, to exhibit excessive shrinkage when used in concrete, may be deemed unacceptable by the Representative/Agent.

3.3.2 A certificate of proof is required from the Contractor that the aggregates are not alkalireactive. The cost of testing and certification are to be borne by the Contractor.

3.4 CONCRETE:

Concrete shall be of the classes given in the following table. The proportions of the ingredients and the nominal size of the coarse aggregate for each class shall be as laid down therein, viz:

CLASS	CEMENT	AGGREGATES			STRENGTH (MPa)
	PART	FINE	COARSE	SIZE	
		PART	PART		
A	1	4	8	50	10
B	1	3	6	38	15
C	1	3	6	19	15
D	1	2	4	38	25
E	1	2	4	19	25
F	1	1 ¹ / ₂	3	19	30
G	1	1	2	19	40

The strength given in the above table shall be the minimum required at 28 days.

Unless otherwise specified. Class B concrete shall be used for mass concrete and Class E concrete for reinforced concrete.

Maximum concrete slumps acceptable for different types of construction concrete are as follows:

- (a) Vibrated reinforced concrete = 50 mm
- (b) Unvibrated reinforced concrete = 75 mm
- (c) Mass concrete = 75 mm

When so required by the Representative/Agent, and whilst concreting is in progress, the consistency of the mixture shall be ascertained by means of the slump test as later described herein.

3.5 VOLUME BATCHING:

The coarse and fine aggregate shall be measured by volume and, unless otherwise directed, cement shall be measured by mass: the volume of a 50 kg bag of cement shall be taken as 33 litre. Suitable measuring boxes for the coarse and fine aggregates shall be provided to the approval of the Engineer.

The proportions given above are approximate only, and should the Director: Structural Engineering Services consider that the voids in the coarse aggregate require more or less matrix than is formed by the proportions specified, he may vary the quantities of coarse and fine aggregates to obtain the required density and workability of the concrete, provided that the proportion of cement to the total volume of the aggregate shall not be less than that specified.

When the sand is not completely dry, allowance must be made for bulking due to the moisture content. The amount of bulking shall be determined by the Contractor in the presence of the Representative/Agent.

The proportion of water used for mixing concrete shall be determined by the Representative/Agent and once the water-cement ratio has been fixed, it shall be rigidly adhered to. On no account shall the amount of water exceed 34 litres to every bag of cement used. This figure includes the water contained in the sand.

The length of time each batch shall be mixed in the mixing machine shall be decided by the Representative/Agent.

Effective screens shall be provided to protect the mixing of concrete during windy weather.

3.6 WEIGH BATCHING:

The proportioning of the coarse and fine aggregates by mass will be permitted, providing the method used is approved by the Director: Structural Engineering Services.

- (a) All requests received by the Representative/Agent to make use of weigh batching must be submitted to the Director: Structural Engineering Services for approval.
- (b) If the weigh batching process is preferred to volume batching, the proposed mix proportions are to be equivalent to the relevant volumetric mixes as documented previously herein and be based upon a minimum cement content.
- (c) The following procedures must be complied with:
 - (i) The Contractor must timeously obtain written approval for the use of weigh batching and submit all information as set out below, with his application.
 - (ii) The mix transformation from volume to weigh batching shall be carried out at an approved laboratory.
 - (iii) Weigh batching equipment must be calibrated and a certificate of accuracy must be submitted before such equipment may be used.
On contracts of long duration and/or requiring large quantities of concrete, new calibration certificates may be required every four months.
 - (iv) The cement to aggregate ratio by volume for the following mixes will apply:
 - Class C (15 MPa) - c/a = 1:9
 - Class E (25 MPa) - c/a = 1:6
 - Class F (30 MPa) - c/a = 1:4,5
 - Class G (40 MPa) - c/a = 1:3
 - (v) The following cement/water ratios by mass must also be complied with:
 - Class C (15 MPa) - c/w = 1,30 to 1,35
 - Class E (25 MPa) - c/w = 1,65 to 1,80
 - Class F (30 MPa) - c/w = 1,90 to 2,05
 - Class G (40 MPa) - c/w = 2,30 to 2,50

3.7 READY MIXED CONCRETE:

Any application to use Ready Mixed Concrete shall be submitted by the Contractor to the Regional Representative at an early stage for approval by the Directorate: Structural Engineering Services. Only suppliers on the Department's approved list will be considered. New applications must be submitted to the Director: Structural Engineering Services, well in advance.

3.8 STRENGTH CONCRETE:

The Contractor shall be responsible for the design of strength concrete and for the measurement of the constituent materials to produce concrete that complies with the specified requirements. The relevant Engineer will decide the class and grade designation of the concrete required for each part of the work and determine suitable limitations on the constituent materials and mix proportions in accordance with the said requirements.

(a) Trial mixes:

The Contractor must ensure that samples of the constituent materials of the concrete, together with evidence that they comply with the provisions, are supplied for approval in good time and provide the Engineer with—

- i) a statement from an approved independent laboratory of the results of tests, or
- ii) an authoritative and acceptable report, or record of the previous use of, and experience with, the material concerned.

The cement, types of aggregate and their origins may not be changed throughout the duration of the contract without giving prior notification to the Engineer who shall verify that the above requirements are complied with and that the important qualities of the concrete will not be impaired.

(b) Durability:

For each grade of concrete the Engineer will, notwithstanding strength considerations, specify the cement/water ratio appropriate to the exposure conditions indicated in Table 5, SABS Specification 1200G, Subclause 5.5.1.5.

(c) Consistency:

Unless otherwise indicated by the general workability of the concrete, method of transportation, conditions of placement or otherwise specified by the Engineer, the suggested slump values, for different mixes of concrete shall be as specified in Clause 3.4.

(d) Workability:

Ensure that the concrete is of such workability that it can be readily compacted into the corners of the formwork and around reinforcement without segregation of the materials and without excessive "bleeding" of free water at the surface.

3.9 EXPANSIVE ALKALI-AGGREGATE REACTION:

The use of some local aggregates may lead to an expansive alkali-aggregate reaction if the concrete in the structure will be exposed to continual dampness, or will be subject to alternate wetting and drying.

Alkali reactive aggregates, i.e. certain granites, quartzites and Malmesbury hornfels (shale), shall not be used in conjunction with high alkali cement for concrete in any part of the works. High alkali cement is one in which the equivalent alkali content exceeds 0,60% by mass of the cement.

If the Contractor chooses to use one of the aggregates stated above in lieu of stone as described in Clause 3.3 of this section he shall comply with the following requirements regarding the cement:

- (a) he shall ensure that no high alkali cement is delivered to the site. Any such high alkali cement shall be rejected and the cost of its removal and replacement with cement having an acceptable alkali content shall be borne by the Contractor.
- (b) Certificates stating the alkali content of each delivery of cement to the site shall be supplied by the Contractor. These certificates shall be based on tests carried out at a laboratory approved by the Engineer. The cost of testing, including sampling, transporting of samples and issuing of certificates, shall be borne by the Contractor.
- (c) The Contractor shall be entitled to use an approved brand of cement as a means of ensuring that the permissible alkali content is not exceeded. The Contractor shall make allowance for the higher price of such approved brand, if he chooses to use this method.

3.10 PUMPING OF CONCRETE:

The placing of concrete by pumping in any section of the works shall be subject to the written approval of the Engineer. The Contractor shall furnish full details regarding the mix proportions of the concrete that he intends to place by pumping.

3.11 ADMIXTURES TO CONCRETE:

The use of admixtures in concrete will only be considered should special circumstances warrant this and then only with the prior written approval of the Engineer. The Contractor shall provide the following information:

- (a) The trade name of the mixture, its source and the Manufacturer's recommended method of use.
- (b) Typical dosage rates and possible detrimental effects of both under and over dosage;
- (c) The expected average air content of freshly mixed concrete containing an admixture which causes air to be entrained when used at the Manufacturer's recommended rate of dosage.

3.12 SLUMP TEST:

The apparatus and the method of determination of the slump of freshly mixed concrete shall comply with SABS STM 862.

(a) Apparatus:

- (i) A mould in the form of a frustum of a cone and having the following nominal internal dimensions:

Bottom diameter: 200 mm

Top diameter: 100 mm

Height: 300 mm

The mould shall be of a metal (other than brass or aluminium) of side thickness at least 1,6 mm and shall have a smooth internal surface.

The mould shall have suitable base plate and handles to facilitate lifting it from the test specimen in a vertical direction.

- (ii) The tamping bar shall have a nominal diameter of 16 mm, a length of 600 mm and with sharp corner rounded off at one end.

(b) Procedure:

The test shall be carried out in an area that is free from vibration and shocks.

Ensure that the internal surfaces of the mould are free from set concrete and are clean and dry.

Place the mould with the bottom on a smooth, horizontal, rigid, non-absorbent surface and hold the mould firmly in place while it is being filled as follows:

- (i) Fill the mould in four layers, each thickness approximately one-quarter of the height of the mould. Tamp each layer with 25 strokes uniformly spaced over the cross-section of the mould. Tamp the bottom layer throughout its depth and ensure that when tamping the second and subsequent layers the strokes penetrate into the underlying layer.
- (ii) After the top layer has been tamped, strike off the concrete level so that the mould is exactly filled. Clean off any concrete that may have leaked out between the mould and the supporting baseplate surface. Remove the mould from the concrete immediately by slowly and carefully raising it in a vertical direction. This will allow the concrete to subside.

Immediately measure the slump, to the nearest 5 mm, by determining the difference between the height of the mould and the height of the specimen.

If a slump specimen collapses or shears off laterally regard the test as invalid, discard the result and repeat the test.

3.13 CONCRETE TEST CUBES:

The apparatus for making and testing of concrete cubes shall comply with SABS STM 863.

(a) Apparatus:

Cubic metal moulds of steel shall be machined and adequately strengthened to resist distortion. The internal distance between faces of a mould shall be 150 mm.

The mould shall be constructed so as to facilitate the easy removal without damage of the moulded specimen.

Each mould shall have a metal base plate which shall be attached to the mould by springs or screws.

When assembling the mould for use, the joints between the sections of the mould, the contact surfaces between the bottom of the mould and the base plate, and the internal faces of the assembled mould shall be thinly coated with a grease or oil that will prevent leakage of water through the joints and adhesion of the concrete to the mould.

The tamper must be a steel bar of length 400 mm and mass 1,8 kg, and having a 25 mm square ramming face.

(b) Sampling and making cubes:

Sampling shall comply with SABS STM 861.

One set of three cubes shall be required for every 40 cubic metres, or part thereof, of concrete cast.

The sample taken from a batch of concrete and sufficient to make three cubes shall be placed in a tray or on a platform and mixed thoroughly.

The moulds shall each be filled in three layers approximately 50 mm thick. Each layer shall be compacted with the tamping rod as previously specified, with at least 35 blows to give full compaction of the concrete.

After the top layer has been compacted, strike off the surface of the concrete with a trowel, level with the top of the mould.

Any small hollows shall be filled in with additional concrete. Cement/sand slurry shall not be worked into the surface.

At this stage, the identity of each sample shall be placed on the moulded cube, by means of a label of absorbent material and not by scouring of the surface of the concrete.

c) Curing cubes on site:

Cover the test cubes in their moulds with an impervious sheet or wet sacking and store indoors in a place that is free from vibration, excessive draughts, cold and direct sunlight.

After 24 hours the cubes shall be demoulded, remarked with a waterproof crayon or marker and placed in a curing tank for seven days before being transported to the laboratory.

The Contractor shall supply the curing tank which shall incorporate a thermostat to control the water temperature at 22 °C to 25 °C and shall be kept within a building.

(d) Testing of cubes:

The testing of all concrete cubes will be done by the Department or by a laboratory approved by the Director: Structural Engineering Services in accordance with SABS STM 863.

A suitable testing machine of sufficient capacity having an accuracy and repeatability that comply with the requirements for Grade A machines of BS 1610 "Method for the load verification of testing machines" shall be used to test the compressive strength of each cube.

The Contractor is responsible for the provision of the cube moulds and for timeous delivery of the cubes to the laboratory.

3.14 CONCRETE QUALITY:

Should the Contractor dispute any results obtained from concrete test cubes, the concrete represented by the cubes will be considered acceptable if the Contractor, at his own cost, proves to the satisfaction of the Engineer that the estimated actual strength of cores taken from the structure (by an approved independent testing laboratory and determined in accordance with SABS STM 865) is not less than the specified strength. If the concrete fails to meet the strength criteria stipulated, the Engineer may at his sole discretion and in addition to the options listed in SABS Specification 1200G-

- (a) accept the concrete subject to approved remedial measures being undertaken by the Contractor at his own cost; or
- (b) permit the concrete to remain, subject to reduced payment for lower strength concrete.

3.15 CONCRETING:

It is essential that the foreman who has charge of the construction of all concrete work, whether reinforced or not, shall be skilled in this class of work, and shall personally superintend the whole construction, paying special regard to—

- (a) the quality, testing and mixing of the materials.
- (b) the laying of the material in place and the thorough compaction of the concrete to ensure solidity and freedom from voids;
- (c) the construction and removal of formwork; and
- (d) the sizes and positions of the reinforcement.

Particular care shall be taken to work concrete against formwork and around reinforcement. Internal vibrators may be used with the approval of the Representative/Agent but external vibrators which act only on the formwork will not be permitted.

Concrete to be reinforced shall be deposited in such quantities as will permit of it being properly compacted around the reinforcement.

The placing of concrete shall be completed within half-an-hour after mixing or within half-an-hour after agitating and within 2,5 hours after mixing in the case of ready mixed concrete. On no account shall concrete be incorporated into the work after it has attained its initial set.

Care shall be taken to prevent, as far as possible, the formation of laitance or scum. Laitance is to be understood to mean the scum of strengthless and inert material which forms on the surface of concrete.

Concrete must not be dropped into position from a height greater than 2,5 m unless prior approval is obtained from the Engineer.

If an inclined chute is used for transporting concrete, it shall be of such slope as will ensure a continuous flow of concrete without the use of an excessive quantity of water and without segregation of the aggregates. The chute must be flushed out and properly cleaned before and after each working period. All waste from flushing shall be discharged outside the formwork.

In beams, each portion of a successive layer shall be placed as soon as the concrete below has been properly worked around rods and against formwork. Concreting shall be carried forward in

irregular steps, that is to say, one layer shall not be completed over the whole section before the succeeding layer is commenced. Concreting of slabs and beams shall, as far as possible, be carried forward in one operation. When concreting has to be interrupted the concrete shall be left with a level, rough top surface with ends vertical. The concrete shall not be merely sloped down.

On resuming concreting, the old surface shall be roughened and all laitance thoroughly and carefully removed before any new concrete is deposited. This must be carried out by brushing the surface of the concrete while it is still green. Great care must be taken to avoid any weakness at the junction of old and new concrete, and the old surface shall be coated with a thin layer of cement and sand mortar, in the same proportions as that of the adjoining concrete.

While the concrete is setting it shall not be disturbed or shaken by traffic, either on the concrete itself or upon adjoining formwork.

No holes in concrete elements shall be patched or filled in without inspection, instruction and approval of the Engineer.

No concreting shall be carried out when the air temperature is below 4 °C when it is rising and 8 °C when it is falling.

Before concreting is commenced the Contractor shall give the Representative/Agent 24 hours notice of his intention to do so. On sites further than 200 km from the Representative/Agent, 48 hours notice must be given.

Concrete surface beds, excluding heavy industrial floors etc. shall be Class C concrete and shall be laid in suitable size panels not exceeding 20 m² in area and with the length of any panel not exceeding 4,5 m.

Where concrete beams are supported on concrete columns, the columns are to be concreted up to the underside of such concrete beams and then concreted up to the top of the beams, integral with the beams.

NB: Any finish applied to the surface of concrete floors, is to be understood as being additional to the thickness of the concrete described or shown on the drawings.

3.16 CURING OF CONCRETE:

After the concrete has been placed, all exposed surfaces shall be kept continuously damp for at least 10 days by methods as may be approved by the Representative/Agent, such as covering with approved building paper, or by means of wet canvas, wet sacks, wet sand, by continuous hosing or ponding with water.

3.17 DESCRIPTIONS (PRICES) OF CONCRETE:

Descriptions (prices) of concrete work shall be deemed to include the design of concrete mixes and all testing of concrete and materials other than compressive strength testing of concrete samples from concrete being placed in the works (the Contractor shall only be entitled to payment for those samples and compressive strength tests called for by the Representative/Agent and which pass the test requirements), handling and depositing (by hoisting or lowering) concrete in the forms, working and packing concrete around reinforcement, all "construction joints" other than "designated joints" as defined in SABS Specification 1200G which are given separately, shaping tops of components as required and striking off and curing. (Treatment of finished faces of concrete other than striking off and curing are given in separate items.)

Descriptions (prices) of concrete in surface beds cast in panels shall be deemed to include formwork, fillets and the like in forming the panels.

3.18 CONCRETE LINTELS (CAST IN SITU):

Concrete lintels cast *In situ* shall be of Class E concrete, reinforced with steel reinforcement as well as of depths specified in the table hereunder. Each lintel shall be the full thickness of walls into which they are cast and 450 mm longer than width of openings.

Clear or daylight span	Depth in Brick Courses	Reinforcement
Not exceeding 1 m	3	Nil
1 m to 1,5m	3	One 12 mm diameter mild steel rod, 40 mm up from bottom, for each half brick width of soffit.
Over 1,5 to 2 m	4	One 16 mm diameter steel rod 40 mm up from bottom, for each half brick width of soffit.
Over 2 m	To detail	To detail.

3.19 BUILDING ON CONCRETE FOOTINGS AND BEAMS:

No brickwork, stone walling or other structure shall be built on concrete footings until at least three days after placement of the concrete in the case of mass concrete footings and after seven days in the case of reinforced concrete footings or as may otherwise be directed by the Representative/Agent.

No brickwork, stone walling or other structure shall be built on reinforced concrete beams or similar members until the formwork and all props or supports have been removed.

3.20 SLIP JOINTS BETWEEN CONCRETE AND BRICKWORK:

Slip joints shall be provided between brickwork and concrete slabs and beams by levelling up and trowelling smooth the bearing surfaces of brickwork with 3:1 cement mortar and covering the bearings before the concrete is cast, with two layers of one side smooth tempered hardboard, with the smooth sides in contact.

The ends and sides of beams and edges of concrete slabs shall be separated from the brickwork with 13 mm thick bitumen impregnated softboard or expanded polyethylene strips placed vertically against the brickwork before the concrete is cast.

Similar slip joints shall be provided between brickwork and concrete lintels cast *in situ*, but without softboard or expanded polyethylene strips at ends.

For details of the joints see Type Drawings S3300/1, S3300/2 and S3300/3.

3.21 MOVEMENT JOINTS:

All movement joints are to be filled in with approved bitumen impregnated softboard or expanded polyethylene strip unless otherwise specified or detailed on drawings. Form similar movement joints where pathways adjoin buildings externally.

Descriptions (prices) of movement joints shall be deemed to include formwork

3.22 CUTTING, PUNCHING OR HACKING CONCRETE:

No reinforced concrete shall be cut or hacked without the sanction of the Representative/Agent.

3.23 FORMING KEY TO CONCRETE FOR PLASTER. MOSAIC TILES AND OTHER FINISHES:

Where rough formwork has been used, surfaces of concrete to receive plaster, mosaic tiles and other finishes, shall, immediately after the formwork has been removed, be well wetted and wire brushed whilst the concrete is still green and then slushed over with 2:1 cement grout to form a key for the finish, all to the approval of the Representative/Agent. The slushing is to be allowed to set hard before the finish is applied.

Where smooth formwork is used, surfaces of the concrete to receive plaster, mosaic tiles and other finishes shall be hacked, on the distinct understanding that hacking of concrete shall be at no extra

cost to the Department.

Surfaces of concrete receiving plaster or other finishes shall not be plastered or finished until the Representative/Agent has signified his opinion in writing that the surfaces are suitable to receive plaster or other finishes.

3.24 SLEEVE PIECES, TIES, ETC.:

Where it is necessary to leave plugs or holes in beams, slabs or any other reinforced concrete, all such plugs or holes must be situated in positions approved by the Representative/Agent before concreting. Where it is necessary to carry pipes, bolts, wires or any other fittings through reinforced concrete members, approved pipe sleeves must be provided and placed in position before concreting.

Where waste, ventilation, water, heating or other pipes under 100 mm diameter pass through concrete slabs and beams, galvanised mild steel sleeve pieces of diameters shown or required shall be cast into such concrete slabs and beams.

Chases shall be formed in edges of slabs or slots shall be formed in the slabs, of sizes required, where two or more pipes pass through together.

All necessary bolts, plugs, brackets, cramps, etc. shall be cast into the concrete as the work proceeds.

Where brickwork abuts against concrete, the brickwork is to be tied to the concrete with galvanised hoop-iron ties 1,6 m thick by 32 mm wide and approximately 600 mm long to every third course of brickwork with one end of each tie cast approximately 150 mm deep into the concrete. Where such fixing is impossible, i.e. where steel formwork is used, the ties are to be gun-nailed against concrete with steel nails not less than 38 mm long.

3.25 BAGGED FINISH TO CONCRETE:

Concrete surfaces to receive bagged finish shall be prepared by removing sharp projections and making good defects with 3:1 cement mortar. Finish by rubbing over the whole area with wet rough sacking and cement grout to obtain an even surface.

3.26 POWER FLOATED FINISH:

Power floated finish to floors etc. means that surfaces shall be floated mechanically to a smooth and even finish before the concrete has set. Small areas inaccessible to the machine are to be floated by hand. Under no circumstances is cement mortar to be added while floating the concrete.

3.27 "NO-FINES" CONCRETE:

"No-fines" concrete, for grading flat concrete roofs and the like to falls, shall be in the proportion of 12 parts 19 iron cubical stone to 1 part cement mixed with 20 litres water per bag of cement and be laid to falls of not less than 15 mm per linear metre for mastic asphalt and not less than 20 mm per linear metre for sheet roof covering. For heavy load applications special mix designs may be required.

(a) Fillets against uostands:

Form triangular fillets, size 75 x 75 mm, in corners with walls, kerbs, etc. neatly mitred at angles, stopped where necessary and finished smooth ready to receive waterproofing.

(b) To raised floors, bases, etc.:

"No-fines" concrete for raised floors, bases, etc. shall be in the proportions specified. Finish smooth with 3:1 sand/cement screed to receive waterproofing.

3.28 CELLULAR CONCRETE:

Cellular concrete, for grading flat concrete roofs and the like to falls, shall be laid in situ in required layers; the bottom layer having a density of 400 kg per cubic metre, dressed to falls by varying the thickness, and a 20 mm thick top layer having a density of 960 kg per cubic metre.

Descriptions (prices) for grading shall be deemed to include for striking the bottom layer to falls, the curing and finishing smooth of top layer ready to receive waterproofing. Samples shall be taken from the bottom layer of concrete at the rate of 3 samples for every 10 cubic metres of concrete cast. In no sample shall the density of the concrete vary more than (plus) 80 kg per cubic metre. Samples shall be made in standard concrete cube moulds.

3.29 FORMWORK

Formwork shall include all shuttering, casing and centring of wever material required for the laying and forming of concrete floors, slabs, beams, lintels, walls, steps, columns, piers, pilasters and any other concrete work requiring moulds or forms and shall embrace all cleats, battens, fillets, wedges, struts, trestles, braces, props, shores and other requirements of wever material for keeping all in correct position. All materials used for formwork must be suitable and substantial and all joints must be tight enough to prevent leakage of liquid matrix.

All formwork must be designed by the Contractor and if requested to do so, he must submit fully detailed and dimensioned working drawings to the Representative/Agent for checking purposes.

Acceptance of the proposals shall not relieve the Contractor of his responsibility for the safety and stability thereof nor for any loss or damage arising out of defective design, materials and/or workmanship.

The formwork must be so constructed that its partial removal can be carried out to the satisfaction of the Representative/Agent and in such stages as are required by the working conditions.

As far as possible, wedges and clamps must be used in preference to nails. All formwork in its various sections for floors, beams, etc. must be so arranged that the whole may be raised or lowered either independently or together with other sections by means of wedges or other approved methods.

Immediately before concreting is begun, the formwork in contact with the concrete must be thoroughly cleaned, wetted and kept damp whilst the concrete is being placed.

Great care must be taken to keep the formwork wedged up to its correct height and this must be checked by taking levels immediately before concreting is commenced and immediately after it has been completed.

All beams shall have a camber of 6 mm to every 3 m of length.

The minimum periods that the formwork to the various parts of the structure is to remain in position after concreting shall be as stated in the following table:

DESCRIPTION	NORMAL CEMENT		RAPID HARDENING CEMENT	
	WEATHER		WEATHER	
	NORMAL	COLD	NORMAL	COLD
Beam sides, walls, unloaded columns	2 days	4 days	1 day	2 days
Slabs with props left under	4 days	7 days	2 days	4 days
Beam soffits with props left under including ribbed slabs	7 days	12 days	3 days	5 days
Removal of slab props	10 days	17 days	5 days	9 days
Removal of beam props	14 days	28 days	7 days	12 days

When determining the stripping time for formwork the weather shall be considered to be "normal" when the temperature is above 18 °C and "cold" when the temperature is between 5° and 10 °C, these being the average daily temperatures of the atmosphere adjacent to the concrete. When the average daily temperature lies between the above values for "normal" and "cold" weather the minimum period for stripping of formwork shall be determined by the Representative/Agent.

Notwithstanding the above minimum periods, formwork may be struck immediately the concrete in the various parts of the structure has attained the crushing strengths required by the Representative/Agent. The crushing strengths must be determined by proper tests, which shall be carried out by the Contractor.

No formwork of any nature whoever shall be struck, either after the elapse of the minimum periods stated in the above table or on the attainment of the required crushing strengths of the concrete, without the prior consent of the Representative/Agent. Such consent will not absolve the Contractor of his responsibility for the safety of the structure.

In structures having either in whole or in part, two or more reinforced concrete floors, props shall be provided under the soff its of any beam or slab of any floor which is being used to support the formwork and wet concrete of the floor above, all to the approval of the Representative/Agent. The props shall not be removed until the formwork supporting the concrete of the floor above has been struck.

On no account shall steel formwork be oiled where concrete is to receive plaster.

Formwork is measured to the net surfaces of concrete to be supported, except at intersections of beams with beams, columns, walls, etc. and tops of columns with slabs, beams, etc. where no deductions have been made and descriptions (prices) shall be deemed to include use and waste, except where the formwork is of a permanent nature or is to be left in, fitting together to all required shapes, all cutting, intersections, cambering where required, holes for rods, bolts, pipes and the like, propping, maintaining, keeping damp whilst the concrete is being deposited and removing.

Formwork "left in" and permanent formwork shall be deemed to include leaving in formwork, props, etc.

Descriptions (prices) of formwork to soffits shall be deemed to include propping not exceeding 3,5 m high unless otherwise described. Descriptions (prices) of formwork to walls and columns shall be deemed to be not exceeding 3,5 m high above bearing level unless otherwise described.

Descriptions (prices) of formwork to sof fits of solid slabs shall be deemed to be to slabs not exceeding 250 mm thick unless otherwise described.

3.30 SMOOTH FORMWORK:

Smooth formwork shall be any material approved by the Representative/Agent which is to be used to leave concrete surfaces smooth when removed and where no other finish is to be applied.

Descriptions (prices) shall be deemed to include for rubbing off all projections at seams etc. after removal of the formwork, making good any defects with 2:1 cement mortar and leaving a smooth surface with all arises slightly rounded, all to the satisfaction of the Representative/Agent.

3.31 LIFT SHAFTS:

Lift shafts may not deviate more than 25 mm out of plumb over the full height of the shaft and must on no account have more than 25 mm spiral due to rotation of the formwork in the horizontal plane as the work proceeds.

3.32 REINFORCING RODS:

3.32.1 Mild steel:

Mild steel shall comply with the requirements of SABS Specification 920, Type A or B.

3.32.2 High tensile steel:

High tensile steel shall comply with the requirements of SABS Specification 920, Type C or D.

3.33 CONCRETE REINFORCEMENT:

3.33.1 Rod reinforcement:

Bending and hooking of rods shall be done in accordance with SABS Specification 82. Rods shall be bent cold in an effective bending machine, or properly designed rod-bender using a steady pressure and not by hammering.

Diameters, lengths and positions of rods as shown on the drawings must be strictly adhered to. Joints in rods in beams, stairs, etc. will be permitted only where shown on drawings.

Before being placed in position, the rods shall be thoroughly cleaned of all grease, dirt, bituminous material, scale and loose rust.

All distribution rods shall be straight and shall extend at least 150 mm into beams or other support.

Unless otherwise shown on the drawings, all joints in reinforcing rods shall be lapped 40 times the diameter of the rod. The laps shall be securely tied with 1,25 mm diameter annealed mild steel binding wire.

Reinforcement for piles, column footings, columns and walls shall be tied at every intersection, or as directed or shown on drawings, with similar binding wire•

Reinforcement in beams shall be tied at alternate intersections in a diamond pattern, unless circumstances demand every intersection.

Great care must be taken to retain the reinforcement in its correct position during the entire period of concreting. Blocks of fine concrete, size approximately 40 x 40 mm, or plastic spacers, shall be provided on the formwork to soff its of beams to ensure than the rods are retained in position and than the correct concrete covering to the main reinforcing rods is provided. The blocks shall be of thickness required and shall be placed under the main reinforcing rods at approximately 600 mm centres.

Reinforcement in the top of slabs and the like shall be retained in position by means of cradles (stools), formed of steel reinforcing rod as follows:

R10 for height range 100-300 mm and maximum width of 300 mm.

R12 for height range 310-500 mm and maximum width of 450 mm.

Recommended spacing of supports for horizontal bars in slabs:

Not further than 600 mm apart (cradles ± 1000 mm c/c in both directions) for bar diameters up to 12 mm.

Not further than 1 000 mm apart (cradles $\pm 1\ 500$ mm **c/c** in both directions) for bar diameters of 16 mm and over.

Stools are to be placed on the bottom layer of reinforcement, securely retained in position and with correct concrete cover as specified. Cradles are to be securely wired to the slab reinforcement with binding wire. Beam rods in different layers shall be separated by means of steel spacer bars of suitable diameters and lengths.

Double mats in concrete walls shall be kept in their respective positions by means of suitable steel clips as follows:

Recommended spacing of supports for vertical bars in walls:

1 000 mm centres in both directions for bars up to 12 mm diameter,
1 500 mm centres in both directions for bars of 16 mm diameter and over.

Supports can be spaced more closely by the design Engineer, depending upon the circumstances.

All stirrups shall be properly fastened to the rods so as to retain their relative positions during the entire period of concreting.

Welding of main rods will not be permitted unless approval has been given by the Representative/Agent. Spot welding in lieu of wiring may be used to secure rods and stirrups in position.

The concrete covering the main reinforcement, unless otherwise specified, shall not be less than that stated in the following table:

Position	Amount of Amount of cover
Soffit of slabs	The diameter of the main rods, but never less than 15mm (mm)
End of beams	40
Soffits of beams	40
Sides of beams	40
Sides of columns	40
Slab under ground (cable	40
Concrete walls	40
Walls exposed to ground (cable	25
Ground beams	40
Foundations	40
Water retaining structures and within 1 km from coast	75
	50

In cases not included in the above table the cover shall be not less than 25 mm.

Depending on the condition of exposure and fire resistance requirements, concrete cover can be varied by the design engineer but in no case shall the concrete cover be less than the diameter of the rod to be covered.

The cover shall be measured from the face of the concrete to the outside of main reinforcement nearest the face of the concrete, and shall exclude plaster and similar finishing materials.

Three samples of each diameter of reinforcing rods, each approximately 600 mm long, must be taken from each consignment of rods of similar diameter, for testing.

If any sample is found unsatisfactory, the whole consignment of rods from which the samples were taken will be rejected,

Top reinforcement in cantilever slabs to be kept in position with a first row of stools or chairs 300 mm from the beam or support, and thereafter at a maximum of 40 bar diameters under each bar.

The cover blocks, spacers, bars and stools or chairs are to be placed and/or wired in position by the steel fixer.

3.33.2 Welded steel fabric reinforcement:

All welded steel fabric reinforcement shall comply with the requirements of SABS

Specification 1024.

The preferred dimensions are as follows:

1	2	3	4	5	6
Fabric Reference number	Nominal pitch of wires		Nominal diameter of wires		Nominal mass*
	Longi- tudinal mm	Cross mm	Longi- tudinal mm	Cross mm	kg/m ²
617	200	200	10,0	10,0	6,17
500	200	200	9,0	9,0	5,00
395	200	200	8,0	8,0	3,95
311	200	200	7,1	7,1	3,11
245	200	200	6,3	6,3	2,45
193	200	200	5,6	5,6	1,93
100	200	200	4,0	4,0	1,00
772	100	200	10,0	7,1	7,72
655	100	200	9,0	7,1	6,55
517	100	200	8,0	6,3	5,17
433	100	200	7,1	6,3	4,33
341	100	200	6,3	5,6	3,41
289	100	200	5,6	5,6	2,89
278	100	300	6,3	4,0	2,78
226	100	300	5,6	4,0	2,26
133	100	300	4,0	4,0	1,33

*These mass values are based on the wires having mass of 0,00785 kg/mm² per metre of length.

The actual mass of the fabric should not differ from the nominal value by more than 6%.

3.33.3 Descriptions (prices):

Descriptions (prices) for all steel reinforcement to concrete shall be deemed to include cutting and waste, bending, hooked ends, binding at lappings and intersections with annealed wire all as above described, hoisting or lowering and maintaining in position whilst the concrete is being deposited and cover blocks and spacers in accordance with the relevant SABS Codes of Practice.

Descriptions (prices) of standard fabric reinforcement as included in Table 1 of SABS Specification 1024 shall be deemed to include 300 mm wide laps.

The mass of binding wire is not included in the mass of the reinforcement and the cost thereof shall be deemed to be included in the prices for the reinforcement.

SECTION 4

PRECAST CONCRETE

4.1 MATERIALS:

Cement, water, aggregates and reinforcement shall be as described under SECTION 3: CONCRETE, FORMWORK AND REINFORCEMENT.

4.2. CONCRETE:

Concrete shall be as described under SECTION 3: CONCRETE, FORMWORK AND REINFORCEMENT and, unless otherwise specified. Class E concrete shall be used but with coarse aggregate of an appropriate size.

4.3 MOULD UNITS:

The whole of this work is to be carried out by a Specialist having workers skilled in this class of work.

All materials and finishes are to be to the approval of the Representative/Agent.

The moulds are to be properly constructed in the best and most up to date practice, made up in suitable sections with all necessary reinforcement, cramps, bands, bolts, etc. for fastening together and are to be constructed so that castings can be easily removed and the moulds re-used without distorting.

Those sections of the moulds which will produce the finished faces of the units are to be specially prepared, perfectly smooth, except where the finish is of exposed aggregate, true to shape and coated with a suitable solution which will prevent units adhering to the moulds, while not in any way discolouring the finished surfaces.

All cast units are to be properly cured and no units are to be fixed or built in until 28 days after casting. Units are to be properly protected from the elements while curing and are to be kept wet for at least 10 days after casting by frequent spraying with clean water.

Form all necessary checkings, mortices, lugs, etc. for cramps and dowels when casting.

4.4 TERRAZZO BLOCKS:

Precast terrazzo work shall be generally as prescribed for precast concrete above.

The coarse aggregate of the mix of which blocks are to be formed shall be of 10 mm stone.

The finish to exposed faces shall be 10 mm thick.

4.5 SMOOTH FINISH:

Where described as "finished smooth from the mould" such surfaces shall have a layer of fine stuff composed of 1 part cement and 4 parts clean fine sand by volume packed against the faces of the mould before placing the concrete backing. The concrete backing shall be deposited into the moulds in a wet state (not dry pressed) whilst the facing is still wet.

Projections shall be rubbed off and faces shall be of even colour and free from blemishes, cracks and other imperfections. Salient angles shall be arris rounded.

4.6 SIZES:

Sizes of blocks given are approximate. The Contractor shall be responsible for ascertaining the exact sizes of all blocks.

4.7 REINFORCEMENT:

Unspecified reinforcement required for manufacturing, handling and erection purposes and for reinforcing projecting and other unwieldy portions of blocks shall be provided by the Contractor at his discretion.

4.8 BEDDING, JOINTING AND POINTING:

Blocks shall be bedded and jointed solidly in cement mortar composed of 3 parts (by volume) of sand and 1 part (by volume) of cement and shall be pointed with slightly keyed joints

Descriptions (prices) of precast concrete shall be deemed to include reinforcement required for manufacturing, handling and erection purposes, steel rod or wire loop hooks and/or mortices for lewis bolts required for handling and transporting, any necessary temporary propping and strutting, bedding, jointing and pointing.

SECTION 5**MASONRY**

(Including brickwork and stone masonry)

NB: Where sizes in descriptions are given in brick units, "one brick" shall represent the length and "half brick" the width of a brick.

5.1 LIME:

Lime shall be hydrated bedding mortar lime complying with the requirements of SABS Specification 523.

5.2 CEMENT:

Cement shall be as described in Clause 3.1.

5.3 SAND:

Sand shall comply with the requirements of SABS Specification 1090, unless specialist advice is obtained. A sample of 25 kg must be delivered to the Departmental Laboratory for testing purposes.

5.4 BURNT CLAY BRICKS:

5.4.1 Burnt clay bricks shall comply with the requirements of SABS Specification 227, and shall be equal in all respects to the selected samples.

5.4.2 Clay bricks for foundations shall be as described in 5.4.1 above, but extra hard burnt.

5.4.3 Where bricks with holes are used, the holes in such bricks must only be filled in solid with mortar where specifically specified.

5.4.4 All bricks that do not carry the SABS Mark, must be tested by the Departmental or an approved laboratory.

5.5 FIREBRICKS:

Firebricks shall be of well burnt refractory fireclay, resistant to spalling and cracking and of same size as ordinary bricks.

5.6 LOCAL STONE:

Local stone shall be from an approved quarry, free from defects and to the satisfaction of the Representative/Agent.

5.7 FREESTONE:

All freestone shall be the best and most durable of its kind, free from vents, loose beds, oxide veins and other imperfections to the satisfaction of the Representative/Agent and shall be set on its natural quarry bed.

5.8 GRANITE:

Granite shall be free from iron stains, metallic veins and other defects and equal in all respects to the sample (s) submitted to and approved by the Representative/Agent.

5.9 MARBLE:

All marble shall be free from loose beds, metallic veins, iron stains, sand holes and other defects, all to the approval of the Representative/Agent.

5.10 SLATE:

All sawn slate shall be obtained from an approved Transvaal quarry, free from all defects and equal in all respects to the sample to be submitted to and approved by the Representative/Agent.

5.11 WORKS MORTAR TESTS:

5.11.1 Sampling:

The frequency of sampling will be decided by the Representative/Agent. Sufficient mortar shall be taken from each of the points of laying to prepare a composite sample to make a set of three mortar cubes.

5.11.2 Moulding:

Cube moulds with a nominal size of 100 mm, that comply with SABS STM 863 must be used.

Fill each mould with mortar in three equal layers and compact each layer by means of a tamper.

The tamper must be made of hard wood with a flat tamping surface with nominal dimensions of 50 x 25 mm and shaped to provide a round stem of approximately 25 mm diameter and long enough to afford sufficient hand grip. Immerse the tamper in water for 15 minutes before use.

Each layer of mortar must be compacted by means of 8 evenly spaced pressing strokes of the tamper. After the final layer has been tamped, the excess mortar must be struck off level with the top edges of the moulds.

5.11.3 Curing:

Cover the test cubes (in their moulds) with an impervious sheet followed by wet matting, sacks or similar material, and store them in a place free from vibration, excessive draughts and direct sunlight.

After 24 hours mark each cube so that it can be identified. After 48 hours the cubes must be removed from their moulds and placed into water in a curing tank at 22° — 25 °C for a minimum period of 7 days before they are transferred to the testing laboratory. Ensure that loss of moisture **is** prevented during transportation and that they are well protected against damage.

5.11.4 Testing of cubes:

The testing of all mortar cubes will be done by the Department or by a laboratory approved by the Director: Structural Engineering Services in accordance with SABS STM 863.

NB: MORTAR USED FOR CELLS AT POLICE STATIONS AND PRISONS MUST BE TESTED AND HAVE A CRUSHING STRENGTH OF NOT LESS THAN 6 MPa AFTER 28 DAYS.

5.12 CEMENT MORTAR:

Cement mortar shall be composed of 6 parts (by volume) of sand and 1 part (by volume) of cement. The material shall be mixed dry until of uniform colour and then water added and the mixture turned over until the ingredients are thoroughly incorporated. Cement mortar shall be produced in such quantities as can be used before commencing to set as no cement mortar that has once commenced to set shall be used in any way.

Care shall be taken in mixing cement mortar to remove from the mixing machine or platform any old mortar that has already set as such mortar may not be incorporated into any new batch.

5.13 COMPO MORTAR:

Compo mortar shall be composed of 6 parts (by volume) of sand — depending on the quality of the sand available, 1 part of lime and 1 part of cement (by volume) . The lime and sand shall be mixed dry, then mixed wet, before the cement is added, approximately half an hour before using and the adding of the necessary additional water as required.

Compo mortar shall be produced in such quantities as can be used before commencing to set, as no compo mortar that has once commenced to set shall be used in any way.

In all cases the mortar should achieve the minimum required strength (in MPa) for the classes of mortar as set out in the National Building Regulations.

5.14 BRICKWORK:

Brickwork, wherever practicable, shall be built in English bond. No false headers shall be used and none but whole bricks employed, except where legitimately required to form bond.

Brickwork shall be built level and plumb with mortar as specified. (See **NB** to Clause 5.15.)

The bricks shall be laid on a solid bed of mortar and all joints thoroughly grouted up solid throughout the whole width of each course.

The brickwork shall be carried up in a uniform manner, no one portion being raised more than 1,2 m above another at any one time.

Clay bricks shall be well saturated with water, in the stack or dump, approximately 2 hours before being used. The tops of walls left unfinished shall be well wetted before work recommences.

NB: Cement or concrete bricks shall not be wetted.

All rough and fair cutting, cutting of splays, skewbacks, chamfers, etc. shall be properly performed.

Form or leave all necessary openings for pipes etc. and make good after pipes etc. are fixed in position.

5.15 BRICKWORK IN CEMENT MORTAR:

5.15.1 All brickwork below damp course level, all isolated piers three bricks wide and under, half brick thick walls and chimney stacks above ceiling level, shall be built in cement mortar as described in Clause 5.12.

5.15.2 Brick arches and brick lintels shall be built in cement mortar as described in Clause 5.12, but in the proportion of 3:1.

NB: This clause is essential where compo mortar has been specified.

5.16 MORTAR JOINTS:

Mortar joints to brickwork generally shall be 10 mm in thickness with level bedding joints and vertical perpends.

The joints in brickwork receiving plaster, tiling or similar finishes shall be raked out whilst the mortar is soft to form key for the plaster or mortar backing. The depth of the raking out will depend on the condition of the bricks; the rougher the bricks on face the shallower the raking out and the smoother the bricks the deeper the raking out.

The joints in brickwork shall be flushed off where walls are to be bagged, in readiness for the bagging.

5.17 GROUT IN JOINTS IN BRICK FOUNDATION WALLS:

All joints in brick foundation walls shall be grouted in solid with 3:1 liquid cement mortar to obviate

any crevices for ant (termite) tracks.

5.18 BRICKWORK IN THICKNESSES:

Walls built in two or three half brick thicknesses shall only be built where bonded brickwork proves impractical (see Clause 5.14) or where required due to the prescribed bond of faced brickwork, all tied together with metal ties in accordance with SABS Specification 28, of the Butterfly or Modified PWD Types only, of sufficient length to allow not less than 75 mm of each end to be built into brickwork. Ties shall be evenly spaced at not more than 1 m apart to every third course and staggered.

5.19 BRICKWORK IN LININGS:

Brick linings to concrete shall be tied thereto with 4mm diameter galvanised crimped wire ties bent at ends and of necessary length to allow 75 mm to be cast into concrete and 75 mm of the other end to be built into brickwork and evenly spaced at not more than 1 m apart to every third course and staggered.

5.20 HALF BRICK THICK WALLS:

Half brick thick walls shall be built in cement mortar as described in Clause 5.12 and reinforced with 75 mm wide brick reinforcement as described in Clause 5.23, 1 row to every 8 course in height, and built 100 mm into main connecting walls. The reinforcement shall be lapped 150mm at end joints, where these are necessary, and 75 mm at angles.

Brickwork shall be built level and plumb.

5.21 CAVITY WALLS:

Cavity walls shall be built with two half brick thicknesses of brickwork in stretcher bond with 50 mm cavity between, and the two thicknesses tied together with 200 mm long metal wall ties evenly spaced at not less than the rate of 9 ties per m² of face area. The ties shall comply with the requirements of SABS Specification 28 and be of the Butterfly or Modified PWD Type only.

The brickwork shall be built level and plumb with mortar as specified.

The cavities shall be carried up from 1 course of brickwork below damp course level up to two courses below roof plate level. The brickwork above cavities shall be built solid and where 270 mm thick shall be cut and well bonded where possible.

The cavities shall be kept free of all rubbish, mortar droppings and projecting mortar.

The tops of walls shall be covered with planks or sacking during wet weather to prevent rain from entering the cavities.

Form weepholes in outer skin of external cavity walls by leaving the perpendicular joints open, one every 1 m apart in the second brick course below the damp-proof course.

The cavities shall not be ventilated.

At door, window and other openings the cavities shall be stopped 110 mm back from jambs of openings with the inner thickness of brickwork returned and stopped against the outer thickness and not bonded to same. A 100 mm wide strip of damp-proof sheeting as described for damp courses in Clause 6.1 shall be built into the joint formed between the return and the outer thickness. Each damp-proof strip shall be lapped at least 50 mm on to the damp-proof course between the two wall thicknesses of sills and between the two wall thicknesses of lintels.

Sills of windows shall be divided into external and internal thicknesses with strips of damp-proof sheeting as above, built in line with the damp-proof sheeting in jambs and extending 100 mm beyond the jambs of openings.

The lintels shall be provided with damp-proof sheeting as described under lintels.

Cavities shall be stopped 1 course below and 1 course above and 110 mm from sides of openings for air bricks and the like.

5.22 BEAM FILLING:

Beam filling shall be half brick thick, built up in mortar as used in the walls below, cut in between roof timbers and carried hard up to underside of roof covering and flushed up with mortar.

5.23 REINFORCED BRICK LINTELS:

Reinforced brick lintels shall be built with sound machine made bricks in 3:1 cement mortar with all vertical and horizontal joints filled solid with mortar throughout the required number of courses and to a distance of at least 330 mm on either side of the clear opening.

The number of courses in lintels over the various size openings shall be as specified in the table hereunder and reinforcing steel wires or rods shall be built into the first horizontal joint over the bottom course to the number specified in the following table:

Clear or daylight span	Number of Courses	Reinforcement
Not exceeding 1 m	4	One row of 75 mm wide brick reinforcement as described below, for each half brick width of soffit.
Over 1 m to 1,5 m	6	Ditto.
Over 1,5 m to 2, 5 m	7	Three 6,3 mm diameter mild steel rods for each half brick width of soffit.
Over 2,5 m to 3,0 m	8	Ditto.

Brick reinforcement shall be of hard drawn mild steel comprising two 2,8 mm diameter main wires spaced 75 mm apart and 2,5 mm diameter cross wires spaced at not exceeding 300 mm apart, welded to main wires.

The reinforcing wires and rods shall be of length at least equal to the width of the clear opening plus 330 mm at each end. The reinforcement shall be evenly spaced in the brick joints with the outer wires or rods having at least 20 mm cover from face of brickwork.

Brick lintels in 270 mm thick cavity walls shall be built with inner face of outer thickness, for a depth of three courses above soffit, covered with sheeting as for dampcourse, the full length of lintels, and space between the two thicknesses for the depth of the sheeting filled in solid with Class E concrete. Where cavities continue above lintels, the sheeting shall be taken up and turned on to top of first course of brickwork to inner thickness of wall above the concrete filling in lintels. The sheeting is not required in lintels protected from the weather.

The lintels, except where built over pressed steel door frames and the like, shall be supported on temporary turning pieces of suitable and substantial construction left in position for at least 14 days for long spans (1 to 3 m).

5.24 HOLLOW TILE LINTELS:

Hollow tile lintels shall be formed with approved 300 x 220 x 110 mm burnt clay hollow tiles each having not more than three cavities. The tiles shall be set end to end and the cavities filled up solid with Class E concrete.

Lintels shall have bearings of not less than 220 mm on walls at ends.

The lintels over the various size openings shall be rein-forced as specified in the following table:

Clear or daylight span	Reinforcement
Not exceeding 1m	One 12mm diameter mild steel rod in upper and lower cavities
Over 1 m to 1,5 m	One 16mm diameter mild steel rod in upper and lower cavities

The reinforcing rods shall be placed 12 mm from top and bottom edges of concrete filling to upper and lower cavities respectively.

Lintels over openings not exceeding 1 m wide in 1 brick thick walls shall be on flat and in all other cases shall be on edge using two or more lintels in walls 1 brick thick and over, built side by side, to make up the thickness of walls.

Lintels in 270 mm thick cavity walls shall be in two 110 mm thicknesses with inner face of outer thickness covered with sheeting as for damp-course, the full length and depth of lintel, and the space between the two thicknesses filled in solid with Class E concrete. Where cavities continue above lintels the sheeting in lintels shall be taken up and turned on to top of first course of brickwork to inner thickness of wall.

Lintels shall be made not less than 21 days before building in and shall be cured for at least 14 days by being kept damp in a shaded position.

The lintels shall be hoisted into position and bedded and grouted in solid in cement mortar.

5.25 PRESTRESSED LINTELS

Prestressed lintels shall be vibrated concrete reinforced with stressed high tensile steel wires, or of burnt clay blocks with similar reinforcing wires embedded in grooves in the blocks in 1:1½ cement/sand mortar, or of other approved form of construction.

Concrete in lintels shall attain a crushing strength of at least 34 MPa at 28 days for ordinary and at 7 days for rapid hardening cement.

The reinforcing wires shall be of ductile high tensile steel wire not less than 4 mm diameter and of tensile strength of at least 1 350 MPa and shall be stressed to not less than 850 MPa.

The lintels may be in a single width to the thickness of wall or may be in two widths, placed side by side, and shall have a depth of not less than 60 mm. Top surface of lintels shall be suitably roughened, indented or shaped to give a good bond between the lintels and the mortar for the first course of brickwork above,

Lintels shall have bearings of not less than 225 mm on walls at each end. 32PW 371/OCT '93

The number of reinforcing wires in lintels for the various wall thicknesses and spans shall be not less than specified in the table hereunder, and brick courses over lintels of the number indicated in the table and for the full length of lintels shall be built in 3:1 cement mortar with all joints filled solid with mortar, viz:

Nominal wall thickness (mm)	Clear or daylight span	Number of wires (in total number of lintels used)	Number of brick courses over lintel
90 - 110	Not exceeding 1,8 m	2	3
90 - 110	Over 1,8 m to 3 m	3	4
180 - 230	Not exceeding 1,8m	6	4
180 - 230	Over 1,8 m to 3 m	6	5
270	Not exceeding 1,8 m	7	4
270	Over 1,8 m to 3 m	7	5
340	As described for 1 of 230 mm plus 1 of 110 mm, or 3 of 110 mm		

Lintels in 270 mm thick cavity walls shall be in two widths with joint between the two arranged directly over the window or frame below, and the brickwork above shall be built in two half brick thickness with inner face of the outer thickness covered with sheeting as for damp-course, the full length and depth of lintels, and taken down between the two widths of prestressed lintels. The cavity to height of lintel courses shall be filled with Class E concrete, and where cavities continue above the lintel courses the sheeting shall be taken up and turned on to top of first course of brickwork to inner thickness of wall above the lintel course. The sheeting is not required in lintels protected from the weather.

5.26 BAGGED FINISH TO BRICKWORK:

Bagging to walls is to be carried out after the mortar in joints has set. The wall surfaces shall be rubbed over with wet rough sacking until all joints and crevices are filled up and an even surface is obtained. Cement grout shall be added if necessary to fill up the joints and crevices.

5.27 RAKING OUT FOR AND POINTING FLASHINGS:

Brick joints shall be raked out where required for fixing cover flashings and flashings, which shall be pointed in 3:1 cement mortar.

5.28 MASTIC POINTINGS:

Where steel door and window frames are specified to be pointed with mastic compound they shall be pointed all round externally with an approved waterproofing compound of such composition that it will not stain surrounding surfaces and that it will adhere tenaciously, remain plastic without sagging or running, be capable of accommodating any normal movement of the joint sealed, and will receive paint without "bleeding". The pointing material shall be forced into the joints, which shall have been previously prepared to receive same, by means of a pressure gun or by other suitable method, all in accordance with the Manufacturer's instructions.

5.29 SMOKE FLUES

Smoke flues shall be 230 x 230 mm and carried up as straight as possible with easy bends where necessary.

Flues not lined with firebrick, or similar material, shall be parged with mortar and cored at completion.

Firebrick linings to flues shall be half brick thick, built to fair face, bedded and jointed in approved fireclay or fire cement, flush pointed and properly cleaned out as the work proceeds.

Flues shall be properly gathered over fireplace openings, and where flues start from top of flue slabs, steep flaunching of Class E concrete shall be provided on slab, worked up round flue to prevent lodgement of soot on the slab.

5.30 BUILDING IN:

Ends of timbers, holdfasts, cramps, gratings, air bricks, dowels, etc. shall be built-in in cement mortar.

Door and window frames, lift door frames and the like shall be set up in position for building in and securely strutted to prevent distortion whilst the brickwork, lintels, etc. are being built.

Pressed steel door frames and lift door frames shall be grouted in solid at back with cement mortar as the work proceeds.

Wood slips, fixing bricks, hoop iron roof ties, etc. shall be built in as the work proceeds.

The frames to lift doors are to be built in as the work proceeds and shall be placed in position by the Lift Contractor.

5.31 FIXING STRONG ROOM DOORS AND VENTILATORS:

Strongroom doors shall not be built into walls as the work proceeds but shall be set up and fixed into openings formed in the walls, after plastering etc. has been completed, and secured in position with grip lugs supplied with doors and grouted in solid all round with 3:1 cement mortar, all in accordance with the Manufacturer's instructions. The strongroom doors shall swing 25 mm clear above finished floor level. Floor and wall finishes shall be made good if disturbed.

Ventilators to strongrooms shall be correctly built into openings formed in the walls in 3:1 cement mortar and grouted in solid with similar mortar and wall finishes made good if disturbed.

5.32 SECURING OF ROOFS:

Roof trusses shall be fixed at each support to walls with ties of 1,6 mm thick galvanised hoop iron, 32 mm wide, built 750 mm deep into brickwork or embedded 300 mm deep into concrete or wrapped around bottom layer of reinforcing in a reinforced concrete beam and wrapped over truss and fixed with four galvanised nails, 40 mm long

5.33 CRAMPS TO WOOD FRAMES:

Wood frames to doors, windows, etc. shall be set up in position for building in as described and built in as the work proceeds with cramps to jambs of 1,6 mm thick galvanised hoop iron, 32 mm wide, with ends turned 50 mm up against stiles of frames and each twice screwed to frame and built 450 mm into wall with end turned up into brickwork joint. Cramps shall be built in approximately 0,3 m up from bottom and approximately 0,3 m down from head of frames and intermediately at not exceeding 0,85 m apart. No frame shall have less than two cramps to each jamb irrespective of height.

Cramps to frames in 270 mm thick cavity walls shall be cranked as necessary and built into inner and outer thickness of walls alternately.

5.34 BEDDING AND POINTING:

All door, window and similar frames shall be bedded and pointed in 3:1 cement mortar. All wall and floor plates shall be set true and level and bedded in 6:1 cement mortar.

Steel door and window frames shall be carefully pointed all round and made perfectly watertight.

5.35 FACED BRICKWORK:

Faced brickwork shall be built fair and pointed with a keyed or recessed joint as specified.

Keyed joint shall mean that the joints are to be pointed with a round jointing tool, well pressed into the joints as the work proceeds.

Recessed "joint shall mean that the joints are to be square recessed to a depth of approximately 6 mm formed with a rectangular jointing tool well pressed into the joints as the work proceeds.

Facing bricks shall be sorted by the brick manufacturer at his yard or by the Contractor on the site to

ensure that proper mixing of the bricks within the colour range of each type of facing brick being used is obtained. Sudden changes in the general colour of face work in any 1 type of facing brick will not be acceptable.

5.36 FIBRE CEMENT SILLS:

Sills shall where in any way possible be in single lengths, cut between reveals, fitted with fixing lugs and solidly bedded in 3:1 cement mortar with a slight projection beyond the finished wall face below.

Internal sills shall be level. External sills shall be set sloping on cut brickwork.

5.37 QUARRY TILES:

Quarry tiles shall be of approved quality, even in thickness, truly square, free from cracks, twists and blemishes and uniform in colour and, unless otherwise specified, be of approved red colour.

Joints to quarry tiles shall be continuous in both directions with a free space around the perimeter.

Tiles shall be solidly bedded and jointed in 3:1 cement mortar with joints, unless otherwise specified, 6 mm wide and pointed with a slightly keyed in joint. Tiles shall be well soaked in water before fixing and thoroughly cleaned off after fixing.

Tiles in sills, copings, etc. shall be set with slight projection over finished wall face, and where full tiles do not fit into the length, two cut tiles shall be used, symmetrically placed as directed.

Do all cutting to tiles as necessary.

5.38 INSTALLATION OF ELECTRICAL SERVICE:

The installation of electrical service, where such service is being provided, will be carried out under separate contract or Departmentally, but the Contractor must embed in the concrete, as the work proceeds, all conduits, boxes, etc., which will be fixed in position by the electricians, and must cut all necessary chases and holes in walls for conduits and form recesses in walls for distribution boards, all in the positions directed. Alternatively, distribution boards may be built into walls as the work proceeds, providing prior approval is obtained from the Representative/Agent.

The Contractor shall afford every facility and shall render reasonable assistance to the electricians in carrying out their work and shall make good where necessary, in all trades, after installation has been completed.

Chases, holes and recesses required in walls shall be cut and formed as follows:

Vertical chase for single conduit.

Vertical chase for two conduits.

Vertical chase 150 mm wide and 110 mm deep for conduits.

Vertical chase 250 mm wide and 110 mm deep for conduits.

Vertical chase 380 mm wide and 110 mm deep for conduits.

Vertical chase 560 mm wide and 110 mm deep for conduits.

Horizontal chase for single conduit.

Holes 25 mm diameter, or knocking out bricks and filling space and making good after a pipe has been fixed through a wall.

Recesses for distribution boards

Width mm	Height mm	Depth mm
330	330	110
455	330	110
635	330	110
610	660	110
610	910	110

5.39 CABLE SLEEVES:

Provide under buildings where required 100 mm diameter vitrified clay, pitch fibre or plastic pipes as sleeves for electric cable taken up to floor level in cable duct or switch cupboard with easy bends. The pipes shall be as specified for drainage including laying and jointing.

5.40 SPECIAL WORKS:

The work in connection with the installation of heating, air conditioning, ventilation, refrigeration, automatic sprinklers, telephone systems and lifts will be carried out under separate contracts or Departmentally. In order to facilitate this work the Contractor must act on the instructions of the Representative/Agent with regard to special preparations for fittings, leaving holes and openings, forming chases in floors, walls, etc. for pipes, cables, etc. and for building in pipes, sleeves, pipe clips, bolts, etc. as required or directed.

All cutting of holes through finished floors, walls, etc., after the concrete has set, must be avoided as far as possible. The Contractor must give ample notice to the Representative/Agent who will ascertain the exact positions where pipe sleeves, pipes, pipe clips, etc. are to be fixed.

5.41 RUBBLE WALLING:

All stones are to 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 m².

All stones are to be laid and flushed up solid (unless otherwise described) in compo mortar and well hammered down to their bearings and carefully fitted into position in the strongest manner so as to avoid interstices, but where these are unavoidable they are to be hand packed with flat spalls bedded into the mortar. Walls are to be levelled with selected long flat stones to form a bedding for damp-proof courses and elsewhere as required.

5.42 STONework:

Only skilled labour is to be employed for this work.

All joints are to be 6 mm thick, unless otherwise described, and grouted or flushed up solid in cement mortar.

(a) Freestone:

The work involved is to include for all templates, hoisting and setting in position in compo mortar, all rough labours such as plain and sunk beds, joints and backs, and hacking of surfaces where required for plaster. All exposed joints are to be raked out not less than 12 mm deep from finished face of stonework and pointed with white lime putty. Provide casing and protection from injury and clean down at completion.

Holes 25 mm diameter, or knocking out bricks and filling space and making good after a pipe has been fixed through a wall.

(b) Granite:

All as specified for freestone above, but with joints flushed up solid and pointed with a neat,

square, recessed joint as the work proceeds,

(c) Samples of finished faces to freestone and granite:

The finished faces of freestone and granite shall be as described and equal in all respects to a finished sample to be submitted to and approved by the Representative/Agent.

(d) Marble and slate:

Polished samples, size 150 x 150 mm, of each different type of material to be used are to be submitted to the Representative/Agent for approval before the work is put in hand and the slabs used are to be equal in all respects to the approved samples.

The slabs are to be rectangular except where otherwise described and sawn die square. Linings, skirtings, pavings, etc. are to be properly matched for veining, colour and texture and laid out for approval by the Representative/Agent. After approval each slab shall be numbered and kept in the same relative position when fixing with veinings running in the approved directions.

Artificial patching will only be allowed where approved by the Representative/Agent.

Descriptions (prices) shall be deemed to include square cutting, bedding of linings against walls etc. on daubs of cement mortar not exceeding 20 mm thick and keeping joints as even as possible but not exceeding 3 mm wide, all flushed up solidly, as the work proceeds with plaster of Paris tinted to match the colour of the stone; all fixing of slabs to walls, soffits, etc. with suitable 4 mm thick copper cramps (two to each slab), each cut and pinned or built into brickwork or concrete in 3:1 quick setting cement mortar, dowelling slabs together along horizontal joints with 6 mm diameter copper dowels, 40 mm long (two to each slab), including drilling, cutting mortices or slots for cramps, all casing, protecting from injury and cleaning down on completion.

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

5.43 PROTECT AND CLEAN DOWN FACE BRICKWORK, STONEMWORK. ETC.:

All face brickwork, stonework, tiling, etc. liable to damage shall be covered up and protected during the progress of the remaining work and any damage done shall be made good to the satisfaction of the Representative/Agent.

All face brickwork, stonework, tiling, etc. shall be cleaned down as the work proceeds and shall be covered up with paper, pasted on, or by other approved means where necessary to prevent soiling of the surfaces during the progress of the remaining work. At completion of the works the coverings shall be removed and the surfaces again cleaned down to the satisfaction of the Representative/Agent.

Any detergent or other materials used in the cleaning down of face brickwork etc. shall be of such nature that will not harm adjoining paint and other finishings in any way.

All pavings shall be thoroughly cleaned off after laying to remove all traces of mortar and other substances, covered up and protected from damage during the progress of the works and again cleaned off at completion.

SECTION 6

WATERPROOFING

6.1 DAMP-PROOF COURSE:

The horizontal and vertical damp-proof course shall be of black **polyethylene** sheeting complying with SABS Specification 952 Type B having embossed surfaces, 0,38 mm thick (375 microns) and manufactured in widths of less than 1000 mm.

The damp-proof course shall be the full thickness of walls above foundations, plus the width of floor plates where these occur, and shall be laid without longitudinal joints. At end joints, angles and intermediate junctions the sheeting shall be lapped for 150 mm.

Where so required all laps in the damp-proof course shall be sealed over the whole area of laps as recommended by the Manufacturer. Care shall be taken not to tear or otherwise damage the sheeting.

Similar damp-proof course, 120 mm wide x 250 mm long, shall be laid on sleeper piers under the floor bearers.

Similar damp-proof course, but in unbroken lengths, shall be laid behind all window sills, sealed with an approved bituminous solution to the back of the sills and taken down within the thickness of the wall and under the first full course of external brickwork.

NB: No damp-proof course shall be laid directly below the mortar or other bedding material under sills.

6.2 PAMP-PROOF MEMBRANE:

The damp-proof membrane under surface beds shall, unless otherwise specified, be of green polyethylene sheeting complying with SABS Specification 952 Type C — plain surface — 0,25 mm thick (250 microns) and manufactured in widths of 1000 mm and greater, all laid in the widest practical widths to minimise joints, turned up and dressed to load bearing walls and, if applicable, lapped with the damp-proof course in the walls. All joints shall be sealed with pressure sensitive tape applied over the leading edge of the joint.

NB: All cutting of plastic membranes shall be carried out using sharp instruments.

6.3 TANKING:

Horizontal and vertical tanking shall, unless otherwise specified, be as hereunder and carried out in accordance with SABS Code of Practice 021:

- (a) of bituminous sheeting complying with the requirements of SABS Specification 248 and as Type FV (Fibre Felt Base) or Type GH (Hessian Base) sheeting specified therein as—
 - (i) one layer lapped 75 mm at edges and ends and sealed together with hot bitumen. (The sheeting laid free of the sub-floor but sealed to primed walls); or
 - (ii) two layers laid shingle fashion, lapped 475 mm at edges and 150 mm at ends and sealed together with hot bitumen. (The sheeting laid free of the sub-floor but sealed to primed walls); or
 - (iii) three layers laid shingle fashion, lapped 617 mm at edges and 150 mm at ends and sealed together with hot bitumen. (The sheeting laid free of the sub-floor but sealed to primed walls); or
- (b) of polymeric sheeting complying with the requirements of SABS Specification 952 and as Type C — plain surface — specified therein as —
 - (i) one layer Orange EVA polyethylene sheeting, 1,00 mm thick (1000 microns), lapped and jointed with the specially formulated joining strip to form a fully waterproof seal, all

strictly in accordance with the Manufacturer's instructions; or

- (ii) one layer Orange EVA polyethylene sheeting, 0,50 mm thick (500 microns), lapped and jointed with the specially formulated joining strip to form a fully waterproof seal, all strictly in accordance with the Manufacturer's instructions; or
- (c) of an approved torch-on type of material, 4 mm thick, consisting of polymer modified bitumen, all laid strictly in accordance with the Manufacturer's instructions, with 100 mm side and end laps fully bonded.

The manufacture of such material shall comply with SABS Code of Practice 0157.

NB: Approved filling shall be carefully placed against tanking material for the full height of same and shall be free of stone or other hard, sharp particles larger than will pass a mesh of 10 mm in the clear.

If the material from the excavations is found to be unsuitable, written approval must first be obtained from the Representative/Agent to use imported fill.

6.4 FLAT ROOF COVERING:

6.4.1 General:

The work of covering flat roofs shall be carried out by skilled workmen who are experienced in this type of work, all in accordance with SABS Code of Practice 021.

Surfaces to be covered shall be perfectly dry and, immediately before the material is laid, swept clean of all chips, dust, etc.

No burnt mastic shall be used in the work.

The Contractor shall furnish the Department with a written guarantee covering the time period stated for each type of roof covering specified, the workmanship and materials. This guarantee shall be signed by the Contractor and countersigned by the supplier of the materials used.

It is a specific requirement that the guarantee for the flat roof waterproofing specified or offered, be underwritten by a recognised insurance company.

Should any maintenance be required during the guarantee period the Contractor must allow for the cost of such in his tender price as the Contractor will be held solely responsible for any leaks that occur during the guarantee period.

6.4.2 Bituminous Sheetting:

Covering to flat concrete roofs shall be of *two or three layers* of Type 60 bituminous sheeting, as specified, having a mass of not less than 57 kg per roll of 18 m², all in accordance with SABS Specification 92.

The sheeting is to be unrolled on to the surface to be covered and allowed to warm in the sun to remove all wrinkles and to ensure that the material is perfectly flat when laid in position. All layers and lappings are to be sealed together with hot bitumen.

The hot bitumen is to be applied at a rate of not less than 1,5 kg/m² of roofing between each layer. Where direct adhesion of the bituminous sheeting to the concrete deck occurs such as perimeters, turn-ups and turn-downs, etc. the respective areas must be primed with bituminous primer and allowed to dry before any sealing with the hot bitumen takes place. Turn roof covering up, over triangular fillets, against vertical surfaces for a total height of not less than 100 mm. The turn-ups and turn-downs are to be well fixed to all angles and fillets, well dressed around pipes and into outlets and finished off with a fibre bitumen fillet where applicable. Dress the full thickness of the roof covering to splayed edge of outlets as well as to all other relevant surfaces.

All sheeting is to be laid shingle fashion with not more than 283 mm exposure of each sheet in three layer work, and 424 mm exposure in two layer work, all laid with 150 mm end laps.

The surfaces, unless otherwise specified, must be finished on top with a heavy brush application of bituminous based aluminium paint complying with SABS Specification 802.

On completion the work shall be thoroughly sound and guaranteed to remain water tight for a period of 10 years for 3-layer work and seven years for 2-layer work.

6.4.3 Mastic Asphalt:

Covering to flat concrete roofs shall be of asphalt roofing mastic manufactured in accordance with SABS Specification 297 with each block bearing the "MARK". Over the entire area to be covered lay an underlay of black felt or kraft paper which is to be lapped at least 25 mm at all joints.

The mastic is to be laid on top of the underlay in two 10 mm thick layers, applied hot and trowelled to an even surface to form a voidless mass.

Care must be taken when laying the second layer that the working joints do not coincide with those of the first layer.

At the junctions of horizontal and vertical surfaces the mastic is to be turned up approximately 150 mm high and tucked into a 25 x 25 mm chase. Where the flat roofs discharge into eaves gutters, apron flashings of 0,60 mm thick galvanised mild steel sheet (or sheet copper in coastal areas) are to be provided, bent as required into eaves gutters and bedded in mastic on top of the underlay to roof slab, and must be lapped 50 mm at joints and bent, riveted and soldered at angles.

The mastic is to be dressed down into patent type outlets and up and around all pipes passing through roofs to a height of not less than 150 mm.

The surface, unless otherwise specified, must be finished on top with a heavy brush application of bituminous based aluminium paint complying with SABS Specification 802.

On completion the work shall be thoroughly sound and guaranteed to remain watertight for a period of 10 years.

6.4.4 Polyester based sheeting:

Covering to flat concrete roofs shall consist of an approved single layer system of 4 mm thick, torch-on, polymer modified bitumen with polyester base, protected on exposed surfaces with UV resistant mineral chip coating applied during manufacture of the sheeting.

The sheeting shall be laid in strict accordance with the Manufacturer's instructions with 75 mm side laps and 100 mm end laps, all fully bonded.

All concrete surfaces to be covered with torch-on sheeting are to be primed with a suitable bituminous primer at the rate of 3,5 m²/litre and allowed to dry.

The waterproofing system shall be manufactured in accordance with SABS Code of Practice 0157.

On completion the work shall be thoroughly sound and guaranteed to remain watertight for a period of 10 years.

SECTION 7 ROOF**COVERINGS ETC.****7.1 GENERAL:**

Prior to the laying of tiles or slates, the roof structure shall be covered with an approved waterproofing underlay having a non-combustible reflective foil finish on upper surface and a layer of plastic on the underside all bonded to a substrate of kraft paper having synthetic reinforcing, all as described in SABS Specification 1381.

The waterproofing underlay shall be laid longitudinally and pulled taut over the top edges of the rafters and then nailed thereto with galvanised clout nails. Working from the eaves level upwards, a minimum overlap of 150 mm shall be allowed to ensure complete protection.

Roofs shall be left perfect, clean and watertight on completion and all eaves and valley gutters shall be cleaned out.

Valleys shall be of open or closed construction as follows:

- (a) Open valleys: a strip of underlay approximately 1 m wide shall be laid along the whole length of the valley and nailed into position with clout nails close to the edges of the valley boards farthest from the centre line of the valley. Provide metal valley lining as described in Clause 7.15, ensuring that it extends at least 50 mm beyond the edges of the tiling, all securely fixed along both edges. Matching roof tiles/slates shall be neatly cut to the line of the valley and laid to project over the edges of the valley lining by at least 50 mm. A gap of at least 50 mm shall be provided down the centre line of the valley between the edges of the tiles.
- (b) Closed valleys: all constructed as for open valleys except that the tiles are to be cut in such a manner that when laid they form a butt joint closing valley.

7.2 ROOFING TILES (CLAY):

Clay roofing tiles shall comply with the requirements of SABS Specification 632 and shall be of the pattern specified.

Unless otherwise specified, the tiles shall be of an approved red colour.

Plain tiles shall be laid "broken bond" and vertical joints between tiles and the bottom edge of each course of tiles shall range perfectly straight and, unless otherwise specified, shall be laid to a lap of at least 62 mm. –

Half tiles in the case of interlocking tiles and tile-and-a-half tiles in the case of plain tiles shall be provided as required at abutments and at verges of roofs. Plain tile roofs shall be provided with a double course at eaves.

Tiles shall be carefully cut and dressed at hips, valleys and where necessary at abutments etc.

Unless otherwise specified, tiles shall be securely fixed as follows:

- (a) Interlocking tiles: every tile in every third course shall be secured using 1,6 mm diameter galvanised steel wire passed through the holes in nibs and wound around battens for inland use whilst copper, aluminium or Grade 304 stainless steel wire shall be used in coastal areas.
- (b) Plain tiles: every tile in every fifth course shall be secured using copper, aluminium or Grade 304 stainless steel nails for all services, coastal or inland. All nails shall be of such length as will penetrate the battens to a depth of at least 25 mm.

NB: All tiles in ridge courses.. all cut end tiles along each side of valleys and hips and all

tiles to open eaves and verges shall be secured with wire or nails as specified above. Where necessary the mitred portions of tiles along each side of valleys and hips are to be holed and properly secured with wire or nails as above.

Hip and ridge tiles shall be half-round, of the same material and manufacture as the roofing tiles, with a minimum cover of 75 mm on each side over the top course of tiling and with collars for overlapping joints, all bedded and pointed in 3:1 cement mortar. All hip tiles and every fourth ridge tile shall be holed for and fixed with Grade 304 stainless steel nails for all areas. The hip and ridge junction tiles, stopped ends, etc. shall be of approved design, made to work in with ridging and ordinary tiles and bedded and pointed as before.

7.3 ROOFING TILES (CONCRETED):

Concrete roofing tiles shall comply with the requirements of SABS Specification 542 and shall be of pattern and colour specified.

The body of each tile shall be of such a colour throughout that the colour of any part of the surface that may be abraded or worn away will resemble or tone in with that of the rest of the surface.

Tiles shall be laid to a lap of at least 100 mm in the case of roof pitches between 17 ½° and 25° and in the case of roof pitches 26° and upwards to a minimum lap of 75 mm. Vertical joints between tiles and the bottom edges of each course of tiles shall range perfectly straight.

Unless otherwise specified tiles shall be securely fixed as follows:

- (a) Every third tile in each course; all tiles in ridge courses; all cut end tiles along each side of hips and valleys; all tiles to open eaves and verges shall be fixed to the battens with copper, aluminium or Grade 304 stainless steel clout nails for all areas. All nails shall be of such length as will penetrate the battens to a depth of at least 25 mm.
- (b) For coastal areas all tiles are to be clipped using approved nylon storm clips nailed to the tile battens.

Ridges and Hips:

Ridges and hips shall be covered with collared or butt jointed, half-round or angular ridge tiles, all of colour to match the general tiling. A strip of DPC sheeting as described in 6.1, of such width as will give a lap of at least 75 mm on to the roof tiling at each side and lapped not less than 100 mm at end joints, shall be laid under the mortar bedding. All mortar shall consist of 3 parts clean fine sand to 1 part of cement, pigmented to approved colour, for both bedding and pointing.

Pointing shall not be performed with separate materials and no lime shall be added. Only inorganic pigment shall be used at all times to colour the mortar and match the shade of the tiles used. Painting with pigmented mortar or pigment/water concentrate is not acceptable.

Butt ended ridge tiles shall be bedded solid with the 3:1 mortar squeezed up to fill the joint and struck off cleanly. Where a large mass of bedding mortar is required, e.g. junctions of ridge/hip tiles or in the troughs produced by deeply contoured tiles, broken pieces of tiles shall be used to prevent excessive shrinkage and cracking of the mortar. The mortar bedding shall be trowelled smooth at exposed ends of ridges.

Hip and ridge tiles shall be neatly cut and fitted together at junctions and shall be bedded solid in pigmented 3:1 mortar.

Unless otherwise specified, verge tiles shall be used, neatly finished and secured as before described.

For hips at steep pitches above 40°, hoop iron shall be used and fixed to the hip tree with two screws or nails to support the first hip tile.

7.4 ROOFING SLATES:

Roofing slates shall be from an approved Transvaal quarry, free from cracks, veins, patches and

other defects, squared up and dressed to the size specified and holed or slotted as required for fixing. All slate shall be equal to the samples to be submitted to and approved by the Representative/Agent.

Unless otherwise specified, the slates shall be of variegated colours in the proportion of approximately 90% natural grey and 10% coloured.

Slates shall be laid "broken bond" and vertical joints between slates and the bottom edge of each course of slates shall range perfectly straight. Slates shall be laid to a lap of 75 mm and shall be double nailed with approved 40 mm long Grade 304 stainless steel nails.

Half slates shall be provided as required at abutments and at verges of roofs and a double course of slates shall be provided at eaves.

Slates shall be carefully cut and dressed close to the ridge and, where necessary, at abutments etc. and cut and close mitred at hips and valleys.

Where slates vary in thickness they shall be sorted on site and used in such manner that all slates in each course are of the same thickness with the thickness being gradually reduced in each successive course towards the ridge.

Hips and ridges shall be made watertight with approved soakers fixed under the slates in an approved manner.

NB: Slate roofing that relies solely on the provision of a waterproofing membrane for watertightness is not acceptable.

7.5 FIBRE CEMENT ROOFING SLATES:

Roofing slates shall be manufactured from fibre cement of grey or other approved colour and shall be free from cracks and other defects, holed as required for fixing and fixed in strict accordance with the Manufacturer's instructions.

Slates shall be laid in a staggered pattern with vertical joints between slates approximately 6 mm wide and the vertical line shall range perfectly straight from eaves to ridge. Slates shall be laid to a lap of 110 mm and shall be double-nailed with approved 40 mm long Grade 304 stainless steel or copper clout nails. The lower end of each slate to be fixed with a copper disc rivet.

Half slates shall be provided as required at abutments and at verges of roofs with a double course of slates provided at eaves.

Slates shall be carefully cut close to the ridges and, where necessary, at abutments etc. and cut and close mitred at hips and valleys.

Hips and ridges shall be made watertight with approved soakers fixed under the slates in an approved manner.

Where "Boston" hips are employed a 380 mm wide continuous soaker of bitumen impregnated felt or 375 micron plastic damp-proof course shall be placed centrally over the full length of hips. Standard slates, halved longitudinally, are to be fixed in accordance with the Manufacturer's specification.

7.6. ROOFING SHEETS (METAL):

7.6.1 GENERAL:

Profiled metal sheet roof coverings shall comply with the following minimum requirements:

- (a) Galvanised metal roof sheets shall have a minimum thickness of 0,8 mm for roofs of 4° — 14° pitch inclusive and 0,6 mm for roof pitches of 15° and upwards.

Where any profile requires the use of steel manufactured in accordance with ASTM 446, Grade E, such steel shall be 0,5 mm thick for all pitches.

NB: All steel which is claimed to comply with ASTM 446, Grade E, shall be supplied complete with a certificate of such compliance issued by the Manufacturer.

- (b) Roof trusses shall be spaced at not exceeding 1,2 m centres, except where the pitch is 12° or less, when the spacing may not exceed 1 m centres.
- (c) Purlins shall be spaced at not exceeding 1,0m centres for roof pitches of 4° to 30° inclusive and at 1,2 m maximum for roofs having pitches of 31° and greater. Purlin spacings for flat metal roofs are to be as specified in Clause 7.8.
- (d) Unless otherwise specified in this section, profiled metal roofing sheets shall be used and fixed all in accordance with SABS Code of Practice 0237.
- (e) Roofing sheets for use inland shall have galvanised coating of Z275 quality.
- (f) Galvanised roofing sheets for use in coastal areas shall be finished with an approved factory applied paint coating.
- (g) All necessary cutting of sheets shall be properly performed. Cut edges at sides of valleys and where otherwise exposed shall be perfectly straight.
- (h) Drive screws will not be permitted. The sheeting shall be drilled and not punched for fixing screws. Only special wood screws with proper thread will be permitted in conjunction with neoprene and metal washers.
- (i) Hook bolt type fasteners shall each be provided with neoprene and metal washers under nut.
- (j) Metal covered roofs having a pitch of 4° or less shall be as later specified for flat metal roofs in Clause 7.8. The provision and use of protective roof boards is compulsory.
- (k) The Contractor is to submit a certificate, signed by the Merchant, stating that the galvanised roof covering supplied complies with the required thickness specified.
- (l) Roof sheets shall be in single lengths to each slope of roof or to both roof slopes where a ridge is to be formed by bending the sheets over the ridge.
- (m) The use of any approved factory applied paint finish shall in all cases be in addition to the galvanised coating as specified.

7.6.2 PROFILES:

(a) Corrugated roofing sheets:

Corrugated galvanised iron roofing sheets shall comply with SABS Specification 934 with corrugations 17,5 mm deep at 76 mm centres giving an effective width of approximately 610 or 762 mm between the crests of the outermost corrugations respectively, all coated with zinc having a mass of not less than that indicated in the following table for the three classes of galvanising specified:

	g/m ² of surface area	
	Average	Individual (Minimum)
	600	510
	450	385
	275	235

At exposed verges of roofs the iron shall be finished with neatly formed rolls. The sheets shall have side laps of not less than one and a half corrugations. The minimum end laps for the different roof slopes shall be in accordance with the following table:

Slope of roof	End lap ¹ , (mm)
greater	150
30°	175
25°	200
20°	225
	300

(b) Rib-trough roof sheeting:

Rib-trough roofing sheets shall be pressed to troughed profile with ribs not less than 50 mm deep at not exceeding 275 mm centres or with ribs not less than 28 mm deep at not exceeding 190 mm centres.

The sheets shall be lapped one rib at sides and fitted with approved sealing strips as supplied by the Manufacturer of the sheeting and fixed at each alternate rib to every purlin. The fixing of roof sheeting shall be as previously specified under Subclause 7.6.1.

(c) Interlocking rib-trough roof sheeting with concealed fixing:

Interlocking roofing sheets shall be of mild steel, coated with zinc having a mass of not less than that specified in the table under Sub-clause 7.6.2 (a) and comply with SABS Specification 563.

The ribs of the profile shall be not less than 40 mm deep for both the plain centre rib and the female clip-over rib. The male clip-in rib shall be not less than 38 mm deep, formed to accommodate the fixing clips and with a capillary action break.

The male rib will also be provided with a vertical section to give strength to the sheet with a water channel profile along the lower outer edge.

Ribs shall not exceed 180 mm centres with a beading rolled into bottom of trough to enhance the strength of sheets.

The sheets shall be cold rolled profiled on site in single lengths to each roof slope.

A galvanised flat iron starter strip of at least 1 mm thick as supplied by the Manufacturer shall be provided and properly nailed at each intersection with wooden purlins using nails of suitable length and diameter. The first sheet shall be clipped over the starter strip and secured thereto with self-tapping screws of suitable length and diameter at approximately 500 mm centres.

Sheeting is to be laid in the direction of the prevailing winds, wherever possible, all fixed to each purlin with clips supplied by the Manufacturer. All fixing clips shall be of at least 0,8 mm thick galvanised flat iron, nailed to wooden purlins with two nails, each 50 mm in length, or be screwed to mild steel purlins with two self-tapping screws.

All sheets must be secured at both top and bottom ends by means of self-tapping screws passed through overhang on fixing clips into male section overhang at edges of sheets.

Bottom ends of troughs are to be bent down to form drips at gutter and bent upwards

at ridges to prevent backflow of water using an approved tool.

NB: Notwithstanding anything to the contrary, the spacing of purlins for interlocking rib-trough roofing sheets, measured centre to centre for any roof slope, shall be 1,9 m maximum.

(d) Standing seam roofing sheets:

Standing seam roofing sheets shall be of galvanised steel, pressed to shape, with plain, trapezoidal or other profile standing seams on the upper side of the sheeting at not exceeding 250 mm centres and with headings pressed into the sheeting between the standing seams to provide the necessary stiffness to the sheeting. The standing seams shall be of such shape as will accommodate the fixing clips and those along sides of the sheets shall be male and female to interlock with adjacent sheets. The standing seams, including the male and female standing seams when interlocked, shall be not less than 32 mm deep.

The sheets shall be fixed with clips which must hold the sheets securely in position without the sheets having to be holed in any way. Male standing seams shall if required be closed, where the clips occur, by means of a special tool to ensure both the proper seating of the clips and that the standing seams will slide in the clips to allow for the expansion and contraction of the sheets. Fix clips to wooden purlins with galvanised driving screws, at least 50 mm long, through holes in the clips. Each clip shall be fixed to steel purlins with securing clips of required shape and size to suit the purlins, or with self-drilling and tapping screws.

Only after all sheets have been laid, the interlocked standing seams at sides of sheets shall if required be button punched by means of a special tool at approximately 175 mm away from each side of fixing clip and intermediately at not exceeding 900 mm centres and also near ends of the standing seams.

The fixing of the roof covering shall be carried out in strict accordance with the Manufacturer's instructions by a firm specialising in the fixing of this type of roof covering.

No end laps and no perforations for fixing screws will be allowed.

(e) Aluminium roofing sheets:

Aluminium roofing sheets shall comply with the requirements of SABS Specification 903, and be of corrugated or rib-trough profile and thickness specified.

Sheets shall be in single length to each roof slope. Corrugated sheets shall be lapped not less than one and a half corrugations and rib-trough sheets one rib at sides.

Sheets shall be fixed to purlins as previously specified for corrugated and rib-trough mild steel sheets. Screw and hook bolts shall be of aluminium fitted with bituminous felt underwashers and shaped aluminium overwashers. Side laps shall be bolted together through the crest of the ribs with 6 mm aluminium seam bolts and nuts fitted with neoprene washers under heads and spaced at not exceeding 600 mm centres. Screws and bolt holes in sheets shall be drilled (not punched) and shall be 1,5 mm larger than the diameter of the screws and bolts. Purlins shall be spaced at 1,0 m centres maximum for all thicknesses of aluminium.

Surfaces of any steelwork in contact with aluminium roof covering shall be given two heavy coats of bituminous base aluminium paint.

The roof coverings shall, wherever possible, be kept clear of concrete, mortar, plaster and masonry but where this is not possible such surfaces, where in contact with the aluminium, shall be painted as before.

Roof boards shall be used by all workmen to avoid damage to the sheeting.

7.6.3 INSULATION:

Steel framed industrial buildings and the like without ceilings shall be insulated using an approved material having a reflective foil surface on both sides and having an acceptable reinforcing fibre.

Air bubble cushion type insulating material having one reflective foil side and one side coloured plastic is approved for this purpose.

7.7 RIDGING (METAL):

7.7.1 For corrugated roofing:

Galvanised iron ridging for ridges and hips of corrugated iron covered roofs shall be 0,60 mm thick (after galvanising), coated with zinc of mass as specified for roofing iron in the table in Subclause 7.6.2 (a).

The ridging shall be 450 mm girth with roll top and bent down edges, lapped 225 mm at heading joints; cut, properly lapped and fitted at intersections of ridges, hips and valleys; and beaten into corrugations of roofing iron to close openings. Roll shall be closed at feet of hips and at gable ends.

Ridging shall be fixed with screws to wood purlins and hook bolts to steel purlins using washers under heads and nuts, all as described for fixing corrugated iron roofing, but spaced at not exceeding 300 mm centres.

7.7.2 For rib-trough roofing:

Galvanised iron ridging for roofs covered with rib-trough roofing sheets shall be as previously specified in Subclause 7.7.1, but without roll top; provided with serrated metal closers under the wings and approved poly-closers in troughs. Ridging shall be fixed with screws to wood purlins and hook bolts to steel purlins with washers under heads and nuts respectively, all as described for fixing the roof sheeting and at the same spacings.

7.7.3 For interlocking rib-trough roof sheets with concealed fixing:

Galvanised iron ridging for ridges of roofs covered with interlocking rib-trough roofing sheets shall be as previously specified in Subclause 7.7.1, but without roll top; provided with serrated metal closers under wings according to profile and with approved poly-closers in troughs. Fixing shall be by means of screws through the outer edge of the clip-over section.

7.7.4 For standing seam roofing:

Ridging for roofs covered with standing seam roofing sheets laid to a fall of more than 7° shall be as previously specified in Subclause 7.7.1, but without roll top, not less than 430 mm girth, bent to suit angle of ridge and bent down at each side and notched for ribs by means of a special notching shear with male and female interlocked ends and fixed with lugs attached to the ridging and with strips riveted to the lugs and to underside of the roofing sheets.

For roofs laid to a fall of 7° the standing seam roofing sheets shall be in one length to both roof slopes and sheets shall be bent over the ridge. The sheets shall be laid and fixed on one roof slope, after which the standing seams of each sheet shall be cut vertically with a hack-saw from the top to a depth of approximately 12 mm and the sheet then bent over the ridge and fixed on the other roof slope. Rib caps of galvanised mild steel, approximately 75 mm long, shall be fitted over the saw cuts in the standing seams and set in a suitable sealing compound.

All work shall be carried out in strict accordance with the Manufacturer's instructions by a firm specialising in this type of work.

7.7.5 For aluminium roofing:

Ridging or ridges of roofs covered with aluminium roofing sheets shall be of aluminium complying with the requirements of SABS Specification 903 and of thickness specified. The ridging shall be without roll top and shall be not less than 400 mm girth, bent to suit angle of ridge, provided with notched poly-closers and aluminium closers under each wing of same thickness as the ridging, with end laps of not less than 150 mm and fixed with screws to wood purlins and hook bolts to steel purlins with washers under heads and nuts, all as described for fixing the roof covering and spaced at not exceeding 450 mm centres.

7.8 FLAT METAL ROOFS:

A flat metal roof is defined as a flat structure covered with profiled metal roofing sheets laid with a fall of between 0° and 4° maximum. The use of such roofs is restricted to relatively small outbuildings/roof areas where no other solution proves viable or possible.

The supporting structure shall be such that any permissible deflection of the covering and/or roof under the sustained load of snow or hail in susceptible areas and of heavy rain will not cause the roof to leak.

The profiled steel sheets shall be of an approved type in single lengths preferably using concealed fixing. Where conventional fixing screws are used, these are to be rendered permanently watertight by means of a profiled cover strip held securely in place with the Manufacturer's fixing clips.

In all areas of the country subject to heavy thunderstorms and/or hail the principal of "the deeper the profile the better" is to be followed.

Side laps of profiled sheets are to be sealed by permanently welting with a machine or, be side stitched in accordance with the Manufacturer's instructions and sealed using a butyl rubber sealant strip or, are to be provided with an acceptable capillary action break formed as part of the edge profile.

Ends of troughs are to be bent down at an angle of 45° into the eaves gutters to prevent rain-water from running back along the underside of the sheets and entering the building. The bending down of each trough shall be carried out with the utmost care to avoid tearing the sheet using a tool designed for that purpose.

Purlins are to be spaced at 1,0 m centres maximum.

7.9 ROOFING SHEETS (FIBRE CEMENTS:

Corrugated fibre cement roofing sheets shall comply with the requirements of SABS Specification 685. The sheets shall be not less than 6 mm thick with corrugations at 178 mm centres, or shall be not less than 7 mm thick with corrugations at 241 mm centres, or shall be of other approved pattern as specified.

Fibre cement roof sheeting for use in coastal areas shall be purchased with an approved factory applied paint finish or may be painted on site prior to erection with paint approved by and in strict accordance with the instructions of the Manufacturer of the roof covering.

The sheets shall be laid with smooth surface on top, mitrecut at corners as necessary, all secured to wood purlins with 7 mm diameter galvanised drive screws not less than 114 mm long and to steel purlins with 8 mm diameter galvanised hook bolts, each provided with a plastic or felt washer and a galvanised steel cupped washer over the plastic or felt washer. Felt washers shall be of bituminous roofing felt as SABS Specification 92 Type 60.

Holes for fixing screws or bolts shall be drilled (not punched) and shall be 2,0 mm larger than the diameter of screws and/or bolts.

The fixing screws and nuts on fixing bolts shall not be tightened more than is necessary for holding down the sheets and the proper seating of the washer over the corrugations so as to allow for slight movement between the sheets and the supporting structure. On no account shall sheets be

deflected at the intermediate purlins.

The side laps of sheets shall be sheltered in the opposite direction to that of the prevailing wind wherever possible.

All necessary cutting to sheets shall be properly performed. Cut edges at sides of valleys and elsewhere where exposed shall be perfectly straight.

The minimum end laps of sheets and the spacing of purlins, unless otherwise specified, shall be in accordance with the following table:

Slope of roof	End lap (mm)	Purlin spacing (m)
26° and greater	200	1,400
21° to 25°	250	1,400
15° to 20°	300	1,350

The Manufacturer's instructions regarding laying and fixing of sheets, including side laps, mitre of corners and spacing of screws or bolts shall be followed in all cases.

One month after fixing, the roof covering shall be thoroughly examined, any defects made good and loose screws or bolts tightened.

Roof boards shall be used by all workmen for safety and to avoid damage to the sheeting.

7.10 RIDGING (FIBRE CEMENTS)

7.10.1 Adjustable type corrugated:

Adjustable fibre cement ridging with corrugated wings for ridges of corrugated fibre cement covered roofs shall be of the same manufacture as the roofing sheets, of not less than 6 mm thick material and with collared end joints.

Width of wings shall be not less than 300 mm measured from the centre of roll.

The ridging shall be secured all as described for fixing corrugated fibre cement roofing.

7.10.2 Plain:

Adjustable plain fibre cement ridging for ridges and hips of corrugated fibre cement covered roofs shall be as described above for the corrugated type, but wings shall be plain and thereby suitable for use on ridges and hips. The ridging shall be fixed as described in Subclause 7.10.1.

The openings between the wings of ridging and corrugations in roofing sheets shall be filled with 5:1 cement mortar neatly finished.

7.11 FLASHINGS (FIBRE CEMENTS)

Fibre cement sole flashings for horizontal top edges of roofs butting against vertical wall or other surfaces shall be of the same manufacture as the roofing sheets, of not less than 6 mm thick material and with overlapping heading joints. The flashings shall be corrugated and extend not less than 300 mm on to the roof sheeting, have plain upstands against the vertical surfaces and be flashed over with sheet metal as described in Subclause 7.19.2.

The Manufacturer's instructions regarding fixing of the flashings, including spacing of screws or bolts, shall be strictly adhered to.

7.12 GALVANISED SHEET IRON:

Galvanised sheet iron shall be 0,60 mm thick (after galvanising) and coated with zinc having a mass

of not less than that indicated in the following table for the three classes of galvanising specified:

CLASS	g/m ² of surface area	
	Average	Individual (Minimum)
Z600	600	510
Z450	450	385
Z275	275	235

The galvanised sheet iron for inland use shall be of Class Z275 quality.

Corroded or otherwise defective sheets shall not be used. All nailing and screwing shall be done with galvanised iron nails and screws.

7.13 SHEET LEAD:

Sheet lead shall be best milled sheet of the mass specified, and of equal thickness throughout. All nailing and screwing shall be done with copper, copper alloy or stainless steel (Type 304) nails and screws.

7.14 SHEET COPPER:

Sheet copper for flashings, linings, soakers and the like shall be cold rolled and of dead soft temper. All copper sheet shall be 0,56 mm thick. All nailing and screwing shall be done with copper **or** copper alloy nails and screws.

7.15 LININGS TO VALLEYS:

Linings to valleys in roofs shall be of galvanised sheet iron or sheet copper as specified having 225 mm laps at end joints and dressed up and on to purlins at each side of valleys in corrugated iron and fibre cement covered roofs, but for slate and tile covered roofs shall have each edge folded back as open bead. Linings shall be cut and properly fitted at top and bottom of valleys.

7.16 LININGS TO CHIMNEY GUTTERS:

Linings to gutters at back of chimney stacks and the like shall be of galvanised sheet iron or sheet copper as specified, turned up for at least 100 mm against vertical surfaces and carried not less than 225 mm up roof slope, dressed up and on to purlins or tilting fillets along upper edges, all properly lapped on to flashings, linings to secret gutters or soakers at sides of stacks,

7.17 LININGS TO SECRET GUTTERS:

Linings to secret gutters at raking intersections of slate and tile covered roofs with vertical wall and other surfaces, e.g. sides of chimney stacks, shall be of galvanised sheet iron or sheet copper as specified, turned up for at least 100 mm against vertical surfaces and up and on to batten along outer edges, all properly dressed at bottom to discharge on to the tiles or into eaves gutter as required.

7.18 SOAKERS:

Soakers to slate covered roofs shall be of galvanised sheet iron or sheet copper as specified, 450 mm wide to closed valleys and 250 mm wide to raking intersections of roofs with vertical wall and other surfaces and sides of chimney stacks, turned up 100 mm against vertical surfaces. Soakers shall be 75 mm longer than the gauge of slate (i.e. distance from centre to centre of battens plus 75 mm).

7.19 FLASHINGS (METALS)

7.19.1 Sole flashings:

Sole flashings to the various types of roofs shall be as follows:

(a) To corrugated iron:

Sole flashings to corrugated iron roofs, where butting against vertical wall or other surfaces and sides and front of chimney stacks, shall be of galvanised sheet iron, turned up for at least 100 mm against vertical surfaces and close dressed for not less than 200 mm on to top of the roofing iron.

(b) To corrugated fibre cement:

Sole flashings at raking intersections of corrugated fibre cement roofs with vertical wall or other surfaces and sides of chimney stacks shall be of galvanised sheet iron or sheet copper as specified, turned up for at least 100 mm against vertical surfaces and close dressed on to the fibre cement and over the nearest full corrugation. Sole flashings along horizontal top edges of such roofs where butting against vertical surfaces and front of chimney stacks shall be of fibre cement as described in Clause 7.11.

(c) To slate roofs:

Sole flashings to horizontal top edges of slate covered roofs where butting against vertical wall or other surfaces and to front of chimney stacks in such roofs shall be of galvanised sheet iron or sheet copper as specified, turned up for at least 100 mm against vertical surfaces and close dressed not less than 200 mm on to the slates.

(d) To tile roofs:

Sole flashings to horizontal top edges of clay and concrete tile covered roofs where butting against vertical wall or other surfaces and to front of chimney stacks in such roofs shall be of sheet lead of a mass not less than 24 kg/m^2 , turned up for at least 100 mm against vertical surfaces and close dressed not less than 200 mm on to the tiles.

7.19.2 Cover flashings:

Turned up edges of sole flashings, chimney and secret gutter linings, soakers, etc. including waterproofing turn-ups, shall be flashed over with cover flashings of galvanised sheet iron or sheet copper as specified, having upper edges bent and set not less than 25 mm deep into joints in the masonry and stepped as required at raking intersections.

Cover flashings of sheet metal, unless otherwise specified, shall be fixed with 75 mm long flashing nails with hook portion not less than 20 mm long and securely driven into the masonry joints at ends and intermediately at not exceeding 400 mm centres. The flashing nails must not be driven through the flashings, but over the bent top edge with hook portion holding the flashing in position.

Flashing nails to copper cover flashings shall be of copper. All flashings shall be properly lapped and made completely watertight.

7.20 PIPE FLASHINGS:

7.20.1 To metal sheet roofs:

Cast iron, mild steel and copper pipes of 50 mm or more in diameter shall be flashed where passing through galvanised profiled steel sheet covered roofs with 0,60 mm thick galvanised sheet iron sole piece, holed for pipe and fitted with sleeve piece of similar sheet iron, riveted and soldered at joint with sole piece, clamped to pipe at top with 25 x 3 mm galvanised mild steel band fixed with galvanised gutter bolt.

Sole piece shall be close dressed on to the roofing iron and secured where necessary with galvanised gutter bolts having lead washers as Sample 58 under heads, V-cut at top edge,

dressed into corrugations and soldered to roofing iron.

Mild steel and copper pipes under 50 mm diameter shall each be flashed where passing through sheet covered roofs with 0,60 mm thick galvanised sheet iron sleeve piece around pipe, heavily soldered to roofing iron and flashed over with conical cover of similar sheet iron, heavily soldered at joint and to pipe.

7.20.2 To corrugated fibre cement roofs:

Cast iron, mild steel and copper pipes of all sizes shall be flashed where passing through corrugated fibre cement covered roofs with 24 kg/m² sheet lead sole piece, closely dressed into the corrugations and bedded in mastic along top edge, secured to roof covering as necessary with galvanised gutter bolts, holed for pipe and fitted with sleeve piece of similar sheet lead wiped on to sole piece. In the case of pipes 50 mm and more in diameter the sleeve piece shall be clamped to pipe with 25 x 3 mm galvanised mild steel band fixed with galvanised gutter bolt and in the case of pipes under 50 mm diameter secured to pipe with copper wire.

7.20.3 To tile and slate roofs:

Cast iron, mild steel and copper pipes of all sizes shall be flashed where passing through tile and slate covered roofs with 24 kg/m² sheet lead sole piece, dressed under and over the tiles or slates, holed for pipe and fitted with sleeve piece of similar sheet lead, wiped on to sole piece and clamped to pipes 50 mm and more in diameter with band and secured to pipes under 50 mm diameter with copper wire, all **as** described in Subclause 7.20.2.

7.21 MAKING GOOD:

Roofs, gutters, valleys, flashings, etc. shall be carefully examined at completion of the work, any holes or other defects soldered up or otherwise made good and the whole left perfect and watertight.

SECTION 8**CARPENTRY AND JOINERY****8.1 TREATMENT OF TIMBER:**

Timber shall be treated in accordance with Government Gazette Notice No. R. 602 of 27 March 1986 and any amendments thereto in all areas defined in the aforementioned notice. Proof of treatment is to be lodged with the Representative/ Agent prior to the use of any timber in the service. The specific properties mark shall also be indicated on all treated timber in accordance with SABS Specification 1288.

8.2 WOOD PRESERVATIVE:

Where all timbers are not required to be treated in accordance with Clause 8.1 in the remaining areas of the country, floor and roof plates, sleeper bearers, floor joists, boards and ends of timbers built into walls shall be given two good brush coats of one of the undermentioned wood preservatives, which shall comply with all relevant requirements of the SABS Specification shown in brackets after the name of the preservative, viz:

- (a) Metallic naphthenates (SABS Specification 38).
- (b) Pentachlorophenol (SABS Specification 42).
- (c) Pentachlorophenolzinc naphthenate (SABS Specification 565).
- (d) Tributyltin Oxide-Lindane (SABS Specification 1388).

All timbers shall be coated with the preservative before being fixed in position. After application of the preservative, any freshly cut and/or exposed surfaces shall also receive two coats of preservative.

8.3 WROUGHT FACES:

Exposed woodwork shall be wrought to a smooth surface and properly sandpapered to remove all machine or other tool marks.

For each wrought face on structural timber an allowance will be made off the "nominal" or rough sawn dimensions specified or stated on the drawings, as follows:

- (a) 2,5 mm for "nominal" dimensions up to and including 75 mm.
- (b) 3,5 mm for "nominal" dimensions over 75 mm.

For each wrought face on softwood joinery timber an allowance will be made off the "nominal" dimensions specified or stated on the drawings as follows:

- (a) 3 mm for "nominal" dimensions up to and including 75 mm.
- (b) 5 mm for "nominal" dimensions over 75 mm.

The above will be the nett allowances permitted off the "nominal" dimensions specified or stated on the drawings and will not be additional to the tolerances specified for rough sawn timbers.

NB: No allowance shall be made off the dimensions given for hardwood joinery. The dimensions given shall reflect the exact, finished sizes required.

8.4 ANGLES OF WROUGHT WOODWORK:

Unless specified to be angle rounded, all exposed angles of wrought woodwork shall be arris rounded. The term "arris rounded" denotes that the angles shall be rounded off to approximately 3 mm radius and sandpapered to a smooth surface.

Angles of wrought woodwork specified to be angle rounded shall be rounded off to 6 mm radius, unless otherwise shown on the drawings, and shall include, in framed joinery, for scribed and mitred joints.

8.5 STRUCTURAL TIMBER:

Structural timber shall be of South African softwood (pine) complying with the requirements of SABS Specification 563 or 1245 and shall be of Grade 4 or better (Grade 6 for some components of bolted roof trusses), all marked as laid down in the relevant specifications.

In addition all timbers shall bear the full standardisation mark of the South African Bureau of Standards.

Structural timbers between 50 mm and 65 mm in width and between 38 mm and 50 mm in thickness shall be of South African softwood (pine) complying with the requirements of SABS Specification 653.

All timber, as far as practicable, must be ordered in the dimensions in which it will be used, and must not be sawn into smaller cross sectional sizes as this is a contravention of the grading rules as laid down in R651.

Wrought structural timber, or any part of a structural member where wrought, shall be free from any edges or other defects which will spoil the appearance of the timber.

The timber shall be in single lengths or in two or more lengths, jointed end-to-end by finger jointing with each length not less than 1 m long.

Battens, brandering and purlins, jointed by means of nail plates, will be acceptable if they are manufactured in accordance and comply with the requirements of SABS Specifications 563 or 653.

Finger jointed timber shall be manufactured in accordance with SABS Code of Practice 096. The joints in timbers used for general roof construction and other components, where the timbers will not be exposed externally, shall be glued with a Class 2 type adhesive whilst joints in timbers used for external timber structures shall be glued with a Class 1 type adhesive, both types complying with the requirements of SABS Specification 1349. The timbers shall be marked with the letter "FJ" in black for timbers where a Class 2 type adhesive is used and in red for timbers where a Class 1 type is used; the letters shall be at least 25 mm high.

Timber not used immediately and required to be stored on site shall, at delivery, be properly stacked horizontally on timber bearers. The minimum height above ground level shall be 100 mm and the spacing of the bearers shall be such as will prevent distortion of the timber. Each stack of timber shall be completely covered with waterproof materials and protected from the elements.

If the above conditions are not adhered to the Representative/Agent reserves the right to have tests carried out by an independent institution and to table a report for consideration, all at the Contractor's expense.

8.6 DIMENSIONS OF SAWN SOUTH AFRICAN SOFTWOOD:

The tolerance by which "actual" dimensions may vary from the "nominal" dimensions specified or stated on the drawings for sawn South African structural softwood, shall be as laid down in SABS Specifications 563, 1245 and 653 where applicable.

8.7 STRUCTURAL LAMINATED TIMBER:

Structural glued laminated timber shall comply with the requirements of SABS Specification 1460, be marked as laid down in the specification and bear the standardisation mark of the SABS.

The timber shall be of—

- (a) softwood or hardwood;

- (b) the stress grade;
- (c) the exposure category;
- (d) dimensions; and
- (e) of appearance and surface finish/treatment, all as specified.

In services having timbers treated against infestation by insect pests, treatment against pests, shall be as laid down in the specification for laminated timber.

Laminated fascia boards and barge boards are to be absolutely knot free and such timber must also comply with the requirements described in Clause 8.5.

8.8 LENGTHS OF TIMBERS AND METHODS OF JOINTING:

Plates, sleeper bearers, joists, purlins, battens, laths, slats, etc. shall be in single lengths, but where this is not possible the end joints will be formed as described below. The joining of plates, battens, etc. at junctions and angles shall also be formed as stated hereunder, viz:

(a) Plates:

Floor and roof plates shall be halved at joints, junctions and angles, all well spiked together.

(b) Sleeper bearers:

Sleeper bearers under floors shall be butt jointed over sleeper piers.

(c) Joists:

Floor joists shall be lapped at least 300 mm with joints positioned over sleeper bearers, all well spiked together.

(d) Purlins:

Purlins shall be splay cut and spliced at joints using timber side plates of the same dimensions as purlins, not less than 600 mm long and six times nailed with 100 mm long 3,5 mm diameter wire nails. Adjacent purlins shall not be jointed between or on the same rafters.

(e) Battens, laths, slats, etc.:

Except where timbers are spliced together by means of nailplates, sawn battens, laths, slats, etc. shall be butt jointed at heading joints and angles. Wrought battens, laths, slats, etc. shall be splay cut at heading joints and mitred at angles over points of support. Adjacent tile battens shall not be jointed on the same rafter. (Not applicable in the case of nailplate-spliced timber).

8.9 BOLTED ROOF TRUSSES:

8.9.1 Timber connectors:

Timber connectors for strengthening the joints between timbers of bolted roof trusses shall be made up as laid down in the National Building Regulations, SABS 0400, and shall consist of approved shear plates of adequate size or steel splitting connectors, inserted in grooves cut in the timbers. The grooves shall be cut with a special grooving tool, as supplied by the Manufacturer of the connectors, comprising cutter head and spindle for location in the bolt holes. The joints shall then be assembled with connectors in position, the bolts inserted and tightened up.

Where connectors are used the bolts shall be M12 complete with 50 mm diameter x 3,5 mm thick washers under heads and nuts.

8.9.2 Bracing:

Approved bracing according to the detail drawings shall form part of the roof system.

8.10 PRE-FABRICATED ROOF TRUSSES:

Pre-fabricated timber roof trusses shall comply with the requirements of SABS Specification 0163 and be constructed of South African pine as described in Clause 8.5 to the designs shown on the Manufacturer's detail drawings. The timber shall be of cross-sectional dimensions shown, cut to correct lengths with ends square or at the required angle. Trusses shall be assembled in truss fabricating jigs with the truss having the proper camber, all tightly clamped together with joints secured using approved connector plates of galvanised steel sheet. Connector plates shall be pressed into the timber simultaneously from both sides of the truss with a hydraulic press capable of exerting such pressure as will ensure complete penetration of the teeth into the timber. The connector plates shall be of such size as will ensure that the joints so made will adequately withstand the forces exerted on the joints.

In coastal areas connector plates in buildings without ceilings shall be painted with two coats of epoxy tar complying with SABS Specification 801 Type 2, or rust neutralising paint.

Approval of pre-fabricated roofing systems, whether measured as an alternative or not, shall be subject to the following requirements:

- (a) The Manufacturer of the pre-fabricated trusses shall hold a certificate of competence issued by the Institute for Timber Construction.
- (b) A polyester print, size A1 having a minimum thickness of 0,5mm, shall be submitted by the Contractor to the Regional Representative at an early stage for approval by the Directorate: Structural Engineering Services.
- (c) The drawings shall be signed by a Registered Professional Engineer whose name appears on the Departmental panel for structural work.
- (d) In the case of systems buildings, approval shall be given with submission of the contract drawings on acceptance of the tender.

Where a pre-fabricated roofing system is offered as an alternative to the conventionally bolted trussed rafter system, the Contractor shall offer the Department a reasonable cost saving.

The following minimum information shall be shown on the drawings:

- (a) Details of the roof system with the position of the rafters and purlins indicated thereon as well as typical elevations.
- (b) Bracing as recommended by the Institute for Timber Construction.
- (c) Sizes and grading of the timber components.
- (d) Truss sizes, e.g. height of ridge or angle of pitch.
- (e) Plate sizes for every connection point. (Code numbers only are deemed insufficient.)
- (f) Separate connection details for hip, valley and jack rafters.
- (g) Maximum spacing for purlins and bracing to ceilings shall be according to Subclauses 7.6.1 and 7.6.2 and Clauses 7.8, 7.9 and 9.5.
- (h) The type of roof covering as well as the design load.

Over and above the supervision undertaken by the Representative/Agent, the Truss Fabricator or his Design Engineer shall inspect the completed roof structure and issue a certificate of confirmation to the Department that:

"The roof structure(s) has (have) been erected in accordance with the Design Engineer's drawings, as accepted by the Department, and the relevant details given in the manual "THE ERECTION AND BRACING OF TIMBER ROOF TRUSSES" issued by the National Timber Research Institute and the Institute for Timber Construction."

Descriptions (prices) of pre-fabricated roof trusses shall be deemed to include design.

8.11 VALLEYS IN ROOFS:

Valleys in roofs generally shall be formed with two 228 x 25 mm sawn boards, treated in accordance with Clause 8.2, well spiked down to roof timbers with purlins or tiling battens, depending upon the roof covering to be used, fixed along outer edges.

8.12 CHIMNEY GUTTERS:

Gutters at back of chimney stacks, where stacks pass through roofs, shall be formed with 25 mm thick sawn boarding, laid with proper falls and fixed on 75 x 38 mm bearers nailed to roof timbers. The boarding shall be carried 228 mm up the roof slope and, where the roof is covered with either corrugated iron or corrugated fibre cement roof sheeting, shall have purlins fixed along top edges, but for slate and tile covered roofs shall have tilting fillets, as for eaves of roofs, fixed along top edges.

Provide 25 mm thick sawn gusset pieces at ends of gutters as required.

8.13 SECRET GUTTERS:

Secret gutters at raking intersections formed between clay or concrete tile covered roofs and walls or sides of chimney stacks shall be 75 mm wide formed with 25 mm sawn boarding, all fixed on 75 x 38 mm sawn bearers nailed to roof timbers and with a length of tile batten nailed along outer edge of the boarding and to ends of the abutting tile battens.

The gutters shall be raised at the lower ends to discharge on top of tiling or into eaves gutters. The upper-ends of secret gutters into which other gutters discharge from, i.e. horizontal gutters at back of stacks, other walling and the like, shall be continued up to the top edge of such horizontal gutters and be properly joined to same.

8.14 TIMBERS NEAR FLUES AND FIREPLACES:

No timbers shall be fixed nearer than 110 mm to any smoke flue or the inside of any fireplace opening. Similarly wood plugs for fixing shall be kept at least 100 mm away from smoke flues and the inside of fireplace openings. In all cases there must be at least 110 mm of masonry between timbers and flues and inside flues and inside of fireplace openings.

8.15 FIXING OF WOOD (GENERALS):

Woodwork shall be fixed to walls with hardened steel nails driven into the brickwork or to wood plugs driven into joints where necessary with wire nails. In no case shall fixing be spaced at more than 700 mm centres. All nail heads shall be punched and filled in with an approved matching filler.

Jamb linings and the like shall be fixed with steel nails as above or with wire nails to 75 mm wide wood fixing slips. Each slip to be of thickness equal to width of mortar joints and of lengths equal to the thickness of wall or width of lining, all built into brick joints as the work proceeds and in such a manner as to permit nailing into cross grain only. Nailing into end grain is unacceptable.

On completion of the work no hammer marks shall be visible on the finished surface of any timber. Where hardwood is to be fixed to walls all screw heads shall be sunk and pelleted.

Items described as "plugged" shall be deemed to include screwing to fibre, plastic or metal plugs at not exceeding 700 mm centres. Where items are described as "bolted", the bolts and holes have been given separately.

8.16 FLOOR AND WALL PLATES:

Floor plates shall be 75 x 38 mm and roof plates 100 x 38 mm and shall comply with Clause 8.5. Intermediate floor plates traversing rooms shall be laid on sleeper walls spaced at not exceeding 1,5 m centres.

NB: Refer to Clauses 5.30 and 5.32 for further information.

8.17 FLOOR JOISTS AND BEARERS:

Floor joists shall be of 38 x 100 mm timber which shall comply with Clause 8.5, of at least Grade 6, spaced at not exceeding 400 mm centres and all well spiked to plates and bearers.

Floor bearers under floor joists shall be 75 x 150 mm timber, of at least Grade 6, spaced at not exceeding 1,5m centres, built 100 mm into walls at ends and resting on sleeper piers. The ends of bearers, where built into walls, shall be protected against dampness by covering the bottom edge, ends and sides with plastic sheeting as for damp-course, neatly dressed around the bearers for a distance of 150 mm from each end.

8.18 BATTENS AND PURLINS:

Battens and purlins shall be in accordance with SABS Specification 653 if not exceeding 63 mm wide x 50 mm thick and in accordance with SABS Specification 563 if exceeding 63 mm wide x 50 mm thick, securely nailed to roof timbers with 4 mm diameter wire nails, having a length of at least twice the thickness of battens and 120 mm for purlins, one nail for each intersection, at centres specified ranging perfectly straight and square to roof with butt joints at heading joints and angles and in the case of wrought battens splayed joints at heading joints and mitred joints at angles,

8.19 PURLIN TIES:

Purlins shall in addition be secured to rafters at each intersection with a single 3,2 mm diameter galvanised wire tie with ends twisted.

8.20 BOLTED CONNECTIONS:

Joints between timbers of roof trusses shall be spiked and bolted together, with M12 steel bolts, complete with 50 mm diameter x 3,5 mm thick washer under each head and nut. No bolt hole shall occur within 50 mm of a finger joint.

8.21 CEILING JOISTS:

The tie beams of roof trusses will serve as ceiling joists but 38 x 100 mm sawn ceiling joists shall be provided at right angles to tie beams at walls and elsewhere where support for brandering is required.

The supporting timbers for brandering shall in no case be spaced further than 1 m centres.

Ceiling joists shall rest on and be spiked to roof plates wherever possible. Where fixed parallel to tie beams the joists shall be hung, at not exceeding 3 m centres, with 50 x 38 mm sawn hangers spiked to joists and to 38 x 75 mm sawn runners fixed on top of tie beams, and where fixed at right angles to tie beams shall be cut in between and well spiked to the tie beams.

All necessary trimming at chimney stacks and elsewhere as required shall be properly performed.

8.22 PRESSED FIBRE CEMENT ROOF TRIM:

Fascias and barge boards, where prescribed, shall be of pressed fibre cement boards, of section described and in long lengths, butt jointed with 75 mm wide galvanised steel plates four times bolted with galvanised bolts over joints or with standard aluminium jointing strips and bolts.

8.23 STRIP AND BOARD FLOORS:

8.23.1 Flooring:

Softwood flooring boards shall comply with the requirements of SABS Specification 629, be of Clear Grade and of the specified species.

Hardwood strip flooring shall comply with the requirements of SABS Specification 281, be of Clear Grade and of the specified species.

The flooring shall bear the standardisation mark of the South African Bureau of Standards.

Strip and board flooring shall be of widths specified with softwood flooring having a finished thickness of 22 mm whilst hardwood flooring shall be 20 mm thick

Hardwood flooring shall have splaytype tongues and grooves on edges suitable for secret-nailing and square-type tongues and grooves on ends.

Softwood flooring shall be plain ended or end-matched as specified. End-matched flooring shall be in random lengths, the shortest being not less than 0,5 m long. Not more than 30% of the flooring shall be less than 0,75 m in length.

The moisture content of all flooring shall be as laid down in the abovementioned SABS Specifications and hardwood flooring shall be treated on the underside with timber preservative as specified in Clause 8.2.

The underside of softwood flooring in services where all softwood timbers are not treated against infestation by insect pests, shall be given two good brush coats of wood preservative as specified in Clause 8.2.

8.23.2 Seasoning of flooring on site:

Flooring shall be properly stacked under cover on site, in such a manner as will allow for the free circulation of air around the flooring, for a period of not less than 14 days,

8.23.3 Laying of flooring:

Strip and board flooring shall be tightly cramped together and nailed to the supporting timbers, all in accordance with SABS Code of Practice 043.

The flooring shall be neatly fitted against adjoining floors, thresholds, etc.

Skirting and quadrants shall not be fixed to the flooring in any way.

8.23.4 Protection and finishing of wood floors:

Strip and board floors shall be covered and protected against damage during the progress of the remaining work. On completion the floors shall be sanded, given a coat of penetrating sealer and polished as described in Subclause 10.2.4.

8.24 FLAT FIBRE CEMENT SHEETS:

Flat fibre cement sheets shall comply with the requirements of SABS Specification 685.

8.25 FRAMED JOINERY:

Where the word "framed" is used, it is to include for all mortice and tenon joints, dovetail joints, grooves, stop grooves, rebates, stop rebates, housings, notchings, etc. including housed ends of shelves, divisions, etc.

8.26 TIMBER FOR JOINERY:

GENERAL:

Counter and other tops, where only one face will be visible, is to be of Semi-Clear Grade.

All joinery work shall be put in hand immediately the order has been given to commence work; or after the receipt of details, where such are to be supplied, and shall not be wedged or glued up until just before fixing in the building. Timber stored on the site shall be properly stacked on delivery and adequately protected against extreme weather and exposure to the sun, until required for use.

(a) Hardwood:

Hardwood for joinery shall comply with the requirements of SABS Specification 1099, and shall be of Clear Grade and free of sapwood.

(b) Softwood:

Softwood for joinery shall comply with the requirements of SABS Specification 1359 and shall be of Clear Grade.

8.27 JOINERY:

No framed joinery, except for stock framed doors, for services situated inland shall be manufactured in the humid coastal belt, and no framed joinery for the services situated in the coastal belt shall be manufactured inland. This applies to both purpose made and stock joinery.

All exposed softwood timber in joinery which is not to be painted shall be free from large, loose or dead knots, knot holes, checks, splints, wane or other defects, and in joinery which is to be painted shall be free from all defects other than those which can be filled or otherwise made good in such a way as will not impair the paint finish. All exposed hardwood joinery timber shall be free from all knots, knot holes, checks, splints or other defects.

Purpose made joinery shall be manufactured strictly in accordance with detail drawings where these are provided.

Stock joinery shall be of the best quality.

Joinery shall not be primed until it has been inspected and approved.

Skirtings, picture rails and the like shall be in long lengths. Heading joints where necessary shall be splayed. Counter tops, table tops, drainers and the like shall be formed with wide boards, jointed with grooved, cross-tongued and glued joints or with grooved rebated and glued joints of approved type; cross tongues shall be stopped 25 mm back from ends where ends are exposed to view. The boards shall be in single lengths to tops etc., but where this is not possible, the heading joints shall be staggered and jointed as above.

Skirtings, picture rails, angle moulds and headings of all kinds shall be close fitted, mitred or scribed at angles and securely fixed; skirtings, picture rails and the like shall be fixed with hardened steel nails driven into the brickwork or with other suitable nails to wall plugs spaced at not more than 700 mm apart. Glazing beads and the like shall be mitred at angles and shall be fixed with panel pins.

Descriptions (prices) of joinery shall be deemed to include arris rounded angles, blocking and planting on.

NB: No visible hammer marks shall be permitted to spoil the appearance of finished surfaces.

8.28 HARDBOARD:

Hardboard shall comply with the requirements of SABS Specification 540 and be of thickness specified. Tempered hardboard shall comply with the requirements for tempered hardboard as laid down in the above specification.

All hardboard used for interior work, sheets exceeding 0,75 m² in area and not permanently attached to a solid backing and all hardboard used for exterior work shall be prestretched before fixing by thoroughly wetting the boards with water and scrubbing screen side with a stiff brush or broom until a dark chocolate colour is obtained. Stack the boards, screen side to screen side for a period of 12 to

24 hours and air-dry for 1 or 2 hours immediately prior to fixing.

Hardboard not fixed permanently in position such as linings to concrete formwork, will not require the above treatment.

8.29 BATTEN BOARD:

Batten board shall be 19 mm thick manufactured with 17 mm thick kiln dried South African pine timber core formed of laminations not exceeding 45 mm wide, faced both sides with 1,0 mm veneer (after sanding) suitable for painting or clear finish, all complying with SABS Specification 929, assembled under hydraulic-pressure with water resistant synthetic resin adhesives and sanded to a smooth finish.

8.30 COMPOSITE BOARD:

8.30.1 Blockboard:

Blockboard suitable for painting shall be of 5 ply type and 22 mm thick, manufactured with 17 mm thick kiln dried South African pine core laminations not exceeding 34 mm wide, crossbanded on both sides with 1,5 mm veneer and faced on both sides with 1,0 mm veneer (after sanding), all in accordance with SABS Specification 929.

Blockboard with decorative veneer suitable for staining, varnishing or oiling shall be of 5 ply type 22 mm thick, manufactured with 17 mm thick kiln dried South African pine core laminations not exceeding 34 mm wide, crossbanded both sides with 2,0 mm veneer and faced both sides with 0,5 mm decorative veneer. Decorative veneer applied to one face only is to be balanced with 0,5 mm veneer on reverse side, all in accordance with SABS Specification 929.

Edge strips to blockboard shall be formed with 10 mm thick strips to match the face veneer and to be the full thickness of the board.

8.30.2 Decorative laminated plastic-faced board:

Boards lined with approved high pressure decorative plastic laminate shall comply with SABS Specification 1405 with laminate having a nominal thickness of 1,2 mm and glued on under pressure with waterproof synthetic resin adhesive.

Where rounded edges or splashbacks are required, post forming quality high pressure plastic laminate sheets are to be used. The radius must not be less than 15 mm for heat controlled forming and the nominal thickness shall be reduced to 1 mm.

Worktops are to be covered on underside with a high pressure laminate sheet, without a decorative face, as a balancing back.

8.30.3 Particle board:

(a) Exterior and flooring type:

Particle board for exterior and flooring use shall comply with the requirements of SABS Specification 1300 and be of the thickness and exposure class specified.

(b) Interior type:

Particle board for interior use shall comply with the requirements of SABS Specification 1301 and be of the thickness and exposure class specified.

8.31 VENEER TO BLOCKBOARD:

Unless otherwise described, all blockboard is to have veneer suitable for painting both sides.

8.32 MATCHED VENEER:

Where specified, hardwood veneers in all units are to be matched.

8.33 WOODEN DOORS:

All stock wooden doors shall comply with the requirements of SABS Specification 545 and bear the "MARK".

In addition all framed and ledged batten doors and combination doors, where battens are utilised, for exposed, external use shall only be of construction acceptable to the Department, i.e. mortice and tennon where the tennon is exposed on the outside edges of styles and where the tennon is wedged to form a dovetailed shape.

Framed and ledged batten doors for use as yard doors or where both faces of doors will be exposed to the elements and are specified to have paint finish shall be of hardwood as described in Clause 8.26, and 44 mm thick hung on hardwood or pressed steel door frames.

Framed panel and glass doors for main entrances, where fully protected from the weather, or for decorative internal use, shall be of hardwood, all as described in Clause 8.26, 44 mm thick, and hung to hardwood door frames internally and externally.

NB: The middle rail/ledge in purpose made framed panel or glass doors shall be positioned at such a height that the fitting of a mortice lock will not require the destruction of any joint between rail/ledge and stiles.

Flush doors may be of the following constructions: solid laminated, chip core, semi-solid or hollow core. Flush doors shall not be used as external doors.

All flush doors shall, unless otherwise specified, be 40 mm thick and hung to pressed steel door frames internally.

Heavy duty flush panel doors shall be of solid laminated construction. Medium duty doors shall, depending upon the frequency of usage, be of at least semi-solid construction for light usage and of chip core construction for heavier usage.

NB: The Contractor shall provide the Representative/Agent with full constructional details of all flush doors that he proposes to use for approval.

Hollow core doors in dwellings, flats, etc. shall be used for cupboards only with semi-solid doors for general use, but in barracks and single quarters cupboard doors shall be of semi-solid construction only.

See following table:

DEPARTMENTAL USAGES	EXPOSURE CLASS	PERFORMANCE		
		Heavy	Medium	Light
Hardboard entrance & external doors	2	X		
Hardwood framed, ledged and braced yard doors, gates, etc.	2	X		
Hardwood internal doors depending on frequency of use	4	X	X	X
Flush doors for use in office blocks and general internal use in such buildings	4		X	
Ditto, but for high class prestige buildings	4	X	X	
or in dwellings for cupboards	4			x
or for general use in dwellings	4		X	X
or for use in military and/or police barracks and single quarters	4		X	
or for use for cupboards to military or police barracks and single quarters	4		X	

The performance rating stamp on doors shall not be removed or obliterated until inspected in the hung position and approved,

Unless any door is designed for such, door furniture on large or oversize backplates may not be specified.

8.34 HANGING OF DOORS:

These requirements are all in addition to paragraph 3.4.4 of SABS Specification 545.

All doors are to be hung in such a way that the completed door functions smoothly and perfectly.

The clearance gap between door and frame after hanging shall not exceed 2 mm (+0 mm —1 mm) at sides and head of door. The gap between meeting stiles of doors hung folding shall also comply with the foregoing.

The clearance gap between foot of door and floor may be increased to 6 mm (+0 mm —3 mm) to accommodate any minor unevenness in the floor surface. The foregoing is not applicable where floor springs are specified to be used.

Any door frame found to be distorted or out of plumb shall be reported to the Representative/Agent before any door is hung to such frame. Failure in this regard will result in the Contractor being held liable for all rectification work at his own expense. The foregoing shall be rigorously enforced where the door as hung will not close and latch properly, especially if specified to be fitted with a door closer of wever type, or is a stable door.

When hung, no strain upon the hinges shall be detectable due to hinge binding. Depending upon the

hinges supplied with pressed steel door frames the hanging edge of door may be angled back slightly from the hinge face of door to obviate such binding.

External doors shall be hung on brass hinges from which the hinge pin is not removable.

Any door that is too wide or tall to fit the door frame shall be reduced in size by removing material equally from each edge — removing material from one edge only to obtain a fit is unacceptable.

Mortice locks where specified are to be snugly fitted into the mortice with face plate flush with edge of door. In flush doors the mortice is to be deep enough to accept the lock, but must not penetrate through to the core of the door.

Lever handle door furniture is to be fixed with the backplate parallel to the edge of the door. Ensure that the handles of wever type function smoothly and do not bind.

Screws used for fixing of hinges shall be screwed into holes of suitable sizes.

In addition, prior to the final hanging of any unprotected external door, where such door opens to the outside of the building, both the top and bottom concealed edges shall be sealed with not less than two coats of the finish specified for the exposed surfaces of the door. Where the door opens to the inside of the building only the bottom edge of the door shall be so finished.

8.35 SET UP IN POSITION FOR BUILDING IN OF TIMBER FRAMES:

Timber frames to doors, windows, etc. shall be set up in position for building in as described in Clauses 5.30 and 5.33 respectively.

The jambs of timber door frames and similar frames, where a sill is not required, shall be dowelled to the threshold with 10 mm diameter mild steel dowels, 75 mm long, one to each jamb.

8.36 ACCESS DOORS IN FIREWALLS:

Access doors to firewalls in roofs shall be purpose made Class "D" fire doors complying with SABS Specification 1253.

8.37 DRAWERS:

Drawers are to be constructed with 19 mm thick wrought rebated and off-set front, of the timber described, 12 mm thick wrought softwood sides and back and 6 mm thick tempered hardboard bottom, all properly grooved, dovetailed and glued together. Fit each side of drawer with two 19 x 19 mm wrought hardwood runners, spaced to take wrought hardwood guide. Guides and runners are to be fixed with brass countersunk screws and greased with candle wax on completion. Sizes of drawers stated shall be the internal sizes.

8.38 CLEANING OUT ETC.:

All shavings, cuttings and rubbish shall be cleaned out as it accumulates during the progress of the work. Care shall be taken that no debris is left under suspended timber floors.

Before giving up possession, the Contractor must ensure that all doors, fanlights, casements, etc. work easily, make any necessary adjustments and leave the whole of the work complete and perfect to the satisfaction of the Representative/Agent.

SECTION 9**CEILINGS, PARTITIONS AND ACCESS FLOORING****9.1 TREATMENT OF TIMBER:**

Treatment of timber shall be as described in Clause 8.1.

9.2 DIMENSIONS OF SAWN SOUTH AFRICAN SOFTWOOD:

Dimensions of sawn South African softwood shall be as described in Clause 8.6,

9.3 FIXING OF WOOD (GENERALS):

Fixing of wood shall be as described in Clause 8.15.

9.4 BRANDERING TO CEILINGS:

Branding not exceeding 65 mm in width shall be of South African softwood complying with the requirements of SABS Specification 653. Branding exceeding 65 mm in width shall be in accordance with SABS Specification 563. All branding shall bear the standardisation mark of the South African Bureau of Standards.

The branding shall be securely spiked up to the supporting timbers with 90 mm wire nails. Cross branding shall be cut in between the longitudinal branding, all securely skew nailed to same with 90 mm wire nails. The sizes and spacing of branding for the various types of ceilings shall be as follows:

(a) Gypsum plaster board:

Size 38 x 38 mm, fixed parallel to the ceiling boards at centres not exceeding 450 mm for 900 mm wide boards and 600 mm for 1200 mm wide boards. In the other direction branding shall be spaced at 450 mm centres for both 900 and 1 200 mm wide boards. Branding shall also be fixed around edges of ceilings where required for fixing cornices.

Size 38 x 38 mm, at not exceeding 450 mm centres in one direction at right angles to the supporting timbers where metal H-section jointing strips are to be used.

(b) Gypsum plaster board with plaster finish:

Size 38 x 38 mm, at not exceeding 400 mm centres in one direction at right angles to the supporting timbers, and around edges of ceiling where required for fixing cornices.

(c) Fibre board

Size 38 x 50 mm, at all joints between ceiling boards where joints between the boards are close butted or do not exceed 6 mm wide or size 38 x 76 mm where joints between the boards exceed 6 mm wide and elsewhere size 38 x 38 mm, fixed parallel to the ceiling boards at not exceeding 450 mm centres for 900 mm wide boards or 400 mm centres for 1 200 mm wide boards. Branding in other direction shall be spaced at 900 mm centres for both 900 and 1 200 mm wide boards. Branding shall also be provided around edges of ceilings where required for fixing cornices.

(d) Fibre cellulose board:

As described in Subclause 9.4 (a).

(e) Fibrous plaster board:

Size 38 x 38 mm, spaced at not exceeding 380 mm centres in one direction with 38 x 38 mm double branding at longitudinal joints between ceiling boards where access above the ceilings is available, 50 x 38 mm single branding at longitudinal joints where access above

the ceilings is not available (i.e. where fixing of the ceiling boards is to be done entirely from the underside). The 50 x 38 mm single brandering shall be grooved, 25 mm wide and 18 mm deep, along the underside as key for the reinforcing plaster which shall be forced into the joints between ceiling boards and up into the grooves in the brandering. Brandering shall also be provided around edges of ceilings where required for fixing cornices.

9.5 COVERING TO CEILINGS:

9.5.1 Gypsum plaster board:

Gypsum plaster board shall be 6,4 mm thick gypsum board complying with the requirements of SABS Specification 266.

The boards shall be nailed to the brandering with 2 mm diameter galvanised or cadmium plated clout headed nails, 40 mm long, spaced at not more than 100 mm centres at edges of boards and 150 mm centres along the intermediate brandering.

Cover strips to joints in gypsum plaster board ceilings shall be of plaster board as for ceilings, 50 mm wide, with smooth machined edges, neatly jointed and fixed with 2 mm diameter galvanised or cadmium plated clout headed nails, 40 mm long, spaced at not more than 150 mm centres.

Where brandering has been installed at right angles to ceiling boards metal H-section jointing strips shall be the acceptable means of distinguishing joints between boards.

The ceiling boards shall be in 900 or 1 200 mm widths layed out and with fixing commencing at the centre line of the ceiling. Ceiling boards shall only be cut down the length to form infill panels against walls, where such panels shall not be less than 300 mm wide and shall be in single lengths to the width of ceilings wherever possible.

9.5.2 Gypsum plaster board with plaster finish:

Gypsum plaster board ceilings with flush plaster finish shall be of gypsum plaster board as described in Subclause 9.5.1, but nails shall be spaced at not more than 100 mm centres along the lines of the brandering.

Joints between boards shall be covered with wire or self-adhesive strips of brown paper scrim tape, all in accordance with the Manufacturer's instructions.

For plaster finish to ceilings see Clause 14.10.

9.5.3 Fibre board:

Fibre board for ceilings shall be 13 mm thick insulation board complying with the requirements of SABS Specification 540, having a density of not less than 400 kg/cubic metre.

The boards shall be nailed to the brandering with 2 mm diameter galvanised or cadmium plated clout headed nails, 40 mm long, spaced at not more than 100 mm centres at edges of boards and 150 mm centres along the intermediate brandering.

Before being fixed the boards shall be stood on edge, in the room in which they are to be used, in such a manner as will allow for the free circulation of air around all the boards, enabling each board to reach equilibrium with the atmospheric conditions in the room. The boards shall remain in this position for a minimum period of 24 hours.

9.5.4 Fibre cellulose board:

Fibre cellulose boards for ceilings shall, unless otherwise specified, be 6 mm thick complying with the requirements of SABS Specification 803 and of flat unpressed type.

The boards shall be nailed to the brandering with 2 mm diameter galvanised or cadmium

plated clout headed nails, 40 mm long, spaced at not more than 100 mm centres at edges of boards and 150 mm centres along the intermediate branderling.

The joints between the boards shall be covered with 25 mm half-round softwood cover beads fixed with 40 mm oval nails spaced at not exceeding 300 mm.

9.5.5 Flush fibrous plaster boards

Fibrous plaster board for ceilings shall be of approved manufacture and, unless otherwise specified, shall be 8 mm thick.

The boards shall be of sizes required to suit the area of ceilings, all nailed to the branderling with smooth surfaces exposed using 2 mm diameter galvanised or cadmium plated clout headed nails, 40 mm long, with heads flush with surface.

Where access above the ceilings is possible nails shall be spaced at approximately 380 mm centres, additional fixing shall be provided using suspensory ties of twisted sisal and gypsum plaster, passed over the branderling and fixed to tops of boards with daubs of gypsum plaster. All joints between boards shall be reinforced with a mixture of sisal and gypsum of not less than 12 mm thick spanning each joint for a width of at least 40 mm on either side. This reinforcement shall be applied on top of the boards.

Where access above the ceilings is not possible (i.e. where fixing is to be done entirely from underside) the nails shall be spaced at not exceeding 225 mm centres. Joints between boards shall be reinforced with sisal and gypsum as described above, the mixture being forced into the joints between the boards and up into grooves previously specified to be machined in the underside of the branderling as for Subclause 9.4 (e).

Gaps between ceiling boards and all visible nail holes shall be filled with a mixture of gypsum plaster and sisal, scraped flush and trowelled to a smooth surface.

Fibrous plaster board ceilings shall be erected in strict accordance with the Manufacturer's instructions by experienced craftsmen.

9.6 COVE CORNICES TO CEILINGS:

9.6.1 gypsum plaster board:

Gypsum plaster board cove cornices to ceilings shall comply with the requirements of SABS Specification 622 and shall be of 76 or 125 mm girth as specified, all nailed through the ceiling boards to the branderling and to walls at not exceeding 300 mm centres with 2 mm diameter galvanised or cadmium plated clout headed nails, 40 mm long, or fixed to walls with hardened steel nails driven into the brickwork with heads flush with surface.

Cornices shall be scribed at internal angles, mitred at external angles and shall be in long lengths with splayed heading joints where necessary.

Moulded plastic corner pieces, manufactured for use with gypsum plasterboard cornices, may be used to eliminate scribed and mitred joints.

Fixing of cornices by means of an appropriate adhesive is acceptable, but this method of fixing shall be carried out in strict accordance with the Manufacturer's instructions.

9.6.2 Fibrous plaster board:

Fibrous plaster board cove cornices to ceilings shall be of 100 mm girth and of approved manufacture, nailed to the ceilings and to wall plugs at not exceeding 300 mm centres with 2 mm diameter galvanised or cadmium plated clout headed nails, 40 mm long, or fixed to walls with hardened steel nails driven into the brickwork with heads flush with surface.

Cornices shall be scribed at internal angles, mitred at external angles and shall be in long lengths with splay cut heading joints where necessary.

All joints and nail holes in cornices shall be filled in and finished off flush and smooth as described for ceilings. Where access above ceilings is possible all joints shall be grouted from behind with a mixture of gypsum plaster and sisal; daubs of this mixture shall be placed at approximately 0,75m intervals between the back of all cornices and walls.

Cornices shall be fixed by experienced craftsmen.

TRAP DOORS IN CEILINGS:

Openings for trap doors in ceilings shall be trimmed with 38 x 100 mm timbers, all securely spiked to the supporting timbers. The framework for the trap door shall be formed out of 38 x 50 mm softwood, properly spiked to supporting timbers and trimmers. The size of the opening shall be 650 x 650 mm.

Trap doors shall be formed with skeleton frame of brandering as for ceilings, covered on underside with ceiling boards and hung on a pair of 75 mm steel butts as Sample 84. Soffits of trap doors shall be flush with soffit of ceiling when closed and flap back 180° on to top of the brandering when opened.

Closed trap doors shall rest on 50 x 19 mm softwood fillets all around opening, mitred at angles and securely fixed to soffit of ceiling.

Any trap door larger than 650 x 650 mm shall be provided with brandering along the centre, securely spiked to the skeleton frame.

In lieu of the above, pressed steel trap doors complete with frame and hinges may be offered as an alternative.

CEILING INSULATION:

All ceiling insulation materials shall comply with SABS Specification 1381.

Ceilings shall be insulated, where so specified or where indicated on drawings, with approved resin bonded glass fibre or rock mineral wool insulation, not less than 75 mm thick, in blanket form manufactured for the insulation of ceilings and laid in single thickness. The insulation shall be cut to size to closely fit between walls, ceiling joists, rafters, etc. and laid over brandering, or insulation may be of an approved mechanically blown cellulose fibre insulation having a minimum thickness of 75 mm.

SECTION 10

FLOOR COVERINGS. WALL LININGS. ETC.

10.1 GENERAL:

The floors and skirtings shall be protected from damage during the progress of any remaining work and at completion shall be cleaned and handed over in a perfect condition. The work shall be carried out by skilled workmen experienced in laying these types of floor finishes.

10.2 WOOD MOSAIC FLOORS:

10.2.1 Mosaic panels:

Mosaic panels for floors shall comply with the requirements of SABS Specification 978 and shall be of Grade 1 and of species specified.

The mosaic panels shall bear the standardisation mark of the South African Bureau of Standards.

Moisture content of panels shall be as laid down in the above specification and panels shall be treated with timber preservative as specified therein.

The nominal size of the panels shall be 480 x 480 mm, made up of 120 x 120 mm units in basket pattern. Each unit shall consist of five fillets, laid edge-to-edge, having a nominal thickness of 8 mm.

10.2.2 Seasoning of panels on site:

The panels shall be unpacked from the containers in which they are delivered. If any excess preservative solvent is present in the timber, the panels shall be stored under cover on site, in such a manner as will allow for the free circulation of air around each panel for such period as required for the excess solvent to dry out. The panels shall also be stored in this manner for such additional period as may be directed by the Representative/Agent to allow the panels to reach equilibrium with the atmospheric conditions of the locality.

10.2.3 Laying of panels:

Wood mosaic panels shall be laid in accordance with SABS Code of Practice 043.

Prior to laying of the panels the screeded surfaces of such floors shall be swept clean.

No mosaic flooring shall be laid until the floor screed is perfectly dry, nor shall it be laid until internal plaster work has been completed and allowed to dry out, the glazing completed and external doors hung.

A free space of at least 16 mm shall be allowed between panels and walls where skirtings and the like are provided. The plaster finish to walls etc. shall be stopped at, or above floor level, so as to increase the width of the free space.

Skirtings and quadrants against skirtings etc. shall not be fixed to the flooring in any way.

10.2.4 Protection and finishing of wood mosaic floors:

Wood mosaic floors shall be covered and protected from damage during the progress of any remaining work and on completion shall be sanded as laid down in the code of practice specified in Subclause 10.2.3. The final surface shall be entirely free from visible scratch or other marks, and shall then be given 1 coat of approved penetrating sealer, mixed and applied in accordance with the Manufacturer's instructions and after a period of not less than 48 hours once polished with an approved clear wax polish.

10.2.5 Descriptions (prices):

Descriptions (prices) of wood mosaic flooring shall be deemed to include sanding, penetrating sealer and polish.

10.3 VINYL FLOOR FINISHES AND SKIRTINGS:

10.3.1 Materials:

Semi-flexible vinyl floor tiles shall comply with the requirements of SABS Specification 581 and fully flexible vinyl (PVC) floor tiles and sheeting shall comply with the requirements of SABS Specification 786, all 2 mm thick unless otherwise specified.

The flooring shall be of marbled pattern, of approved light colour and tiles shall be 300 x 300 mm in size. Vinyl cove skirtings shall be of approved manufacture and 70 mm in height.

10.3.2 Laying and fixing:

Vinyl sheeting and tiles and such like floor finishes shall be laid in strict accordance with the Manufacturer's instructions on a perfectly dry and clean screeded surface. The adhesive shall be of the emulsion type such as bitumen, rubberbitumen or latex-resin, all as described in SABS Code of Practice 070. The floor finishes shall be rolled with a suitable roller to ensure complete adhesion of the material. The flooring shall be cut where required and neatly fitted against adjoining floors, thresholds, etc. Vinyl skirtings shall be close fitted to floors and walls, butted at heading joints, neatly mitred at internal angles and dressed round external angles, and fixed with adhesive as for flooring.

Sheet flooring shall be in standard widths with cut sheets at sides of floors against walls etc. as necessary.

The floors and skirtings shall be protected from damage during the progress of any remaining work and at completion shall be cleaned and handed over in a perfect condition.

The work must be carried out by skilled workmen experienced in laying these types of floor finishes.

10.3.3 Descriptions (Prices):

Descriptions (prices) of floor coverings and wall linings shall be deemed to include dressing around and into corners.

SECTION 11**IRONMONGERY****11.1 IRONMONGERY:**

All ironmongery shall be of the best quality and shall be approved prior to fixing.

Articles shall be fixed with matching screws.

No key shall pass a second lock unless master keyed,

11.2 FIXING:

Ironmongery is to be taken as fixed to wood unless otherwise described.

Items described as "plugged" shall be deemed to include screwing to fibre, plastic or metal plugs.

All necessary preparation of pressed steel door frames for the fixing of ironmongery to the frames has been included with the pressed steel door frames.

All screws, nails, bolts, etc. required for completion of the work shall be supplied by the Contractor.

11.3 BRASS STRIPS AT JUNCTIONS OF FLOOR FINISHES:

At junction of different floor finishes with each other provide and build in 3 x 25 mm brass strips with top edges flush with adjoining finishes.

11.4 DOWELS AND MORTICES:

The stiles of wood door frames, and similar frames not having sills framed in, shall be dowelled to concrete, brick, stone and similar thresholds with 10 mm diameter mild steel dowels, 75 mm long, one to each stile.

11.5 KITCHEN CUPBOARDS:

Descriptions (prices) of kitchen cupboards shall be deemed to include ironmongery and fixing with necessary screws and fibre, plastic or metal plugs.

SECTION 12**STRUCTURAL STEELWORK****12.1 STEEL:**

All structural steelwork shall be of mild steel complying with the requirements of SABS Code of Practice 0162 for Structural Steel in General Building Construction.

12.2 STRUCTURAL STEELWORK:

(PORTIONS ENVELOPED BY ROOF CLADDING, CEILINGS AND OTHER SIMILAR FINISHES INCLUDED.) All structural steel shall be hot rolled mild steel. For inland areas, cold rolled steel sections may be used for purlins and side cladding rails only.

Construction methods and the design of steelwork shall be in accordance with the provisions contained in the latest edition of the National Building Regulations:

SABS 0400. Notwithstanding the requirements of the foregoing specifications; materials, workmanship, setting out, erection methods, riveting, bolting, welding, etc. shall be of the best quality, all to the satisfaction of the Representative/ Agent.

12.3 DETAILED DRAWINGS FOR STRUCTURAL STEELWORK:

The steel fabricator is to prepare a complete set of shop drawings and submit two sets to the Representative/Agent for approval before commencing fabrication. Approval of such drawings will not release the Contractor from his responsibility for the accuracy of his drawings. Details of substitutions of profiles and alternative details must be submitted to the Representative/Agent for approval. All designed members shall be of unbroken lengths and no splicing, jointing or welding to make up such lengths will be permitted.

12.4 PRESERVATION OF STRUCTURAL STEELWORK:

All surfaces of structural steelwork are to be thoroughly cleaned of all rust, scale, oil or grease, all in accordance with SABS Code of Practice 064 and then primed and finished as described in Clause 18.9.

12.5 INSPECTION:

The Contractor shall notify the Representative/Agent of the completion of the fabrication of steelwork at the Steel Fabricator's works to enable him to make inspections if he so desires.

SECTION 13**METALWORK****13.1 STEEL:**

Steelwork shall be as described in Clause 12.1.

13.2 PRESERVATION OF STEELWORK:

All surfaces of steelwork are to be thoroughly cleaned of all rust, scale, oil or grease, all in accordance with SABS Code of Practice 064 and then be given 1 coat of primer complying with SABS Specification 909 before leaving the workshop.

13.3 HOT DIP GALVANISING TO STEELWORK:

Where prescribed, all steelwork built in as the work proceeds shall be hot dip galvanised after fabrication, but before leaving the Manufacturer's works, by the hot dip process, all in accordance with SABS Specification 763.

All welding carried out on site shall be zinc sprayed in order that zinc coating be even and continuous over all surfaces.

13.4 MANUFACTURED STEELWORK: GENERAL:**13.4.1 Welded -joints:**

Welding is to be done electrically in the most up to date manner by skilled workmen and cleaned off on completion.

All welding is to be carried out using welding rods of the same chemical composition as the tubes, rods, bars, etc. to be welded. All exposed welds are to be finished off clean and smooth.

Welding to all exposed edges is to be continuous fillet welding unless otherwise described.

13.4.2 Protection:

No scaffolding shall be allowed to rest on or be fixed to steel windows, doors, frames, etc. in any way.

13.5 PRESSED STEEL DOOR FRAMES

Pressed steel door frames shall be of welded "one piece" construction or of approved knock-down type for assembly on site, all in accordance with SABS Specification 1129.

13.6 STEEL DOORS, SIDELIGHTS AND FANLIGHTS: (RESIDENTIAL USE ONLY)**13.6.1 General requirements:**

Steel doors, sidelights and fanlights manufactured from hot rolled mild steel sections as described for steel windows (see Clause 13.8) shall, in the case of stock types, comply with the requirements of SABS Specification 727, but purpose made types need only comply with the constructional and other requirements of the above specification where applicable. All such doors, sidelights and fanlights shall also comply with the following additional and/or amended requirements, viz:

- (a) Suitable weather bars shall be provided where required to render opening sections completely watertight.
- (b) Frames to such doors etc. where fixed to concrete columns, beams, etc. shall be provided with suitable holes for screw fixing to plugs in the concrete, all at the same

spacing as for the standard fixing lugs.

- (c) Doors, sidelights, fanlights and components, except where specified to be hot dip galvanised, shall be cleaned and primed as described for steel windows.
- d) Doors, sidelights and fanlights, unless otherwise shown, shall be of "one piece" construction, but where shown to be in two or more "one piece" units, the units shall be coupled together with standard coupling mullions and/or transomes.
- (e) All bottom openings in doors and sidelights shall be fitted with kicking plates formed with 1,6 mm thick mild steel sheet and fixed with metal beads.
- (f) Outward opening doors shall have door frames fitted at bottom with sills of door framing section (stepped sills), but inward opening doors shall have door frames with metal ties, welded to frames, for embedding in thresholds (flush sills)
- (g) After doors, sidelights and fanlights have been built in, but just prior to being glazed, they shall be overhauled, adjusted as necessary and left in good working order.

13.6.2 Construction:

The doors, sidelights and fanlights shall be constructed as follows:

(a) Stock doors, sidelights and fanlights:

Stock doors, sidelights and fanlights shall be of the types shown on drawings; the doors constructed of approved steel sections and sidelights and fanlights of 25 mm sections as described for steel windows (see Clause 13.8).

Each leaf of double doors and each single door shall be hung on three steel hinges having brass pins. Hinges shall be of the parliament type where door frames are set back from the face of the wall and the doors are shown to fold 180° back against the adjacent wall.

Doors shall be fitted with mortice locks having not less than three levers complete with heavy brass or chromium plated brass lever handles. One leaf of each double door shall be fitted with two brass or chromium plated brass bolts as Sample 28. Handles and bolts shall have polished brass or satin chrome finish.

Fanlights shall be hung and fitted as described for steel windows (See Clause 13.8).

(b) Purpose made doors, sidelights and fanlights:

Purpose made doors, sidelights and fanlights shall be as described in (a) above, but constructed to the forms and sizes shown on drawings.

13.7 BALANCE TYPE PRESSED STEEL DOORS:

Balance type steel doors are to be of the "back track" type constructed of not less than 0,80 mm thick mild steel sheeting pressed to form troughed or fluted pattern horizontal panels, each approximately 200 mm wide, all strongly reinforced at back with 1,2 mm thick top-hat section mild steel braces and/or stiffeners and provided all round exposed edges with 1,2 mm thick mild steel channels, all properly welded together and with all welding cleaned off flush and smooth.

Each door is to be hung on two flexible steel cables of not less than 5 mm diameter, connected at lower ends to 125 mm diameter steel encased counterweights of such length and mass as will balance the door in the full open position and connected at upper ends to door unit by passing cables over 140 mm diameter bushed cast aluminium pulleys, securely fixed to 2,50 mm thick mild steel top plates.

The movement of doors are to be controlled by means of sintered metal rollers (nylon rollers are not acceptable), securely fixed at top and centre of outer edges of door units so as to operate in both the

horizontal and vertical runner guides respectively. Guides on both sides are to be formed of 37 x 32 x 2,5 mm thick mild steel channels with horizontal channels welded to upper ends of vertical channels as back track for top rollers. Each vertical channel is to be four times bolted to jamb of door opening and each horizontal channel is to be securely fixed in position on internal walls with mild steel angle brackets, twice bolted to wall to form rigid construction.

The counterweights to doors are to be encased with 2,50 mm thick mild steel cover plates, each the full height of door, and securely fixed to wall and channel guide.

Each door shall be fitted with a chromium plated locking handle complete with control rods as Sample 27 and with striking plate bolted to lintel over door opening. The locking handle is to be operated from the outside and provided with two keys.

Before leaving the Manufacturer's works, all metal is to be painted with a protective coat of metal primer, all in accordance with the requirements of SABS Specification 909.

13.8 STEEL WINDOWS:

13.8.1 General requirements:

Stock residential and industrial type steel windows shall comply with the requirements of SABS Specification 727. All other types both stock and purpose made shall comply with the constructional and other requirements of the above specification wherever applicable. All windows shall comply with the following additional and/or amended requirements, viz:

- (a) Suitable weather bars shall be provided to bottom of opening in and vertically pivot hung ventilators and also to the bottom of all opening out ventilators where they occur above other ventilators and elsewhere as may be required to render the opening sections watertight.
- (b) Frames of windows where fixed to concrete columns, beams, etc. shall be provided with suitable lugs for fixing to plugs in the concrete, or with holes for screwing to plugs in the concrete at same spacing as the standard fixing lugs.
- (c) Windows and components, except where specified to be hot dip galvanised, shall, before leaving the Manufacturer's works, be cleaned by acid pickling, rinsing and drying, all as laid down in SABS Code of Practice 064, or by other approved means, to remove all scale, rust, grease, oil and foreign matter and then primed with red oxide zinc chromate primer complying with the requirements of SABS Specification 909, applied by dipping or by means of a spray gun.

Side hung ventilators intended to open outwards in windows above ground floor level and not accessible for cleaning in the same window or from verandahs, balconies and the like shall be hung on projecting hinges.

Windows shall be of "one pietse" construction, but where shown to be constructed from two or more "one piece" units, the units shall be coupled together with standard coupling mullions and/or transoms.

Windows shall be fitted with brass handles, stays, catches and other fittings as later described those to windows constructed of residential sections having polished finish and those to all other windows tumbled finish. The fittings shall be fixed in such a way as to be removable after windows have been glazed.

After the windows have been built in, but before being glazed, they shall be overhauled, adjusted as necessary and left in good order.

13.8.2 Construction:

The various types of windows shall be constructed as follows:

(a) Stock residential type windows:

Stock residential type windows shall be of the types shown on drawings, constructed of standard 25 mm mild steel sections (except for glazing bars which are to be of 19 mm size) with metal not less than 3 mm thick.

Side hung ventilators:

Each ventilator shall be hung on steel hinges having brass pins complete with casement fastener and sliding stay.

Top hung ventilators:

Each ventilator shall be hung on hinges as above complete with combined fanlight stay and fastener, size 200 mm for one pane high ventilators and size 250 mm for two pane high ventilators.

Bottom hung ventilators:

Each ventilator shall be hung on hinges as above complete with approved concealed friction side arms and fitted with spring catch and keep as Sample 89.

Pivot hung ventilators:

Each ventilator shall be hung on friction pivots and be fitted with spring catch and keep as Sample 89.

Projecting out ventilators:

Each ventilator shall slide on approved spring loaded brass shoes operating in channels attached to the fixed frame, and shall be balanced on steel arms, pivoted at ends and housed within the vertical frames; each ventilator shall also be fitted with an approved casement fastener at bottom.

(b) Purpose made residential type windows:

Purpose made residential type windows shall be as described in (a) above, but constructed to the forms and sizes shown on drawings.

(c) Stock industrial type windows:

Stock industrial type windows shall be of the types shown on drawings, constructed with standard 33 mm steel sections with metal of not less than 3 mm thick but with ventilators of standard 25 mm steel sections with metal of not less than 3 mm thick.

Pivot hung ventilators:

Each ventilator shall be hung on friction pivots and be fitted with spring catch and keep as Sample 89.

Bottom hung ventilators:

Each ventilator shall be hung on steel hinges having brass pins complete with approved concealed friction side arms and fitted with spring catch and keep as Sample 89.

(d) Purpose made industrial type windows:

Purpose made industrial type windows shall be as described in (c) above, but constructed to the forms and sizes shown on drawings.

13.9 METAL CURTAIN PELMETS:

Pelmets shall be of stock pattern and approved manufacture not less than 300 mm longer than the width of opening between reveals, wherever possible, or they may be continuous over windows occurring in series.

Fascias shall be of sheet steel not less than 0,71 mm thick, twice ribbed to provide additional stiffness and with top and bottom edges beaded and with ends returned on to the face of wall. Fascias shall be of width required to provide at least 65 mm cover from bottom of curtain rail to bottom edge of pelmet,

Pelmets shall be fitted with a good quality curtain rail, attached to the fixing brackets, and provided with end stops and twelve approved curtain runners per linear metre of rail,

Pelmets are to project not less than 100 mm out from face of wall, all fixed on strap brackets made up of 19 x 5 mm or 25 x 3 mm mild steel secured to fascia at ends of pelmets and intermediately at not exceeding 750 mm centres. Each bracket shall be holed for and screwed to plugs in walls.

The fascias and brackets to be given 1 coat light colour metal primer before leaving the Manufacturer's works.

13.10 BURGLAR BARS TO STEEL WINDOWS:

Where windows are fitted with burglar bars, these are to be of standard pattern welded at each intersection, flattened and welded to steel window frame to opening sections only.

13.11 GAUZE SCREENS TO WINDOWS:

Gauze screens to windows shall be constructed with pressed steel or extruded aluminium frames and filled in with approved fibreglass gauze having 1,5 x 1,5 mm meshes.

The screens to outward opening ventilators shall be attached to the inside of windows with studs or clips in such a way as to be readily removable, and shall have sliding portions for access to window fasteners etc. Screens to top hung ventilators may be hinged for access to fasteners.

Frames to screens of inward opening windows shall be of thicker metal than those to outward opening windows or be of rolled mild steel sections and fixed on outside face of windows with screws and nuts or other approved means.

Screens to pivot hung ventilators shall be in two units, one internally and one externally, with gaps between screens and ventilators closed with approved rubber flashings, all fixed in such a way as to be easily renewable.

The frames to screens of windows fitted with louvres or other projecting attachments shall be of such width as will allow for adequate clearance between the screens and the attachments.

The screens are to be spray painted with enamel of approved colour and baked on or with natural anodised surfaces to aluminium screens.

13.12 CELL WINDOWS (TYPE DRAWINGS POL. 27/2 AND 27/4):

13.12.1 Windows (Police Type)

The windows shall be purpose made in steel to the forms and sizes shown on drawings, complying with the constructional and other requirements of SABS Specification 727 wherever applicable, electrically welded in the most up to date manner and cleaned off on completion.

Each window is to be made up in three units and each unit is to be constructed with frame and single light sash formed with RFX7 and RF7 standard residential window sections coupled together and with each sash hung on purpose made hinges, all as shown on drawings.

Each hinge marked No. 2 on the Type Drawings is to be formed to detail with an upper and

lower pin housing formed with 16 mm diameter mild steel of the length shown and with upper housing provided with a 2 mm diameter oil hole and both top and bottom housing holed to the depth required to take a 46 mm long x 9 mm diameter brass hinge pin tapered at each end and when assembled a 1 mm gap between the top and bottom housing is to be provided all as shown on Type Drawings.

Hinges marked No. 1 on the Type Drawings are to be used only when windows are to be hot dip galvanised and are each to be formed to detail and sizes shown with 2 mm thick mild steel plate holed or bent as necessary for a 9 mm diameter non-removable brass hinge pin.

The hinges are to be securely welded in position in such a way that the opening sash can not be removed from the frame,

Provide each sash with a pull handle made of standard residential type mild steel profile, 60 mm long, welded in the position shown to the bottom rail of sash.

Provide each sash with a wing grip turn button formed of mild steel to the forms and sizes shown on Type Drawings, holed for 6 mm diameter round head mild steel rivet. The turn button to be riveted to a 3 mm thick cranked and shaped mild steel plate welded in the position shown to the vertical rail of sash.

The units of each window shall be coupled together as shown with 30 x 16 mm thick vertical manganese steel bars set between the standard window sections, built 150 mm into walls and provided with 65 mm wide x 3 mm thick mild steel cover plates of required length welded to the frame.

Provide similar vertical manganese steel bars where shown, each set into the core of a 38 x 25 x 2 mm thick mild steel hollow section, built into walls as before described and with mild steel hollow sections welded in the position shown to the inside of the window frame.

The above specified manganese steel bars to be of Y-steel having a manganese content incorporated, all in accordance with the specification for Y-steel, and heat treated to have surface hardness of 50 on the Rockwell C Scale with not less than 2 mm penetration on all four surfaces and obtainable only from the contractor who has been awarded the State Tender Board contract for the provision of such steel for the financial year in question and whose name and address is available from:

The Chief Director:
Procurement Administration,
Private Bag X49,
PRETORIA, 0001.

A certificate issued by the above contractor shall be provided with each and every consignment of the steel bars above described and such certificate shall be deemed *prima facie* proof that the steel, covered by such certificate, complies with the specification.

13.12.2 Fixed screens:

Each window shall be provided with a fixed mesh screen formed to detail with 50 x 50 x 6 mm thick mild steel angle section framing, mitred and welded at corners, with 50 x 6 mm thick vertical and horizontal flat bars, spaced as shown, cut and welded together at each crossing and also to angle section framing.

Each frame shall be filled in all round with 5 mm diameter galvanised mild steel mesh having 5x5 mm maximum openings, welded to angle framing and riveted to the 6 mm thick mild steel vertical and horizontal bars at 100 mm centres.

Each screen shall be fixed to wall with 50 x 50 x 6 mm thick mild steel angle section fixing clamps, each formed to detail and welded to frame in the positions shown. Each clamp shall be holed for and bolted to wall with M7 expansion bolts and with head of each bolt welded to clamp.

13.12.3 General:

Before leaving the Manufacturer's works, all welding shall be cleaned off flush and smooth and all the surfaces of the windows and screens etc. are to be properly cleaned and primed with zinc phospe primer.

NB: The notes below are applicable to cell windows for both Correctional Services and Police.

- (a) The windows intended for Coastal Services are to be hot dip galvanised as Clause 13.3 of this document except the manganese steel bars which are to be properly cleaned and primed with zinc phospe primer before it is set between the window sections or into the core of the mild steel hollow sections.
- (b) Before general manufacture of cell windows is commenced, a sample window is to be submitted for approval which in the case of cell windows for use in prisons may include further testing of the hardened steel bars by the Department of Correctional Services.
- (c) Under no circumstances may any welding be carried out near the hardened steel bars during any stage of the manufacturing process.
- (d) After written approval for both Prison as well as the Police cell windows have been obtained, the manufacturing of the cell windows may be proceeded with.

13.12.4 Cell windows (for Correctional Services):

The windows shall be purpose made in steel to the forms and sizes shown on drawings, complying with the constructional and other requirements of SABS Specification 727 wherever applicable, electrically welded in the most up to date manner and cleaned off on completion.

Each window shall be made up of the number of units as indicated on the window schedule and constructed with RFX7 and RF7 standard residential window sections with each sash hung on purpose made hinges all as before described in Subclause 13.12.1 for Police type cell windows including pull handles, wing grip turn buttons and manganese steel bars set between window sections or into the core of hollow sections.

The manganese steel shall be as before described in Subclause 13.12.1, but the steel to have not less than 2 mm surface penetration hardness of between 55 and 63 on the Rockwell C Scale on all four surfaces.

NB: Fixed screens are not required.

13.12.5 General:

As described in Subclause 13.12.3.

13.13 STRONG ROOM DOORS:

Strong room doors shall be of Category 1, 2, 3 or 4 as specified, in compliance with the requirements of SABS Specification 949, but also conforming in all respects to the following additional requirements:

(a) Dimensions

The dimensions of the clear opening for each of the four categories of doors shall be not less than those specified in the following table:

CATEGORY OF DOOR	HEIGHT (mm)	WIDTH (mm)
1	1 850	760
2 (20 mm front plate)	1 850	760
3	1 850	760
4	1 850	830

The width of the clear opening shall be measured when the door is opened to 180°, but this dimension shall not exceed 880 mm for any category of door.

(b) Fittings:

Doors shall be fitted with lever handles for operating the sliding bolts and bow handles for opening and closing of doors. Provide and fit covered escutcheon over keyhole, or over each keyhole if door is fitted with more than 1 lock, all securely attached to door. All fittings shall have chromium plated finish.

The door shall be badged on outer face with the Manufacturer's name and on the inside of door with a permanent marking indicating the category of door.

(c) Finish:

In lieu of the paint finish described in SABS Specification 949, the door and frame shall be thoroughly cleaned of all scale, rust, grease, oil and foreign matter and given 1 coat of metal primer described in Clause 18.3 applied by means of a spray gun or brush before leaving the Manufacturer's works.

(d) Samples:

The Contractor shall, if requested to do so by the Representative/Agent, submit for approval the lock and fittings being used in the construction of the door, including such other component parts as may be called for. Articles submitted for approval shall not be built into any door until approved.

(e) General:

The door frame shall not be built into walls as the work proceeds, but shall be fixed in position in the opening in the wall with the grip lugs provided with the frame.

The Contractor shall ensure that the lock and other vital parts of the door are in no way tampered with either before or after fixing in the building. Should it be discovered and proved to any tampering has taken place, the Contractor will be held solely responsible and if necessary shall, at his own expense, furnish a new door or lock and keys as the Representative/Agent may decide.

The Contractor shall arrange with the Manufacturer for the keys to be posted, by the Manufacturer, direct to the Regional Representative, Department of Public Works under registered cover giving the following particulars, viz:

- (i) Manufacturer's name.
- (ii) Manufacturer's door number/s.
- (iii) Category of door/s.
- (iv) Size of door/s (clear opening).
- (v) Name of Contractor by whom ordered.

(vi) Building and place where installed.

On no account shall keys be delivered to the building site. Failure to observe these instructions may entail the provision of a new lock or locks and keys.

13.14 STEEL ROLLER SHUTTERS

Roller shutter doors shall be of approved manufacture, fit flat against surface of opening and consist of curtain, vertical guides and overhead mechanism.

The curtain is to be formed of machine rolled interlocking slats with malleable iron end stocks riveted or spot welded onto alternate ends. The bottom slat is to be fitted with heavy angle iron riveted on and the vertical edges to run in heavy channel guides bolted to wall.

The overhead mechanism is to be enclosed in a canopy formed of sheet steel. The whole is to be primed before leaving the Manufacturer's works.

PUSH UP TYPE: The canopy and curtain shall be manufactured from 0,91 mm thick metal with 50 mm wide slats, for curtain operating on a horizontal steel barrel shaft of ample strength and balanced by a high grade tempered steel adjustable helical spring, mounted on casting with ball bearings and provided with fusible link, a pair of 100 mm pull handles and a heavy hasp and staple with a 50 mm padlock as Sample 32.

GEAR OPERATED: Gear operated type roller shutter doors shall be manufactured from 1,22 mm thick metal with 75 mm wide slats and operated by means of bevel gears driven by a vertical shaft operated by means of a detachable handle.

13.15 STRONG ROOM VENTILATORS:

Strong room ventilators shall be of the straight-through double ended type each constructed with telescopic sleeve not less than 127 x 127 mm internally and suitable for the thicknesses of walls into which they are to be built, all fitted with baffle plates and flame proof wire gauze screen and cast steel ends having slotted fascias.

The sleeve and baffle plates shall be of mild steel having a minimum thickness of 2 mm, all strongly welded together with welds ground off smooth and flush where exposed, and with fascias not less than 225 x 225 mm square. Fascia at outer end of ventilator shall be fitted with drop shutter held in position by a fusible metal plug.

13.16 FOOT SCRAPERS:

Foot scrapers shall be formed with 25 mm diameter mild steel rod four times bent with horizontal portion forged to a taper, and ends set in a block of Class B concrete, size 225 x 225 x 380 mm long, floated smooth on exposed surface in 2:1 cement mortar and set in the ground.

13.17 FLAGSTAFFS (Type Drawing GEN. 013):

Flagstaffs shall be 8,850 m high above base plate, each constructed with two lengths of aluminium tubing, the lower length 5,800 m long of 88,90 mm outside diameter tubing and of 6,36 mm wall thickness and the upper length 3,5 m long of 50,8 mm outside diameter tubing and of 3,18 mm wall thickness inserted into top end of the lower length of tubing for a distance of 450 mm and welded thereto with three spacers inserted between the two tubes at top and at bottom of the joints.

A tapered circular sleeve of 2 mm thick sheet aluminium shall be provided above the joint as shown and welded into position.

The staff shall be holed for and secured with two 20 mm diameter hexagon headed stainless steel bolts and nuts to two 127 x 63,5 x 6,36 mm aluminium channels, each 1,065 m long, joined together on one side of staff with 90 x 6 mm aluminium vertical plate, welded to channels; the channels and vertical plate shall be fitted at bottom end with 450 x 450 x 13,5 mm thick aluminium base plate, four times holed for the anchor bolts, welded to channels and vertical plate and reinforced with four 6 mm thick triangular shaped aluminium gusset plates, welded to channels and base plate.

The flagstaff shall be fitted at top with a solid 165 mm diameter hemispherical cast aluminium cap with centre shaft and with cap twice slotted, once on each side of cap, for wheels and pins for halyards as shown. The staff shall also be fitted at height shown with four cleats, each formed with 12 mm diameter aluminium rod, bent and welded to staff.

The staff shall be provided with two 18 m long halyards of 7 mm diameter solid basket braided nylon rope, each threaded around wheel in the cap and jointed with a strong knot.

Exposed surfaces of tubing, channels, plate, etc. shall have mill finish and castings a smooth matt finish. All welding shall be cleaned off flush and smooth where exposed.

The staff shall be fixed on a 1 370 x 1 370 x 538 mm Class B concrete base with four 20 mm diameter Grade 304 stainless steel hooked anchor bolts, embedded in the base and provided with nuts and washers. The base shall be cast in the ground, weathered on top to all sides away from base of flagstaff and finished smooth in 3:1 cement mortar.

The underside of base plate shall be given two coats of epoxy tar paint before flagstaff is fixed in position.

13.18 STAINLESS STEEL. ALUMINIUM, BRONZE. ETC.:

13.8.1 General:

The work shall be constructed of the best quality materials (high tensile in the case of extruded aluminium sections), all in accordance with the detail drawings, free from flaws, hammer marks and other defects.

The whole shall be framed together in the strongest possible manner with all joints reinforced as necessary and neatly finished off.

Screws are to be of stainless steel and shall not be visible, except under special circumstances and where used to fix glazing beads.

Glazing beads and other fixing or finishing strips shall be mitred at angles and secured with raised headed screws spaced at not more than 150 mm centres.

Metals, other than stainless steel, used in the fabrication of aluminium work must be kept from direct contact with the aluminium by means of an approved method.

13.18.2 Finish and protection:

Surfaces shall be finished as specified and none is to be fixed in position until it has been inspected and approved. Aluminium work, except as otherwise described, is to have a natural anodised finish.

Descriptions (prices) shall be deemed to include coating finished surfaces with a thick coating of lacquer or other approved materials as protection from damage by contact with brick, concrete, plaster, etc.

Finished surfaces shall be cleaned down to a consistent colour and texture equal to a sample approved by the Representative/Agent before any work is commenced.

13.18.3 Design:

No deviation may be made from the general requirements or dimensions, but improvements in construction and design affecting neatness, strength, durability or efficient work may be introduced, but only after approval by the Representative/Agent.

The detail drawings are for guidance only and Tenderers are permitted to offer their own sections, providing they are similar to those detailed. Full particulars and detailed drawings must be submitted with any alternative offer and such drawings and details are to be approved before manufacture is commenced. Every facility must be given for the work to be

inspected during manufacture,

SECTION 14**PLASTERING****14.1 LIME:**

Lime shall be hydrated plaster lime complying with the requirements of SABS Specification 523.

14.2 CEMENT:

Cement shall be as described in Clause 3.1.

14.3 SAND:

Sand for plaster shall be as described in Clause 5.3.

14.4 FORMING KEY TO CONCRETE FOR PLASTER FINISH:

All surfaces of concrete receiving plaster or similar finishes shall be well wetted and wire brushed immediately the formwork has been removed and slushed over with 2:1 cement grout to form key for the finish, all to the approval of the Representative/Agent. The slushing shall be allowed to set hard before any finish is applied

Where smooth formwork has been used, particular care shall be taken in forming the key for plaster as described in Clause 3.23.

NB: The Contractor's attention is drawn to the fact that the forming of a key to concrete for all types of finish is to be executed in strict accordance with Clauses 3.23 and 5.16

14.5 LIME PLASTER**14.5.1 One coat work on walls:**

Lime plaster for 1 coat work on walls shall be composed of 4 parts by volume of sand and 1 part by volume of lime. The material shall be mixed dry until of uniform colour, water shall then be added and the mixture turned over until the ingredients are thoroughly incorporated.

Lime plaster not used on the day it is mixed, shall be kept moist until required for use by covering with wet sacks or by other approved means.

14.5.2 Two coat work on walls:

The rendering coat shall be of compo plaster as described in Clause 14.6 well scratched over to form key for the setting coat. The setting coat shall be composed of 1 part hydrated putty plaster lime, complying with the requirements of SABS Specification 523 referred to in Clause 14.1 and 1 part fine washed sand, to which retarded hemi-hydrate hardwall finishing gypsum plaster shall be added in the proportion of 1 part of gypsum plaster to 4 parts of sand, all proportioned by volume.

The gypsum plaster shall not be added to the mixture until the setting coat is to be applied and shall then be thoroughly incorporated into the mixture and used immediately.

14.5.3 Two coat work on metal lathing:

The rendering coat shall be of compo plaster as described in Clause 14.6 to which sisal shall be added in the proportion of 4 kg of sisal to 1 cubic metre of plaster. The rendering coat shall be well scratched over to form a key for the setting coat.

The setting coat shall be all as described in Subclause 14.5.2. 85

14.6 COMPO PLASTER:

Compo plaster shall be composed of 10 parts of sand, depending on the quality of the sand available, 1 part lime and 1 part cement all measured by volume.

The lime and sand shall be mixed dry until of uniform colour and then mixed wet. Approximately half an hour before use, add the cement and any additional water as may be required and remix until thoroughly incorporated.

Compo plaster shall be produced in such quantities as can be used whilst remaining workable as no compo plaster that has become unworkable shall be used in any way.

14.7 CEMENT PLASTER:

14.7.1 One coat work on brickwork:

Cement plaster for 1 coat work on brickwork shall be composed of 4 parts of sand to 1 part of cement for internal work and 5 parts of sand to 1 part of cement for external work, all measured by volume, and mixed as described for cement mortar in Clause 5.12.

14.7.2 One coat work on concrete ceilings and beams:

Cement plaster to concrete ceilings and beams shall be composed of 3 parts of sand to 1 part of cement, all measured by volume and mixed as described for cement mortar in Clause 5.12.

14.7.3 TWO coat work on brickwork?

The rendering coat shall be as described in Subclause 14.7.1, well scratched over to form key for the setting coat. The setting coat shall be composed of 1 part of cement, 2 parts of putty plaster lime as described in Subclause 14.5.2 and 1 part of fine washed sand, all measured by volume.

The cement and putty plaster lime shall not be added to the mixture until immediately before the setting coat is to be applied and shall be thoroughly incorporated in the mixture and shall be used immediately.

14.8 HARDWALL GYPSUM PLASTER:

Hardwall gypsum plaster shall be a retarded hemi-hydrate hardwall gypsum plaster of finishing quality, gauged with a small percentage of well slaked lime putty, mixed in strict accordance with the Manufacturer's instructions or a hemi-hydrate neat finishing gypsum plaster, applied over a rendering coat of cement plaster, in two thicknesses by the trowel-float-trowel method.

The rendering coat shall be of 4:1 cement plaster as described in Subclause 14.7.1, all well scratched over to form key for the setting coat.

14.9 CONCRETE BONDING PLASTER:

Concrete bonding plaster shall be a retarded hemihydrate woodfibre concrete bonding gypsum plaster, applied in two thicknesses by the trowel-float-trowel method to a total thickness of not less than 6 mm and finished with a very thin layer of finishing plaster as described in Clause 14.8, applied immediately the second layer of bonding plaster stiffens.

14.10 PLASTERBOARD BONDING PLASTER:

Plasterboard bonding plaster shall be a light weight retarded hemi-hydrate gypsum plaster, applied in two thicknesses by the trowel-float-trowel method, to a total thickness of not less than 6 mm, well pressed into the wire scrim over the joints between the ceiling boards and finished with a very thin layer of finishing plaster as described in Clause 14.8. The finishing plaster shall be applied as soon as the second layer of bonding plaster stiffens.

For gypsum base boarding to ceilings see Subclause 9.5.2.

14.11 THICKNESS OF PLASTER:

Plaster on walls shall be not less than 12 mm or more than 20 mm in thickness and plaster on concrete ceilings and beams shall not be less than 9 mm or more than 16 mm in thickness.

14.12 APPLICATION OF PLASTER:

Walls shall be well wetted before plastering is commenced.

The surfaces of plastered walls internally shall be steel trowelled to a smooth, even and true finish. All external plaster shall be finished to a true and even surface with a wood float. All plaster surfaces shall be free from blemish.

Plaster shall be returned into reveals and soffits of openings and all angles shall be true and straight with salient angles slightly rounded.

The rendering coat of plaster in two coat work shall be approved by the Representative/Agent before the setting coat is applied and notice shall be given to the Representative/Agent when the plaster is ready for inspection.

All cracks, blisters and other defects shall be cut out, made good and the whole left perfect at completion.

NB: See Clause 14.4 for forming key for plaster on concrete.

14.13 GRANOLITHIC FINISH (For sand-cement finish see Clause 14.19):

Granolithic finish to floors, treads of steps, thresholds and similar horizontal surfaces shall be not less than 25 mm thick, composed of 2 parts granite, or other approved hard stone chippings, or approved hard coarse sharp washed granitic or quartzitic river sand, graded up to a maximum size of 5 mm, ¹/_^ part clean pit sand screened through a 2.4 mm mesh sieve and 1 part of cement, and hand or mechanically steel trowelled to a true and smooth surface.

The material must test between 30 and 35 MPa. No dry cement powder or grout shall be applied to the surface.

The granolithic shall be laid before the concrete subfloor has matured otherwise the exposed surface of the concrete shall be thoroughly cleaned with a wire brush and a coat of neat cement grout applied immediately before the granolithic is laid.

The granolithic shall be laid in panels not exceeding 20 m² in area and joined to lines of panels with V-joints as directed. The length of any panel shall not exceed 4.5 m and wherever possible the joints between the panels shall coincide with any joints in the concrete sub-floor.

Where granolithic is to be tinted, it shall be laid in two thicknesses in one operation, the lower thickness being brought up to within 6 mm of the finished level and the upper thickness, into which the requisite quantity of approved colouring material has been mixed, shall be laid. NO DUSTING OF COLOURING MATERIAL WILL BE ALLOWED.

Granolithic finish to stair risers, sides of kerbs and other vertical surfaces shall be not less than 12 mm thick.

Exposed salient angles of granolithic shall be neatly rounded to approximately 20 mm radius.

All granolithic work shall be carried out by experienced workmen and shall be protected from injury caused by rain or other extremes of weather for 12 hours after being laid, and against drying out too rapidly whilst hardening by covering with wet sacks or other suitable material and shall be protected from other injury and discoloration during the progress of the remaining work.

Edges of granolithic floors adjoining other floor finishes, edges of margins, etc. shall be true and sharp, all protected by fixing temporary wood strips which shall remain in position until laying of the adjoining flooring material is commenced.

14.14 GRANOLITHIC SKIRTINGS:

Granolithic skirtings shall be formed by turning the granolithic floor finish up against walls and other vertical surfaces, hollow rounding the granolithic at junction with floors and finishing the top edge perfectly straight. The skirtings shall be at least 75 mm high.

Skirtings shall finish flush with glazed wall tiling, but shall project approximately 5 mm beyond face of plastered wall surfaces and 10 mm beyond faces of face brick and bagged wall surfaces. Projecting top edges of skirtings shall be slightly rounded.

All mitres, stopped and returned ends, etc. shall be neatly formed.

14.15 GRANOLITHIC STOOLINGS:

Granolithic stoolings under jambs of door frames etc. shall be formed in Class E concrete with granolithic finish as for floors and of same height and shape as the granolithic skirtings, all to finish flush with jambs of door frames where skirtings finish flush with wall face and projecting beyond stiles to match skirtings, where skirtings project beyond face of wall.

All mitres etc. shall be neatly formed.

14.16 REEDINGS TO STEPS ETC.:

The treads of steps and upper surfaces of external thresholds finished with granolithic or sandcement finish shall be rendered non-slip by reeding same near front edge for a width of 100 mm and stopped 100 mm from ends.

14.17 POLISHING OF GRANOLITHIC:

All tinted granolithic finishes to floors, steps, thresholds, skirting, etc. shall at completion of all other work be twice polished with wax floor polish of approved type.

14.18 SCREEDING TO FLOORS:

Concrete sub-floors finished with wood mosaic, semi-flexible tiles and fully flexible vinyl sheeting and tiles and similar finishes shall be screeded with 3:1 cement plaster of thickness required, but in no case less than 12 mm, all steel trowelled to true and smooth surfaces. The sand used in the plaster shall be of such fineness as will allow for the screed being trowelled to a surface suitable to receive the finishes.

The screeding shall be laid before the concrete sub-floors have matured, otherwise the exposed surfaces of the concrete shall be thoroughly cleaned with a wire brush and a coat of neat cement grout applied immediately before the screeding is laid.

The screeding shall be laid in good time, but no finishes are to be laid if the screed exceeds 70% moisture content when measured with a hygrometer.

No traffic shall pass over nor shall any building operations take place on the screeding unless a proper protective covering is first provided.

14.19 SAND-CEMENT FINISH:

Sand-cement finish to treads of steps, thresholds, etc. shall be of 2:1 cement plaster not less than 20 mm thick and steel trowelled to true and smooth surfaces. If specified to be tinted the requisite quantity of approved colouring pigment shall be mixed in as no dusting of colouring material will be allowed. The finish to risers of steps, sides of kerbs and other vertical surfaces shall be not less than 12 mm thick. Exposed salient angles shall be neatly rounded to approximately 20 mm radius.

The floors of lift motor rooms and lift pits are to be finished in accordance with the requirements of the Lift Contractor.

14.20 NATURAL AGGREGATE CONCRETE FLOOR HARDENER:Definition:

All natural aggregate hardeners for concrete floors shall consist of a factory prepared blend of clean, properly graded and oven dried natural aggregate, Portland cement and chemical aids, all suitable for monolithic application to the surface of newly placed concrete. Where required the hardener may contain certain compatible pigments for tinted floors.

Quality testing:Sampling:

A minimum of 1 percent of every 5 tons of production shall be sampled and factory tested for water demand, compressive strength and proportioning.

Independent abrasion test:

A SABS abrasion test shall be conducted at least twice a year in accordance with the method described in CKS Specification 208 "Concrete Flooring Tiles". Test results are to be submitted with tenders.

Suppliers shall provide the SABS with sufficient material for making test cubes. At least two cubes per batch of material are to be made and the procedure to be followed shall be as specified under compressive strength and water demand hereinafter.

After 28 days each cube is to be cut in two and the newly exposed surfaces prepared to determine the abrasion resistance. Test specimens to be measured accurately to the nearest 0,02 mm and weighed. A test is to be conducted on each half and the average result reported.

A test load of SOON shall be applied and after every 22 revolutions 20 g of fresh abrasive powder used for a total of 110 revolutions. Specimens are then to be revolved through 90° around their vertical axis and the procedure repeated.

On completion of the test, specimens are to be measured and weighed as before. The wear from loss in mass shall not exceed 1,49 mm and calculated from the formula:

$$\text{Wear in millimetre} = \frac{W1 - W2 \times t}{W1}$$

Where t = initial thickness in mm
 $W1$ = initial mass in g
 $W2$ = final mass in g.

Compressive strength and water demand:

Mix with sufficient water to give a slump of 20 to 25 mm in a 35 x 90 x 75 mm high slump cone filled in three layers; tamping each layer with 15 strokes of a 16 mm diameter rod, shall give the following minimum compressive strengths when tested in a 70 mm mortar cube vibrated for 3 mm on a vibrating table and stored in a curing room or tank at 22 °C - 25 °C and not less than 90% humidity:

At 7 days: 50 MPa

At 28 days: 70 Mpa

Test records:

Each quality test record shall be so referenced that the batch numbers on bags of the product may be traced back to the relevant quality control report. Such reports shall be available for inspection by the Directorate's Representative for up to 1 year after manufacture.

Packaging:

The bags used for packaging the offered product shall meet Spoornet (SAR) Specification CP.7/606 and shall be composed of woven polypropylene with an internal polythene liner. Batch numbers shall be displayed on each bag.

Curing:

As an integral part of this hardener, a membrane curing compound, which must be both compatible with the floor hardener offered and comply with the ASTM C.309 Type 1 Specification for moisture retention, shall be used.

Local content:

Preference will be given to materials fully manufactured in South Africa and from all South African raw materials.

Site service:

The successful tenderer shall be expected to supply samples free of any other additional charge, and the services of a qualified technical representative on all of the building sites pertaining to the particular contract in order to train the placing team in the correct application methods of the product during initial placing upon 1 week's notice.

Circumstances may necessitate follow-up inspections.

Shelf life:

The shelf life of the offered product shall be stated in the tender and the expiry date displayed on each bag.

References:

Tenderers shall submit with their tenders, names and locations of projects in South Africa where the offered product has been in successful use for a period of at least 5 years under similar traffic conditions and at similar rates. If the Directorate's Officials wish to inspect such reference projects sites. Tenderers shall make arrangements with the project owners for access for such inspection.

Approved products:

Only products that have been tested and which have been approved by the Directorate shall qualify.

Application rates:

As specified.

Control testing:

Suppliers shall be required to provide materials from site for control testing as and when requested by the Directorate's Representative/Agent.

14.21 FERROUS AGGREGATE CONCRETE FLOOR HARDENER:

Definition:

The ferrous aggregate hardener for concrete floors shall be a factory prepared blend of clean, properly graded ferrous metal aggregate, Portland cement and chemical aids for application and hardening, ready to apply as a dry shake to the surface of newly placed concrete before finishing. The ferrous aggregate shall be guaranteed to be free of matter deleterious to concrete, such as oil and non-ferrous particles and shall be treated for rust inhibition. Where required it may contain compatible pigments for tinted floors.

Quality testing:

Sampling:

A minimum of 1% of every 5 tons of production shall be sampled and factory tested for water demand, compressive strength and proportioning.

Independent abrasion test:

A SABS abrasion test to be conducted at least twice a year in accordance with the method described in CKS Specification 208 "Concrete Flooring Tiles". Test results to be submitted with tenders.

Suppliers shall provide the SABS with sufficient material for making of test cubes. At least two cubes per batch of material are to be made and the procedure to be followed shall be as specified under compressive strength and water demand hereinafter.

After 28 days each cube is to be cut in two halves and the newly exposed surfaces prepared to determine the abrasion resistance. Test specimens shall be measured accurately to the nearest 0,02 mm and weighed. A test is to be conducted on each half and the average result reported.

A test load of SOON shall be applied and after every 22 revolutions 20 g of fresh abrasive powder used for a total of 110 revolutions. Specimens are then to be revolved through 90° around their vertical axis and the procedure repeated. On completion of the test, specimens shall be measured and weighed as before. The wear from loss in mass shall not exceed 0,62 mm and calculated from the formula:

$$\text{Wear in millimetre} = \frac{W1 - W2 \times t}{W1}$$

Where t = initial thickness in mm

$W1$ = initial mass in g

$W2$ = final mass in g.

Compressive strength and water demand:

Mix with sufficient water to give a slump of 20 to 25 mm in a 35 x 90 x 75 mm high slump cone filled in three layers; tamping each layer with 15 strokes of a 16 mm diameter rod, shall give the following minimum compressive strengths when tested in a 70 mm mortar cube vibrated for 15 seconds, on a vibration table and stored in a curing room or tank at 22 °C - 25 °C and not less than 90% humidity:

At 7 days: 50 MPa At 28 days: 70 MPa.

Test records:

Each quality test record shall be so referenced that the batch numbers on bags of the product may be traced back to the relevant quality control report. Such reports should be available for inspection by the Directorate's Representative for up to 1 year after manufacture.

Packaging:

The bags used for packaging the offered product shall meet Spoornet (SAR), Specification CP.7/606 and shall be composed of woven polypropylene with **an** internal polythene liner. Batch numbers shall be displayed on each bag.

Curing:

As an integral part of this hardener, a membrane curing compound which must be both compatible with the floor hardener offered and complying with the ASTM C.309 Specification for moisture retention shall be used.

Local content:

Preference shall be given to materials fully manufactured in South Africa and from all South African raw materials.

Site service:

The successful Tenderer shall be expected to supply samples free of any other additional charge, and the services of a qualified technical representative on all of the building sites pertaining to the particular contract in order to train the placing team in the correct application methods of the product during initial placing upon 1 week's notice.

Circumstances may necessitate follow-up inspections. In certain specialised applications full time supervision may be required.

Shelf life

The shelf life of the offered product shall be stated in the tender and the expiry date displayed on each bag.

References:

Tenderers shall submit with their tenders, names and locations of projects in South Africa where the offered product has been in successful use for a period of at least 5 years under similar traffic conditions and at similar rates. If the Directorate's Officials wish to inspect such reference project sites. Tenderers must make arrangement with the project owners for access for such inspection.

Approved products:

Only products that have been tested and which have been approved by the Directorate shall qualify.

Application rates:

As specified.

Control testing:

Suppliers shall be required to provide materials from site for control testing as and when requested by the Directorate's Representative/Agent.

Descriptions (prices) of plaster and other in situ finishes shall be deemed to include the necessary preparatory work and working around pipes, balusters, etc. Plastering described as "on walls" is on brick walls or block walls unless otherwise stated and shall include plaster on concrete columns, beams and lintels flush with the face of the wall.

Descriptions (prices) of skirtings shall be deemed to include a fair edge with arris or rounded external angle at top edge or V-joint to finish flush with plaster and coved or square junction with floor finish.

Descriptions (prices) of mouldings shall be deemed to include dubbing out where necessary and ends, mitres and intersections when the girth of the moulding does not exceed 300 mm.

SECTION 15**TILING****15.1 CEMENT:**

Cement shall be as described in Clause 3.1.

15.2 SAND:

Sand shall be as described in Clause 5.3.

15.3 FORMING KEY TO VERTICAL CONCRETE SURFACES FOR TILING:

All vertical surfaces of concrete receiving tiling shall be treated as described in Clause 14.4.

15.3 GLAZED WALL TILING:

Glazed tiles for wall tiling shall comply with the requirements of SABS Specification 22 and shall be white, size 152 x 152 mm and 6,5 mm or 5,0 mm thick.

The tiles shall be fixed in accordance with SABS Code of Practice 0107 with horizontal and vertical joints continuous, and shall have all joints rubbed in solid with neat white cement grout. Tiles shall be well soaked in water before fixing with cement mortar and thoroughly cleaned off after fixing. Walls shall be well wetted before tiling is commenced.

Tiling shall be returned into reveals of openings and on to window sills, and shall be butted at internal angles and provided with mitred joints to external angles. All necessary cutting to tiles shall be properly performed.

15.4 VITRIFIED CERAMIC TILES:

Finish floors or surfaces with Grade 1 acid resisting vitrified tiles, size 240 x 115 x 11,5 mm thick, of Load Group 4 and of approved colour, all bedded to a true and even surface in 3:1 cement mortar and with joints not exceeding 8 mm wide. After the tiles have been allowed to set for a period of not less than 24 hours, the joints shall be grouted in with an approved epoxy compound or acid resistant cement mortar.

Form vitrified ceramic tile skirtings, 100 mm high, coved at junction with floor and rounded on top edge to project 6 mm beyond plaster face above or flush with tile face above, bedded, jointed and pointed as described for floors.

15.6 CERAMIC TILES:

Finish floors or surfaces with Grade 1 acid resisting ceramic tiles, 8 mm thick and of Load Group 4, but of sizes available in the market and of approved colour, all bedded to a true and even surface in 3:1 cement mortar and with joints not exceeding 8 mm wide. After the tiles have been allowed to set for a period of not less than 24 hours, the joints shall be grouted in with an approved epoxy compound or acid resistant cement mortar.

Form ceramic tile skirtings where required, 100 mm high, coved at junction with floor and rounded on top edge, bedded, jointed and pointed as described for floors.

15.7 MOSAIC FINISH:

Glass or ceramic mosaic is to be of approved South African manufacture and colours specified with tessera approximately 20 x 20 x 4 mm thick, fixed to paper in squares about 316 x 316 mm or 330 x 330 mm and bedded to 3:1 cement screed finished to a lightly scratched surface in mortar composed of 1 part white cement to 3 parts of marble dust and after setting, remove paper and flush-up joints solid with white cement.

SECTION 16**PLUMBING AND DRAINAGE****GENERAL****16.1 REGISTERED PLUMBERS AND DRAINLAYERS:**

Only registered plumbers and drainlayers shall be employed on any plumbing and drainage work.

16.2 SPECIFICATIONS AND DESCRIPTIONS IN OTHER SECTIONS:

Reference shall be made to other sections for full specifications and descriptions of items not fully specified or described in this section which shall apply equally to the work in this section, unless otherwise described,

16.3 EARTHWORKS:**16.3.1 Excavations generally:**

Excavations shall be deemed to be in "earth", unless otherwise described.

16.3.2 Excavations for drainage trenches etc.:

Excavations for drainage trenches, gullies, chambers, french drains, etc. shall be of depths and gradients shown on drawings or as directed. Trenches shall be excavated to straight lines and shall be of sufficient width to allow adequate working space. Sight rails, boning rods, etc. shall be employed in excavating the trenches to ensure even gradients.

Any soft or loose areas in the trenches shall be filled in with well rammed earth, or other approved filling. Uneven bottoms in rock cutting shall be made good with Class A concrete, but with 19 mm stone. Any excavations taken out too deep shall be made up with well rammed/compacted earth, or other approved filling, at the Contractor's expense.

Hand holes shall be cut or left under pipe joints, as short as practicable but sufficiently deep to enable the jointing and filleting to be properly performed.

Properly perform all planking and strutting to sides of trenches and excavations as may be required.

The excavations and trenches shall be kept free from water and other liquids, by pumping, baling or otherwise.

16.3.3 Measurement of rock excavations in drain trenches:

Where trenches for drainage pipes are included in the descriptions of the pipe or group of pipes and are excavated in hard and/or soft rock, in measuring the volume of "extra over" based on excavations in earth, the following shall apply:

Trenches not exceeding 1 m deep shall be taken of such width as to provide a clearance of 300 mm on each side of the pipe or group of pipes.

The width of the trench shall be increased by 100 mm for each successive depth of 1 m to a maximum width which provides a clearance of 500 mm on each side of pipe or group of pipes.

In calculating any adjustments, these widths shall not be exceeded under any circumstances.

16.3.4 Backfilling to drain trenches:

Approved backfilling shall be carefully placed around the pipes to a height of 300 mm above

top of pipes, watered and lightly rammed on either side and filled in above this level with similar filling, watered and well rammed in layers not exceeding 300 mm in depth and thoroughly consolidated to finished ground level.

Backfilling to sides of gullies, chambers, etc. as required shall be as above.

If and when plastic drain pipes are approved for use by the Director: Civil Engineering Services, all backfilling to a depth of 300 mm above the top of pipes shall be free of stone or other hard particles larger than will pass a mesh of 10 mm in the clear.

If the material from the excavations is found to be unsuitable as backfilling for drainage trenches and inspection chambers, etc. written approval must first be obtained from the Representative/Agent to use imported fill.

16.3.5 Surplus excavated material:

All surplus earth and other materials arising from the drainage work shall be deposited and levelled on the site or carted away as directed by the Representative/Agent.

16.3.6 Descriptions (prices) :

Descriptions (prices) for excavations shall be deemed to include backfilling to trenches etc. and spreading and levelling of surplus excavated material over site except where separate items for filling are given.

16.4 CONCRETE:

Mass concrete shall be Class B prescribed mix concrete and reinforced concrete shall be Class E prescribed mix concrete, unless otherwise described.

Descriptions (prices) of concrete encasing around pipes etc. shall be deemed to include additional excavation.

16.5 BRICKWORK:

Bricks shall be extra hard burnt bricks and brickwork shall be built in cement mortar, unless otherwise described.

16.6 CONNECTIONS:

Descriptions (prices) of connections of new to existing pipes shall be deemed to include searching for the existing pipe and exposing if necessary.

16.7 CATCHPITS, MANHOLES, INSPECTION CHAMBERS, VALVE CHAMBERS, ETC.:

Descriptions (prices) of catchpits, manholes, inspection chambers, valve chambers and the like where given in number shall be deemed to include excavation, reinforcement, step irons and channels where applicable.

16.8 DIAMETERS OF PIPES ETC.:

Diameters stated for pipes, traps, valves, etc. are internal diameters except PVC, polyethylene, stainless steel and copper pipes and traps for which external diameters are stated.

16.9 GALVANISED SHEET IRON:

Galvanised sheet iron shall be 0,60 mm thick (after galvanising), coated with zinc having a mass of not less than that indicated in the following table for the three classes of galvanising specified

CLASS	g/m ² of surface area	
	Average	Individual (Minimum)
Z600	600	510
Z450	450	385
Z275	275	235

The galvanised sheet iron for inland use shall be of Class Z275 quality.

Corroded or otherwise defective sheets shall not be used. All nailing and screwing shall be done with galvanised iron nails and screws, where the roof specification does not contradict.

16.10 SHEET LEAD:

Sheet lead shall be best milled sheet of the mass specified, and of equal thickness throughout. All nailing and screwing shall be done with copper, copper alloy or stainless steel (Type 304) nails and screws.

16.11 SHEET COPPER:

Sheet copper for eaves gutters, rainwater pipes and other unsupported or semi-self-supported work shall be cold rolled and of half-hard temper. All copper sheet shall be 0,56 mm thick. All nailing and screwing shall be done with copper or copper alloy nails and screws.

RAINWATER DISPOSAL AND PROTECTION AGAINST LIGHTNING

16.12 EAVES GUTTERS (METAL):

16.12.1 Sheet iron gutters:

Sheet iron gutters shall be of galvanised sheet iron of thickness specified in table hereunder, have beaded edges and with all joints riveted and soldered or bedded with an approved epoxy sealant.

Gutters shall be laid to proper falls and be provided with angles, stopped ends and outlet nozzles as required. Angles shall be strengthened with 50 mm wide strips of 0,60 mm thick galvanised sheet iron soldered over the internal mitres inside the gutters.

Gutters shall be fixed on galvanised mild steel brackets of size specified in table hereunder, bent to shape of gutters with front end taken up to underside of beaded edge of gutter and each twice screwed to roof timbers. Gutters shall be bolted to brackets at front with and including 6 mm diameter galvanised gutter bolts, one to each bracket, positioned close to underside of beaded edge of gutter.

Brackets shall be spaced at not exceeding 1 m centres.

The thickness of sheet iron and size of metal from which brackets are made for the various sizes of gutters shall be in accordance with the following table:

Gutter shape	Gutter size not Exceeding (mm)	Sheet thickness (mm)	Size of metal brackets (mm)
Half round	150	0,60	32 x 3,5
Square	125 x 125	0,60	32 x 3,5
Square	175 x 175	0,80	40 x 5
Square	225 x 225	1,00	40 x 6
Rectangular	Width 150 depth 100	0,60	32 x 3,5
Rectangular	Width 200 depth 150	0,80	40 x 5
Rectangular	Width 250 depth 200	1,00	40 x 6

The 5 mm and 6 mm thick brackets shall be hot dip galvanised after fabrication.

16.12.2 Sheet copper gutters:

Sheet copper eaves gutters shall be as described in Subclause 16.12.1, but of 0,56 mm thick cold rolled sheet copper of half-hard temper, fixed on brackets as before described, but made of hard copper strip. The bolts securing the square and rectangular gutters to brackets shall be of copper or copper alloy.

The size of copper strip from which brackets are made for the various size gutters shall be in accordance with the table in Subclause 16.12.1 above.

16.13 RAIN-WATER PIPES (METAL):

16.13.1 Sheet iron rain-water pipes shall be of 0,60 mm thick galvanised sheet iron, seamed at back and jointed with slip joints neatly soldered. Pipes shall be provided with offsets, elbows and shoes as required.

The pipes shall be fixed 25 mm clear of finished wall face on galvanised mild steel rain-water pipe brackets as Sample 69, spaced at not exceeding 2,4 m apart, and having tails built into walls in 3:1 cement mortar.

Rain-water pipes connected to storm-water drains shall each be fitted at bottom end with flange of 0,60 mm thick galvanised sheet iron of diameter required to fit into socket of drain pipe, riveted and soldered to pipe. Pipes shall be jointed to drains with 3:1 cement mortar, well caulked into sockets and finished with trowelled fillets.

16.13.2 Sheet copper:

Sheet copper rain-water pipes shall be as described in Subclause 16.13.1, but of 0,56 mm thick cold rolled sheet copper of half-hard temper, fixed on brackets as before described, but made of hard copper strip and provided with copper or copper alloy bolts.¹

16.14 EAVES GUTTERS (FIBRE CEMENT):

Fibre cement eaves gutters shall have a wall thickness of not less than 6 mm and be of approved manufacture with spigot and socket end joints, all bedded in approved bituminous mastic compound and secured with 6 mm diameter galvanised gutter bolts with heads of bolts on inside of gutters. Each bolt is to be provided with an asphaltic felt and galvanised steel washer under head and nut all in accordance with the Manufacturer's instructions. The inside surface of each socket and the outside surface of each spigot end shall be primed with a thin coat of bitumen to assist the compound to adhere when applied.

Surfaces of washers in contact with each other and with gutters shall also be coated with bitumen. After tightening the bolts all surplus compound squeezed out of the joints shall be removed and the joints finished externally with neatly trowelled fillets of 2:1 cement mortar.

The spigot ends of gutters shall be lapped on to the socket ends in the direction of the flow wherever possible.

The gutters shall be fixed with proper falls on heavy quality galvanised steel or non-ferrous metal gutter brackets, of the fascia type where fixed to fascia boards and of the purlin type where fixed to purlins, all as supplied by the Manufacturer of the gutters. Brackets shall be securely fixed at not exceeding 1 m centres and with extra brackets at angles and outlets.

Gutters shall be provided with all necessary angles, stopped ends, outlet nozzles, etc., all jointed as described above.

16.15 RAIN-WATER PIPES (FIBRE CEMENT):

Fibre cement rain-water pipes shall be of approved manufacture with spigot and socket ends, jointed with tarred hemp rope gasket caulked into each joint and the joint filled with a suitable bitumen compound and finished off with neatly trowelled fillet of 2:1 cement mortar.

The wall thickness of circular rain-water pipes up to 75 mm diameter shall be not less than 6 mm thick, but in circular pipes of over 75 mm diameter and for all sizes of square and rectangular pipes shall be not less than 8 mm thick.

The pipes shall be fixed to walls with galvanised steel holderbats or heavy duty holderbats of non-ferrous metal, bolted around pipes immediately below the collars and with tails built into walls in 3:1 cement mortar.

Rain-water pipes shall be provided with all necessary swannecks, branch pieces, plinth bends, radius bends, shoes, etc., all jointed as described above.

16.16 PROTECTION AGAINST LIGHTNING:

Buildings specified to be provided with lightning protection shall have a system installed as described hereunder which shall be in accordance with the latest revision of the SABS Code of Practice 03 and must comply with the performance requirements laid down therein.

DESCRIPTION OF MATERIALS:

(a) air terminals and down-conductors:

For inland areas all conductors must be of electrical conductor grade aluminium alloy. For coastal areas the conductors must be of aluminium alloy in accordance with the requirements of BSS 1476/H/E9 or American Standards Specification 6063,

(b) earthing electrodes:

Earthing electrodes must consist of either extensible copper clad steel rods not less than 12 mm diameter driven into the ground or of 50 mm² (35 mm² for domestic dwellings) bare copper conductor buried in a trench or a combination thereof. Where extensible earthing rods are used these are to be manufactured from copper clad steel and to have a molecular bond between the two metals to prevent moisture ingress. Where it is necessary to join earth rods together, a non-ferrous corrosion resistant coupling device is to be used which prevents ingress of moisture into the joint.

(c) Joints:

Where it is necessary to join lengths of circular section conductor, this must be done by crimping and in the case of flat conductor by either double riveting using aluminium rivets, two bolts of at least 6 mm diameter and nuts, or other approved method. Each joint made, using dissimilar metals, is to be thoroughly cleaned before assembly and subsequently rendered watertight by painting or covering with an inert tenacious material.

(d) Bonds:

Where it is necessary to bond the aluminium conductor to any other metallic surface, this

must be done by bolting or riveting. Care should be taken when attaching aluminium to a dissimilar metal to prevent electrolytic corrosion in that the joints are to be thoroughly cleaned and subsequently sealed as described in (c) above.

(e) Conductor guides:

The conductor must be mounted in aluminium alloy guides conforming with the material specification given in (a) above, which allow free longitudinal movement of the conductor to cater for expansion and contraction of the system due to temperature variation. The guides must be attached to the structure by screwing and plugging, using two screws, which must be suitably plated for use in inland areas, or manufactured from stainless steel for use in coastal areas.

NB: No part of the conductor system is to come into direct contact with concrete or plaster as this may cause the aluminium to corrode.

The conductor system should preferably be supported in guides so that an air gap exists at all times between the aluminium and the concrete surface, the guides being seated upon plastic or other similar insulating material. Should conductors be installed directly upon the surface of the concrete or plaster an insulating strip is to be installed over its whole length to prevent contact between the two surfaces. Guides should be installed to support the conductor at intervals not exceeding 1,2 m horizontally or 1,5 m vertically.

(f) Expansion loops:

Where conductors are installed horizontally without deviation from a straight line over long distances, expansion loops must be provided at distances not exceeding 30 m. These expansion loops must have a cross-sectional area which is at least the same as that of the conductor used on the project.

STORM-WATER DRAINAGE

16.17 CONCRETE PIPES:

All storm-water drain pipes shall be of concrete complying with the requirements of SABS Specification 677 of SC Type and of Class B quality, all marked as laid down in the specification.

The pipes shall be socketed or have plain ends with loose collars. The loose collars shall be of the same material and manufacture as the pipes.

16.18 DRAIN LAYING

Storm-water drains shall be accurately laid to the lines and gradients shown on drawings with pipes of the diameters shown.

Socketed pipes shall be closely fitted together. Joints are to be filled with semi-dry mortar composed of not more than 2 parts fine washed sand and 1 part cement, well caulked in with a steel tool, all as laid down in SABS Code of Practice 058, but without gaskets and fillets.

Where loose collars are used, ends of pipes shall be butted together in stiff 2:1 cement mortar with space between pipes and collars filled with similar mortar and well caulked.

All bends, junctions, etc. for pipes up to and including 150 mm diameter shall be of vitrified clay as for soil and wastewater drains, including cement mortar jointing, but joints shall be without gaskets and fillets. Where one or more of the pipes are over 150 mm diameter, the bends and junctions shall be made with junction boxes as described in Clause 16.19.

Drains of different diameters shall be laid at such levels as will provide for the top of the pipe bores all being at the same level where the drains enter or leave chambers, catch pits and junction boxes, and for the invert of the largest diameter drain being at bottom of the chamber, pit or box.

Where rain-water pipes connect to drains, drain pipes shall be brought up to ground level, or to the

level required, with the necessary bends.

Where pipes pass through foundation and similar walls, openings shall be formed in the walls for passage of the pipes.

Pipes shall be built into walls of chambers, catch pits, etc. in 2:1 cement mortar.

16.19 JUNCTION BOXES (PWD DRAINAGE DETAILS, PAGE 44)

Bends and junctions in storm-water drains, where one or more of the pipes are over 150 mm diameter, shall be made with junction boxes cast in position in Class C concrete, after the drains are laid. The bottoms and sides of boxes shall be not less than 150 mm thick and sides shall be carried up slightly above top of pipes and finished level on top. Each box shall be covered with a 80 mm thick slab of similar concrete, laid loose.

16.20 CATCH PITS:

16.20.1 Type A (PWD Drainage details, Page 14):

Catch pits Type A, shown on page 14 of "Drainage Details", shall be of size and of depth shown or required, built with 1 brick thick sides of extra hard burnt bricks in 3:1 cement mortar on 100 mm thick Class C concrete bottoms.

Each catch pit shall be fitted with an approved cast iron catch pit grating, of size required to match size of catch pit, set in an approved cast iron frame fitted with lugs and surrounded with a 100 mm thick kerb of Class C concrete, splayed down on top towards pit and finished where exposed with 2:1 cement mortar, trowelled smooth and rounded on salient angles.

16.20.2 Type B (PWD Drainage details. Page 14):

Catch pits Type B, shown on page 14 of "Drainage Details", shall be as described in Subclause 16.20.1, but kerbs around the gratings shall be of a thickness equal to the overall thickness of the surface channels discharging into catch pits and shall be rounded, sunk and splayed down on top as detailed, hollowed where surface channels connect to kerbs and finished where exposed with cement mortar as for surface channels.

16.20.3 Type C (PWD Drainage details. Page 15):

Catch pits Type C, shown on page 15 of "Drainage Details", shall be of size and depth shown, each formed with 150 mm thick bottom of Class C concrete and 1 brick thick walls built of extra hard burnt bricks in 3:1 cement mortar, fitted with grating constructed with 40 x 12 mm mild steel framing and 40 x 12 mm mild steel cross bars spaced at 40 mm centres, all welded together and set in rebates formed in kerb of Class C concrete as shown.

Kerbs shall be flush on top with surrounding ground or paving and splay finished with 2:1 cement mortar, trowelled smooth.

16.20.4 Type D (Drainage details. Page 14):

Catch pit Type D, shown on page 14 of "Drainage Details", and as used in prison yards where one or more of the drain pipes entering or leaving the catch pits are 380 mm or more in diameter, shall be as described in Subclause 16.20.1, but concrete bottoms shall be 150 mm thick and each catch pit shall be fitted with an approved cast iron dished catch pit grating, hinged to a cast iron frame set in the concrete kerb. 20 mm Diameter mild steel bars shall be built in horizontally across drain pipe opening/openings with ends built 100 mm into the brickwork. The bars shall be spaced one course apart with the lowest bar not more than two courses above invert of drain pipe and the uppermost bar not more than 150 mm from the top of the pipe bore.

16.21 SURFACE WATER DRAINS

Surface water drains shall be 450 mm or 380 mm wide formed of Class C concrete (in situ or

precast), not less than 75 mm thick at any part, with drains having not less than 300 mm wide and 100 mm deep segmental channels for 450 mm wide drains and not less than 230 mm wide and 75 mm deep segmental channels for 380 mm wide drains.

The drains shall be laid to even and sufficient falls on hard earth bottoms, and the *in situ* drains shall be finished on exposed surfaces with 2:1 cement mortar, trowelled smooth and rounded on salient angles.

All stopped and returned ends, angles, sweeps around gullies, etc. shall be neatly formed.

Drains exceeding 1,8m in length shall be cast in sections not more than 1,8 m in length.

16.22 STORM-WATER MANHOLES:

Manholes shall be provided to storm-water drains where indicated on drawings with 1 brick thick walls of extra hard burnt bricks in 3:1 cement mortar laid on 100 mm thick Class C concrete bottoms. Fit on top with Type 9C cast iron single seal manhole covers, each size (daylight) 600 x 450 mm and mass approximately 39 kg, unless otherwise specified, complying with the requirements of SABS Specification 558 and coated with an approved preservative solution before leaving the Manufacturer's works with frames of covers bedded in 150 mm thick surrounds of Class C concrete, splayed on top and finished with 2:1 cement mortar, trowelled smooth and rounded on salient angles.

Manholes shall be of the types and sizes specified in the table hereunder for the various depths of drains, viz.:

Type	Depth of drain	Size of manhole	
		Length (m)	Width (m)
A	Under 0,6 m	0,6	0,45
B	0,6 m and under 1,5m	0,9	0,6

Bottom of manholes and walls to a height of 450 mm or to the top of the pipes entering or leaving the manholes, whichever is the higher, shall be rendered with 3:1 cement plaster. Brickwork above the plaster shall be built to a fair face and neatly struck jointed.

SOIL AND WASTE-WATER DRAINAGE

16.23 VITRIFIED CLAY PIPES AND FITTINGS:

All clay drain pipes and fittings shall be of vitrified clay complying with the requirements of SABS Specification 559.

16.24 DRAIN LAYING:

Drains shall be accurately laid to the lines and gradients shown on drawings, or as directed, with pipes of the diameters shown.

Barrels of pipes shall rest on solid ground, well rammed earth or concrete filling, as shown on page 1 of "Drainage Details", or alternatively if the Contractor so desires, the pipes may be bedded in Class A concrete, but of 19 mm stone, haunched up on both sides of pipes. In all cases at least two thirds of the length of the barrels shall rest on the ground or filling, or be bedded in the concrete.

Pipes shall be closely fitted together and provided with a gasket of closely twisted hemp, jute or tarred yarn, soaked in cement grout and inserted in the joint to support the pipe spigot at the proper height and well rammed into position. Joints are to be filled with semi-dry mortar composed of not more than 2 parts fine washed sand and 1 part cement, well caulked in with a steel tool and finished with smoothly trowelled angled fillets of similar mortar, all as laid down in SABS Code of Practice 058.

Alternatively, pipes shall be closely fitted together and jointed as laid down in SABS Code of Practice 058, but jointing executed with factory applied mechanical compression joints comprising socket liner and spigot collar, or spigot seal ring, of suitable resilient material designed to form a perfectly watertight and permanent seal.

Pipes with plain ends must be jointed with approved polypropylene couplings as prescribed by the Manufacturer.

Drains passing underneath buildings are to be of cast iron.

Drains shall be provided with easy bends, junctions, taper pipes, etc. as required and be brought up to ground level where cast iron soil, ventilation and similar pipes connect directly to the drains.

Drains laid with top of sockets less than 300 mm below finished ground level shall be encased in Class C concrete as shown on page 2 of "Drainage Details".

All vertical bends shall be bedded on and encased in Class C concrete, from bottom of trench up to ground level. The concrete shall be not less than 100 mm thick at any part. Where cast iron pipes connect to clay pipes, the concrete casing shall be taken to not less than 75 mm above the connections.

Pipes shall be built into walls of inspection and other chambers in 2:1 cement mortar.

Open ends of drains shall be plugged to prevent the entry of soil or mud during wet weather.

All drains shall be suitably protected against damage until they have been tested, approved and covered in. Should they be damaged in any way the Contractor shall make good the damage at his own expense.

16.25 PIPES IN GENERAL (FOR DRAINAGE):

16.25.1 Pipe connections:

Connections between pipes of different materials shall be formed as described below:

CONNECTION	METHOD OF JOINTING
Between socketed cast iron and vitrified clay pipes and vice versa,	Semi-dry caulking cement and 2:1 cement mortar fillet.
Between hubless cast iron pipes and fittings.	Approved stainless steel-neoprene "No-Hub" couplings with stainless steel bands and worm drive clamps.
Between mild steel or copper and vitrified clay pipes.	Semi-dry caulking cement and 2:1 cement mortar fillet, or bitumen.
Between lead and vitrified clay pipes.	Brass ferrule wiped onto lead pipe and caulked in vitrified clay pipe socket with bitumen or semi-dry caulking cement and 2:1 cement mortar fillet.

16.25.2 General:

Diagonally fixed or unsightly vertical surface mounted waste pipes must not be allowed to spoil the external appearance of buildings at ground floor level.

If other suitable solutions cannot be found, metallic waste pipes up to a maximum of 40 mm in diameter, may be chased into walls by special permission of the Representative/Agent and plastered over or built into floors provided that adequate permanently accessible cleaning eyes are provided.

At ground floor level external "P" traps should be used for soil fittings. Where these become unsightly because of large differences in level or where they are unsightly because they are situated in prominent positions, "S" traps in conjunction with manholes should be employed. Generally "S" traps should be used with the greatest discretion as they are difficult to clean.

Vertical 100 mm vent pipes at heads of drains should be placed inside lavatories, store rooms or other suitable places.

All other drainage work on buildings higher than single storey should preferably be housed in easily accessible properly designed drainage ducts. If this is not possible, exposed soil and waste water drainage work should be placed inside lavatory accommodation or store rooms, but must be neatly executed with straight lines and without any unsightly bends etc.

Where drainage work in important rooms or spaces is considered to be unsightly it should be encased in a composite timber board duct with suitable access panels.

16.26 CLEANING EYES (DRAINAGE DETAILS, PAGE 2):

Cleaning eyes shall be provided to drains in the positions indicated on the drawings by the letters "CE" (or "SO") each formed by inserting junction in the drain, or bend at end of drain, and bringing a branch up to ground level with easy bends, the vertical pipe being of same diameter as the drain, and fitting top of pipe at ground level with approved cast iron access branch and cover with the letters "CE" (or "SO") cast on the cover. The cover shall be set in tallow and secured with non-ferrous metal screws and the branch shall be jointed to socket of clay pipe with jointing as described for drain pipes.

The vertical bends and pipes shall be bedded on and encased in Class C concrete from bottom of trench up to ground level, not less than 100 mm thick at any part and finished on top with 2:1 cement mortar, trowelled smooth and rounded on salient angles.

16.27 INSPECTION EYES (DRAINAGE DETAILS, PAGE 2):

Inspection eyes shall be provided to drains in the positions indicated on the drawings by the letters "IE" (or "10") each formed by inserting an access pipe or bend in the drain and each fitted with oblong vitrified clay access lid sealed with bitumen.

When the letters "IE" (or "10") shown on the drawings are enclosed in a square, Class C concrete blocks, each size 350 x 350 x 75 mm, shall be provided at ground level directly over the inspection eyes.

These blocks shall be finished with 2:1 cement mortar, trowelled smooth and the letters "IE" (or "10") formed in the top surface.

16.28 GULLIES (DRAINAGE DETAILS, PAGE 4) :

Gullies shall be provided to drains where indicated on drawings, each formed with 100 mm diameter vitrified clay gully trap with gully head carried up to not less than 40 mm above finished ground level and provided with 50 mm diameter vertical and/or side inlets as required. Fit head with 190 mm diameter cast iron gully grating, laid loose in the socket.

The trap, vertical pipe and head shall be bedded on and encased in Class C concrete, not less than 100 mm thick at any part, and finished where exposed with 2:1 cement mortar, trowelled smooth, flush with top of gully head and splayed on edges.

16.29 DISHED GULLIES (DRAINAGE DETAILS, PAGE 4):

Dished gullies shall be provided to drains where indicated on drawings, each formed with trap and head, with or without inlets as required and fitted with cast iron grating, all as described in Clause 16.28, but with head carried up to the height required.

The trap, vertical pipe and head shall be encased in concrete as described in Clause 16.28, but with

dished hopper, size 750 x 525 mm overall, formed around gully head with Class C concrete having 50 mm wide rounded kerb to front and sides and 25 mm wide kerb at back, all 40 mm high above top of dishing, and finished on exposed surfaces with 2:1 cement mortar. Top of kerb shall be not less than 40 mm above finished ground level.

16.30 STABLE GULLIES (DRAINAGE DETAILS. PAGE 4):

Stable gullies shall be 150 mm diameter of vitrified clay, each with 100 mm diameter outlet, fitted with loose cast iron grating and perforated container of 2 mm thick galvanised sheet steel provided with galvanised mild steel handle. Gully shall be bedded on and encased in Class C concrete, not less than 100 mm thick at any part, carried up to top of gully, hollowed for channel as and where required and finished where exposed with 2:1 cement mortar trowelled smooth.

16.31 UNIVERSAL TRAPS (DRAINAGE DETAILS. PAGE 5):

Universal traps shall be provided to drains where indicated on drawings, each formed with vitrified clay trap and vertical shaft, all of same diameter as drain pipes, jointed together and to drain pipes as described for drains. The vertical shaft shall be carried up to not less than 40 mm above finished ground level and fitted on top with plain cast iron grating laid loose in the socket.

The trap and vertical shaft shall be bedded on and encased in Class C concrete, not less than 100 mm thick at any part, and finished where exposed with 2:1 cement mortar, trowelled smooth, flush with top of vertical shaft and splayed on edges.

16.32 CLEANING EYES AND RAMPS (DRAINAGE DETAILS, PAGE 2):

Cleaning eyes and ramps shall be provided to drains where indicated on drawings, each formed by bringing the lower drain up to ground level with easy bends and vertical pipe. Fit vertical pipe at height required with junction and at top of pipe with cast iron access branch and cover as described for "Cleaning Eyes". The upper drain shall be connected to junction.

The bends, junction and vertical pipes shall be bedded on and encased in Class C concrete, not less than 100 mm thick at any point or position, carried up to ground level and finished on top with 2:1 cement mortar, trowelled smooth and rounded on salient angles.

16.33 GREASE TRAPS:

16.33.1 Type A (Drainage Details, Page 5):

Grease traps Type A, shown on page 5 of "Drainage Details", shall be 150 mm, 225 mm or 300 mm diameter, as indicated on the drawings, of vitrified clay, each fitted with 100 mm diameter vitrified clay outlet junction and jointed to trap as described for drain pipes. Access opening in trap and junction shall be fitted with vitrified clay stoppers, laid loose in the socket of trap, but sealed into the socket of junction with bitumen. Trap and junction shall be encased in Class C concrete, not less than 100 mm thick at any part, finished where exposed with 2:1 cement mortar, trowelled smooth and splayed on edges.

Trap shall be provided with a 75 mm deep perforated container of 2 mm thick galvanised sheet steel provided with galvanised mild steel handle stayed to container at height shown.

16.33.2 Type B (Drainage Details. Page 5):

Grease traps Type B, shown on page 5 of "Drainage Details", shall each be formed with bottom and sides of Class C concrete, size 600 x 450 x 750 mm deep internally, with inlets formed with 100 mm bends, but with outlet formed with 100 mm bend, 100 mm vertical junction and two 100 mm bends as shown, all in vitrified clay and jointed together as described for drain pipes, all embedded in. Class C concrete. The outlet junction shall be fitted at top with vitrified clay stopper, set in bitumen.

A 50 mm diameter galvanised mild steel pipe bend shall be embedded in the concrete in position required with top end projecting vertically and screwed for connecting the ventilation pipe provided for later herein under "WATER SUPPLIES, FIRE SERVICE AND SANITARY

PLUMBING AND FITTINGS".

Grease trap shall be fitted at top with Type 9C cast iron single seal manhole cover and frame, as described in Clause 16.36. The frame shall be bedded in the concrete.

Surfaces of concrete where exposed externally shall be finished with 2:1 cement mortar, trowelled smooth and rounded on salient angles.

Trap to be provided with 80 mm deep perforated container of 2 mm thick galvanised sheet steel provided with handle of similar metal stayed to container and supported on two 20 mm diameter mild steel bars embedded in the concrete as shown.

16.33.3 Type C (Drainage Details, Page 9):

Grease traps Type C, shown on page 9 of "Drainage Details", shall each be formed with bottom and walls of Class C concrete as indicated. The bottom shall have 200 mm deep sumps for the grease trays with division between splayed down to the sumps. Top of walls shall be finished where exposed with 2:1 cement mortar, trowelled smooth and splayed down on salient angles.

Inlets to grease trap shall be formed with 100 mm bend and gully head with 50 mm or 75 mm vertical inlets as required, all in vitrified clay, jointed together as described for drain pipes and set in the concrete with top of gully head flush with top of wall. Fit gully head with cast iron grating as described for gullies in Clause 16.28.

Outlet to grease trap shall be formed with 100 mm bend, 100 mm vertical junction and two 100 mm bends as shown, all in vitrified clay, jointed together as described for drain pipes and embedded in Class C concrete. The outlet junction shall be fitted at top with vitrified clay stopper, set in bitumen.

The cover to grease trap shall be of 6 mm thick mild steel chequer plate in two sections with meeting edges supported on 64 x 64 mm T-bar with ends embedded on concrete, each section being fitted with a 50 mm wide strip of steel plate welded on to form hasp and holed for staple formed of 10 mm mild steel flat bar, bent as shown and embedded in the concrete. Each section shall be hung on hinges, as detailed, welded to cover with 12 mm diameter hinge pins bedded in the concrete, fitted with a lifting handle of 12 mm diameter mild steel, bent and set in holes in the cover, all as shown on page 39 of "Drainage Details".

Grease traps shall be provided with 80 mm deep trays of 2 mm thick galvanised sheet steel, perforated with 6 mm diameter holes and each fitted with two handles of 12 mm diameter galvanised mild steel rods, welded to 20 x 5 mm galvanised mild steel straps and stays as detailed.

16.33.4 Type B (Drainage Details, Page 8):

Grease intercepting traps for Car Washing Areas Type B, shown on page 8 of "Drainage Details", shall each be formed with bottom and sides of Class C concrete, size internally 600 x 450 mm and depth to suit depth of drain with water line 800 mm above bottom. Form inlet and outlet with 100 mm bends, 100 mm junctions and 100 mm raising pieces, all in vitrified clay, jointed together as described for drain pipes and embedded in the concrete. The raising piece to inlet shall be fitted at top with 140 mm diameter plain cast iron grating laid loose in the socket, but the raising piece to outlet shall be fitted at top with vitrified clay stopper, set in bitumen.

Traps shall be fitted at top with Type 9 D cast iron single seal manhole cover and frame as described in Clause 16.36. The frame shall be bedded in the concrete.

Surfaces of concrete where exposed internally shall be finished with 2:1 cement mortar, trowelled smooth and rounded on salient angles.

Traps shall each be provided with a 75 mm deep container of 1,20 mm thick galvanised

sheet steel, perforated with 6 mm diameter holes and fitted with galvanised mild steel handle stayed to container.

The container shall rest on two 2t) mm diameter galvanised mild steel rods with ends embedded 75 mm deep in concrete sides of pit, level with top of outlet pipe.

The outlet pipe from Car Washing Area to grease trap shall be of 100 mm diameter vitrified clay, connected to junction and provided with short bend at inlet having socket to take grating and fitted with 140 mm diameter plain cast iron grating, laid loose in the socket, all encased in Class C concrete as shown and finished where exposed with 2:1 cement mortar, trowelled smooth.

16.34 URINAL TRAPS:

Where urinals connect direct to drains, provide 75 or 100 mm diameter vitrified clay "P" traps under the urinal outlet with 100 mm vitrified clay vertical pipe and where outlet of urinal is 75 mm with 75 mm to 100 mm taper piece, all connected together as described for drain pipes and similarly connected to outlet nozzle of urinal, but with bitumen joint to tail piece of metal outlet grating where urinal is provided with such outlet.

The traps, vertical pipes and taper pieces shall be bedded on and encased in Class C concrete not less than 100 mm thick at any part,

16.35 INSPECTION CHAMBERS (DRAINAGE DETAILS, PAGE 1 OA AND 11 A):

Inspection chambers shall be provided to drains where indicated on drawings with 1 brick thick walls of extra hard burnt bricks in 3:1 cement mortar laid on 100 mm thick Class C concrete bottoms. Fit on top with Type 8A cast iron double seal manhole covers as described in Clause 16.36 with frames of covers bedded in 150 mm thick surrounds of Class C concrete, splayed on top and finished with 2:1 cement mortar, trowelled smooth and rounded on salient angles.

Chambers shall be of the types and sizes specified in table hereunder for the various depths of drains, viz:

Type	Depth of drain	Size of manhole	
		Length (m)	Width (m)
A	Under 0,6m	0,6	0,45
B	0,6 m and under 1,5 m	0,9	0,6

Chambers shall be provided with half-round vitrified clay straight and curved channels, junctions, tapers, etc. as required, joined in 2:1 cement mortar and laid to regular falls, benched up to sides of chambers with Class C concrete, brought up vertically at sides of channels to same level as top of main drains and then sloped up to walls of chambers as shown and finished smooth with 1: 1 cement mortar. All edges of benching, angles, slopes, etc. shall be rounded off.

All pipes shall enter and leave at bottom of chambers.

Internal walls of chambers shall be rendered with 3:1 cement plaster above top of benching.

16.35.2 Type 11A:

Inspection chambers Type IIA to be as generally described above, but depth of drain is deeper than 1,5 m and chamber to be provided with corbelling, slab and step irons as shown.

16.36 MANHOLE COVERS:

Manhole covers to inspection chambers shall be of cast iron complying with the requirements of SABS Specification 558 and coated with an approved preservative solution before leaving the Manufacturer's works.

The covers shall be of the types, sizes and approximate mass specified in the table hereunder, viz:

TYPE	DESCRIPTION	NOMINAL SIZE (DAYLIGHT HT) (mm)	APPROXIMATE MASS (kg)
2A	Roadway type	550 dia	190
2B	Roadway type with ventilation openings	550 dia	180
8A	Double seal	600 x 450	72
9C	Single seal	600 x 450	39
9D	Single seal	600 x 450	74

16.37 SEPTIC TANKS:

16.37.1 PWD Type Drawing D260/239:

Septic tanks as Type Drawing D260/239 shall be of sizes shown, each formed with bottom and outer walls with inner wall dividing the tank into two chambers, constructed of Class E concrete reinforced with two layers of steel mesh reinforcement as Ref. 123, bent and lapped at intersections of bottom with walls. The tank shall be covered on top with slab of reinforced concrete, as above, but reinforced with one layer of steel mesh, holed for manhole cover(s) over each chamber and with kerbs formed around the openings as shown.

The bottom of the tank must slope from the ends of the tank towards the dividing wall as indicated. The top of the dividing wall must be splayed to one side as indicated.

Cast iron drain pipe and junction, of same diameter as drain leaving tank, shall be built into wall at outlet end of tank at height shown in 2:1 cement mortar. A similar pipe and junction shall be built in at inlet end of tank, but junction shall be of 150 mm diameter. A 50 mm thick baffle of sawn slate or Class E precast concrete, reinforced with mild steel rods as shown, shall be provided across large chamber of tank at height shown and spaced 75 mm away from dividing wall with ends built into grooves in wall of tank in 2:1 cement mortar.

Manhole openings in slab over tank shall each be fitted with Type 8A cast iron double seal manhole cover and frame as described in Clause 16.36. Kerbs shall be finished where exposed above ground with 2:1 cement mortar, trowelled smooth and rounded on salient angles.

Fill in over tank up to ground level with lightly rammed earth filling.

16.37.2 PWD Type Drawing D260/241:

Septic tanks as Type Drawing D260/24h shall be as described in Subclause 16.37.1 except :

- (a) the tank is to be of greater capacity;
- (b) the reinforcement throughout is to be of mild steel rods as shown; and
- (c) one cleaning eye shall be provided in slab over tank, above the inlet junction.

16.38 CONSERVANCY TANKS (PWD TYPE DRAWING D260/251):

Conservancy tanks where shown shall each comprise of tank with chamber for vacuum tank connection, all of sizes and depths shown on Type Drawing D260/251.

The tank shall be formed with bottom and walls of Class E concrete, reinforced with two layers of steel square mesh reinforcement and mild steel rods as shown, bent and lapped at intersections of bottom with walls and covered on top with slab of Class E concrete, reinforced with mild steel rods as shown, holed for manhole and with brickwork carried up one-brick thick in 3:1 cement mortar around opening to concrete surround to finished ground level and splayed down to outside as shown. Chamber for vacuum tank connection shall be formed with bottom of Class C concrete and brickwork as above specified, including surround.

Openings shall be formed in wall of tank for drain pipe entering and leaving tank, all built into openings in 2:1 cement mortar.

Bottom of tank shall be graded to outlet as shown and channel shall be formed in centre with 100 mm diameter halfround vitrified clay channels, jointed in 2:1 cement mortar, benched up to sides of tank as shown with Class C concrete and finished smooth with 2 :1 cement mortar.

Provide between main and vacuum chambers a 100 mm diameter emptying out pipe of cast iron built into wall of tank in 2:1 cement mortar and laid to fall, provided with bend and taken up through bottom of chamber and fitted with extension piece having machine faced collar and two bolts provided with wing nuts, for attaching suction pipe from vacuum tank, all in accordance with the requirements of the Local Authorities,

Opening over tank shall be fitted with Type 8A cast iron double seal manhole cover and frame and top of chamber for vacuum tank connection with Type 9C cast iron single seal manhole cover and frame as described in Clause 16.36 and with frames bedded in the concrete; exposed surfaces of concrete around the manhole covers and frames shall be finished with 2:1 cement mortar, trowelled smooth and rounded on salient angles.

On completion the tank shall be filled with clean water and tested. Any leakages that may occur shall be made good by the Contractor as directed and to the satisfaction of the Representative/Agent and when finally passed, the tank shall be emptied and left clean.

The Contractor shall make all arrangements with the Local Authorities, erect all necessary guard barriers around the excavations and provide all necessary lighting and watching until the completion of the work.

16.39 FRENCH DRAINS (PWD DRAINAGE DETAILS. PAGE 16):

French drains shall be 0,6 m wide, of length shown and 1,8 m deep below invert of drain pipe where entering the drain. Build cavity chamber, size 300 x 300 mm internally, under end of drain pipe with dry rubble walls, in rough local hard stone, from bottom of trench up to top of drain pipe and fill remainder of trench in up to same level with clean, hard, durable stone, graded from a minimum of 40 mm to a maximum of 80 mm as shown.

A distribution drain shall be provided in the stone filling at height shown from cavity chamber to end of trench, or to both ends of trench if chamber is built further than 1,8 m from end of trench, and formed with 100 mm diameter socketed or plain vitrified clay pipes, laid with loose dry joints or 12 mm wide open joints respectively, and to an even fall from cavity chamber of approximately 1 in 240 (Reject vitrified clay pipes may be used for this drain).

Cavity chamber and drain pipe entering the drain shall be covered with a slab of stone, slate or concrete, size approximately 800 x 600 x 75 mm thick. The remainder of trench, above the stone filling, shall be provided with approved bituminous or other suitable sheeting, laid over the stone filling and lapped 75 mm at joints.

Trench shall be filled in above the slab and sheeting with approved filling, lightly rammed

Descriptions (prices) of french drains shall be deemed to include excavation and backfilling.

16.40 SOAKAGE PITS (PWD DRAINAGE DETAILS. PAGE 17):

Soakage pits shall be of size shown, 1,8m deep below invert of drain pipe entering the pit, with cavity chamber under end of drain pipe. Fill remainder of pit in with clean, hard, durable stone, graded from

a minimum of 40 mm to a maximum of 80 mm up to top of drain pipe. Cover cavity chamber and drain pipe with slab of stone, slate or concrete, approximately 800 x 600 x 75 mm thick, and remainder of pit with sheeting. The pit shall be filled in above the slab and sheeting with approved filling, all lightly rammed as described for "French Drains", but without distribution drain.

16.41 AGRICULTURAL DRAINS (PWD DRAINAGE DETAILS, PAGE 41):

Agricultural drains shall consist of branch spreader drains, of lengths shown, run out from either side of the main drain, in trenches 0,6 m wide and of depth required, but not less than 0,7 m deep. The trenches shall be not less than 2 m apart.

The branch spreader drains shall be laid with 100 mm diameter approved agricultural drain pipes, on 150 mm thick beds of clean, hard, durable stone, graded from a minimum of 35 mm to a maximum of 75 mm and covered at sides and above pipes to a height of approximately 280 mm above top of pipes with similar stone for the full width of trenches. The pipes shall be laid with 12 mm wide open joints, each covered with a flat stone or slate, of sufficient size to prevent infiltration of soil. The lower end of main drain shall be plugged with approved stopper, laid in 2:1 cement mortar.

The stone filling in trenches shall be covered with approved bituminous or other approved sheeting, lapped 75 mm at joints and the trenches filled in with earth filling, lightly rammed.

16.42 TESTING:

The whole of the soil and waste water drainage system shall be tested as described hereunder. The Contractor shall provide all necessary testing apparatus, expanding plugs, stoppers, water, smoke composition, any other materials that may be required and all labour required for carrying out the test, viz.:

(a) Preliminary or open test:

All underground drains and fittings shall be tested before being covered in or encased in concrete by means of air or water pressure.

In carrying out the air test all openings in the drains shall be plugged or sealed and all traps associated therewith filled with water. Pump air into the drains until a manometric pressure of 40 mm is indicated after which, without further pumping, the pressure shall not drop below 25 mm for a period of at least 30 seconds.

The water test shall be applied by temporarily plugging up all openings, except the highest one, filling the drains with water so that every part of the system is tested under a head of water of not less than 1,5 m and not more than 3 m. After allowing a period of 10 minutes for initial absorption, the amount of water it shall be necessary to add to maintain the water level over the next 15 minutes shall not exceed a rate, per 100 m of drain, of 2,5 litre for 100 mm, 3,75 litre for 150 mm drains and an equivalent rate for larger drains.

The air or water test may be applied to the drains in one operation or drains may be divided into sections and each section tested separately.

In carrying out the water test the head of water shall be obtained by providing temporary pipes, bends, etc. wherever necessary, at the head of drains or at the head of each section or by such other method as may be approved, in cases where the maximum head of water would be exceeded in any section owing to the gradient of the drains. In order not to subject the lower portion of the drain to a greater head of water than that required, inspection eyes at suitable intervals may be provided and the drain plugged. Arrangements shall be made for the release of any air trapped in the drains.

The drains shall not be tested until a period of 24 hours (or such other period as may be ordered) has been allowed for the cement mortar joints to set.

Before carrying out the above test, an internal inspection of the drains shall be made with a torch and mirror in the direction of the flow. The drains shall be free of invert lips and the

bore of the pipes shall be straight.

(b) Final test:

After the drainage has been completed, all plum-bing fittings installed and permanently connected up and trap seals filled with water, a final air test as described in (a) above, shall be applied to the whole system.

(c) Defects to be made good:

Should the drainage system fail to withstand the tests described in (a) and (b) above, all defects causing such failure shall be made good and the test repeated until the whole of the work is shown to be thoroughly sound and tight, all to the entire satisfaction of the Representative/Agent.

In making good, all defective parts shall be carefully cut out and replaced with new in a proper manner. No patching of pipes, joints or connections will be allowed.

WATER SUPPLIES, FIRE SERVICE AND SANITARY PLUMBING AND FITTINGS

16.43 MILD STEEL PIPES:

16.43.1 Water pipes:

Mild steel water piping shall be in accordance with SABS Specification 62, be galvanised inside and outside with screwed ends and shall be of medium class complete with sockets, bends, elbows, tees, long-screws, back nuts and other fittings as may be required, all complying with the requirements of SABS Specification 509.

Screwed joints shall be made with lead paint and hemp or PTFE tape to cold water piping and with graphite and hemp or PTFE tape to hot water piping.

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

Pipes shall be firmly and neatly built in or fixed to walls as directed by the Representative/Agent.

In order that no air may lodge in the pipes, a proper inclination shall be maintained in fixing same.

If practicable, bends shall be used at angles in preference to elbows. If a reduction in the size of the pipe takes place at an angle, the bend or elbow shall be of the size of the inlet or larger pipe.

Due provision shall be made in long lengths of mains for expansion. Long-screws with back nuts to sockets, or approved couplings, shall be inserted at convenient points to provide for alterations and repairs.

All hot and cold water piping up to 20 mm in diameter inside toilets, kitchens and other rooms, which can be considered as direct supply connections to sanitary, kitchen or laboratory fittings are to be chased into walls and plastered over wherever practicable, or be fixed to walls, as directed by the Representative/Agent, with brass holderbats, saddles or brackets for pipe sizes up to and including 50 mm diameter, or to timber work with brass or copper pipe clips screwed on with brass screws.

All galvanised water piping greater than 20 mm diameter, including lagged piping, rising mains, ring mains and large supply pipes may be surface mounted, but preferably are to run in suitable ducts. Where such pipes are not run in ducts, they must be kept to the absolute minimum and be fixed in neat vertical and horizontal runs. No unsightly work will be permitted. Pipes shall be firmly and neatly fixed to walls with galvanised malleable iron brackets (School Board pattern) for pipes up to and including 80 mm diameter and with galvanised cast iron hinged holderbats fastened with brass pins or bolts for pipes over 80

mm diameter. Brackets and holderbats are to be built into walls in 3:1 cement mortar. Pipes shall be fixed to timber work with galvanised mild steel pipe clips screwed on.

No surface mounted water piping will be permitted on external wall surfaces except for a short distance of vertical rising main from ground level to floor provided this is not unsightly, all to approval of the Representative/Agent.

16.43.2 Waste, ventilation and anti-siphon pipes:

Mild steel waste, ventilation and anti-siphon pipes shall be as described in Subclause 16.43.1, including jointing, fixing, etc., but fitted at angles and intersections with cast iron, brass or malleable cast iron bends and junctions, respectively, as Sample 92. The bends and junctions to waste pipes where accessible, and to other pipes wherever necessary, shall have inspection eyes.

16.44 COPPER PIPES:

Copper pipes for domestic cold water and gas services in all cases shall comply with the requirements of SABS Specification 460 Class 0, 2 and 3. For applications below ground only Class 2 or 3 shall be used.

Pipework above ground shall be of Class 0 or 2 jointed with capillary soldered fittings. Provision must be made for union couplings in strategic places.

Hot water piping to be of thin wall hard-drawn copper.

NB: Copper tubes shall not be used for acetylene gas installations.

16.45 JOINTING OF COPPER PIPES:

Unless otherwise specified, all copper pipes shall be jointed with approved capillary solder type fittings, each joint being formed by cutting the pipe-ends square, preferably with a pipe cutter. If the tube end, to be soldered, is dirty due to cement, bitumen or tape-gum, it should be mechanically cleaned with steel wool or abrasive paper. The area to be soldered should then be thinly coated with a "self-cleaning" flux. After inserting the pipe into the fitting, apply a flame using a LPG gas blow lamp (or an electric resistance machine) to the assembly to heat the tube and fitting for not longer than about 10 seconds. Then remove the flame completely and test the temperature of the joint by placing the wire solder at the mouth of the fitting. If the solder does not melt, remove the solder and heat again with the flame for a few seconds more. Test again with the solder. If the solder melts freely, hold the solder at about 45° to the mouth of the fitting, allowing it to melt and with steady pressure the solder will be drawn into the joint. **DO NOT OVERHEAT THE ASSEMBLY AND NEVER HOLD THE SOLDER IN THE FLAME.** Allow only the heat of the assembly to melt the solder.

Unless otherwise specified, use only 2 mm solid core wire solder. Type 97/3 (97% tin and 3% copper). A careful check should be made to ensure that a ring of solder is visible around the mouth of the fitting.

Fittings and pipes must be wiped clean with a damp cloth after jointing. Joints that have been fluxed should be soldered within 1 hour.

Copper pipes specified to be jointed with compression fittings shall be jointed with approved brass metal fittings with coupling nuts and rotary sleeve pieces, all as Sample 30.

All necessary couplings, connectors, bends, elbows, tees and other fittings as may be required, shall be provided.

Copper pipes specified to be jointed with flared type fittings shall be jointed with approved brass metal fittings with coupling nuts and cones, all as Sample 30.

NB: Capillary, compression and flared type fittings used in jointing copper pipes must be of such bore as will correctly fit the pipes to ensure satisfactory jointing.

16.46 CAST IRON PIPES:

Cast iron soil, waste, ventilation pipes and fittings shall comply with the requirements of SABS Specification 746, and shall have spigots and sockets, be of spun- or sand-cast type, coated inside and outside with bituminous solution, jointed with gaskin and blue lead, properly caulked or jointed with approved rubber rings comprising three parts: a seal ring, an external supporting ring and an internal supporting ring of wedge shaped profile, or jointed with stainless steel-neoprene socketless couplings, complete with stainless steel bands with worm drive clamps, and fixed to walls with cast iron hinged holderbats complying with the above specification, fastened with brass bolts and built into walls in 3:1 cement mortar, or bolted to wood framing through ears cast on to pipes.

Bends, junctions, WC-connectors, etc. shall be provided wherever necessary with cast iron cleaning lids, bedded in putty and bolted on.

No joints will be permitted in wall thicknesses where pan connectors pass through walls. Long WC outleg pan connectors with loose collars must be made use of.

16.47 FIBRE CEMENT PRESSURE PIPES:

Fibre cement pressure pipes shall comply with the requirements of SABS Specification 1223, of Class C, be provided with bends, tees, crosses, reducers and other fittings as may be required, which shall be of cast iron complying with the requirements of SABS Specification 546.

Fibre cement pressure pipes and fittings shall be jointed together by means of either –

- (a) cast iron short collar detachable couplings, each comprising centre collar, rubber ring on each side of collar and outer flange rings, clamped against the rubber rings with bolts evenly tightened, or
- (b) fibre cement collars fitted over the ends of pipes, each grooved internally and fitted with rubber centre spacer ring and two rubber gaskets or with two rubber gaskets only. The gaskets shall have holes all around on the pressure side which will serve to expand the gaskets hydraulically using the water pressure in the pipes. Pipes and fittings shall be machine turned at ends to ensure proper fit between the gaskets and pipes.

Cast iron bends or fibre cement pressure bends, conforming in all respects to the straight fibre cement pipes, shall be used at all changes of direction or grade in pipe lines where such changes exceed the angle of deflection permitted by the pipe couplings.

BRANCH CONNECTION 50 mm AND LESS IN DIAMETER may be made at joints between pipes by the use of cast iron couplings described in Subclause 16.47 (a), but of the collar type, drilled and tapped for the connections.

BRANCH CONNECTIONS 40 mm AND LESS IN DIAMETER may be made to the pipes using a saddlepiece supplied by the Manufacturer of the pipes, bolted around the pipe and with boss of each saddle-piece drilled and tapped for the size of connection, positioned over the new hole in the pipe with rubber washer between the boss and the pipe.

The Manufacturer's instructions regarding the laying and jointing of fibre cement pressure pipes, including amount of expansion gap to be allowed between ends of pipes in cases where centre spacer rings are not provided, and the maximum angular deflection that may be made in a pipe joint shall be followed in all cases*

16.48 LEAD PIPES:

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

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

Lead pipes shall be jointed with wiped soldered joints and pipes shall be supported by strong 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.

16.49 PIPE CONNECTIONS:

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

CONNECTION	METHOD OF JOINTING
Between bath waste fitting and rubber trap.	See Clause 16.51.9 "pressed steel baths".
Between sink, bath or basin waste fitting and Mild steel pipe.	Screwed
Between pillar tap and supply pipe.	ON BASIN – copper connector with brass caps.
Between flushing cistern and supply pipe.	ON BATHS – As above, or with mild steel pipe with sockets and lock nuts. Copper connector with brass caps and linings.

16.50 BUILDING BEARERS INTO WALLS:

Mild steel bearers for supporting drainers, sinks and other fittings shall be built into brick walls in Class E concrete, well packed into holes, size approximately 220 x 110 mm x 2 courses of brickwork deep, formed in the walls. The bearers shall be properly strutted up in position for building in.

16.51 SANITARY FITTINGS:

NB: Unless otherwise stated, descriptions (prices) of WC suites shall be deemed to include the following: WC pan, flushvalve or 11 litre cistern with flushing apparatus, float valve and flush pipe (overflow not included) and all finishings to pipes and cistern. It shall, however, be clearly stated whether a cistern or flushvalve is to be used.

Descriptions (prices) of flush and sparge pipes shall be deemed to include matching pipe fittings, holderbats and spreaders.

16.51.1 Sundry fittings:

(a) Toilet roll holders:

Chromium plated brass thief proof toilet roll holder shall be as Sample 71, screwed to hardwood or patent plastic plugs in wall.

(b) Towel rails:

Chromium plated brass or aluminium towel rail with brackets shall be as Sample 115, screwed to hardwood or patent plastic plugs in wall.

16.51.2 Wash troughs:

- (a) Reinforced concrete washing trough of approved manufacture shall be all as Type "A", Detail Drawing D.260/110, size 600 x 380 mm deep, 457 mm wide at top and 254 mm wide at bottom internally, with reedings 200 mm wide, finished internally on front with polished terrazzo, angle rounded on top edges and front bottom edge and at all internal angles; the bottom holed for and fitted with 50 mm chromium plated brass outlet union, and vulcanite plug and chain; set on and including two precast Class E concrete pedestals, size 380 mm wide by 380 mm high by 75 mm thick, and finished on exposed surfaces in 2:1 cement mortar with salient angles rounded and bedding pedestals to floor and wall at back, and trough to pedestals in 2:1 cement mortar neatly pointed.
- (b) Reinforced concrete drainer shall be of approved manufacture with lip to fit over side of trough, finished on exposed surfaces with polished terrazzo with all salient angles rounded and grooved on top surface, with one end of drainer provided with 6 mm diameter copper dowel, 50 mm long, set into and including mortices in underside of drainer and top of trough and bedded in 2:1 cement mortar and with other end of drainer supported on tee section bearer (given separately), twice screwed to lead plugs in underside of drainer.

16.51.3 Pedestal water closet pans:

Pedestal water closet pans shall be of the washdown type, approximately 400 mm high, of white glazed fireclay or vitreous china, complying with the requirements of SABS Specification 497.

The pans shall have "P" traps with straight outlets or right or left hand side outlets, as required.

Pans shall be bedded onto the floors in 3:1 cement mortar.

- (a) The pans shall be fitted with approved solid hardwood or plastic double flap seats having open fronts and of size and shape required to fit the pans, each attached to pan with non-ferrous metal fixing bolts; or
- (b) The pans shall be fitted with approved solid plastic double flap seats, having closed fronts of size and shape required to fit the pans each attached to pan with non-ferrous metal fixing bolts.

16.51.4 Pedestal water closet pans (School type):

Pedestal water closet pans for nursery schools shall be as described in Subclause 16.51.3, but approximately 300 mm high, of white glazed fireclay or vitreous china and fitted with hardwood inserted seat pads securely fixed with brass screws having heads sunk and pelleted.

16.51.5 Squatting water closet pans:

Squatting water closet pans shall be of white glazed fireclay or vitreous china, without foot treads, complying with the requirements of SABS Specification 497, each provided with compatible "P" or "S" trap as required and jointed to pan in 2:1 cement mortar.

The pans and traps shall be set on and encased in Class B concrete not less than 100 mm thick at any point or position.

Top of pans shall be flush with floor.

16.51.6 Flushing cisterns:

Low level cisterns shall be of the valveless siphonic type or of the flushing valve type, each with body and removable cover –

- (a) of cast iron coated internally and externally with an approved metallic finish spray;

- (b) of cast iron finished off with vitreous enamel;
- (c) of galvanised pressed steel, coated internally and externally with an approved metallic finish spray;
- (d) of galvanised pressed steel finished off with vitreous enamel;
- (e) of composition as "Duranite" or other similar approved; and complying with the requirements of SABS Specification 821, or shall have body and removable cover of white glazed fireclay or vitreous china complying with the requirements of the above specification and with the requirements of SABS Specification 497.

NB: Flush pipes to flushing cisterns shall have an internal diameter of not less than 34 mm for the various lengths of pipe under 1,5m.

16.51.7 Wash hand basins:

(a) White glazed:

Wash hand basins shall be of the bracket type with back skirting of white glazed fireclay or vitreous china complying with the requirements of SABS Specification 497 having weir type overflow and fitted with chromium plated grid or slot type overflow.

Basins shall be 558 x 406 mm, each fitted with an approved 32 mm chromium plated brass waste fitting with screwed outlet complete with vulcanite or rubber plug attached to basin with chromium plated chain, two 15 mm chromium plated brass, easy clean pattern, screw down pillar taps as described in Clause 16.53 where hot and cold water is supplied to basin or with one such tap where only cold water is supplied to basin. 2 Tap hole basins fitted with 1 tap only shall be plugged with stopper button in unused taphole.

Basins in ablutions are to be fitted with approved chromium plated brass-bodied taps with built-in flow controllers as Sample 207.

Basins shall be fixed on approved white enamelled cast iron brackets, fixed to walls with M6 bolts, 120 mm long, built into walls in 3:1 cement mortar. Basins in ranges shall be spaced approximately 75 mm apart.

(b) School type:

Wash hand basins for nursery schools shall be of the bracket type and of approved manufacture, of white glazed fireclay or vitreous china, size approximately 457 x 304 mm, with back skirting, two soap sinkings, integral slot or weir type overflow and holes for taps and waste unions.

Basins shall each be fitted with waste fitting complete with plug and chain and 1 or 2 taps as required, all supported on brackets as described in Subclause 16.51.7 (a). 1 Tap hole in basins fitted with 1 tap only shall be plugged with stopper button in unused taphole.

Basins in ranges shall be spaced approximately 75 mm apart.

(c) Stainless steel:

Wash hand basins shall be of bracket type, pressed to form out of 1,2 mm thick Type 304 stainless steel and complying with the requirements of SABS Specification 906 and be of approved manufacture.

The size of the basin shall be 550 x 430 mm with bowl, size 410 x 305 x 145 mm, and with 50 mm high splash back, two soap sinkings, semi-pierced tap holes and holed and recessed for 40 mm waste outlet.

Basins shall each be fitted with approved 40 mm chromium plated brass waste outlet complete with plug and chain, 1 or 2 taps as required and supported on brackets, all as

described in Subclause 16.51.7(a). Basins fitted with 1 tap only shall have one semi-pierced hole left unpierced.

Basins in ranges shall be spaced approximately 75 mm apart, or may be in banks pressed out of a single stainless steel sheet. (Banks are obtainable containing "two to six basins")

16.51.8 Handrinse basins:

Handrinse basins are to be of approved manufacture and of white glazed fireclay or vitreous china complying with the requirements of SABS Specification 497, each approximately 330 mm high and 470 mm wide, designed for recessing approximately 50 mm deep into wall, complete with soap sinking and holes for tap and waste outlet.

Each handrinse basin to be provided with a waste outlet (without plug) and one 15 mm chromium plated brass screw down pillar tap of easy clean pattern, for cold water, complying with the requirements of SABS Specification 226.

Each handrinse basin is to be built into wall with 3:1 cement mortar.

16.51.9 Pressed steel baths:

Baths shall be of 1,6 mm thick metal, rectangular topped with recessed rims, holed for overflows, holed and recessed for waste unions and fitted with metal feet. The fall along bottom of baths from head ends to outlets shall be adequate for complete emptying.

The overall widths and minimum mass for baths shall be as specified in the table hereunder for the four sizes, viz:

SIZE (mm)	WIDTH (mm)	MASS (kg)
1 820	762	47
1 820	724	44
1 670	762	27
1 670	724	26

If one of above-mentioned bath measurements are not specified, baths shall be 1 820 mm in length and 762 mm in width, and each fitted with 32 mm chromium plated brass bent overflow union; 40 mm chromium plated brass screwed waste outlet complete with vulcanite or rubber plug, attached to bath with chromium plated chain; 40 mm lead bath trap having lead flange and back nut wiped on, bedded in putty and screwed up to waste fitting;

32 mm diameter lead overflow pipe wiped on to trap and overflow union, holed for and fitted with two 20 mm chromium plated brass, easy clean pattern, screw down pillar taps as described in Clause 16.53.

16.51.10 Acrylic baths:

Acrylic baths shall be of white cast acrylic sheet, be manufactured in accordance with SABS Specification 1402 and carry a minimum guarantee against latent material and manufacturing defects for five years.

The overall dimensions and description of the baths shall be as specified in the table hereunder and shall be bricked in as is usual practice, viz:

DESCRIPTION	WIDTH (mm)	LENGTH (mm)
1 825 Standard - no handles	1 825	716
1 825 Luxury - with handles	1 825	760
1 660 Luxury - with handles	1 660	760
1 670 Standard - no handles	1 660	715

Baths shall be fitted with outlet, overflow unit, plug and chain by the Manufacturer who shall also supply the necessary installation instructions, sealant and advice for effecting a watertight seal between the bath and each abutting wall plane.

If one of above-mentioned bath measurements are not specified, baths shall be 1 825 mm Standard in length x 716 mm in width and shall be fitted with a 40 mm lead bath trap having a lead flange and back nut wiped on, bedded in putty and screwed up to waste fitting, holed if required and fitted with two 20 mm chromium plated brass, easy clean pattern, screw down pillar taps as described in Clause 16.53.

16.51.11 Wall mounted bowl urinals:

Wall mounted urinals shall be of white glazed fireclay or vitreous china **type**, each approximately 700 x 380 mm in overall size, with back flush entry and secured to wall with not less than two concealed hanger brackets. The urinals shall each be fitted with 38 mm diameter chromium plated domical grating, approved urinal flushing valve complete with push button assembly, spreader and all other necessary chromium plated fittings.

Fit each urinal outlet with a chromium plated bottle trap.

16.51.12 Drip sinks:

Drip sinks shall be of white glazed fireclay or vitreous china complying with the requirements of SABS Specification 497, where relevant, size 525 x 450 x 175 mm deep (overall), and with back increased to a total of not less than 320 mm high to form splashback and fitted with hinged chromium plated bucket grating with rubber stops and hardwood pad.

Drip sinks shall each be fitted with chromium plated brass waste outlet of size to suit size of trap or waste pipe specified, complete with vulcanite or rubber plug and chromium plated chain. The chain shall be attached to sink or to metal eye having tail built into wall.

Drip sinks shall be fixed on two approved heavy white enamelled cast iron brackets fixed to walls with M6 bolts, 120 mm long, all built into walls in 3:1 cement mortar.

16.51.13 Stainless steel sinks:

(a) For domestic use:

Stainless steel sinks with draining boards for domestic use shall comply with the requirements of SABS Specification 242, and shall be constructed of Type 304 stainless steel with exposed surfaces having satin finish, all provided with splash backs and tiling keys at back and at ends where against walls.

The stainless steel for bowls and draining boards having an overall length not exceeding 1,52 m shall be 0,9 mm thick, but for draining boards having an overall length exceeding 1,52 mm shall be 1,25 mm thick.

Draining boards shall be flu-bed and a sound deadening material shall be permanently attached to the outside surface of the bowls and to the underside of the draining boards.

Outlet holes in bowls shall be towards the end of the bowl remote from the drainer as laid down in the above specification. In the case of a centre bowl fitting, the hole may be towards either end of the bowl. The outlets shall each be fitted with waste fitting, plug and chain as

described in Subclause 16.51.12.

(b) For institutional use:

Stainless steel sinks with draining boards and pot sinks for institutional use shall be as described in Subclause 16.51.13 (a), but shall comply with the requirements of SABS Specification 907, and constructed of Type 304 stainless steel which shall be 1,20 mm thick for bowls having a length less than 600 mm and 1,60 mm thick for a length of over 600 mm.

16.52 WATER STORAGE TANKS:

16.52.1 Corrugated iron tanks:

Corrugated iron tanks shall be circular on plan with walls of 0,80 mm thick Z275 quality galvanised corrugated iron as described in Subclause 7.6.2 (a), all strongly riveted and soldered at joints, fitted with top and bottom of 0,80 mm thick Z275 quality galvanised sheet iron as described in Clause 16.9, seamed and heavily soldered to body of tank. Provide top with manhole and removable cover of similar sheet iron. Manhole covers to tanks in roofs shall be flat covers, attached with galvanised gutter bolts, and those to tanks on stands outside shall be rimmed covers each with handle riveted into position.

Tanks shall be provided with connections for pipes of diameters and in positions required, each formed with galvanised iron screwed socket secured to flattened hole in side of tank with screwed nipple and back nut, all securely soldered and reinforced externally with 0,60 mm thick galvanised sheet iron gusset piece strongly soldered to both tank and socket.

Each tank shall be provided with copper ball valve of same bore as supply pipe.

Tanks in roofs shall be provided with 40 mm diameter overflow pipe of 0,60 mm thick galvanised sheet iron from top of tank to discharge into tray below.

Tanks on stands outside shall be provided with a similar overflow pipe, but of 75 mm diameter, taken down to discharge at ground level, except for tanks on elevated stands where overflow pipes shall be approximately 225 mm long only, and in both cases taken down inside tanks to within 150 mm of bottom; overflow pipes shall be secured to tanks where necessary with sheet iron bands soldered on.

The bottom outside surface of tanks on stands externally shall be twice tarred and sanded before fixing on stands.

16.52.2 Pressed steel tanks:

Pressed steel tanks shall be formed with steel plates, flanged all around and holed for bolts and embossed to add stiffness and strength to the plates, size approximately 1,22 x 1,22 m, all assembled with the necessary bolts, nuts and washers, and with a suitable plastic jointing compound in all joints to render tank watertight, and provided with all necessary corner plug pieces and bracing members as required, bolted to brackets and tank plates. Unless otherwise specified, the plates shall have external flanges.

Tank plates for the various depths of tanks shall be of thicknesses stated in the table hereunder, viz:

DEPTH OF TANK	THICKNESS OF PLATES	
	To bottom of tank (mm)	To sides of tank (mm)
1,22	4,5	All plates 4,5
2,44	6	Top row 4,5 and bottom row 6
3,66	6	Top row 4,5 middle and bottom rows 6
4,88	8	Top row 4,5 two middle rows 6 and bottom row 8

Tanks shall be fitted with all necessary inlet, outlet and overflow pipe connections, of diameters and in position required, welded to tank plates and fitted with standard drilled flanges for connecting the pipes. Each tank shall be fitted with flat top of 3 mm thick steel plate complete with manhole and lockable, hinged cover in convenient position.

Unless otherwise specified, each tank shall be provided with copper ball valve of same bore as supply pipe.

All plates, bracing members, brackets, bolts, nuts, washers, etc. shall be hot dip galvanised as described in Clause 13.3.

16.53 WATER TAPS AND VALVES:

All water taps (other than those to special hospital and similar fittings) and stop cocks shall comply with the requirements of SABS Specification 226.

Taps for hot water shall be marked with the letter "H" or "W" or with the word "Hot" or "Warm" or shall have red colour plastic inserts, and taps for cold water, when both cold and hot taps are provided to a fitting, shall be marked with the letter "C" or "K" or with the word "Cold" or "Koud" or shall have green or blue colour plastic inserts,

Ball valves shall comply with the requirements of SABS Specification 752.

16.54 WATER METERS:

Water meters shall be of the semi-positive rotary piston type, each with brass or bronze working chamber, hinged cover to cyclometer dial and screwed ends for coupling to water mains, Registration of consumption shall be in Kilolitres.

The meters shall be of at least 50 per cent South African manufacture, judged on a cost basis, and shall, at a working head of 700 KPa, comply with the requirements laid down in the table hereunder in respect of accuracy and rate of flow for the various sizes of meter, viz:

SIZE OF METER (mm)	ACCURACY WITHIN 2% AT LITRES/HOUR	CONTINUOUS RATED FLOW LITRES/HOUR
15	22	900
20	2^	1 800
25	54	4 100
40	109	7 250

16.55 STOP COCK CHAMBERS:

Stop cock chambers shall be 225 x 225 mm internally with half brick sides in cement mortar and with 225 x 225 mm cast iron box with hinged lid set in and including 375 x 375 x 100 mm thick Class C

concrete kerb finished on top with granolithic with angles rounded including formwork, filling around and ramming.

16.56 GARDEN HOSE CHAMBERS:

Garden hose chambers shall be 337 x 225 x 225 mm deep internally with half brick sides finished on top with 75 mm thick Class C concrete kerb flush with ground and finished on exposed faces with granolithic, provided with cover of 6 mm thick chequer plate, size 437 x 325 mm, fitted at one end with two 50 mm x 6 mm mild steel strap hinges with 12 mm diameter mild steel rod, bent to U-shape, embedded in concrete kerb and fitted at other end with 50 x 6 mm mild steel hasp welded to cover and 50 x 6 mm mild steel staple rounded and holed for padlock and split and spread and embedded in concrete kerb and cover holed for and fitted with 12 mm diameter mild steel lifting handle four times bent and riveted through cover including 50 mm ^brass padlock as Sample 32, and filling in around and ramming.

16.57 PIPE INSULATION:

Insulation to pipes shall consist of limpet fibre cement, sectional fibre cement covering, fibre glass insulation, mineral wool or other approved insulation including metal bands etc., as supplied by the Manufacturers, with moulded sections where required to tees, bends, etc. and fixed complete, all in accordance with Manufacturer's instructions.

16.58 CIRCULATING CYLINDERS:

Circulating cylinders shall be constructed of 1,4 mm thick galvanised mild steel of capacity required with domed up top and bottom, riveted and soldered or welded at joints and with screwed and riveted flanged connections for and joints to pipes of diameters specified and hoisting and fixing cylinder on stand (stand given elsewhere).

16.59 FIRE HYDRANTS:

Fire hydrants shall comply with SABS Specification 1128 and must be supplied to the approval of the local Fire Brigade and in accordance with SABS Code of Practice 0400 as specified.

16.60 FIRE EQUIPMENT AND CUPBOARDS:

16.60.1 Fire hose reels:

30 Meter long 20 mm diameter fire hoses that comply with SABS Specifications 988, 1096 and 543 with reels (non-swivel type) that comply with SABS Specification 543, including all valves, nossels, etc., all to the approval of the local Fire Brigade and in accordance with SABS Code of Practice 0400 as specified, must be provided.

The Contractor is to fix fire hose reels against walls with 10 mm diameter hook or rag bolts, not less than 150 mm long and built into walls in 3:1 cement mortar. Descriptions (prices) of fire hose reels shall be deemed to include same.

Centre of fire hose reel to be approximately 2,1 m above floor level.

Provide the reel with an approved slide-over type fibre glass security cupboard or a high impact resistant, UV-stabilised, clear acrylic cover with a numbered twist-action closer seal if so specified.

16.60.2 Fire extinguishers:

Supply number and type of fire extinguishers as specified, all in accordance with SABS Code of Practice 0400 and to the approval of the local Fire Brigade.

Hang extinguishers on appropriate approved wall mounted hangers at heights as directed.

All extinguishers to be of the refillable handheld portable types according to the capacities indicated.

- (a) Dry powder (DCP) extinguishers in accordance with SABS Specification 810.
- (b) CO₂ extinguishers approved by the Representative/Agent.
- (c) BCF(1211) extinguishers in accordance with SABS Specification 1151.

If so specified, hang fire extinguisher inside approved watertight, ultra high impact resistant, UV-stabilised, corrosion resistant cupboard with a similar clear acrylic hinged door. Fix cupboard at an appropriate height against a permanent support and supply with a numbered twist-action closer seal and if thus specified an approved alarm. Supply fire extinguisher cupboard according to size and requirements of specified extinguisher.

Descriptions (prices) of fire extinguishers shall be deemed to include charging thereof,

16.61 FIXED WATER STORAGE HEATERS:

The water heaters shall comply with SABS Specification 151 and shall bear the "MARK".

This specification covers the following types of water heaters:

- TYPE 1: (Free outlet type) - A water heater provided with an open outlet. The flow of water is controlled by means of a stopcock in the inlet pipe.
- TYPE 3: (Low pressure type) - A water heater designed for a working pressure of 100 kPa with or without an open expansion or vent pipe and intended to work from a supply derived from either a pressure control valve or a cold water cistern that does not form an integral part of the heater. The flow of water is controlled on the outlet side.
- TYPE 4: (High pressure type) - A water heater designed for a working pressure of 400 kPa derived from the mains via a combined pressure control/expansion valve. The flow of water is controlled on the outlet side.

The working pressure of Type 1 shall be 20 kPa, and the minimum working pressure of Type 3 shall be 100 kPa. Where a working pressure higher than 100 kPa is required. Type 4 shall be used.

The rating of the heating elements shall be as follows:

TYPE	CAPACITY (LITRES)	220/250 V, 50 Hz (kW)
1	15	0,5
1 & 3	25	0,5
3	50	1,0
3 & 4	100	2,0
3 & 4	150	3,0
3 & 4	200	4,0
3 & 4	250	4,0
3	350	3,0
3	450	3,0
3	550	3,0

The paint finish shall be at least equal to Class I baked enamel of SABS Specification 757 with a dry film thickness of at least 0,03 mm.

The insulation between the cylinder and the outer casing shall consist of a 50 mm high

density fibreglass blanket or granulated cork.

The heating element shall be of the immersion type. The following safety accessories shall be supplied as standard:

On Types 1 & 3: Fail-safe type thermostat graduated to operate at any temperature between 40 °C and 75 °C.

On Type 4: a) Fail-safe type thermostat graduated to operate at any temperature between 40 °C and 75 °C.

(b) Emergency overpressure/temperature relief valve relieving at 600/650 kPa or at 94°-97°C.

In areas with aggressive water, an incolloy heating element shall be provided.

The background colour of the nameplate indicating details of the cylinder shall be in accordance with the appropriate working pressure specified in SABS Specification 151, namely:

50 kPa maximum — Yellow
 100 kPa maximum — Blue
 200 kPa maximum — Black
 300 kPa maximum — Brown
 400 kPa maximum — Red
 500 kPa maximum — Grey

16.62 HOLES FOR PIPES ETC:

All necessary holes shall be cut in walls, floors, roofs, ceilings, etc. for pipes, brackets, etc. and any damage shall be made good in all trades, after pipes, etc. have been built in, all to the satisfaction of the Representative/Agent.

16.63 TESTING OF PLUMBING:

The plumbing work shall be tested in accordance with the instructions of the Representative/Agent and any imperfect work shall be taken out and renewed at the cost of the Contractor and again tested until found to be perfect.

16.64 TESTING OF WATER RETICULATIONS AND PIPELINES:

If State owned water is available on site, such water will be available free of charge to the Contractor, but if State owned water is not available the Contractor is responsible for the provision of all water, pumps, etc. required for the proper testing of the water system for leakages.

Before carrying out the pressure test of water reticulation and pipelines the entire system must be filled with water and all air evacuated.

The test shall be carried out by pressurising the water in the system to one and a half (1,5) times the expected working pressure that the installation is designed for, by means of a pump. The pressure shall be maintained at that level for a period of at least four (4) hours during which time all pipes, joints and fittings are to be thoroughly inspected.

Any leakages that may appear must be repaired to the satisfaction of the Representative/Agent. When the system is connected to the main water supply and is operational a final inspection must be carried out under normal working pressure and any defects shall be rectified.

SECTION 17**GLAZING****17.1 GLASS:**

Glass in panes not exceeding $0,65 \text{ m}^2$ of surface area shall be clear float glass of "GG" quality (Glazing quality) and of 3 mm thickness.

Glass in panes exceeding $0,65 \text{ m}^2$ and up to $1,5 \text{ m}^2$ of surface area shall be clear float glass of "GG" quality (Glazing quality), but of 4 mm thickness.

All laminated safety glass shall carry the Manufacturer's warranty against all manufacturing defects and discoloration for a minimum period of 5 years. A stencil mark is to appear in a prominent place on all types of safety glass.

Laminated safety glass shall comprise two nominally 3 mm thick sheets of selected factory run quality (FRQ) glass. The thickness of the interlayer shall be in accordance with the requirements of the following performance classes for laminated safety glass:

- (a) Normal strength glass (NS): This shall be marked in accordance with SABS Specification 1263 Part I. The vinyl interlayer shall have a thickness of 0,38 mm.
- (b) High penetration resistant glass (HPR) : This shall be marked as such and shall comply with accepted ball drop test requirements for this product. The vinyl interlayer shall have a thickness of 0,76 mm.
- (c) High impact glass (HI): This shall be marked in accordance with SABS Specification 1263 Part II. The vinyl interlayer shall have a minimum thickness of 1,14 mm.
- (d) Bullet resisting glass (BRG): Determine the level of attack or protection requirements. Glass for each level of attack shall be marked in accordance with SABS Specification 1263 Part III. Multilaminate glass/interlayer construction shall be in accordance with the Manufacturer's recommendations.
- (e) Bomb blast resistant glass: Where required high penetration resistant glass (HPR) shall be used for the first 3 floor levels and normal strength glass (NS) above this level. Where bomb blast resistant glass is installed in aluminium frames, silicone sealants must be utilised in accordance with the Manufacturer's instructions.
- (f) Toughened safety glass: This shall be marked in accordance with and comply with SABS Specification 1263 Part I. For glazing in panes of up to 3 m^2 such glass shall be 4 mm thick and ordered to the correct size. Toughened glass cannot be cut after manufacture. (For larger sizes and special applications the Manufacturer's instructions are to be followed.)

Unframed glass doors shall be of toughened safety glass all marked in accordance with and comply with SABS Specification 1263 Part I. Unframed glass doors for internal use shall be 10 mm thick, but doors for exterior use shall be 12 mm thick.

Glazing in inclined rooflights or inclined glazed roofs shall be of wired, laminated or laminated toughened glass and shall not be less than 6 mm in nominal thickness. The minimum support for such glass in square or rectangular pane form shall be along two opposite edges. Any such glass in any other pane shall be supported around at least 75 percent of its periphery.

Obscure glass for glazing shall be an approved figured rolled glass having a nominal thickness of not less than 4 mm for glass panes up to a surface area of $0,65 \text{ m}^2$ and not less than 5 mm for panes over $0,65 \text{ m}^2$ in area.

17.2 GLAZING:

The glazing and fixing of glass in buildings shall be carried out in strict accordance with SABS Code

of Practice 0137 .

(a) Safety glazing:

Where any pane of glass is to be installed—

- (i) between the finished floor level and a level of 800 mm above such floor; or
- (ii) anywhere in a door below a height of 1,8 m above the floor level; or
- (iii) within 1 m of either side of a doorway; or
- (iv) in any wall or balustrade forming part of a stairway or ramp below a height of 1,8 m above the treads or surface of such stairway or ramp, including the surface of any landing forming part of such stairway or ramp;
- (v) in any shop window having an area greater than 1,0 m² such pane shall be made of safety glass.

The work in connection with safety and security glazing shall in addition be performed in accordance with the instructions of the Manufacturer of the safety glass.

(b) Glass louvres:

The use of glass louvres is not favoured, but if such are considered essential, prior approval must be obtained from the Chief Director: Architectural Services.

All glass louvres shall be of normal strength laminated safety glass, regardless of length or width, with polished edges.

17.3 MIRRORS:

Mirrors shall comply with the requirements of SABS Specification 1236, Class A. Unframed mirrors shall have polished edges (Bevelled edges are not permitted).

17.4 DESCRIPTIONS (PRICES):

Descriptions (prices) of glass shall be deemed to include putty, sprigs, pegs or clips and removal and refixing of glazing beads where applicable.

SECTION 18**PAINTING****18.1 PREPARATORY WORK FOR PAINTING:****18.1.1 General:**

All floors shall be swept clean, walls dusted down and surfaces not being painted (i.e. face brickwork, sills, floors and stained woodwork) covered and protected against spotting before any painting is carried out.

No sweeping or dusting shall be done whilst painting is in progress or whilst paint is still wet.

18.1.2 On woodwork

Woodwork being painted shall be well brushed down, knots treated with knotting and all surfaces primed, stopped with hard stopping and rubbed down to an even surface ready to receive the paint.

Woodwork being oiled or stained shall have all plaster stains, pencil marks and other surface discolorations/blemishes carefully removed, be stopped with tinted stopping and well rubbed down.

Painted woodwork being redecorated shall, if the paint film is firm and sound, be washed down, have all cracks, crevices and holes scraped out, primed, made good with hard stopping, faced up and rubbed down to an even surface ready to receive the new paint. If the old paint film has blistered or broken down, the old paint must be completely removed back to the bare surface by the use of a blow lamp or paint remover and the woodwork prepared as above.

Care must be taken when burning off old paint not -bo char or otherwise damage the woodwork. All paint removers used must be free from soda or other caustic substances.

Existing oiled hardwood being redecorated shall be thoroughly cleaned down, stopped with tinted stopping and rubbed down. Existing stained woodwork shall be cleaned, similarly stopped and rubbed down.

18.1.3 On metalwork:

All metal surfaces being painted, except for structural steelwork, shall be cleaned of all rust, scale and dirt, removed by scraping or with steel wire brushes. All oil and grease shall also be removed and a perfectly clean surface obtained. If necessary, the surface shall be degreased, immediately before application of the priming coat, by the use of a suitable solvent. Any salt deposits on the metal surfaces, as may occur in industrial and marine atmospheres, shall be removed by means of a suitable detergent and the surfaces thoroughly rinsed and allowed to dry.

New galvanised metal surfaces, which are to be painted, shall be cleaned down as above and given 1 coat of self-etching wash primer complying with the requirements of SABS Specification 723.

Protective coatings on new galvanised metal surfaces, applied by the Manufacturer to prevent storage stain and white rust, shall be completely removed by the use of a suitable cleaning agent and the surfaces thoroughly rinsed and allowed to dry before the surfaces are primed.

Existing painted metal surfaces being redecorated shall be thoroughly rubbed and cleaned down before repainting, but if the paint film has blistered or broken down, the paint shall be completely removed down to the bare metal.

After removing rust from metalwork those portions so affected shall be treated with an

approved rust inhibitor or rust neutralising paint.

18.1.4 On plaster:

All plastered wall, ceiling and such like surfaces being painted shall be filled, where necessary, with suitable stopping or patching plaster and the whole rubbed down ready to receive the finishings.

Existing plastered surfaces previously painted and being redecorated shall be washed down, filled as above, where necessary, spot primed and rubbed down ready to receive the new paint.

Existing plastered surfaces previously distempered and being redecorated shall have the old distemper completely removed by wetting and scraping the surfaces, filled as above, where necessary, and rubbed down ready to receive the new finish.

Existing plastered surfaces previously limewashed and being redecorated shall be wire brushed to remove loose, flaking or powdered limewash, filled as above where necessary, and left ready for new limewash. If a finish other than limewash is to be applied, the old limewash must be completely removed, the surfaces washed down, filled, where necessary, and left in a fit state to receive the new finish.

18.1.5 On boarded ceilings:

Boarded ceilings, including cover strips and cornices, being painted shall be filled where necessary with suitable stopping. All nail heads in ceilings, cover strips and cornices being painted shall be primed with flat paint.

Existing ceilings being redecorated shall be prepared for new finish as described in Subclauses 18.1.2, 18.1.3 or 18.1.4, whichever applies.

18.2 SURFACES TO BE DRY:

All wall, ceiling and similar plastered surfaces shall be perfectly dry and in a fit state to receive paint finishes, before the application of any paint.

Special care is to be taken when the plaster is specified to be finished with oil based paints.

18.3 PAINTS ETC.:

All materials for paintwork for which South African Bureau of Standards Specifications have been published shall comply with the requirements of such specifications and bear the standardisation mark of the South African Bureau of Standards on the container or packing. Materials for paintwork for which no SABS Specification have been published shall be of brand and manufacture approved by the Representative/Agent.

All materials for paintwork must be brought on to the site in unopened containers and no adulteration will be allowed.

Primers and undercoats for paintwork shall be as supplied by the Manufacturer of the paint being used for the finishing coat.

Paints etc. shall be suitable for application on the surfaces on which they are to be applied and those used externally shall be of exterior quality.

If necessary, paints etc. shall be strained free from skins and similar impurities immediately before application.

The various primers, undercoats and paints shall comply with the requirements of the specifications quoted hereunder and shall be of the type or grade stated, viz:

(a) Primers:

(i) For wood:

SABS Specification 678. Type I shall be used on exterior woodwork and Type III on interior woodwork.

(ii) For metal:

DIP OR SPRAY APPLICATION (RED OXIDE ZINC CHROMATE):

For steel windows, doors, door frames and other articles normally dip or spray primed in the Manufacturer's works: SABS Specification 909.

BRUSH APPLICATION (ZINC PHOSPE):

For all metal surfaces primed on site and then painted: SABS Specification 1319.

(iii) For structural steelwork:

ZINC PHOSPHATE: SABS Specification 1319 or, when specifically specified, RED LEAD: SABS Specification 312, Type II, Grade I as per Clause 18.9.

(iv) For plaster:

Alkali resistant primer shall be as described in SABS Specification 681 [see (b) "Undercoats" hereunder].

(b) Undercoats:

For all surfaces under HIGH GLOSS, OIL GLOSS, FLAT and EGGSHELL finishing paints; SABS Specification 681, Type II.

(c) Finishing paints:

- (i) High gloss enamel paint: SABS Specification 630.
- (ii) Oil gloss: SABS Specification 631.
- (iii) Flat and eggshell: SABS Specification 515.
- (iv) Emulsion paint (interior): SABS Specification 633, Grade I.
- (v) Emulsion paint (exterior): SABS Specification 634 Synthetic Polymer Base Type, but pure aery lie resin base for fibre cement surfaces.
- (vi) Aluminium paint: SABS Specification 682, Grade II.
- (vii) Roof paint: Alkaline type SABS Specification 683, Type B.
- (viii) Structural steel paint: SABS Specification 684, Type B.
- (ix) Textured wall coatings, emulsion base, for interior and exterior use: SABS Specification 1227.

(d) Light sand textured emulsion base acrylic wall coating:

Finish on walls shall be Light Sand Textured Emulsion Base Acrylic Wall Coating complying with SABS Specification 1227, Type II of colour and texture to the approval of the Representative/Agent.

The finish shall be applied in two coats over a base/primer coat of Bonding Liquid if the surface is porous.

The material (all coats) shall be applied by an applicator approved by the Manufacturer of the coating being used (or his agent) and shall be mixed and applied in strict accordance with the Manufacturer's instructions.

Before, proceeding with the application of the coating, the Contractor shall furnish the Representative/Agent with a certificate from the South African Bureau of Standards stating that material being used complies with SABS Specification 1227 and he shall also furnish proof that the applicator has been approved by the Manufacturer of the coating being used.

(e) Emulsion base wall coating:

Finish on walls shall be an Emulsion Base Coating complying with SABS Specification 1227 and of colour and texture to the approval of the Representative/Agent.

The finish shall be applied in three coats and the texture of the base and second coats shall be compatible with the texture of the finishing coat.

The material (all three coats) shall be applied by an applicator approved by the Manufacturer of the coating being used (or his agent) and shall be mixed and applied in strict accordance with the Manufacturer's instructions.

Before proceeding with the application of the coating the Contractor shall furnish the Representative/Agent with a certificate from the South African Bureau of Standards stating that the material being used complies with SABS Specification 1227 and he shall also furnish proof that the applicator has been approved by the Manufacturer of the coating being used.

The Contractor is to arrange for a trial panel of not less than 1 m² to be done and approved by the Representative/Agent before proceeding with the application.

The coating shall be given a final coat of clear liquid which will dry to a hard glossy surface.

NB: The plaster is to contain NO LIME WHOEVER.

(f) Varnish:

(i) SABS 887, Type I with eggshell finish, but not for use externally.

(ii) Exterior varnish/clear sealer:

Exterior quality varnish/sealer shall be clear when dry. It shall be suitable for universal application to bricks, cement blocks, pavers, cement floors, wood, slates, metal, fibre cement, cork, etc., provided that the surface of such materials allows for proper adhesion.

The material shall be a waterbased acrylic product, non-toxic, non-inflammable and unaffected by ultra-violet rays. In addition, it shall also contain algicides, fungicides and bactericides and be resistant to damage by termites and wood boring insects whilst retaining great flexibility.

Once cured, the material shall be highly resistant to staining by petrol, diesel fuel, oil, hot fat, wine, carbon black grease, chemicals and other substances; it shall not deteriorate, dissolve or wash out.

NB: This material shall be covered by a guarantee, underwritten by a recognised insurance company, as Public Liability Insurance to an amount of R500 000 should the product fail due to material or manufacturing defects.

(g) Rust neutralising paint:

Rust neutralising paint shall be of water based type containing suitable chemicals for converting rust to iron phosphate.

The paint shall be capable of being used successfully as a finishing coat or as a primer under epoxy paints, vinyl, chlorinated rubbers, laquers and coal tars. It shall be suitable for painting on steelwork prior to welding and shall not cause the failure of such welds due to flaking and migration of the paint into the weld area. In addition, the paint shall be suitable for application on wet surfaces without permitting rust creep and/or underrusting of the metal surface.

Preparation of rusted metal surfaces shall be limited to no more than wire brushing of such surfaces using power tools.

NB: This material shall be covered by a guarantee, underwritten by a recognised insurance company, as Public Liability Insurance to an amount of R500 000 should the product fail due to material or manufacturing defects.

18.4 APPLICATION OF PAINT ETC.:

All coats of paint etc. shall be thoroughly dry and where necessary rubbed down before subsequent coats are applied.

All work shall be finished to colour approved by the Representative/Agent. The tints of undercoats shall approximate those of the finishing colour and in order to indicate the number of coats applied and to avoid misses when applying a succeeding coat a slight difference shall be made in the tint of each coat.

Priming on wood surfaces shall be by brush application only. Priming on surfaces other than wood shall be by brush application or, if it is the opinion of the Representative/Agent that the primer and the surfaces are suitable for roller application, the primer may be so applied. Priming applied by brush shall be well worked in to obtain maximum penetration.

Undercoat and finishing coats may be applied by brush or roller.

The use of a spray gun for on site application of paint will not be permitted, except in the case of cellulose and other special paints where spray painting is the accepted method of application. Where spray painting is permitted all surrounding surfaces shall be properly masked.

The finishing coat on woodwork and metalwork shall be of high gloss paint, unless otherwise specified.

All materials shall be used in strict accordance with the Manufacturer's instructions.

18.5 PRIMING:

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

Backs of wood frames and 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 articles are to be painted or not, to prevent moisture seeping into the wood from the mortar bedding.

Wood surfaces shall be knotted, primed and stopped before painting.

Tongued and grooved and rebated edges of boards in batten doors and other such like inaccessible parts of purpose-made joinery shall, before the joinery is assembled, be primed, or where the joinery is to receive a finish other than paint, be given 1 coat of such other finishing material.

Priming to external structural timbers shall be applied before the timbers are fixed in position and shall include all wrought surfaces such as backs of timber fascia and barge boards, sprocket ends, purlins, etc.,

18.6 LIMEWASH:

Limewash shall be prepared as follows:

To 50 kg of fresh UNSLAKED White lime add 7 kg salt and 5 kg tallow or equal mass of boiled linseed oil.

The lime shall be placed in a barrel or other container, clean water added and while boiling the salt and tallow (or oil) mixed in. When slaking is complete the mixture shall be passed through a fine sieve.

In humid atmospheric conditions such as in coastal areas, the salt may be omitted.

18.7 POLISHING:

All wood flooring shall, at completion of all other work, be sanded and given 1 coat of an approved penetrating sealer mixed and applied in accordance with the Manufacturer's instructions and after a period of not less than 48 hours be once polished with approved clear wax floor polish.

18.8 LEAVE PERFECT:

The Contractor shall provide all necessary dust sheets, covers, etc. and shall exercise all necessary care to prevent marking surfaces, walls, floors, glass, electrical fittings, etc. and shall keep all parts of the works perfectly clean and free at all times from spotting, accumulation of rubbish, debris or dirt arising from the operations. Any surface disfigured or otherwise damaged shall be completely renovated or replaced as necessary by the Contractor at his own expense to the Representative/Agent's approval.

The premises shall be left clean and fit for occupation at completion of the work.

18.9 CORROSION PROTECTION OF STRUCTURAL STEELWORK:

(PORTIONS ENVELOPED BY ROOF CLADDING, CEILINGS AND OTHER FINISHES INCLUDED.)

18.9.1 Structural steelwork in coastal areas (within 10 km from coast):

Structural steelwork is to be protected against corrosion as follows:

(a) Preparatory work:

Steel to be cleaned down in accordance with SABS Code of Practice 064.

All metal surface defects such as laminations and welding spatter shall be removed by grinding and sharp edges, rags, burrs, etc. shall be rounded off before cleaning. After fabrication, but before erection, all steel shall be abrasive blasted to a condition as shown under SA21/2 of Swedish Specification SIS 05 59 00—1967. The abrasive used shall be so selected as to give a surface profile not greater than 70 micrometers. All steelwork so prepared is not to be touched by bare hands — linen gloves are to be worn. Before priming all abrasive must be removed by blowing down the structure with air or by means of an industrial vacuum cleaner.

(b) Priming:

Within four hours of abrasive blasting, apply, by air assisted airless spray, 1 coat of inorganic ethyl silicate zinc-rich primer to give a minimum dry film thickness of 70 micrometers.

The primed steel shall be allowed to dry sufficiently so as to limit damage due to handling.

After erection, the steelwork shall be washed down with clean fresh water to remove

all deposited salts or corrosion products of the zinc (white rust) and allowed to dry.

Any damaged areas shall be made good by applying an organic zinc-rich primer that complies with SABS Specification 926. (The application of inorganic zinc over inorganic zinc is not permitted.)

Allow the patch priming to dry before finishing. All traces of soluble salts and corrosive airborne contaminants shall be thoroughly removed with potable water and allowed to dry prior to finishing.

(c) Finishing:

After erection, apply, by airless spray or brush, two or more coats of high build chlorinated rubber or vinyl as required to give a total dry film thickness of at least 140 micrometers, followed by one layer of chlorinated rubber or vinyl top coat having a minimum dry film thickness of 30 micrometers.

(d) General:

No surface preparation or painting shall be performed in adverse weather conditions. Edges are to be stripe painted before application of paint over the whole surface. Back to back sections and areas rendered inaccessible for painting after erection are to receive the full paint system before erection and fixing.

Drying times will be determined according to prevailing weather conditions and the Manufacturer's recommendations.

18.9.2 Structural steelwork in inland areas:

Structural steelwork is to be protected against corrosion as follows:

(a) Preparatory work:

Steel to be cleaned down in accordance with SABS Code of Practice 064.

All metal surface defects such as laminations and welding spatter shall be removed by grinding. Sharp edges, rags, burrs, etc. shall be rounded off before cleaning. After fabrication, but before erection, all steel surfaces to be scraped and wire brushed to Grade St 2 of Swedish Specification SIS 05 59 00-1967. Steelwork so prepared is not to be touched by bare hands - linen gloves are to be worn. Before priming, the surface shall be vacuum cleaned or dry brushed to remove all dust and debris.

(b) Priming:

As soon as possible after surface preparation, the first of two coats of red lead (SABS Specification 312, Type 2, Grade 1) or zinc phospe (SABS Specification 1319) primer is to be applied. Each coat is to have a dry film thickness of at least 25 micron for red lead and 30 micron for zinc phospe. A minimum of 24 hours are to be allowed between coats, or as recommended by the Manufacturer. Any damage to the primer during handling or erection is to be repaired by removing any possible rust etc. and patch repaired to make up the original film thickness. All traces of soluble salts and corrosive airborne contaminants shall be thoroughly removed with potable water and allowed to dry prior to finishing.

(c) Finishing:

After erection, apply two coats of alkyd based structural steel paint complying with SABS Specification 684, Type B, in accordance with the Manufacturer's recommendations. Each coat is to have a minimum dry film thickness of 30 microns.

(d) General:

No surface preparation or painting is to be performed in adverse weather conditions.

Edges are to be stripe painted before application of paint over the whole surface. Back to back sections and areas rendered inaccessible for painting after erection are to receive the full paint system before fixing and erection.

18.10 DESCRIPTIONS (PRICES):

Descriptions (prices) of paintwork shall be deemed to include the preparation of surfaces including filling, stopping, sanding and priming of nail heads and screws.

Descriptions (prices) of paint on pipes, gutters, etc. shall be deemed to include painting holderbats, hangers, clips, brackets, etc.

Descriptions (prices) of paint on windows, sashes, etc. shall be deemed to include priming the rebates of openings to be glazed.

18.11 PAINTING WINDOWS AND DOORS (APPLICABLE TO LUMP SUM CONTRACTS ONLY):

Windows and doors specified to be painted shall be deemed to include painting such windows and doors on both sides.

SECTION 19**EXTERNAL WORK****GENERAL****19.1 SPECIFICATIONS AND DESCRIPTIONS IN OTHER SECTIONS:**

Reference shall be made to other sections for full specifications and descriptions of items not fully specified or described in this section which shall apply equally to the work in this section, unless otherwise described.

19.2 EXCAVATIONS:

Excavations shall be deemed to be in "earth", unless otherwise described.

BITUMINOUS SURFACING:**19.3 PREPARATION OF FORMATION:****19.3.1 Definition:**

The formation level is that level of material above which the specified cover of sub-base and/or base-course material may exactly be accommodated. This level extends under the width of the driveway or parking area including, where applicable, curbing.

19.3.2 Excavation and fill:

The excavation and/or fill shall be carried out to such a depth that after compaction the specified cover can be exactly accommodated. Fill material shall be compacted in 150 mm layers to 100% Proctor Compaction. Only material from excavations, free from all grass roots and other deleterious material, shall be used for the grading of open areas or be otherwise disposed of as directed by the Representative/Agent.

19.3.3 Requirements:

The finished surface of the formation is to be tested for smoothness and accuracy of elevation. At no position shall the top of the formation be more than 3 mm above or 10 mm below the specified level and, when tested with a 4 m long straight edge, be more than 10 mm out of level. The area must be protected effectively against storm-water by adequate drainage to prevent softening.

The formation must be approved by the Representative/Agent before construction of the base courses, curbing or concrete edging is commenced.

19.4 CRUSHER RUN BASE COURSE:**19.4.1 Graded crushed stone classification:****(a) Coarse aggregate:**

Coarse aggregate shall consist of hard, durable and sound crushed stone that has the properties set out in Subclause 19.4.2. It shall be free from shale, mica, coal, weathered and decomposed rock, clay and other deleterious material.

(b) Fine aggregate:

Fine aggregate shall be a product of the crushing process and shall be material passing a sieve of nominal aperture size 2,36 mm. The crusher installation shall be capable of producing graded crushed stone material complying with Subclause 19.4.2 except, where the nature of the rock is such that the material is deficient in fine aggregate, the Representative/Agent may allow the admixture of approved soil fines,

crusher fines, or sand in limited quantities. The total amount of such admixed fines and sand shall in no case exceed 15% by mass of the aggregate.

- (c) Combined aggregate:
Combined coarse and fine aggregate shall comply with the requirements set out in Subclause 19.4.3.

19.4.2 Graded crushed stone:

The crushed stone placed in the base shall comply with the requirements of SABS Specification 1083, where applicable, and with the following additional requirements:

- (a) The maximum dimension of crushed stone shall not exceed two-thirds of the thickness of the compacted layer.
- (b) The pH of the crushed stone, determined in accordance with Test Method A20 of TMH 1 shall, in the case of untreated crushed stone and, when relevant, before cement is added, be at least 6.
- (b) The portion of crushed stone passing a sieve of nominal aperture size 4,75 mm shall conform to the following requirements:
 - (i) The percentage by mass of soluble salts shall not exceed 0,2%;
 - (ii) the percentage by mass of magnesium suipec (as MgSO₄) plus sodium suipec (as Na₂SO₄) shall not exceed 0,05%.

19.4.3 Graded crushed stone and soil fines:

Graded crushed stone that is mixed with soil fines shall comply with Subclause 19.4.2, but the soil fines shall comply with the following requirements:

- (a) The liquid limit shall not exceed 25;
- (b) the P₁ shall not exceed 6;
- (c) the linear shrinkage shall not exceed 3.

19.4.4 Construction:

The underlying layers shall be approved by the Representative/Agent before any construction work is undertaken.

Crusher run material shall be dumped in windrows such that when flattened out it will form a layer covering the driveway surface to the depth specified after compaction.

The material shall be thoroughly blade mixed by means of a motor grader and shall be bladed from one side of the driveway or area to the other in ^ successive cuts made to the full depth of the layer.

The mixture shall be maintained at near saturation point during the mixing process. Mixing shall continue until uniformity is obtained.

The mixture shall be shaped and levelled off evenly, true to required lines, grades and cross sections and to such thicknesses that, after compaction, the base shall conform to specified requirements.

19.4.5 Compaction:

Immediately after spreading, initial rolling shall be carried out with pneumatic tyred rollers of not less than 15 tons mass.

To avoid fines being washed to the bottom of the layer, no application of additional water shall be allowed during the initial compaction.

After the whole surface has been covered at least three times, rolling from sides to centre, the layer shall be cut to the required grades and cross sections.

Rolling shall continue until all material displaced or loosened by cutting and shaping has been kneaded firmly into the layer.

Further rolling shall be carried out by means of 3-wheel tyred rollers of not less than 12 tons mass as soon as the layer has dried off sufficiently. Rolling is to be from the sides to the centre with half wheel laps.

19.4.6 Slushing:

On completion of the secondary rolling, sections are to be thoroughly watered, rolled and slushed by means of flat tyred rollers until excess fines are brought to the surface. These fines are to be broomed over the surface to correct any spots deficient in fines. The operation is to continue until no perceptible movement or waving under the rear wheels of the 12 ton rollers is evidenced.

Any patch or section where the road is out of shape, or insufficiently slushed, is to be corrected, remixed or replaced to the satisfaction of the Representative/Agent.

Care must be taken not to saturate the sub-base during this operation.

19.4.7 Requirements:

The base course shall conform to the following requirements:

Compaction: 88% solid density.

Cross section: To within 10 mm.

Thickness: To within 10 mm,

Smoothness: Surface is to be free from any irregularities exceeding 5 mm measured with a 4 m long straight edge parallel with the centre line.

Wave or corrugations: Surface is to be entirely free of waves or corrugations.

19.5 SURFACING OF BITUMINOUS PRE-MIX CARPET:

19.5.1 Prime coat:

The prime coat is to be either Iscor No "0" Tar Primer sprayed at the rate of 0,70 litres/m² at a temperature of between 45 °C and 50 °C; or

MCO Cutback Bitumen sprayed at a rate of 0,70 litres/m² at a temperature of between 20 °C and 30 °C.

19.5.2 Pre-mix carpet: Bituminous emulsion:

The bituminous emulsion is to contain 55% to 60% bitumen and is to conform to SABS Specification 306/309, Type A.

19.5.3 Stone chippings:

Stone chippings are divided into two sizes:

No 1; Passing 10 mm sieve, retained on 5 mm sieve. No 2: Passing 5 mm sieve, retained on

2 mm sieve.

Chippings are to be sound, angular in shape, free from flakes and slivers, clean, uniformly graded, of igneous origin and approved by the Representative/Agent.

19.5.4 Sand filler:

Sand filler is to be clean, dry, quartzitic sand, well graded and free from soft or soluble particles, mica or vegetable matter.

19.5.5 Construction:

PRIME COAT - Before spraying the prime coat, the base course is to be swept clean and free from all dust, dirt and loose particles by mechanical or manual bristle or bass brooms leaving a hard, uniform, smooth, mosaic surface.

At the discretion of the Representative/Agent the surface is to be given a light application of water, 2 hours before the application of the prime coat.

After cleaning and watering, no further traffic shall be allowed on the road or area until the final surfacing has been completed.

All kerbs and channels, catch pits or other structures shall be properly protected with plastic covers or sand layers such that they do not become discoloured during the priming operation.

Priming is to be carried out only after surface has been approved by the Representative/Agent and only in fine weather when the temperature is above 10 °C.

After priming, the surface shall be allowed to dry out properly before the application of the pre-mix surfacing.

19.5.6 Pre-mixed bituminous surfacing:

The pre-mixed material is to be prepared as follows:

Approved stone chippings in the proportion of 50% of 3 mm stone chippings and 50% of 6 mm chippings are to be mixed with bituminous emulsion binder at the rate of 1 cubic metre of stone to 120 litres of emulsion at atmospheric temperature.

The binder is to be added to the stone and mixed until the stone is uniformly coated. Thereafter 5 per cent of clean dry sand is to be added and is to be evenly distributed through the mixture and thoroughly incorporated therein.

The mixture is to be spread immediately after mixing and is to be rolled on the same day.

Spreading shall be done evenly over the prepared base to a loose depth of approximately 30 mm to ensure a consolidated thickness of 25 mm. This spreading shall be performed by means of drag spreaders, rakes and screeds. (The cover ratio is 33 m² per cubic metre of pre-mix.)

Where hand spreading is used, the pre-mix shall not be dumped on the base, but shall be taken from the boards or barrows by shovel and evenly distributed over the base course. Hand raking must be kept to the minimum to avoid separation of the aggregate.

Rolling shall commence as soon as the binder has set sufficiently. This must be done initially with pneumatic rollers and finished with 6-8 tonne flat tyre rollers.

Places inaccessible to the roller shall be compacted with vibratory pad equipment and/or 100 N hand tampers.

Surfacing shall not be carried out in wet weather or when the ground temperature is below

10 °C.

After three days, the final rolling shall be carried out during the hottest part of the day.

A light application of crusher dust may be required by the Representative/Agent during final rolling.

19.5.7 Requirements:

The surface is to be correct and true to grade and level. The surface is to be uniform throughout such that when a 4 m long straight edge is placed parallel to the centre line, the surface shall nowhere vary more than 5 mm from the lower edge.

The Contractor shall not proceed with the construction of any course in the above work prior to an inspection having been carried out and written approval given, by a Professional Engineer, for the proceeding course.

19.5.8 Final course bitumal slurry seal:

Sweep the whole surface with a soft broom. Apply a bitumal slurry seal to the pre-mix as follows:

CRUSHER SAND AGGREGATE:

NOMINAL APERTURE SIZE (mm)	CUMULATE %	MASS	PASSING
2,80		95 - 100	
1,18		70 - 95	
0,600		50 - 70	
0,300		30 - 50	
0,150		15 - 30	
0,075		6	

Mix with bitumals D M 55 in the proportion of 2,5 parts (by volume) of dry aggregate to 1 part (by volume) of bitumals at the rate of 270 to 300 m²/ cubic metre. This quantity is not to be altered without consulting the Chief Engineer: Civil Works.

The final surface must be applied with rubber squeegees to leave a smooth unmarked surface.

The paving shall be surrounded with precast concrete set stones or extra hard burnt brick on edge, set in the ground flush with the tarmac surface and neatly jointed and pointed in 3:1 cement mortar.

19.5.9 Descriptions (prices):

Descriptions (prices) of bituminous premix road surfacing shall be deemed to include protection of kerbs, channels, buildings, etc.

Descriptions (prices) of channels, humps and shoulders formed in road surfacing shall be deemed to include the formation of channels, humps and shoulders in base course, sub-grade, etc. and for angles, ends, etc.

Descriptions (prices) of concrete ..kerbs, channels, etc, shall be deemed to include necessary excavation, risk of collapse of the sides of excavations, keeping excavations free from water, filling back and compacting, spreading and levelling of surplus excavated material over site.

ROADSTONE SURFACING19.6 INTERLOCKING CONCRETE ROADSTONES:

After the base course has been approved and the curbing completed, the prepared base must be treated with a weedkiller similar or equal to HYVAR X at the rate of 4 g/m².

Spread a plus minus 45 mm thick loose layer of bedding sand (to compact to 25 mm). The sand shall be sharp and well graded, silt or clay content not exceeding 3%, with 85% or more passing a 2,36 mm sieve.

The sand must be levelled using straight edges or other suitable means. The sand surface must not be disturbed or walked upon before placing the blocks.

Approved, 80 mm thick, interlocking, 30 MPa concrete roadstones with chamfered top edges are to be laid in a herringbone pattern and compacted with a plate vibrator until the desired line and level is achieved whereafter the sweeping of sand into the joints and additional passes of the plate vibrator are made until the joints are completely filled. The filling sand shall be finer than that used for bedding and should completely pass a 1,18 mm sieve, 90% or more being retained on a 0,075 mm sieve.

Pedestrian walkways and pavements are to be constructed as specified above, except that base and subbase courses are to be omitted, 65 mm - 30 MPa blocks and 25 mm bedding sand is to be laid on the prepared formation.

NB: The exclusion of the use of weedkiller may be indicated on the drawings.

FENCING19.7 GALVANISED WIRE AND WIRE MESH FENCING:

Galvanised wire and wire mesh fencing shall be constructed as follows:

19.7.1 Wire fencing:

Wire fencing shall be 1,2 m high, formed with five strands of 4 mm diameter galvanised mild steel wire passed through the holes in standards, all tightly strained and attached to posts at one end with not less than four turns and at other end with 12 mm diameter galvanised mild steel straining eye bolts, 300 mm long, or permanent wire strainers, passed through holes in the corner posts.

Fencing shall be provided with approved mild steel standards, 1,8 m long, of the Bell Post type having a mass of not less than 4 kg eachy or of H or bulb T section having a mass of not less than 5,4 kg each, driven 0,6 m into the ground at not more than 3 m centres, and with two H section or T type droppers, having a mass of not less than 0,7 kg each, to each bay and attached to the wire strands with 2 mm diameter galvanised wire.

At corners, ends and intersections of fencing and intermediately at not exceeding 90 m centres, or less where so directed, posts of not less than 65 mm inside diameter mild steel tubing having a wall thickness of not less than 3,25 mm shall be provided. Each post shall be 2 m long, fitted at top with mushroom cast iron or pressed steel cap, welded in position, and at bottom with 225 x 225 x 5 mm thick mild steel sole plate firmly bedded 0,8 m deep in the ground and with each surround, just below ground level, with a 400 x 400 mm or 400 mm diameter Class B concrete block, 450 mm deep. The posts shall be holed for straining eye bolts or permanent wire strainers and wires as necessary all fitted with 2 m long stays, of not less than 40 mm inside diameter mild steel tubing having a wall thickness of not less than 2,90 mm, with top ends flattened, holed for and bolted to posts with M12 bolts and bottom ends fitted with 225 x 225 x 5 mm thick mild steel sole plates, all bedded 0,6 m deep in the ground and each surrounded with a Class B concrete block, size 300 x 300 x 300 mm. End and intermediate posts shall each be fitted with one stay and corner posts and posts at intersections of fencing each with two stays.

All wire shall comply with the requirements of SABS Specification 675, and the galvanising shall be of second class quality as laid down therein.

Posts and stays shall be painted with two coats approved bituminous aluminium paint and all sole plates and portions of posts and stays in ground shall be well tarred.

19.7.2 Wire mesh fencing:

Wire mesh fencing shall be 1,2 m high, formed with three strands of 4 mm diameter galvanised mild steel wire, one strand at top, one at bottom and one in centre of fence, attached to posts fitted with stays and to standards spaced not more than 3 m apart, all as described in Subclause 19.7.1 for wire fencing.

Fencing shall be covered with 50 mm mesh chain link netting of not less than 2,5 mm diameter galvanised mild steel wire as described in Subclause 19.7.1, properly strained and secured to posts, standards and wire strands with 2 mm diameter galvanised wire.

Posts and stays shall be painted with two coats approved bituminous aluminium paint and all sole plates and portions of posts and stays in ground shall be well tarred.

19.7.3 Gates:

Gates shall be formed of 25 mm internal diameter mild steel piping with all joints welded, strongly braced as and where necessary, and filled in with netting as described in Subclause 19.7.2, properly strained and securely bound to the piping with 2 mm diameter galvanised wire.

All gates shall be 1,2 m high and, unless otherwise described, single gates shall be 1 m wide and double gates 3,1 m wide.

Gates shall be hung on adjustable hinges. Each single gate shall be provided with steel spring catch and each double gate with U-shaped catch and drop bolt engaging in wrought iron stop embedded in Class B concrete block size 300 x 300 x 300 mm in the ground.

Gate posts shall be 2 m long, each fitted with cap, sole plate and one stay complete with sole plate, all as specified for fencing posts.

The gates, gate posts and stays shall be painted with two coats approved bituminous aluminium paint and all sole plates and portions of posts and stays in ground shall be well tarred.

19.8 PLASTICS COATED MESH FENCING FOR COASTAL AREAS:

The wire mesh fencing to be of green plastics coated chain link fencing wire in accordance with SABS Specification 1373. The wire is to be at least 2,5 mm thick (3,55 mm over plastics coating) and with Class A galvanising as described in Clause 3.1.1 of SABS Specification 1373, with 50 mm meshes as in Clause 3.3 and both sides clinched as in Clause 3.4.2; 1,2 m wide and in 30 m rolls as in Clause 3.6. Prior to delivery, the wire is to be packed and marked as described in Clause 4.1 and 4.2 and in addition to be furnished with a certificate, certifying that the fencing wire complies in all respects with the Specification and that it will pass the tests for resistance to accelerated weathering, salt, fog, heating and chilling.

The plastics coating used shall be suitable for the purpose intended, be of a composition recommended by the Manufacturer and which can be expected to endure at least five years of normal service outdoors. The plastics coating must be of a good adherent quality.

Suitable grades of plastics include PVC (with no more than 10 percent re-worked material of the same grade) such as "Welvic" W1/U1 (B S Softness 10) Grade or "Welvic" W0/U54 (B S Softness 6) Grade, using reliable pigments for the colouring and which will not deteriorate when in use.

During the extrusion coating of the wire, good control is to be exercised to ensure that no cracking at bends of the wire will take place.

The straining wires are to be at least 3,15 mm diameter of Class A galvanising (3,90 mm diameter over plastics coating) and the binding wire is to be 1,8 mm diameter of Class A galvanising (2,55 mm over plastics coating).

The fencing is to be 1,2 m high, formed of three straining wires, one at top, one at bottom and one in centre, firmly secured to corner posts, end posts or distance posts including intermediate posts with not less than four turns tightly strained around corner posts, end posts or distance posts and to be covered with chain link fencing wire, properly and firmly strained and fixed to posts and straining wires with binding wire.

Great care is to be exercised during the erection of fencing to ensure no cracking, punctures or cuts will occur, which could permit rusting and accelerated disintegration, whilst using bending tools, pliers, etc.

Posts and stays are to be of tapered gumpoles treated with creosote as described in SABS Code of Practice 05. Corner posts, end posts and distance posts are to be 100 to 150 mm in diameter and intermediate posts and stays 75 to 100 mm in diameter. Distance posts shall be planted not more than 90 m apart and intermediate posts at not exceeding 3 m apart, with two 50 mm diameter creosoted gumpole droppers to each bay and attached with binding wire as specified.

Corner posts, end posts and distance posts are to be 2 m long, each planted 0,8 m deep into ground and embedded in a Class B concrete block, size 600 x 600 x 800 mm deep. Intermediate posts and stays are to be 1,8 m and 2 m long respectively, each planted 0,6 m deep into ground and embedded in a Class B concrete block, size 500 x 500 x 600 mm deep. Corner posts and distance posts shall each be provided with two stays and end posts with one stay. The stays are to be fitted in an approved manner in checks to posts and bolted with M12 galvanised bolts with nuts and washers.

Gates:

Gates shall be formed of 25 mm diameter hot dip galvanised heavy type mild steel piping with all joints welded, strongly braced as and where necessary, and filled in with plastics coated mesh as described above, properly strained and securely bound to the piping with binding wire.

All gates shall be 1,2 m high and, unless otherwise described, single gates shall be 1 m wide and double gates 3,1 m wide.

Gates shall be hung on adjustable hinges, each single gate shall be provided with steel spring catch and each double gate with U-shaped catch and drop bolt, engaging in wrought iron stop and embedded in Class B concrete block, size 300 x 300 x 300 mm in the ground. Hinges, catches, drop bolt and stop shall be hot dip galvanised.

Gate posts shall be 2 m long, all as described for fencing posts. The gates shall be painted with two coats approved bituminous aluminium paint.

19.9 DESCRIPTIONS (PRICES):

Descriptions (prices) of fencing shall be deemed to include embedding posts, stays, etc. in and including concrete blocks as specified, excavation in "earth", including risk of collapse of the sides, keeping excavations free from water, filling back and compacting, spreading and levelling of surplus excavated material over site and straining of wire strands and mesh.