

**MOKOLO AND CROCODILE
WATER AUGMENTATION PROJECT
PHASE 2 (MCWAP-2)**

TENDER NO 054/2024/PMID/MCWAP2/RFB

**PART C3.1
SPECIFICATION**

SECTION 46

BUILDING WORKS

PART C3.1 SPECIFICATION

SECTION 46 BUILDING WORKS

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SECTION 46

BUILDING WORKS

46.1 SCOPE

The general Building Works are Employer Designed.

This Section covers the requirements for materials and workmanship in the construction of general building work. Materials and construction techniques required by the Bill of Quantities or the Drawings which are not covered by a Clause in this Section shall be supplied and constructed strictly in terms of the appropriate Clauses of SANS 10400, The Application of the National Building Regulations and Regulations issued in terms of the National Water Act.

46.2 NORMATIVE REFERENCES

46.2.1 Definitions

For the purposes of this Section, the definitions and abbreviations given in SANS 10400 as well as the following shall apply:

Wet Services in Buildings: Drainage, Plumbing, Sanitation and Water Disposal as per:

- SANS 10252;
- SANS 10254; and
- SANS 10400- Parts P, R and W;

Wet Services Reticulation: Water supply systems, sewer systems and stormwater systems upstream of the water connection point and downstream of the sewer or stormwater connection points.

46.2.2 Abbreviations

BS EN	:	British Standard and European Norm
BS	:	British Standard
BoQ	:	Bill of Quantities
CQC	:	Construction Quality Control
HDPE	:	High Density Polyethylene
HT	:	High Tensile
MQC	:	Manufacturing Quality Control
NFX	:	Non-Facing Extra
PVC	:	Polyvinyl Chloride
PWD	:	Public Works Department.
SANS	:	South African National Standard
WC	:	Water Closet
UV	:	Ultraviolet

46.2.3 References

When reference is made to a Code of Practice, Specification or Standard, the reference shall be taken to mean the latest edition or replacement at time of tender of the Code, Specification or Standard; including addenda, supplements, modifications and revisions thereto. Where a previous version is intentionally used, it will be indicated as such. Where reference is made to a Code, Specification or Standard that has subsequently been withdrawn and not replaced, the intended content will remain relevant unless confirmed otherwise in writing by the Engineer.

SANS 10400 - The Application of the National Building Regulations applies.

The standards and regulations listed in Annexure 46/1 shall also apply to this Contract. Where SANS 10400 refers to other standards and publications, such standards and publications shall form part of the Contract only in so far as they are referred to.

Annexure 46/2 Lists the applicable project specific specifications for the manufacture, supply and testing of thermoplastic pipes.

46.3 REQUIREMENTS

46.3.1 Drainlayer

The materials used in the construction of sewers, stormwater, manholes and catch pits, and bedding shall comply with all the relevant requirements of Section 15 – Backfilling and Bedding, and Section 27 – Drainage and Erosion Protection.

46.3.2 Excavator

The construction activities dealing with general excavation and trench excavation shall be carried out strictly in accordance with the requirements of Section 9 - Bulk Surface Excavations and Trenching.

46.3.2.1 Filling

Filling shall be G5 material complying with the relevant requirements of Section 25 – Roadworks and Paving, compacted as specified in Clause 46.4.2.1, unless otherwise stated.

46.3.2.2 Hardcore Filling

Where shown on the Drawings or instructed by the Engineer, hardcore filling shall be 150 mm thick unless otherwise specified and shall be formed with hard broken stone or brick of 75 mm maximum size, blinded with clean sand.

No clay, rubbish, tins, wood or vegetation or other debris shall be used in hardcore filling.

46.3.3 Concrete

In addition to Section 20 – Concrete Works (Structural), the following shall apply:

46.3.3.1 Polythene Sheeting

Polythene sheeting shall comply with SANS 952, Type B, 0.25 mm thick. All joints shall be overlapped and sealed by pressure-sensitive tape.

46.3.3.2 Pre-Stressed Concrete Lintels

Subject to prior written approval, pre-stressed concrete lintels may be used provided that they have been manufactured in an approved factory, of mix 35 MPa / 6.7 mm strength concrete, reinforced with steel wire not less than 4 mm diameter, and tensile strength 1300 to 1380 MPa stressed to not less than 900 MPa. The number of reinforcing wires in concrete lintels for the various spans shall be as set out below:

Width of opening (m)	Reinforcing per half brick soffit width
Under 1.80	2 x 4 mm HT wire
1.80 to 3.00	3 x 4 mm HT wire

Such lintels shall be not less than 60 mm deep and suitably roughened, indented or shaped to give a good bond between the lintel and the mortar for the first course of brickwork above.

46.3.4 Masonry

46.3.4.1 Masonry Units

All masonry units used on the Works shall comply with SANS 227 and SANS 1215. They shall be of either burnt clay or concrete as shown on the Drawings or scheduled in the Bill of Quantities. They shall be free from cracks, stones, unground lumps of material, lumps of lime or other defects, and when two are struck together shall give a clear ringing sound. Face bricks shall be hard-burnt and the colour shall be subject to approval. The degree of efflorescence shall be nil.

Masonry units shall be obtained from an approved manufacturer and the Contractor shall submit to the Engineer, at least 28 days before commencement of the work, sample units which if approved will be retained by him as standards. Sampling shall be carried out in accordance with section 6 of SANS 227 and SANS 1215. The Engineer shall have the right to reject any consignment from which units taken at random are not equal in all respects to the standard. The delivery and removal of these shall be solely at the Contractor's cost.

Except where otherwise stated on the Drawings or in the Bill of Quantities, NFX (non-facing extra) bricks complying with SANS 227 for general purpose (special) class of masonry units shall be used.

Bricks for lintels, and for those parts of the structure where chases are required, shall not contain cavities or perforations.

The minimum compressive strength of bricks shall be 7 MPa for walls up to 3 m high and 14 MPa for walls exceeding 3 m in height.

46.3.4.2 Sills

Where external sills are required to be of masonry, the units shall be glazed burnt clay face bricks or concrete units laid on edge.

Where shown on the Drawings or scheduled in the Bill of Quantities, windowsills, internal and external, shall be quarry tiles of the sizes specified. They shall be hard-burnt of approved colour and manufacture, true and even in thickness and in shape and colour, with good appearance, free from all defects and blemishes.

46.3.4.3 Mortar

Lime shall be best quality pressure hydrated type A2P and shall comply with SANS 523. It shall be well slaked and properly hydrated. Cement for mortar shall comply with SANS 50197-1 as specified for concrete.

The sand shall be clean pit sand free from clay or other impurities and shall comply with the requirements of SANS 1090 and shall be properly screened and washed if directed by the Engineer.

The water shall be approved quality fresh water.

Unless otherwise specified, the mortar for masonry shall be Class II in accordance with SANS 10249 and SANS 10165 (1) with mix proportions as follows:

- Cement (kg) : 50;
- Lime (litres) : 0-40; and
- Sand (litres) : 200 – measured loose and damp.

Note: No mortar plasticiser to be used.

46.3.4.4 Wall Ties, Wall Reinforcing and Wall-Plate Anchors

Wall ties for cavity walls (cavity not exceeding 75 mm) shall be 3.50 mm galvanised steel wire ties equal to the "modified PWD Type" or "Butterfly" type wall ties and shall comply with the requirements of SANS 28.

Wall ties for cavity walls (cavity exceeding 75 mm) shall galvanised vertical twist plate ties complying with SANS 10164-1 Figure 1.

Brickforce or masonry reinforcing mesh shall be hard-drawn mild steel, comprising two 2.8 mm diameter main wires spaced 75, 150 or 230 mm apart, and 2.8 mm diameter cross wires spaced not more than 300 mm apart and welded to the main wires.

Reinforcing for lintels and other brickwork where ordered shall be either hard drawn steel wire of 572 to 695 N/mm² ultimate strength or mild steel, both complying with SANS 920. (See also Clause 46.4.4.4).

Wall-plate anchors shall consist of 32 mm wide by 1.6 mm thick galvanized hoop iron 1.5 m long and anchored at least 5 courses before wall plate level.

Anchoring of brick in-fill panels to reinforced concrete or structural steel columns shall be by means of a continuous galvanised lug system, eCo TIBOND, or equivalent approved.

46.3.4.5 Damp Proofing

Damp proofing between filling or blinded hardcore filling and the underside of ground floor slabs or surface beds shall be 250 micron polyethylene sheeting that complies with SANS 952, i.e. USB Green co ex 250 ® or equivalent approved.

The damp-proof course in the brickwork shall consist of BRICKGRIP DPC 375 ® bearing AGREEMENT 2001/284, or equivalent approved, well lapped at joints and intersections and bedded and joined in cement mortar.

46.3.4.6 Air Bricks

Air bricks shall be approved terra cotta or concrete, with vermin proof copper / PVC gauze at back, built in on the outside face of walls. On the inside face 225 x 150 mm square pattern fibrous plaster air gratings with vermin proof copper / PVC gauze at back shall be built in.

46.3.5 Carpentry and Joinery

46.3.5.1 Construction Timber

All timber used shall be of good sound quality thoroughly seasoned, straight, sawn square and free from sap and reasonably free from shakes, large, loose or dead knots, sapwood and diminishing edges.

Unless otherwise specified, all timber work for constructional purposes shall be in "stress graded" timber, complying with the requirements of SANS 1783-2, except that no finger joints within 500 mm of the end of any member, and not more than one finger joint per 3 m length will be accepted. Timber shall be ordered in the nominal cross sectional dimensions and to the nearest 0.3 m length in which it is to be used, except that finger jointed timber made according to SANS 10096 will be permitted.

Timber for brandering shall comply with the requirements of SANS 1783-4.

All softwood timber shall bear the mark of the South African Bureau of Standards.

All timber shall be treated against insect and other wood damaging infestation according to the recommendations of the Department of Entomology, SANS 673 and SANS 10005.

All timber to be built into walls and wall plates shall, in addition to the above, receive two coats of Solignum, Carbolineum or other approved wood preservative, or be wrapped in 250 micron polythene sheeting.

Fascia and barge boards if scheduled or shown on the Drawings as timber, shall be manufactured from stress graded SA Pine treated with Tanalith® to an H3 Hazard class.

46.3.5.2 Joinery Timber

The type of timber shall be as approved by the Engineer prior to the commencement of manufacture.

All timber used for joinery shall be best quality, specially selected, treated against insects as specified in Clause 46.3.5.1, and shall be of good sound quality, well kiln dried and free from sap, large loose or dead knots, shakes, diminishing edges or other defects or blemishes such as flower grain. Solid shelving shall comply with SANS 1783-3.

The glue used shall be compatible with the treatment applied against insect attack and shall comply with SANS 1349. In the case of external doors, an approved waterproof glue shall be used.

46.3.5.3 Timber Doors, Door Frames and Windows

All timber doors, door frames and windows shall be of stout design and construction and of the type listed in the Bill of Quantities.

(a) External Doors

Standard type external doors, shall be of hardwood, and, unless otherwise dimensioned on the Drawings, shall be 2 032 x 813 x 45 mm single leaf, framed, ledged and braced and, except for vertical V-jointing, flush on the outside. The stiles and top rail shall be 140 x 45 mm, middle rail 140 x 23 mm and bottom rail 215 x 23 mm. Bracings shall be 115 x 23 mm. Door panels shall consist of 95 x 22 mm vertical boarding, tongued and grooved and V-jointed on the outside. Panels shall be tongued into slots in stiles and top rails and countersunk-screwed with brass screws to middle and bottom rails and bracings. Where doors are fitted with louvres, the bottom rail shall be 215 x 45 mm, and louvre slats and linings shall be tongued to the stiles and bottom rail. The slats shall be not less than 55 x 10 mm, and spaced at a maximum of 45 mm centre to centre, and sloped downwards to the outside. Louvered doors shall be fitted with vermin proofing on the inside.

Where special bullet resistant doors are specified, these doors shall be capable to protect against a 7.62 mm x 51 mm calibre.

Where listed in the Bill of Quantities, external double doors shall be made in two leaves to the overall dimensions shown on the Drawings, shall be of similar construction to the standard door described above, and shall have rebated stiles meeting flush at the centre.

Where softwood timber Z type doors are listed in the Bill of Quantities, they shall be made to the overall dimensions shown on the Drawings, ledged and braced and, except for vertical V jointing, flush on the outside. The top rails shall be 165 x 45 mm, the middle and bottom rails shall be 165 x 23 mm, and braces 115 x 23 mm. Door linings shall be 95 x 22 mm, tongued and V-grooved, and shall be countersunk screwed with brass screws to rails and braces.

The jambs and head of standard size external frames shall be 95 x 70 mm, while the sill shall be 95 x 45 mm with both a drip mould and groove for the weather strip cut in. All frames shall be rebated.

(b) Wooden Flush Doors

Wooden flush doors shall comply with SANS 545 and shall, unless stated otherwise, be single interior class, hollow core type, 2030 x 812 x 40 mm size, without openings, have top and bottom rails at least 70 mm wide, be clad with plywood type 1A and grade A to SANS 929, unless otherwise specified on the Drawings, and be fitted with two solid timber edge strips. The doors shall be painted.

The jambs and head for internal doors shall be 70 x 70 mm.

(c) Windows

Windows shall be constructed in accordance with the detail on the Drawings, or shall be obtained from the manufacturer specified or scheduled.

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

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

All window frames shall be grooved as required for plaster.

(d) Ceilings

Ceilings shall be 6 mm thick fibre cement cellulose ceiling board complying with SANS 803 or 6.4 mm thick gypsum ceiling board complying with SANS 266, and shall be fitted to branding of approved dimensions depending on the truss / rafter spacing.

Cove cornices shall be fitted to all ceilings. For fibre cement ceilings the cornices shall be 55 mm radius x 6 mm thick fibre cement cove cornices and for gypsum board ceilings they shall be 75 mm gypsum cove cornices.

Joints between ceiling boards shall be covered with 25 mm half-round hardwood cover strips. Gyproc Rhino Lite Multipurpose shall be applied to plasterboard surface to a minimum thickness of 3 mm and finished off with rubber float and steel trowel. The surface for application shall be clean and free of dust, etc. before application.

Where specified, suspended ceilings shall consist of a proprietary suspended grid ceiling system with 9 mm thick tapered edge plasterboard, fixed at right angles to 35 mm concealed face suspended ceiling grid system with 24 x 35 mm high galvanised steel knurled capped main tees at 1200 mm centres and cross tees at 400 mm centres, using 25 mm drywall screws at 150 mm centres. Ceiling perimeter to be finished using 25 mm proprietary Shadowline edge trim, or similar approved with all joints to be taped and plastered using jointing compound and prepared for decoration, all in accordance with SABISA (South African Building Interior Systems Association) installation guides, or similar approved.

(e) Roofing

The type of roofing shall be as scheduled or shown on the Drawings.

Fibre cement roofing shall comply with SANS 685 and shall be straight "Big Six" or "Canadian Pattern" corrugated sheets with a minimum thickness of 5.5 mm and depth of corrugations of 57 and 60 mm, respectively.

Aluminium "Longspan" roofing shall be in straight sheets 0.58 mm thick and shall comply with SANS 903 with profile complying with ISQ550. Sheets to be fixed to trusses with concealed hurricane clips, by a supplier-approved contractor.

Clerestorey Lighting Panels shall be UV stabilised, 1.25 mm thick Polycarbonate sheeting, IBR profile, by Modek, Colour – Grey, with shade coefficient of 0.46, mechanically fixed to mild steel sub-frame, install to supplier's details, to receive 10 year guarantee from manufacturer, or similar approved.

Corrugated galvanized iron sheets shall be 0.63 mm thick before being galvanized. Ridges and hips shall be the same gauge as the sheeting, shall be 450 mm in girth and have a roll top.

"Double Roman" cement tiles shall comply with SANS 542. Their colour shall be subject to approval by the Engineer.

Fascia and barge boards shall be of aluminium, sizes specified on the drawings, unless timber boards are scheduled or shown on the Drawings.

No reflective materials may be used. Coating colours to comply with environmental requirements.

(f) Roofing Underlay

Where indicated or shown on the Drawings, roofing underlay shall be:

- Polyethylene sheeting complying with the requirements of SANS 952, Type E, having a nominal thickness of 250 micron; or
- Three ply, high-tensile, tear resistant, non-woven, poly laminate membrane of 400 micron thickness comprising three layers, two 40 gsm non-woven, spunbond polypropylene fabric outer layers sandwiching a 20 gsm polypro / polyethylene core, as specified on the Drawings or listed in the Bill of Quantities.

46.3.6 Ironmongery

46.3.6.1 Ironmongery

Ironmongery shall be of the strongest manufacture and best finish. "Bakelite" or similar plastic furniture will not be accepted. Samples of each item of ironmongery shall be submitted for approval before any particular item is ordered and fixed.

Barrel bolts shall be 150 mm. Hinges for internal and inward opening doors shall be 100 mm loose pin brass or steel butts depending on the material to which they are to be fixed. Hinges for outward opening external timber doors shall be "Parliament" or projection type fixed with 50 x 12 gauge brass screws. All external doors shall be fitted with one and a half pairs of hinges.

Brass screws shall be used for fixing ironmongery to hardwood. Unless otherwise specified, screws shall be of metal similar to the article to be fixed in the case of metal frames, doors or windows.

Locks for external doors shall be fully rebated heavy quality, 4 lever mortice with bronze or chromium plated furniture. All locks shall be provided with two keys, and all locks shall differ so that the key of any lock will open no lock other than the one to which it belongs.

All outward opening doors shall be fitted with eyes and corresponding 100 mm brass hooks shall be fitted to the walls for holding the doors open. A suitable stop shall be fitted to prevent the door knob from damage against the walls.

All Z-type doors shall be fitted with brass handles and black japanned rim lock with 2 keys. They shall be fitted with 2/250 mm mild steel Tee hinges.

All internal doors shall be fitted with 2-lever mortice locks complete with bronze or chromium plated furniture and locking plates as listed in the Bill of Quantities.

46.3.6.2 Steel Windows and Doorframes

Windows shall be constructed of suitable approved malleable mild steel and of approved medium universal profile. They shall be provided with adequate lugs for fixing to brickwork and be complete with all fittings. They shall comply with the requirements of SANS 727 for Steel Windows and Steel Doors.

Steel doorframes shall be of approved profile manufactured from annealed mild steel, 1.60 mm in the case of single rebated or 1.25 mm in the case of double rebated frames, complying with SANS 727. The whole frame shall be welded into a rigid unit. The specified number of 100 mm loose pin steel hinges for the type of door to be hung shall be welded on to each frame. Frames shall also be fitted with an adjustable plate with mortar guard suitable for a mortice lock.

Steel windows and doorframes shall be hot dip galvanized in accordance with SANS 121, with a minimum mean thickness of zinc coating of 55 micrometre, treated with a metal etch primer complying and painted with one coat of zinc chromate primer complying with SANS 679 type with SANS 723 I at the factory. If any galvanized sections are subsequently welded or damaged in any manner, damage to the galvanizing shall be made good by sand blasting followed by application of zinc coating or otherwise repaired as directed by the Engineer.

46.3.7 Plaster, Paving and Tiling

46.3.7.1 Plaster

Plaster for walls shall be prepared by mixing one part lime to five parts dry sand. Immediately before use, one part cement shall be thoroughly mixed with twelve parts of the above lime / sand mix.

Plaster for rendering to concrete surfaces, beams and manholes shall be composed of one part cement to three parts sand.

46.3.7.2 Screeds

Screeds shall be composed of 3:1 sand / cement mortar.

46.3.7.3 Granolithic

Granolithic floors shall be made from:

- Cement : 1 part;
- Sand : 1.25 parts; and
- Coarse aggregate : 2 parts.

The coarse aggregate shall consist of granite or other approved chippings which shall pass a 10 mm sieve and be retained on a 5 mm sieve.

46.3.7.4 Terrazzo

Where terrazzo is ordered, unless otherwise specified on the Drawings, it shall be composed of granular chippings of South African marble with other aggregates and glass chippings added as required, mixed with water-repellent cement in the proportion of 1 part cement to 2 parts of the mixed aggregate, and water added to make a plastic mixture.

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

46.3.7.5 PVC tiles

PVC floor tiles shall comply in all respects with SANS 786 and SANS 581. They shall have a thickness of not less than 2.24 mm and shall be laid on a cement screed using a rubber base adhesive emulsion in accordance with the manufacturer's instructions. Concave skirtings shall be the same thickness, 40 mm radius and 100 mm high.

46.3.7.6 Glazed Tiles

Glazed tiles shall be best quality of approved manufacture, comply with SANS 22 and be 4.75 mm thick or as indicated on the drawings, true and regular in shape and free from cracks and all other defects. All arrises shall be cushion edged.

PVC corner and edge strips shall be used around window and door openings and along visible tile edges.

Skirtings are to be 100 mm cut floor tile with brushed stainless steel quarter round edge trim.

46.3.7.7 Rainwater and Surface Water Channels

Channels for rainwater and surface water drainage shall be 150 mm half round precast concrete units 1.0 m long, complying with SANS 927.

46.3.7.8 Stonemasonry (In-situ Stone Cladding)

The natural stone to be used shall be Waterberg sandstone sourced from the blasting operations carried out for excavation of the pump station and adjacent structures. Selection and further splitting

or cutting of the rock shall be required to trim it down to a semi-dressed stone with an ideal thickness of approximately 120 mm. The average stone thickness T shall be $90 \text{ mm} < T < 150 \text{ mm}$. The maximum lateral dimension on the exposed face shall not exceed 400 mm unless agreed otherwise with the Engineer.

46.3.8 Wet Services

46.3.8.1 Drainage, Plumbing, Sanitation and Water Disposal

All materials used for wet services shall comply with SANS 10400, The Application of the National Building Regulations.

Unless otherwise listed in the Bill of Quantities, water piping shall be in copper, the piping and valves conforming to SANS 460 and SANS 226 respectively.

When galvanized iron piping is listed in the Bill of Quantities or shown on the Drawings, the piping shall conform to BS EN 10255 Medium Series, and shall have screwed and socketed joints.

Brass bibcocks shall be heavy pattern with polished bodies to the finish listed in the Bill of Quantities or ordered by the Engineer.

Kitchen sinks and baths shall have 40 mm PVC-U traps and waste pipes with cleaning eyes fitted to each bend and trap and complying with SANS 967. Vent pipes shall be 110 mm PVC-U pipes to SANS 967.

Fittings for fixing waste and vent pipes to walls shall consist of approved pressed steel holderbats plugged to walls.

Drain pipes and fittings shall comply with SANS 559 for vitrified clay or SANS 791 for PVC-U. Unless otherwise listed in the Bill of Quantities, sewer and drain connections shall be in vitrified clay pipe with rubber ring or factory applied resilient plastic joints.

Where scheduled in the Bill of Quantities or shown on the Drawings, the following shall apply:

- a) The hot water cylinder shall be a horizontal combination type, bearing the SANS mark, of 90 litres capacity unless otherwise indicated on the Drawings, and shall be installed on brackets sufficient to carry the mass of the filled geyser. The Contractor shall allow for all items, excluding the electrical connection (which is included elsewhere in the Contract), to install the cylinder; and
- b) The kitchen sink shall be of standard stainless, bearing the SANS mark, and fitted with grid, plug, chain and screwed union for waste trap and pipe. The whole panel shall be rigidly supported by metal brackets.

If a hot water system is being installed, two 13 mm brass bibcocks shall be fitted to the sink. If no geyser is being installed, one 13 mm bibcock shall be fitted, with provision made for a future hot water bibcock.

46.3.8.2 Sanitation Fittings

Sanitary fittings shall comply with SANS 497 and shall be subject to selection and approval.

When scheduled in the Bill of Quantities or shown on the Drawings, the following shall apply:

- a) The WC suite shall consist of a close couple WC with metal flushing mechanism of 11 litres capacity and vitreous china WC bowl, with plastic flush pipe and hinged plastic seat flap and cover.

The bath shall be made of premium, sanity grade cast acrylic, seamless with non-slip finish and able to withstand high water temperatures. Standard waste outlet and overflow supplied by manufacturer to be included. Bibcocks shall be fitted as for the kitchen sink.

46.3.8.3 Rainwater Goods

Unless otherwise stated or approved, rainwater goods shall be of fibre cement, of "Everite" or equal approved manufacture.

46.3.9 Glazing and Painting

46.3.9.1 Glazing

Unless otherwise stated, windows up to 300 mm maximum dimension shall be glazed with 7.32 kg/m² (9.76 kg/m² up to 500 mm maximum dimension) clear sheet glass of the best quality of its kind, free from bubbles, waves, air holes, scratches or other defects and conforming to BS 952 "Ordinary Glazing Quality". Obscure figured and texture glass shall be the best of the respective kinds described and approved. Obscure glass shall be used at windows to showers and toilets.

Polished plate glass, if specified, shall be "Glazing for Glazing" quality, conforming to BS 952.

Glazing for Guard huts shall comply with SANS 1263-3 class RC.

46.3.9.2 Paints, Stains, etc.

All paints and stains, etc., or materials used in their preparation, shall be of the best quality of their respective kinds and shall comply with the relevant SANS specification. The paints and stains, etc., their colours and shades, shall be approved as to brand and manufacture, and the Contractor shall submit samples in their respective colours to the Engineer, for approval, at least 28 days before they are required.

Fast lime wash shall be composed of fresh unslaked lime with 7 kg of salt and 5 kg of tallow, or equal mass of boiled linseed oil, added for every 50 kg of lime, well mixed with the lime while slaking. The mixture shall be passed through a sieve. A sufficient quantity of yellow ochre is to be added to bring to a light cream shade for approval.

46.3.10 Feature cladding

Special feature cladding shall consist of concealed fixed, aluminium composite panels or louvres. The panels / louvres shall be fixed to walls using concealed aluminium extruded subframe and clips, installed to supplier's specifications. Sections are to be manufactured by an approved manufacturer in accordance with SABS 1476/HE and of required standard sizes and profiles. Sheets and strips are to be 2S, 1/2H or M575 alloys in accordance with SABS 1470/NS4. Special cladding and connections shall resist wind loads applicable to the area of construction. Finishes to be indicated on the drawings. Colours to be indicated on the Drawings, complying with environmental requirements per Section 46. No reflective material shall be used.

46.3.11 Turnstiles

Single lane turnstiles shall be electrically operated with biometric access control, with manual override, to specialist details.

46.3.12 Access floor

Raised floors shall be rigid, firm and free from rocking. It shall consist of a durable snap-on stringer system, allowing for a standard computer room load. Product to be installed per supplier's specifications. Finishes to be indicated on the drawings.

46.3.13 Paint and coating colours

Colours to be as indicated on the Drawings. All external paint and coating colours of to be dark, non-reflective colours such as grey, khaki or olive green, blending with the natural environment.

46.4 METHODS AND PROCEDURES

46.4.1 Drainlayer

The construction of sewers, stormwater pipes, manholes and catchpits, and bedding shall comply with all the relevant requirements of Section 15 – Backfilling and Bedding, and Section 27 – Drainage and Erosion Protection.

46.4.2 Excavation

The depth of excavation for foundations shall be at least such that the top of concrete foundations are not less than 170 mm below existing ground level or finished ground level, whichever is the lowest. Trenches and holes shall be excavated to the dimensions of the foundations shown on the Drawings or to such other depth as directed in order to ensure a firm foundation.

Bottoms of foundations shall be level and the sides trimmed to full width. The bottoms of trenches shall be stepped in masonry / block course dimensions as required.

Foundation trenches shall be inspected and approved by the Engineer before the concrete is poured.

46.4.2.1 Filling Under Floors

The filling under floors shall be constructed in layers of thickness not exceeding 200 mm before compaction, watered and compacted to 93% (100% in the case of sand) of modified AASHTO maximum dry density.

46.4.2.2 Hardcore Filling

Hardcore filling shall be levelled and thoroughly compacted by ramming, blinded with clean sand to receive the damp proof membrane and concrete floor.

46.4.3 Concrete

In addition to the requirements of the Section 20 – Concrete Works (Structural), the following shall apply in respect of all buildings:

46.4.3.1 Polythene Sheeting

Before casting the floor slab, polythene sheeting complying with Clause 46.3.3.1 shall be laid on the compacted and blinded hardcore or fill.

46.4.3.2 Pre-Stressed Concrete Lintels

Regardless of whether the width of pre-stressed units is full, half brick or 150 mm, they shall be laid to the full width of the bricks in the wall. The lintels shall have a bearing of not less than 225 mm at each side of the opening.

46.4.3.3 Pre-cast Concrete coping

Coping to be installed straight and plumb, on a layer of smooth mortar. When installed above special cladding, the minimum overhang shall be 30 mm.

46.4.4 Masonry

46.4.4.1 Masonry

All brick foundation walls, superstructure walls, piers and the like shall be built to the various lengths, heights and thicknesses shown and figured on the Drawings with masonry units as described, and unless otherwise specified, built in English bond. Where thicknesses of 110, 220, 280 and 330 mm are shown on the Drawings, they are regarded as nominal and are subject to adjustment to suit the masonry units approved for this Contract.

No false headers shall be built in and none but whole masonry units shall be used except where legitimately required for the formation of bond. Burnt clay bricks shall be well soaked in water immediately before being laid and the course of bricks last laid shall be well wetted before laying a fresh course upon it. Concrete units shall not be wetted and if the stockpile has been exposed to rain, the units shall only be used once they have dried out.

Masonry shall have the joints flushed up at every course solid throughout the whole width of each course and all to be laid on a solid bed of mortar.

All walls shall be carried up regularly so that no part of the walling is more than 1.3 m higher than the adjoining work except as shown on the Drawings.

Mortar joints to masonry generally shall not exceed 10 mm in thickness. The joints of all walls intended to be plastered or tiled shall be raked out as the work proceeds to form a key for the plaster or mortar.

Where facing and pointing is specified, the walls shall be faced with facing units as specified on the Drawings and, unless otherwise specified, built in stretcher bond in 3:1 cement mortar, and pointed with a neat recessed joint formed with a steel jointing tool well pressed into the joints as the work

proceeds. The face masonry shall be tied back to the walling with wire ties at the rate of 6/m². The face work shall be protected by pasting paper over exposed surfaces, or by other means approved by the Engineer. On completion, the face shall be cleaned down with spirits of salts, wire brushed and finally washed down with ammonia and water.

Ventilators, gratings, dowels, corbels, ties, ends of timber, and slips for fixing joiner's work shall be built in as the work proceeds.

46.4.4.2 Mortar

The mortar shall be mixed in small quantities, with the materials mixed dry on a proper platform with water added gradually through a fine rose and the mixture turned over until the ingredients are thoroughly incorporated. It is essential that mixing platforms shall be well cleaned and stale mortar removed before any batch of new mortar is prepared for mixing. Mortar shall be used within 2 hours of cement being mixed in.

46.4.4.3 Cavity Walls

Cavity walls shall have the inner and outer skins tied together with ties spaced as follows:

- Cavity up to 100 mm: 3 ties/m² (measured in wall elevation);
- Cavity >100 mm: 5 ties/m² (measured in wall elevation); and
- Provide additional ties at 300 mm c/c at discontinuities and openings.

Mortar droppings shall be carefully gathered up on laths supported on the ties, and the laths shall be removed and cleaned at every fourth course. Openings shall be left at the bottom of walls as required for cleaning, and afterwards built in and made good. The wall ties shall be cleaned of all mortar droppings. Vertical dry joints for drainage to be formed in outside brick skin at approximately 900 mm c/c by leaving open the bottom perpend (directly above apron level).

Cavities at jambs and ends of walls shall be built solid for a depth of 110 mm, and cavities below sills or at heads of walls shall be built solid for three courses of masonry.

Doors and windows shall be provided with damp proof courses to sills and jambs.

46.4.4.4 Masonry Lintels

Masonry lintels shall be formed of masonry units complying with the same specifications as those of the wall in which the lintel is being formed except as specified in Clause 46.3.4.1. They shall be properly bonded longitudinally and be bedded in 1:3 cement mortar. At each reveal, the end unit of the bottom course shall have a bearing of at least half its width.

Masonry lintels shall be reinforced for their full length and shall be formed at least of the minimum number of courses, all as set out in Table 46/1, below.

Masonry lintels shall be formed on rigid temporary supports which shall be left in position for seven days or such longer period as the Engineer shall instruct.

Subject to prior written approval, pre-stressed concrete lintels may be used provided they comply with Clause 46.3.3.2.

Masonry shall be built in 1:3 cement mortar with all joints filled solid with mortar. Lintels shall have a bearing of not less than 225 mm on each side of the opening.

**TABLE 46/1
TYPE OF LINTEL**

TYPE OF LINTEL	WIDTH OF OPENING (m)	MIN. NO. OF BRICK COURSES OVER LINTEL	REINFORCING PER HALF UNIT SOFFIT WIDTH
Brick Reinforced	under 1.50	4	3/3,15 mm HT wire
	1.50 to 2.25	6	3/6 mm Mild Steel or 3/3,15 mm HT wire
	2.25 to 3.00	8	4/3,15 mm HT wire
Concrete Pre-stressed	under 1.80	Beam + 3	(See Clause 46.3.3.2)
	1.81 to 3.00	Beam + 4	(See Clause 46.3.3.2)

46.4.4.5 Window Sills

Unless otherwise specified on the Drawings, external sills shall be constructed of bull-nosed facing masonry units, or quarry tiles, of approved colour as shown on the Drawings or scheduled in the Bill of Quantities. Where specified, masonry units shall be laid to a uniform slope, true to line and level, and solidly bedded in 3:1 cement mortar with damp proofing. Joints, which shall not exceed 9 mm in width, shall be neatly pointed.

Internal sills shall be constructed of red, or other approved colour, quarry tiles set in 3:1 mortar and laid true to line and level. Joints shall not exceed 6 mm in width. When similar tiles are scheduled, or shown for external sills, they shall be laid as for internal sills but on a uniform slope. All sills shall be kept free from cement and other stains, and shall be cleaned off on completion.

46.4.4.6 Damp Proof Course

Damp proofing in the walls shall be laid without any longitudinal joints, and lapped 150 mm at all end joints and intersections. Damp proofing shall be kept 10 mm back from the external face of walls and pointed in cement mortar.

Damp proofing under floors shall be laid with 150 mm laps at all joints in both directions and sealed with pressure sensitive tape.

Damp proofing in cavity walls shall be stepped up one course over a cement mortar triangular fillet in the bottom of the cavity.

Doors and windows shall be provided with damp proofing to sills and joints.

46.4.4.7 Separation of Concrete from Masonry - Jointing

Concrete slabs and beams, including lintels, shall be separated from masonry by covering the contact bearing surfaces with two layers of BRICKGRIP DPC 375[®] as specified in Cause 46.3.4.5, or equivalent approved, bedded on a levelled up 3:1 cement mortar before the concrete is cast.

Unless otherwise specified on the Drawings, a 10 mm cross-linked, closed cell, expanded Polyethylene joint former of minimum density 33 kg/m³, JOINTEX® or equivalent approved, shall be placed against the end of masonry where in contact with the sides of concrete columns and walls.

46.4.4.8 Bagged Finish to Masonry

Bagged finish to masonry, if done whilst the mortar in joints is still soft, shall be formed by rubbing over the wall surfaces with wet rough sacking, until all joints and crevices are filled up and an even surface is obtained. Mortar, as specified in Clause 46.3.4.3 and Clause 46.3.3.2, shall be added as may be necessary.

If bagging to walls is done after the mortar in joints has set, the wall surfaces shall be rubbed over with wet rough sacking as above, but cement grout shall be added as necessary to fill up the joints and crevices and to obtain an even surface.

46.4.5 Carpentry and Joinery

46.4.5.1 Carpentry General

Timber work shall be neatly executed and finished and all jointing shall be accurately cut and well fitted together.

Timber shall be of sizes specified or stated on the Drawings and shall be framed, checked, lapped, spiked and/or bolted together and as detailed below unless otherwise specified.

Wall plates shall be halved at junctions and angles. Purlins, battens, etc., shall be bevelled at junctions, and in all cases the joints shall be placed over a point of support and well spiked.

Where splices are necessary in rafters, ties or ceiling joists, the timbers shall be lapped at least five times the width of the timber and securely spiked. Splices in timber wider than 114 mm shall be bolted with at least three 9.5 mm bolts and washers, in addition to spiking.

Except where framed, or where bolts are specified to be used, all intersections and passing of constructional timbers shall be adequately spiked and where possible clinched in addition.

A patented nail system and factory made jointing techniques for roof trusses will be permitted with the written prior approval of the Engineer.

Roof trusses shall be set up at the centres indicated on the Drawings, or as instructed by the Engineer, on 114 x 38 mm timber wall plates, and securely strapped down with galvanised mild steel straps, with one end wrapped around and spiked to the foot of the truss and purlin, and the other end built sufficiently far into the brickwork to preclude any risk of the finished roof being blown off, as specified in Clause 46.3.4.4.

46.4.5.2 Joinery

All joinery shall be well manufactured, all necessary framing, scribing, notching, mitring, fittings etc. being properly executed. All framed joints shall be pinned in addition to being glued. No portions of panels shall be glued. Nailing, where necessary, shall be done on the surrounding mouldings and in the most concealed manner.

All items shall be constructed of the timber specified on the Drawings, or approved by the Engineer in writing, and shall comply with the finished size dimensions as shown on the Drawings.

The Engineer reserves the right to reject any joinery which is considered to be below the required standard, either because of the timber used or the quality of workmanship.

46.4.5.3 Timber Doors and Windows

Where applicable, windows, doors and other fittings shall be primed with red oxide before leaving manufacturer.

Door frames shall be of profile suitable for the walls in which they are to be fixed, and shall be secured to walls with three lugs to each jamb. The feet of frames shall be firmly strutted and fixed solidly to floors complete with GI weatherproofing strips, as shown on the Drawings.

Softwood doors and frames shall be knotted and primed before fixing.

All doors shall be hung plumb and level, so as to swing freely, and shall be stained, oiled or painted two coats approved paint after erection.

All external doors shall be hung on one and a half pair of hinges screwed into wooden frames or welded to steel frames. The doors shall be furnished with barrel bolts, and mortice locks.

Internal doors shall be hung on frames with one pair of hinges welded or screwed into the frames, and furnished with 2-lever mortice locks and bronze or chromium plated furniture as listed in the Bill of Quantities.

Window frames shall be secured to walls with 2 mm galvanized hoop iron lugs 38 mm wide, one end bent and screwed to frame and two screws to each and built 450 mm into wall with other end turned up into masonry joints. Windows not exceeding 914 mm in height of clear opening shall have two lugs at each jamb, but windows exceeding 914 mm in height of clear opening shall have three lugs at each jamb unless otherwise specified.

46.4.5.4 Ceilings

Ceilings, where shown on Drawings, shall be erected on branderling at 300 x 1 000 mm spacing, or in accordance with the manufacturer's recommendation and approval.

46.4.5.5 Roofing

(a) Fibre Cement

Fibre cement roofing shall be carefully laid and fixed in accordance with the manufacturer's instructions, with side laps of half a corrugation and 300 mm end laps. All cutting shall be done with a suitable saw. Sheets shall be carefully drilled through the crown of the corrugation for, and secured to wood purlins with, galvanized iron drive screws, or secured to steel purlins with galvanized steel hook bolts, with washers as specified by the manufacturer.

(b) Aluminium "Longspan"

Aluminium "Longspan" roofing shall be carefully laid and fixed in accordance with the manufacturer's instructions, by an accredited roofing contractor.

On completion, a five year guarantee on site workmanship and water tightness shall be issued.

For flashings, stop endings must be formed at the apex and drips formed at eaves by turning down the pans. Flashing shall be notched around nibs and fixed using clips where necessary.

(c) Galvanized Iron

Corrugated galvanized iron sheets shall be lapped one and a half corrugations at sides, with end laps not less than 150 mm. Sheets shall be secured to wood purlins with galvanized iron screws and galvanized iron and lead washers. No iron affected by sea water or otherwise damaged shall be used on the Works. Ridges and hips shall be fixed with 150 mm end laps, and edges shall be closely beaten into the corrugations of roofing iron, and fixed with galvanized iron screws and galvanized iron and lead washers spaced not more than 300 mm apart.

Galvanized deep-fluted sheets shall be carefully laid and fixed in accordance with the manufacturer's instructions with side laps of one corrugation and 300 mm end laps, with ends of sheets bent up or down as required. Sheets shall be carefully drilled for, and secured to wood purlins with, galvanized drive screws, or secured to steel purlins with galvanized hook bolts, each with one galvanized steel and flat bitumen washers. Laps at ends or edges shall be primed with one coat approved self-etching primer and sealed with bitumen strips, size 30 mm wide x 3 mm thick, and carefully drilled for, and secured with, self-tapping screws or 6 mm galvanized bolts with bitumen washers.

(d) Cement tile

Cement tile roofing shall be fixed in accordance with the manufacturer's instructions and generally as specified in SANS Code of Practice No. 10062.

(e) FC Facias and Barge Boards

Fibre cement fascia and barge boards shall be carefully drilled and screwed to roof timbers with, 40 x 12 gauge brass cup headed screws and washers, and shall be painted with two coats acrylic paint.

46.4.6 Ironmongery

46.4.6.1 General

All ironmongery shall be cleaned, oiled and eased until it operates smoothly, after it has been fixed in the work.

46.4.6.2 Windows and Door Frames

Before building-in, any damage to the shop primer shall be made good by painting with zinc chromate primer.

Windows and doorframes shall wherever possible be built into walls during construction and the lugs well secured. They shall be securely strutted to prevent distortion while the masonry is being built.

After completion and before plastering, the space between the frames and masonry shall be carefully and thoroughly filled with 3:1 cement mortar, and the external joints raked out to a depth of at least 10 mm and caulked with mastic cement forced into the joints.

Steel windows and doorframes, after glazing, shall receive two coats of oil paint to selected colours, after any damage to the zinc chromate primer has been made good.

46.4.7 Plaster, Paving and Tiling

46.4.7.1 Plasterwork

All masonry joints shall be raked out to afford a proper key for plaster and all surfaces shall be properly cleaned down and well wetted before any plaster is applied.

When plastering is required on concrete surfaces, these shall be hacked and thoroughly brushed with strong wire brushes to afford a proper key for the plaster. Soffits, beams, etc. shall be rendered in cement plaster as thinly as possible to provide a uniform surface on which cement plaster of a similar composition shall be skimmed.

External plaster shall be finished off with wood floats and internal plaster shall be steel trowelled unless otherwise specified. Plasterwork shall be kept damp until properly set and all finished surfaces shall be protected from injury.

No plaster on walls shall be less than 12 mm or more than 18 mm in thickness unless otherwise specified.

All salient angles and arises shall be slightly rounded and all internal angles shall be finished perfectly true, square and smooth.

46.4.7.2 Air Bricks

Openings formed for air bricks shall be rendered with plaster.

46.4.7.3 Screeds

Preparatory to the application of the screed, the concrete sub-floor shall be well soaked with water and coated with the thinnest practicable layer of (a) in the case of a concrete surface which is rough enough to ensure a good bond - a grout of neat cement well brushed on, and (b) in the case of a concrete surface which is not rough enough to ensure a good bond - with a slurry composed of one part of cement to two-and-a-half parts of coarse sand vigorously thrown on by means of a trowel or other suitable device. The screed shall be laid before the grout or slurry has set.

The screed shall be well compacted and rammed in with a wooden punner, and finished off level with a wood float or steel trowel as particularly specified on the Drawings, and then left to mature, being protected from damage during this period.

All screeds to receive special floorings shall be laid with surfaces, and cleaned off or washed, to the satisfaction of the specialist executing such flooring.

A screed on which PVC floor tiles are to be laid shall be between 25 and 40 mm thick. It shall be levelled off with a steel trowel, after the initial set has taken place, to a smooth surface free of all

score marks, grooves and depressions. If shown on the Drawings or required, a 40 mm radius concave skirting 100 mm high shall be formed in the screed against all walls.

46.4.7.4 Granolithic

Granolithic paving shall be not less than 20 mm thick and shall be laid in one operation. The surface shall be divided by V-grooves into rectangular panels not exceeding 9 m² in area.

When hard, the finished surface of granolithic floors shall be repeatedly scrubbed with clean water until all discolouration has disappeared. It shall then be damp-cured by covering with sand or hessian and kept damp for at least seven days. Thereafter the granolithic surfaces shall be protected from damage and discolouration, and prior to handing over the Works they shall again be thoroughly washed with clean water.

All skirtings shall be run direct on the masonry or concrete surface, and not against plaster of walls, and to the heights shown on Drawings or directed by the Engineer. Skirtings shall be coved at floor and angle rounded along the top edge and to finish 6 mm past the face of the plaster.

Where tinting is directed, the pigment shall be mixed with the cement before the addition of water. Dusting on of colouring will not be permitted.

46.4.7.5 Terrazzo Facings

Where shown on the Drawings or ordered by the Engineer, walls or floors shall be surfaced with in situ terrazzo plaster with a scrubbed or polished finish. Such work shall conform to the following:-

- a) The total thickness of terrazzo shall be 18 mm. The surface on which the terrazzo is to be placed shall be wetted and screeded with cement plaster, with the surface scratched over to form a key, and finished with a 10 mm thickness of terrazzo proportioned and mixed as specified in Clause 46.3.7.4;
- b) The terrazzo plaster shall be applied to the wall and floor surfaces and trowelled to an even surface;
- c) The plastered area shall be divided into panels of shapes and sizes shown on the Drawings with dividing strips set into the screed whilst still in a semi-plastic state. The facings shall be scrubbed with a brush to remove the cement and expose the aggregate, or polished, if so specified, after the cement has set; and
- d) The terrazzo shall be covered up, protected and washed down on completion. The work shall be carried out by skilled workmen experienced in this class of work.

46.4.7.6 Glazed Tiling

Glazed tiling shall be fixed in accordance with SANS 10107. The tiling shall be fixed to a plumb-true 3:1 cement mortar screed, not less than 12 mm thick, which shall be scratched and left to dry.

Allowance shall be made for 5 mm grouted movement joints to room perimeter and to finished floor transition using transition strips.

The tiling shall be complete with all internal angles and rounded edge fittings, and shall be of the best quality executed by competent workmen.

46.4.7.7 PVC Tiles

PVC floor tiles shall be laid in accordance with SANS 10070, on straight regular lines, and the finished floor shall have a neat and workmanlike appearance using accessories as listed in clause 8.1 to 8.3 of SANS 10070.

Before the floor covering is laid, the Contractor shall ensure that the screed has dried out to a moisture content of less than 6% and that it is thoroughly cleaned of all dust, grime, oil etc. The tiles shall be stuck down after applying the approved adhesive emulsion to both the screed and to the underside of the tiles.

46.4.7.8 Precast Concrete Paving Slabs

Precast concrete paving slabs shall be laid on a 100 mm thick sand bed compacted to 100% of modified AASHTO maximum density. Joints between slabs shall not exceed 12 mm and shall be filled carefully by washing a weak cement sand mixture into the joints.

46.4.7.9 Concrete Rainwater Channels

Precast concrete channels shall be laid at falls from each downpipe as shown on the Drawings. The ground on which the channels are laid shall be even and well compacted.

46.4.7.10 Stone Cladding

The stone cladding or stonemasonry shall be constructed from foundation level, against the brick wall surface, to the heights and thicknesses shown on the Drawings. The stonemason shall randomly select the semi-dressed stone and dress it to prepare it for laying in a bed of mortar. The largest dimension of each stone shall be laid in the horizontal direction and each individual stone shall be stacked as to stagger the joints.

The mortar joints shall be as thin as possible (average <10 mm) and shall be raked out to create a wall surface appearance of a randomly dry-packed natural stone wall as shown in the images on the Drawings. All cavities between the stonemasonry and existing wall surface shall be filled with mortar. The exposed parts of the stone shall be cleaned by wire brushing.

After construction the wall shall be kept moist and protected from elements with plastic sheeting for at least 4 days.

The stonemasonry shall be tied back to the wall surface with galvanised wire ties with a frequency of 6/m².

46.4.8 Wet Services

46.4.8.1 Drainage, Plumbing, Sanitation and Water Disposal

All workmanship and methods used for the installation of wet services shall comply with Chapter 12 of SANS 10400, The Application of the National Building Regulations except that local Building Regulations having the force of law shall take precedence where conflict exists.

The work will be subject to approval by the Local Authority's Inspectors, if any, and by the Engineer. The Contractor's attention is drawn to the need to employ registered drainlayers and plumbers who

are fully conversant with local regulations and codes of practice for this portion of the Works, to ensure that the Local Authority's Inspectors accept the work when finished.

46.4.8.2 Rainwater Goods

Fibre cement rainwater goods shall be free from cracks, twists or other defects, with walls of uniform thickness, straight and smooth inside and out and truly circular in section. Gutters shall be accurately fixed, closely fitted together and jointed with an approved jointing compound and bolted. Rainwater pipes shall be closely fitted together, jointed with tarred rope gasket and approved jointing compound, and grouted with 3:1 sand / cement fillets.

46.4.9 Glazing and Painting

46.4.9.1 Glazing

Glass shall be cut to fit the rebates with due allowance for expansion, and shall be carefully bedded in putty, pegged or clipped in position, puttied evenly to a uniform level and neatly finished, all in accordance with SANS 680.

46.4.9.2 Painting

Before any paintwork is put in hand, surfaces shall be made good after all other trades and the Contractor shall inspect and satisfy himself that all surfaces of plaster, wood, metal, etc., which are to receive finishes of paint, stain, distemper, oil, etc., or paintwork of any description, are in a proper condition to achieve a high quality paint finish on them. All surfaces shall be filled with suitable stopping where necessary, rubbed down, perfectly clean, free from dust, dirt, grease, etc., before any painting etc., is undertaken. No painting or distempering shall be undertaken on plastered wall or ceiling surfaces until in the opinion of the Engineer they have thoroughly dried out and are in a fit state to receive the finish. All rooms and corridors etc. shall be swept clean before the painting is commenced, and no sweeping or dusting shall be done whilst painting or distempering is in progress.

Each coat of paint shall be a distinctive colour. Sample colours are to be prepared in all cases for the final coat. Every coat of paint, etc., shall be a good thick covering coat, and, if not, the Contractor will be required to apply extra coats at his own expense.

Walls behind baths and sinks to a height of 1.8 m or as shown on the Drawings shall be painted with one coat alkaline resistant primer and one coat gloss oil paint.

New woodwork specified to be painted (including the backs of wood frames etc.) shall be primed with white and red lead priming paint. Knots shall be knotted with shellac knotting before priming. Where special brands of patent paints are to be used, the manufacturer's priming, suitable for the particular brand employed, shall be used in accordance with the manufacturer's instructions.

New wood work shall be properly sandpapered and rubbed down to a smooth even surface before painting or staining and before each successive coat is applied. Stopping is to be tinted as required to match oiled or stained woodwork.

Existing woodwork previously painted shall be properly rubbed down and sandpapered to approval, or the existing paint removed if required. Running knots shall be cleaned off and coated with shellac knotting.

Where new galvanized iron surfaces are specified to be 'oxidised' before being painted, they shall be prepared with a 10% solution of copper sulphate in water, and the galvanized surfaces shall be washed with the solution. The black deposit formed almost immediately shall be thoroughly washed off whilst still wet with clean cold water and the surface allowed to dry. Other patent oxidising solutions, if approved, may be used to render new galvanized surfaces fit for painting, provided these are applied strictly in accordance with the manufacturer's instructions.

Hardwoods shall be given two coats of an approved timber seal or raw refined linseed oil well rubbed in. Fibre cement shall be painted with an undercoat and two coats of acrylic paint.

Exposed timber, unless painted or oiled, shall be given two coats of carbolineum preservative or equivalent.

Steel and iron surfaces, including those bedded in concrete, shall be painted as specified in Section 24 – Structural Steel.

Cast iron work shall be delivered to site without painted or coated surfaces. After erection, the cast iron shall be washed, using a detergent and nylon brushes to remove all rust and foreign matter. All traces of detergent shall then be washed off. As soon as the surface is dry it shall be painted two coats of 60% red lead primer, and then two coats of approved bituminous paint. No cast iron which is to be painted shall be previously dipped in tar or bitumen solution. Under no circumstances may wire brushes be used for removing rust or other contaminants.

The whole of the paintwork shall be touched up and made good on completion, and all paint spots and stains removed from floors, glass, etc. and all left perfect. All glass shall be thoroughly cleaned, all floors washed and the work left in a clean and properly finished condition.

46.4.10 Electrical work

46.4.10.1 General

This Section shall be read in conjunction with the relevant sections of Section 38 – Electrical General and Section 39 - Electrical Plant and Installation.

The Contractor shall provide electrical wiring, internal and external lighting and fittings as shown on the Drawings, shall undertake the relevant electrical work in accordance with SANS 10142-1, the Code of Practice for Wiring of Premises, and, on completion, shall submit to the Engineer a certificate obtained from the relevant authority stating that the electrical work complies with its requirements and regulations. (Certificate of Compliance)

46.5 MEASUREMENT AND PAYMENT

The rates tendered under this Section shall not include for the general obligations, Contractor's Equipment and work deemed to be covered by the items provided in Section 1 – General.

46.5.1 Basic Principles

46.5.1.1 General

Unless the building is measured by the sum in terms of item 46.012, the relevant items 46.001 to 46.011 shall apply.

46.5.1.2 Glazing

The cost of glazing will be held to have been included in the tendered rate for the items such as windows, doors, etc., that require glazing.

46.5.2 Scheduled Items

46.001 Drainlayer

The measurement and payment clauses of the Section dealing with sewers, stormwater, manholes and catchpits, and bedding, as applicable, shall apply.

46.002 Excavation

In addition to the measurement and payment clauses of the Section dealing with general excavation and trench excavation, the following shall apply.

a) Hardcore

**Unit: Square metre (m²)
or Cubic metre (m³)**

Hardcore filling will be measured by area or volume as listed in the Bill of Quantities.

The unit rate shall cover the cost of the provision, placing and compacting of the hardcore filling including filling of voids as necessary.

46.003 Concrete

a) Pre-stressed lintels (opening to be spanned to be stated)

Unit: metre (m)

Pre-stressed lintels will be measured by length.

The unit rate shall cover the cost of the supply of all materials and labour in manufacturing and installing the lintels.

46.004 Masonry

a) Masonry

Unit: Square metre (m²)

Masonry will be measured as the net area after all door, window and similar major openings have been deducted.

The unit rate shall cover the cost of the supply and installation of all materials, brick and blockwork of all types, beamfilling, brick on edge, cutting and waste, building in of timber, masonry lintels, wall ties, etc., plumbing openings and angles, forming all openings and reveals, struck jointing, cleaning on completion and all other necessary items, not separately listed in the Bill of Quantities. The cost of building in of windows, door frames etc. will be held to have been included in the unit rates tendered for those items.

b) Sills Unit: metre (m)

External and internal sills will each be measured separately and by length.

The unit rate shall cover the cost of the supply of all materials and for all labour, cutting, waste, jointing, reinforcement, damp proofing of sills where shown on the Drawings, and cleaning on completion.

c) Damp proofing (for walls width to be stated) Unit: metre (m) or Square metre (m²)

Damp proof course for walls will be measured by length as the net length of wall proofed. Damp proofing under floors will be measured as the net area of floor damp proofed.

The unit rates shall cover the cost of the supply and laying of all material, cutting, waste, joining, laps and bitumen sealing where required.

d) Airbricks Unit: set

Air bricks will be measured by sets comprising inside and outside, complete with copper gauze and reveals.

The unit rate shall cover the cost of the supply and building in of the complete set.

e) Bagging Unit: Square metre (m²)

Bagging will be measured by area.

The unit rate shall cover the cost of all material and labour required to carry out the work.

f) Masonry reinforcing (width of wall to be stated) Unit: metre (m)

Where listed in the Bill of Quantities, masonry reinforcing will be measured by length.

The unit rate shall cover the cost of the supply, cutting, waste, installation and tools.

g) Stonemasonry (In-situ Stone Cladding) Unit: Square metre (m²)

Stonemasonry will be measured as the net area after all door, window and similar major openings have been deducted.

The unit rate shall cover the cost of the supply of all labour, all materials not sourced from Site, the sourcing and selection of the stone from the blasted excavations, further cutting, trimming, splitting or any other processing of the stone that might be required, waste, raking of joints, cleaning on completion and all other necessary items, not already covered in the Bill of Quantities.

h) Face Brick**Unit: Square metre (m²)**

Face brickwork shall be given in square meters as extra over brickwork (46.004 (a)). Face brickwork to reveals, returns, piers, lintels and beam filling shall be measured to the net area exposed and shall be included with the general measurement of face brickwork.

The unit rate shall cover the additional cost of the supplying and installation of face brick materials, including additional costs required for cutting and waste, building in of timber, masonry lintels, wall ties, etc., plumbing openings and angles, forming all openings and reveals, pointed with recessed horizontal and vertical joints, cleaning on completion and all other necessary items, not separately listed in the Bill of Quantities.

46.005 Carpentry, joinery, metal work and roofing**a) Timbers****Unit: Metre (m) or Number (No.)**

Timbers will be measured net by length. Roof trusses may be measured by number.

The unit rate shall cover the cost of supply and installation, cutting, scarfing, laps, waste and for nails and spikes.

The unit rate for roof trusses, where these are listed in the Bill of Quantities by number, shall cover the cost of the supply, manufacture and erection of the trusses including for all necessary "beam filling" between the top of the wall and underside of the roofing.

b) Joinery**Unit: Number (No.)**

Joinery items will be measured by number and type.

The unit rate shall cover the cost of the supply of all materials, manufacture of the items and for all fixing and painting or oiling as specified.

c) Doors**Unit: Number (No.)**

Doors will be measured by the number of complete units of each size and type.

The unit rate shall cover the cost of the supply, fixing and sealing of the door and frame (timber or steel, as specified) complete with GI strips, lugs and damp proofing where shown on the Drawings or as required, furniture, all ironmongery, glazing and painting, or oiling. (See also items 46.004 a) and 46.009).

d) Timber windows**Unit: Number (No.)**

Timber windows will be measured by number of each size and type.

The unit rate shall cover the cost of the supply and fixing complete including all ironmongery, lugs, glazing and painting or oiling and sealing with mortar and/or damp proof course or GI strips as applicable (see Clauses 46.3.9 and 46.4.9).

e) Ceilings**i) Ceilings (type to be stated)****Unit: Square number (m²)****ii) Cornice****Unit: Metre (m)**

Ceilings will be measured by area and the cornice will be measured by length.

The unit rates for ceilings and cornices shall cover the cost of the supply of all materials and labour including brandering, fixing, cutting, waste, nails and all fixings and for trimming and forming one trapdoor 600 x 600 mm in each building.

f) Roofing (type to be stated)**Unit: Square metre (m²)**

Roofing will be measured as the net area covered measured on the slope, if any.

The unit rate shall cover the cost of all covering types (roof sheeting, roof tiles, etc.) laps, cutting, waste and fixing, and flashings (including ridges, hips, valleys, etc.) and sealing materials, including roof covering supports to complete the roof to a weatherproof condition.

g) Fascias and barge boards (type to be stated)**Unit: Metre (m)**

Fascia and barge boards will be measured by length.

The unit rate shall cover the cost of the supply and installation of all materials and for all cutting, waste, brackets, fixing, painting, and for all screws, bolts and the like.

h) Skirtings (type to be stated)**Unit: Metre (m)**

Skirtings will be measured by length.

The unit rate shall cover the cost of the supply and installation of all materials and for all cutting, waste, brackets, fixing, painting, and for all screws, bolts and the like.

46.006 Ironmongery**a) Ironmongery**

Ironmongery will NOT be measured or paid as separate items unless the Bill of Quantities includes specific items therefore.

b) Steel windows**Unit: Number (No.)**

Steel windows will be measured by number of each size and type.

The unit rate shall cover the cost of the supply and fixing complete including all ironmongery, glazing and painting.

46.007 Plaster, Paving and Tiling**a) Plaster****Unit: Square metre (m²)**

Plaster work will be measured as the net area plastered, including reveals, lintels and similar areas. Internal and external plaster will be measured separately. Separate items will be provided for plastering on masonry, on concrete and on manholes.

The unit rate shall cover the cost of the supply of all materials, labour and equipment to carry out the specified work.

b) Screeds, granolithic and skirtings**i) Screeds and granolithic****Unit: Square metre (m²)****ii) Skirtings****Unit: Metre (m)**

Screeds and granolith will be measured separately by area of floor surface covered and formed skirtings will be measured by length.

The unit rates shall cover the cost of all materials, compacting and levelling, forming of screeds and concave skirtings, waste, laying, jointing, cleaning and everything necessary to complete the work. The same principles will apply to floors specified to be stained.

c) Terazzo facing (whether floors or walls to be stated)**Unit: Square metre (m²)**

Terrazzo facings will be measured by area of the surface treated.

The unit rate shall cover the cost of the supply, mixing, laying and polishing or scrubbing complete with rebates, coves and edges.

d) Tiling**Unit: Square metre (m²)**

Tiling will be measured by area of completed tile surface.

The unit rate shall cover the cost of the supply and installation of all materials complete with internal angles, rounded edge fittings and specials, and forming screeds.

46.008 Plumbing**a) Rainwater goods****Unit: Metre (m) and
Number (No.)**

Gutters and down pipes will be measured by length and drop ends, swan necks, shoes, etc. will be measured by number.

The unit rates shall cover the cost of the supply of all materials and for all fixing, jointing, cutting and waste, screws, brackets, holder bats and other fixings.

b) Water Reticulation and Drainage**Unit: sum**

Water reticulation and drainage are listed in the Bill of Quantities as “sum”.

The amounts tendered for these items shall cover the cost of the supply of all materials and labour for the complete installation of the relevant facilities in accordance with Clauses 46.3.8.1, 46.3.8.2 and 46.4.8.1 from the service connections on the mains, excluding only the individual units of sanitary ware which are listed in the Bill of Quantities separately. (See item 46.008(c)).

c) Sanitation**Unit: number (No.) or provisional sum**

Sanitary ware items will be measured by number or as Provisional Sums as listed in the Bill of Quantities.

The unit rate for billed items shall cover the cost of the supply and installation, including all fixings.

Provisional Sums will be held to include for the cost of purchase and delivery of the relevant items in terms of the Clause in the Conditions of Contract dealing with Provisional Sums (as amended by the Particular Conditions, if applicable).

46.009 Glazing and painting**a) Painting****Unit: Square metre (m²)**

Painting etc. will be measured and paid on walls and ceilings only. Measurement will be by the net areas painted, reveals, lintels and similar areas being measured.

The unit rates for doors, windows, steelwork, plumbing, fascias and the like will be held to include for painting etc. of the relevant items.

The unit rates for painting etc. shall cover the cost of all labour and material required to prepare the surfaces, paint the specified number of coats and clean up on completion.

46.010 Electrical work**Unit: sum (Sum)**

Electrical items will be measured by number, or will be listed in the Bill of Quantities as sum items.

The unit rates or sum shall cover the cost of all labour and material to complete the installation as specified.

46.011 Miscellaneous trades, fixtures and appliances

These items will be measured in metre, square metre, number or sum as per the schedule.

Supply and install complete as set out in the Pricing Instructions.

46.012 Payment for complete structure

**Unit: number or
sum or
sum per building**

Where specified or listed in the Bill of Quantities, buildings will be measured and paid by the sum or unit rate per each type of building.

The tendered sum or unit sum shall cover the cost of the supply of all necessary materials and the construction of the building complete as specified and shown on the Drawings, assuming the building to be on level ground with the top of the floor slab 225 mm above ground level and the top of the concrete foundation 150 mm below ground level and including:

- i) the compacted fill under floors;
- ii) final clearing up of the site;
- iii) all plumbing, including trench excavation and backfilling, two vertical elbows, 10 m of 20 mm diameter polyethylene leading from the house to the end of the existing house water leading in the vicinity of the front cadastral boundary, the supply and complete construction of the meter / stopcock assembly and chamber and final connection to the existing house water leading; and
- iv) drain laying including trench excavation and backfilling, two vertical 45° bends at the base of the stack, two horizontal 45° bends, 10 m of 110 mm diameter PVC-U pipe and the final connection to the existing end cap in the vicinity of the sewer main.

Furthermore, on sloping sites, the sum or unit rate for each building shall cover the costs of any additional vertical length of piping and drain laying required as a result of the height of foundation walls exceeding minimum dimensions for level sites, and of providing steps in the foundations.

a) Variations in quantities

- i) Any addition to or reduction from the standard horizontal length of 10 m of polyethylene water leading required, will be measured and payment will be adjusted separately.
- ii) Any addition to or reduction from the standard horizontal length of 10 m of PVC-U drain piping or the number of bends required, will be measured and payment will be adjusted separately.
- iii) Where sloping sites require additional work below floor level, the following items of additional work will be measured as listed in the Bill of Quantities:

- i) **Excavation to footings** **Unit: Cubic square (m³)**
- ii) **Footing walls, area in elevation of each wall thickness measures separately** **Unit: Square metre (m²)**
- iii) **Filing** **Unit: Cubic square (m³)**
- iv) **Steps (sets of two, three or more steps will be measured separately as sets)** **Unit: Number (No.)**

In all cases only the extra quantities required as a result of the sloping site will be measured.

The unit rates for these items shall cover the cost of all extra materials, labour, tools, Plant, etc. required to bring the work below floor level to the specified levels over and above that required for a level site.

b) Interim stages

The purpose of interim payments for building units successive stages of completion will be deemed to have the following proportional values:

- Completion of foundations: 5%;
- Completion to window sill height including building-in of windows and door frames: 0%;
- Completion of roof: 40%;
- Completion of plasterwork, floors and ceilings: 60%;
- Completion of doors and plumbing: 85%;
- Completion of glazing and painting: 95%; and
- On handing over: 100%.

Note: The above will be subjected to the normal retention in terms of the General Conditions of Contract.

ANNEXURE 46/1 APPLICABLE STANDARDS AND REGULATIONS

Reference is made to the latest issue of the following standards:

BS 952	Glass for glazing
BS 1199	Building sands from natural sources
BS 1387	Screwed and socketed steel tubes and tubulars and plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads
BS EN 10255	Non-alloy steel tubes suitable for welding and threading. Technical delivery conditions
SANS 22	Glazed ceramic wall tiles and fittings
SANS 28	Metal ties for cavity walls
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specification and test methods
SANS 226	Water taps (metallic bodies)
SANS 227	Burnt clay masonry units
SANS 248	Bituminous damp-proof courses
SANS 266	Gypsum plasterboard
SANS 460	Plain-ended solid drawn copper tubes for potable water
SANS 497	Glazed ceramic sanitary ware
SANS 523	Limes for use in buildings
SANS 542	Concrete roofing tiles
SANS 545	Wooden doors
SANS 559	Vitrified clay sewer pipes and fittings
SANS 581	Semi-flexible vinyl floor tiles
SANS 673	Mixtures of copper - chromium - arsenic compounds for timber preservatives
SANS 679	Zinc chromate primers for steel
SANS 680	Glazing putty for wooden and metal window frames
SANS 685	Fibre-cement sheets (flat and profiled)
SANS 727	Windows and doors made from rolled mild steel sections
SANS 786	Flexible vinyl flooring
SANS 791	Unplasticized poly (vinyl chloride) (PVC-U) sewer and drain pipes and pipe fittings
SANS 803	Fibre-cement boards
SANS 903	Aluminium alloy corrugated and troughed sheets
SANS 920	Steel bars for concrete reinforcement
SANS 927	Precast concrete kerbs, edgings and channels
SANS 929	Plywood and composite board
SANS 952	Polyolefin film for damp- and waterproofing in buildings

- SANS 967 Unplasticized poly(vinyl chloride) (PVC-U) soil, waste and vent pipes and pipe fittings
- SANS 1215 Concrete masonry units
- SANS 1783 Sawn softwood timber
- SANS 10005 The preservative treatment of timber
- SANS 10062 Fixing of concrete interlocking roofing tiles
- SANS 10070 The installation of resilient thermoplastic and similar flexible floor covering
- SANS 10096 The manufacture of finger-jointed structural timber
- SANS 10107 The design and installation of ceramic tiling
- SANS 10142 The wiring of premises
- SANS 50197 Cement Part 1: Composition, specifications and conformity criteria for common cements

The following Standards are applicable and referenced in Regulations:

- SANS 10252: Water Supply and Drainage for Buildings.
- SANS 10254: The installation, maintenance, replacement and repair of fixed electric storage water heating systems.
- SANS 10400: National Building Regulations.

ANNEXURE 46/2
PROJECT SPECIFIC SPECIFICATION FOR THE MANUFACTURE,
SUPPLY AND TESTING OF THERMOPLASTIC PIPES

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PLTP 1 SCOPE

This Specification covers the manufacturing, supply, installation and testing of thermoplastic pipes and fittings.

PLTP 2 STANDARDS

The latest revisions of the following Standards shall be applicable.

COMMONLY USED STANDARDS FOR PLASTIC PIPING SYSTEMS	
SANS 15874-1	Plastics piping systems for hot and cold water installations - Polypropylene (PP) Part 1: General
SANS 15874-2	Plastics piping systems for hot and cold water installations - Polypropylene (PP) Part 2: Pipes
SANS 15874-3	Plastics piping systems for hot and cold water installations - Polypropylene (PP) Part 3: Fittings
SANS 15874-5	Plastics piping systems for hot and cold water installations - Polypropylene (PP) Part 5: Fitness for purpose of the system
SANS 15875-1	Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X) Part 1: General
SANS 15875-2	Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X) Part 2: Pipes
SANS 15875-3	Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X) Part 3: Fittings
SANS 15875-5	Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X) Part 5: Fitness for purpose of the system
SANS 1601	Structured wall pipes and fittings of unplasticized poly(vinyl chloride) (PVC-U) for buried drainage and sewerage systems
SANS 16422	Pipes and joints made of oriented unplasticized poly(vinyl chloride) (PVC-O) for the conveyance of water under pressure - Specifications
SANS 2001-DP1	Construction works Part DP1: Earthworks for buried pipelines and prefabricated culverts
SANS 2001-DP4	Construction works Part DP4: Sewers
SANS 21138-1	Plastics piping systems for non-pressure underground drainage and sewerage - Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene criteria for pipes, fittings and system polyethylene (PE) Part 1: Material specifications and performance(PP)
SANS 21138-2	Plastics piping systems for non-pressure underground drainage and sewerage - Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) Part 2: Pipes and fittings with smooth external surface, Type A
SANS 21138-3	Plastics piping systems for non-pressure underground drainage and sewerage - Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) Part 3: Pipes and fittings with non-smooth external surface, Type B

COMMONLY USED STANDARDS FOR PLASTIC PIPING SYSTEMS	
SANS 21307	Plastics pipes and fittings – butt fusion jointing procedures for polyethylene (PE) pipes and fittings
SANS 22391-1	Plastics piping systems for hot and cold water installations - Polyethylene of raised temperature resistance (PE-RT) Part 1: General
SANS 22391-2	Plastics piping systems for hot and cold water installations - Polyethylene of raised temperature resistance (PE-RT) Part 2: Pipes
SANS 22391-3	Plastics piping systems for hot and cold water installations - Polyethylene of raised temperature resistance (PE-RT) Part 3: Fittings
SANS 370	Steel mesh reinforced polyethelene (PE) pipes for water supply
SANS 4427-1	Plastics piping systems - Polyethylene (PE) pipes and fittings for water supply - Part 1: General
SANS 4427-2	Plastics piping systems - Polyethylene (PE) pipes and fittings for water supply - Part 2: Pipes
SANS 4427-3	Plastics piping systems - Polyethylene (PE) pipes and fittings for water supply - Part 3: Fittings
SANS 4427-5	Plastics piping systems - Polyethylene (PE) pipes and fittings for water supply - Part 5: Fitness for purpose of the system
SANS 4437-1	Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) Part 1: General
SANS 4437-2	Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) Part 2: Pipes
SANS 4437-3	Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) Part 3: Fittings
SANS 4437-5	Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) Part 5: Fitness for purpose of the system
SANS 674	Steel-reinforced spirally wound PE drainage and sewer pipes
SANS 791	Unplasticized poly(vinyl chloride) (PVC-U) sewer and drain pipes and pipe fittings
SANS 8772	Plastics piping systems for non-pressure underground drainage and sewerage - Polyethelene (PE)
SANS 8773	Plastics piping systems for non-pressure underground drainage and sewerage - Polypropylene (PP)
SANS 966-1	Components of pressure pipe systems Part 1: Unplasticized poly(vinyl chloride) (PVC-U) pressure pipe systems
SANS 966-2	Components of pressure pipe systems Part 2: Modified poly(vinyl chloride)(PVC-M) pressure pipe systems
SANS 967	Unplasticized poly(vinyl chloride) (PVC-U) soil, waste and vent pipes and pipe fittings
EN 13476-1 (Parts 1, 2 and 3) and ISO 9969	PE structured wall sewer pipes

**STANDARDS RELEVANT TO THE MATERIAL
AND RAW MATERIAL QUALITY FOR THERMOPLASTIC PLASTIC PIPING
SYSTEMS**

SANS 1133	Plastics - Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics
SANS 2505	Thermoplastics pipes - Longitudinal reversion - Test method and parameters
SANS 2507-1	Thermoplastics pipes and fittings - Vicat softening temperature Part 1: General test method
SANS 3127	Thermoplastics pipes - Determination of resistance to external blows - Round-the-clock method
SANS 9227	Corrosion tests in artificial atmospheres - Salt spray tests
SANS 9852	Unplasticized poly(vinyl chloride) (PVC-U) pipes - Dichloromethane resistance at specified temperature (DCMT) - Test method

**STANDARDS FOR THE INSTALLATION PROCEDURES
AND WELDING APPLICATIONS OF PLASTIC PIPING SYSTEMS**

SANS 10089-3	The petroleum industry Part 3: The installation, modification, and decommissioning of underground storage tanks, pumps/dispensers and pipework at service stations and consumer installations
SANS 10252-1	Water supply and drainage for buildings Part 1: Water supply installations for buildings
SANS 10252-2	Water supply and drainage for buildings Part 2: Drainage installations for buildings
SANS 10254	The installation, maintenance, replacement and repair of fixed electric storage water heating systems
SANS 10268-1	Welding of thermoplastics - Welding processes Part 1: Heated-tool welding
SANS 10268-2	Welding of thermoplastics - Welding processes Part 2: Electrofusion welding
SANS 10268-3	Welding of thermoplastics - Welding processes Part 3: Hot-gas welding
SANS 10268-4	Welding of thermoplastics - Welding processes Part 4: Hot-gas extrusion welding
SANS 10268-5	Welding of thermoplastics - Welding processes Part 5: Solvent welding
SANS 10268-6	Welding of thermoplastics - Welding processes Part 6: Ultrasonic welding, staking and insertion
SANS 10268-10	Welding of thermoplastics - Welding processes Part 10: Weld defects
SANS 10269	Welding of thermoplastics - Testing and approval of welders
SANS 10270	Welding of thermoplastics - Approval of welding procedures and welds
SANS 1655	Welding of thermoplastics - Welding rods, fillers and solvents
SANS 1671-1	Welding of thermoplastics - Machines and equipment Part 1: Heated-tool welding

STANDARDS FOR THE INSTALLATION PROCEDURES AND WELDING APPLICATIONS OF PLASTIC PIPING SYSTEMS

SANS 1671-2	Welding of thermoplastics: Machines and equipment Part 2: Electrofusion welding
SANS 1671-3	Welding of thermoplastics - Machines and equipment Part 3: Hot-gas welding
SANS 1671-4	Welding of thermoplastics - Machines and equipment Part 4: Hot-gas extrusion welding
SANS 1671-6	Welding of thermoplastics - Machines and equipment Part 6: Ultrasonic welding, staking and insertion
SANS 6269	Welding of thermoplastics - Test methods for welded joints

STANDARDS USED TO DETERMINE THE STRENGTH AND DIMENSIONAL REQUIREMENTS AND TOLERANCES FOR PLASTIC PIPING SYSTEMS

SANS 130-1	Thermoplastics pipes, fittings and assemblies for the conveyance of fluids - Determination of the resistance to internal pressure Part 1: General method
SANS 9080	Plastics piping and ducting systems - Determination of the longterm hydrostatic strength of thermoplastics materials in pipe form by extrapolation
SANS 11922-1	Thermoplastics pipes for the conveyance of fluids - Dimensions and tolerances Part 1: Metric series

ADDITIONAL INTERNATIONAL STANDARDS FOR TESTING OF PLASTIC PIPING SYSTEMS

ISO 6259-1	Thermoplastics pipes - Determination of tensile properties - Part 1: General test method
ISO 6259-2	Thermoplastics pipes - Determination of tensile properties - Part 2: Pipes made of unplasticized poly(vinyl chloride) (PVC-U), chlorinated poly(vinyl chloride) (PVC-C) and high-impact poly(vinyl chloride) (PVC-HI)
ISO 11357-6	Plastics - Differential scanning calorimetry (DSC) - Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)
ISO 13761	Plastics pipes and fittings - Pressure reduction factors for polyethylene pipeline systems for use at temperatures above 20 °C
ISO 18553	Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds
ISO 18553 Amd 1 2007	Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds (AMENDMENT 1)
ISO 21307	Plastics pipes and fittings - Butt fusion jointing procedures for polyethylene (PE) pipes and fittings used in the construction of gas and water distribution systems

PLTP 3 CERTIFICATION, DOCUMENTATION AND QUALIFICATIONS

All plastic pipes and fittings have to comply with the relevant SANS Specification and shall be certified accordingly by authorities accredited by SANAS (South African National Accreditation System), for example SABS and SATAS.

Pipe manufacturers have to be members of SAPPMA (South Africa Plastic Pipe Manufacturers Association).

The Contractor shall submit the following documentation of the manufacturers to the Engineer before commencement of the manufacturing of pipes and fittings:

- Proof of current SANS Standard certification for product.
- SANAS accreditation of the certification authority (e.g. SABS or SATAS).
- SAPPMA certificate in order to ensure adherence to the SAPPMA/IFPA code of conduct and quality assurance standards.
- ISO 9001:2015 quality control accreditation.

All pipes shall be marked with the date and time of production, relevant SANS Standard, mark of certification authority (e.g. SABS or SATAS), SAPPMA mark of quality reassurance, pipe diameter and pressure / strength class.

The following work must be performed by IFPA (Installation Fabrication Plastics Pipe Association) members:

- All fabricated fittings and specials manufactured from HDPE pipe or PVC pipe.
- All on site welding/gluing and fabrication work on Site.

IFPA members are bound by a code of conduct calling for full compliance to policies and local standards. IFPA members are able to prove full traceability to all its employees performing IFPA related tasks.

The Contractor shall provide the necessary training to its employees to ensure IFPA standards are maintained. The Contractor shall submit its IFPA member certificate to the Engineer before commencement of manufacturing and construction.

PLTP 4 MATERIALS

PLTP 4.1 General

The following documentation shall be submitted by the Contractor to the Engineer before manufacturing:

- Certificate of Analysis (raw material)
- Quality Certificates (SABS, SATAS, etc.)
- Quality Control Plan

Inspection Documents shall comply with BS EN 10204 and shall be submitted by the Contractor to the Engineer. Unless otherwise specified in the Specifications or by the Engineer, Inspection Documents Type 3.1 are required.

Delivery of material shall only commence upon completion of the minimum required Batch Released Tests (BRT).

Quality systems shall be in accordance with SANS ISO 9001:2015 including Product Quality Plans for all products.

PLTP 4.2 PVC-O Pipes

PVC-O pipes shall be Class 500 with material properties as specified in paragraphs 4.1 and 4.2 of Technical Specification prCEN/TS 15223:2007(E) published by the European Committee for Standardization (CEN).

PLTP 4.3 High Density Polyethylene (HDPE) Pipes

Only unprocessed PE 100 polymer compliant to SANS ISO 4427-1 shall be used. This requirement shall be validated by the manufacturer.

PLTP 5 WELDING

Refer to PLTP 2 for the relevant welding standards.

The Contractor shall be responsible for the following:

- Compiling of Preliminary Welding Procedure Specification, recording of qualification welds and conducting of 3rd party testing;
- Compiling of Welding Procedure Specification and Qualification Report with required testing;
- Compiling of Final Welding Procedure Specification;
- On-site 3rd party inspections;
- Compiling of Welding Quality Packs with inspection reports, COC's, COA's, Certificates, etc.

Employees responsible for electro-fusion or butt welding of HDPE pipes shall have (as a minimum) a certificate of competence at NQF Level 2 (in accordance to SANS 10268).

Welders shall be trained and qualified for a specific pipe diameter and class and for a specific welding process (e.g. butt, electro-fusion, socket fusion, hot gas extrusion) by Plastics SA. On successful completion of training the welder shall be tested and certified in accordance with SANS / ISO 10269 – Testing and approval of welders.

The IFPA stamp is required at all welds. Calibration Certificates are required for welding equipment and welding machines shall be able to produce accurate welding reports.

PLTP 6 TESTING**PLTP 6.1 Hydrostatic pressure testing of spigot / socket joints**

At least three spigot / socket joints per batch of uPVC pipes shall be subjected to the one hour test as described in Section 5.8 of SANS 966 Part 1 at a laboratory approved by the Engineer. The Engineer shall be provided the opportunity to witness these tests. Should any of the tests fail, the associated uPVC pipe batch will be rejected.

PLTP 6.2 Testing of HDPE butt-weld connections

Quality control testing during butt-welding of HDPE pipes will be required. In addition, the welder shall be separately qualified for all pipe sizes to be welded.

The quality control testing for qualifying the welder shall be as follows:

- a) Observe the joining process to confirm that the proper butt-welding procedure is being followed.
- b) Visually inspect the joint and compare it to a sample or picture of an acceptable joint.
- c) Allow the joint to cool for at least one hour.
- d) A 300 mm wide ring section of the HDPE pipe shall be cut with the butt-weld joint centered as illustrated in Figure 1. Cut four strips lengthwise through the joint area, 90 degrees apart for visual examination and bend testing. The width of the test bend is proportional to the pipe wall thickness. If the pipe wall thickness is less than 25.4 mm, a 25.4 mm wide strip is recommended. If the pipe wall thickness is greater than 25.4 mm, the width of the test strip shall be equal to the pipe wall thickness.
- e) Visually inspect the strap samples for voids, discontinuities, lack of bonding, misalignment, bead size, etc.
- f) The bend testing consists of the following steps:
 - Allow each test strip to cool to a temperature ranging between 18°C and 27°C.
 - Each test strip shall then be clamped in a vice 25.4 mm under the weld bead as illustrated in Figure 2.
 - A steel extension pipe of appropriate diameter and length shall then be slipped over the free end of the specimen to 25.4 mm above the weld bead.
 - The bend test shall be performed by bending the test specimen 180 degrees (minimum 90 degrees) in the direction that places the concave interior surface/root of the pipe wall/weld in tension as illustrated in Figure 2. No failures in the butt-weld area are permitted with all four test strips.
- g) If flaws are observed or develop during bending, try to determine the cause, recheck the procedure, and make another joint.
- h) The welder is disqualified if the second joint is also unacceptable.
- i) Butt-weld of HDPE pipes to be installed shall not commence until a trial fission has passed the bend test.

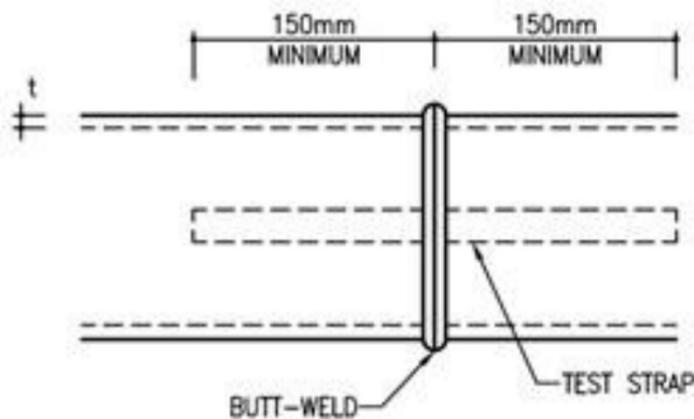


Figure 1: Bend strap test detail

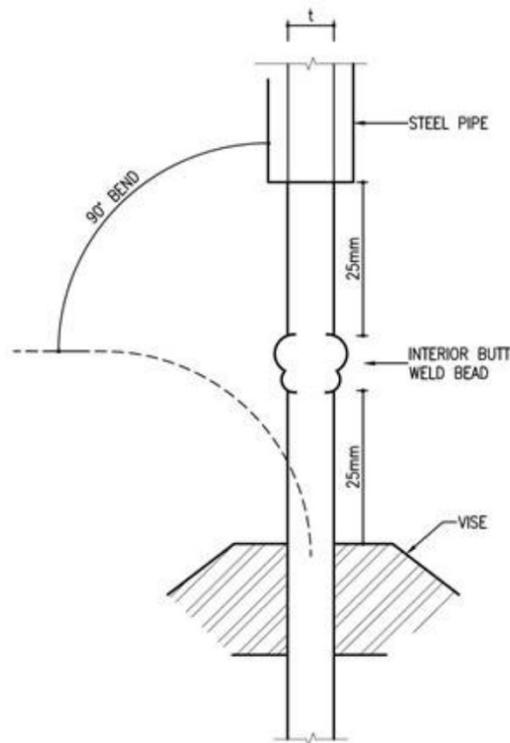


Figure 2: Bend strap test detail (side view)

PLTP 7 HANDLING AND INSTALLATION

PLTP 7.1 General

Handling and installation shall comply with guidelines provided in the Technical Manual of SAPPMA (latest edition).

PLTP 7.2 Ultra Violet (UV) protection

PVC pipes shall be stored under 80% black HDPE UV stabilised shade netting (blocking 80% UV).