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C3.3 – PW 371-B SPECIFICATION

PW 371-B

EDITION 2.2

Department:
Public Works
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CONSTRUCTION WORKS: SPECIFICATIONS

PARTICULAR SPECIFICATION

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Particular Specification

(read with PW371-A)

This specification falls under the Scope of Work as defined in *Standard for Uniformity in Construction Procurement,* published by the Construction Industry Development Board (CIDB), and is based on national or international standards, where such exist.

Works: **EASTERN CAPE: GQEBERHA: MDANTSANE LABOUR CENTRE: DEPARTMENT OF EMPLOYMENT AND LABOUR: SUPPLY AND INSTALLATION OF WATER TANKS.**

Ref no: **14/1/3/1/1/6464/5050**

TABLE OF CONTENTS

1 Earthworks

1.1 Site clearance

Applicable standard: SANS 2001 – Construction Works Part BS1: Site clearance

Specification data[1]:

SANS 2001 standard specifications are deemed to satisfy the provisions of SANS 10400.

SANS 2001-BS1 covers removal of vegetation, fences, guard rails and posts, litter and building rubble, boulders of size up to 0,15 m3, and surface and subsurface obstructions, and demolition and removal of structures (including their basements, if any), not directly associated with or incidental to any excavation.

€ designated area/site in which work is to be carried out: see drawings

€ level of finished earthworks: see drawings

€ site clearing activity numbers: …

1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10 / 11 / 12

1 removal and disposal of vegetation; 2 removal and disposal of structures by means of bulldozing; 3 demolition, breaking up and removal of buildings to ground level; 4 demolition, breaking up and removal of underground structures; 5 ditto septic tanks, soak pits; 6 ditto litter, rubble, rocks on surface; 7 removal and stacking of re-useable materials; 8 removal of asphalt layers; 9 removal of paving; 10 removal of kerbs, channels, haunching; 11 scarifying, ripping to blocks <200 mm; 12 removal of disused foulwater and stormwater drains and watermains

€ description of materials to be reused: …

Activity 7 requires description of reuseable materials

€ depth of underground structures to be demolished: see drawings

Activity 4 requires depth of demolition of underground structures to be specified.

€ depth for ripping or excavation: see drawings

Activity 11 requires depth for ripping or excavation to be specified

€ designated sites for disposal of materials: see drawings

€ designated sites for disposal of reusable materials: see drawings

€ trees, turf, plants, bushes, shrubs and flora to be preserved and/or replanted: see drawings

Look up tree distance guidelines in SANS 10400-H Annex E.

€ topsoil: select and stockpile

Topsoil is mostly a precious commodity.

1.2 Earthworks (general)

Applicable standard: SANS 2001-Construction works Part BE1: Earthworks (general).

Specification data:

SANS 2001-BE1 covers: excavation, filling, compaction and finishing of general excavations for buildings, bridges and structures, terracing, landscaping and private railway sidings, carried out with heavy construction equipment or light construction equipment, or by hand.

€ topsoil: select and stockpile

€ areas where surplus and unsuitable materials shall be disposed of: see drawings

€ areas to be topsoiled: see drawings

[1] The specification data for SANS 2001 standards as listed in this publication is a selection of importance mainly for buildings. See Annex A of the relevant standard for the full list of specification data, and follow instructions when required for civil works.

- € areas to be grassed or vegetated: see drawings
- € degree of accuracy required : II

Relevant standards:
SANS 10400-F Site Operations.
SANS 10400-G Excavations.
To be published: SANS 2001- Construction works Part BE2: Earthworks (small works).

2 Concrete works

2.1 Structural works (SANS 2001-CC1)

Omit this part if not relevant, or SANS 2001-CC2 Concrete Works (Minor Works) is specified.

SANS 2001-CC1 covers: structural concrete in buildings and structures where the design and supervision of reinforced, prestressed and precast concrete are under the direct control of appropriately qualified engineers and technologists. Does not cover piles, harbour and marine works, and underground works in mines.

Specification data:

materials

€ strength concrete grade: see drawings

10 / 15 / 20 / 25 / 30 / 40

Contractor is responsible for design of strength concrete.

Strength concrete is designated by its characteristic strength followed by the size of stone used in its manufacture, for example, grade 30/19 refers to a 30 MPa mix made with 19 mm stone. Stone size has little influence on strength but does affect workability and water demand.

Grades for typical applications are

10 (plain [unreinforced] concrete strip foundations, or surface beds where the slab does not serve as the final wearing surface);

15 (plain concrete strip foundations, floors on the ground that will serve as the final wearing surface);

20 (reinforced concrete subject to non-aggressive (dry) conditions; base courses of lightly loaded floors (no trucking) and one-course domestic and office floors on the ground that will serve as the final wearing surface; landscape footpaths);

25 (general reinforced concrete construction in buildings, bridges, culverts, silos, machine foundations, slab-on-the-ground foundations, unplastered walls above ground);

30 (machine foundations subject to vibration and shock; concrete roads; paving and floors on the ground to carry fork-lift trucks), precast concrete;

40 (specially watertight walls and tanks; highly stressed rc members; precast structural units; concrete subject to severe vibration and shock, abrasion and wear).

€ prescribed mix concrete: SANS 2001-CC2 table 5 / …

SANS 2001-CC2 table 5 (19 mm aggregate) and table 6 (13 mm aggregate) contains generic prescribed concrete mixes for strength grade 10, 15, 20, 25, 30, or specify bespoke requirements.

€ characteristic strength of tendon steel for prestressing: …

€ joint fillers, sealants, waterstops, bearings and accessories: … / see Section 6

€ steel joint cover plate finish: not galvanized / galvanized

off-form surfaces

€ concrete off-form surface finish (smooth-special): steel forms, uniform texture, appearance and colour

Specify special off-form and exposed aggregate surfaces only with permission: timber boards, special patterned finish (hardboard, rubber, plastic), brushed, tooled, sand-blasted or aggregate transfer. See SANS 2001-CC1 table 1.

construction joints

€ type: see drawings

construction joint / movement joint / contraction joint / expansion joint

In general, in off-form surfaces, construction joints should be shown where a day's casting starts and ends, e.g. bottom and top of slab/column.

€ joint sealing requirements: see Section 6

SANS 2001-CC1 specifies the finishing of exposed horizontal cast in situ concrete surfaces excluding industrial floors. Public ramps must have a safe gradient and frequent landings for disabled persons. Check with SANS 10400-S. See note on stairways at end of section.

€ parts of the structure which need to be watertight: see drawings

€ degree of accuracy required: II

precast/prestressed concrete

€ surface finish required to precast units: special off-form / exposed aggregate / mosaic / ...

€ prestressing particulars: ...

€ order of loading and magnitude of load for each component of prestressing tendon: ...

€ prestressing test requirements: ...

€ position of lifting and supporting points, method of lifting, type of equipment and transport used in handling and erection of precastunits: ...

€ method of assembly and erection of precast units: ...

€ design requirements for structural connections of precast units: ...

€ degree of accuracy required: II

additional requirements

€ low-density concrete if not breeze (clinker) concrete at 800-960 kg/m^3

60-160 (vermiculite) / 120-240 (perlite) / 450-720 (foamed slag) kg/m^3

€ form drip joint or downstand under all exposed off-form slab edges; chamfer exposed edges of off-form columns, slabs, joints etc.; use standard plastic joint formers

2.2 Minor works (SANS 2001-CC2)

Omit this part if SANS 2001-CC1 is specified.

SANS 2001-CC2 covers concrete works in foundations, slabs, stairways, masonry walls, pipelines, manholes, latrines, conservancy tanks, septic tanks and the like where the design and supervision of plain, reinforced and precast concrete are not necessarily under the direct supervision of approved, qualified engineers and technologists and no special finishes to the concrete are required. Use SANS 2001-CC1 when special finishes are required.

Specification data:

€ horizontal surfaces that need to be non-skid: see drawings

2.3 Foundations (SANS 2001-CM2)

SANS 2001-CM2 covers construction requirements for strip footings, pad footings and slab-on-the-ground foundations to receive masonry walling, and the construction of lightly loaded concrete surface beds.

Specification data:

€ site class designation: see drawings

R / H / C / S / P / H1 / C1 / S1 / H2 / C2 / S2 / H3

R rock; H heaving (expansive) soils; C collapsible soils; S compressible sand; P fill, dolomite, marshy areas, mine waste, very soft clays. Site class designations R, H, C,S indicate that the expected range of total soil movements arising from ground movements is such that no special precautionary measures are required to minimize the effects of differential ground movements on buildings. Number denotes higher range of movement. Behaviour of P is variable and the reason for such classification should be given in brackets, e.g. P (fill).

€ foundations: in accordance with the requirements of SANS 10400-H for strip footings, slab-on-the-ground foundations or modified normal construction for category of expected damage 1 or 2 / rational design by competent person

See SANS 10400-H for geotechnical and/or structural solutions for foundations on problem soils.

€ construction of steps in foundations in excess of 400 mm: see drawings

€ minimum founding depth: see drawings

Required where the geotechnical report indicates a deeper requirement than that provided for in SANS 10400-H.

additional requirements

€ protection against termites: SANS 10124.

2.4 Concrete floors and paving on the ground

€ industrial floors: direct-finished one course slab as designed and constructed to SANS 10109 under direction of a competent person

Direct-finished one-course concrete floors on the ground are superior to concrete bases with screed or topping, and should be used if floor is to be left as is, or if to be covered with resilient floor finishes like thermoplastic tiles or carpet.

concrete

€ concrete grade: see drawings

20 / 30

Show grades on drawings.

Default: (grade 20 for base courses of lightly loaded floors [no trucking] and one-course domestic and office floors on the ground that will serve as the final wearing surface, or grade 30 for paving and floors on the ground to carry fork-lift trucks) is acceptable.

damp-proof under-surface membrane

€ DPM under floor area: required / not required

Dpm normally not required under external floors.

fabric reinforcement

€ fabric reinforcement ref. no. 100 / ... / not required

€ floor/paving thickness: see drawings

Floor thickness ranges between 120 and 360 mm, depending on loading, use

placing

€ levels and gradients: see drawings

joints

€ joint sealing: left open / sealed

Joints should be sealed when the floor is used under wet conditions, or where hygiene or dust has to be controlled.

2.5 Strongrooms

€ fire rating, burglar resistance and wall thickness class: see drawings

1 / 2 / 3 / 4

Class: 1 (4h, no burglar resistance, 200 mm wall, 125 mm floor/ceiling); 2 (4h, limited burglar resistance, 300 mm); 3 (4h, medium burglar resistance, 450 mm); 4 (4h, high burglar resistance, 525 mm)

NOTE ON STAIRWAYS

The rule in SANS 10400 – M of a minimum going of 250 mm and a maximum rise of 200 mm often leads to a disregard for two other rules, i.e, "*the dimension of each step of the stairway shall be such that the sum of the going and twice the riser is not less than 570 mm and not more than 650 mm*", and "*any stairway ... shall have dimensions appropriate to its use*" (NBR part M Stairways). A maximum rise of 180 and a minimum going of 280 is a more comfortable and safer proportion, and should be used in most public buildings.

The full range of a more comfortable and safer proportion would be (rise/going):

180/280 mm; 170/280 – 320 mm; 150/280 – 350 mm; 120/280

3 Masonry

3.1 Masonry Walling (SANS 2001-CM1)

SANS 2001-CM1 Masonry Walling covers requirements for masonry walls, materials, the laying of masonry units in unreinforced and reinforced applications, the building in of door and window frames, holes and chases, the securing of timber roof structures and the fixing of slips.

Specification data:

masonry units

Bricks and blocks are collectively termed *masonry units,* whether solid or hollow. A block has dimensions which satisfy any one of the following conditions: a length of 300–650 mm, width of 130–300 mm, or height of 120–300 mm.

€ type: burnt clay / concrete

€ masonry units: SANS 2001-CM1 clause 4.1.1.3

Omit if masonry units to SANS 227 and SANS 1215 are specified.

SANS 2001 CM1 clause 4.1.1.1 states "Masonry units shall comply with the requirements of either 4.1.1.2 (SANS *227 and* SANS *1215*) or 4.1.1.3". Clause 4.1.1.3 is a generic description, which may be more practical in areas where bricks to SANS 227 are unobtainable. Specify to clause 4.1.1.3 only with permission.

burnt clay masonry units (SANS 227*[2])

Omit if requirements of SANS 2001-CM1 clause 4.1.1.3 are acceptable.

€ nature of face unit: hollow / solid / contractor's choice

€ class of face units: FBS / FBX / FBA

Class E bricks are any class of masonry unit produced for structural or load-bearing purposes in face or non-face work, and is supplied to an agreed compressive strength e.g. FBSE2, where the number equals the nominal compressive strength in megapascals.

€ nominal dimensions: 222 x 103 x 76 mm

See SANS 227 for modular sizes, e.g. 190 x 90 x 90 mm.

€ colour of face units: …

concrete masonry units (SANS 1215*)

Omit if requirements of SANS 2001-CM1 clause 4.1.1.3 are acceptable.

€ nature of unit: hollow / solid

€ colour of face units: …

€ nominal dimensions: 190 x 90 x 90 / 290 x 90 x 90 / 390 x 90 x 190 / 390 x 190 x 190 mm

mortar

€ sand: SANS 1090*

Omit if default (clause 4.1.4.1) is acceptable.

Clause 4.1.4.1 states that "Sand shall either comply with all of the following requirements or, if required in terms of the *specification data*, the requirements of SANS 1090 for mortar sand (natural or manufactured)"

€ mortar class: II

[2] Asterisk (*) denotes the preferred attribute or value.

Class I mortar is *suitable* for highly stressed masonry, e.g. multi-storey loadbearing buildings; class II is *suitable* for normal loadbearing applications, including parapets, balustrades, retaining structures, freestanding and garden walls, and walls exposed to severe dampness; class III mortar (not mentioned in SANS 2001-CM1) is *suitable* for lightly stressed bearing walls where exposure to dampness is not severe, or for renovation to unburnt clay masonry walling.

€ pigments for mortar: ... ; colour: ... ; other requirement(s) : ...

reinforcement

€ prestressing steel (hot-rolled bars or high tensile steel wire and strand) : ...

Provide particulars or omit if not required.

NOTE on metal wall ties: SANS 204 requires masonry walls enveloping habitable portions of the building fabric in all climatic zones to be cavity or insulated cavity walls. Note that existing wire tie types may not be able to be centred centrally and conform to the minimum embedment rule of 50 mm. Note that crimp wire ties are not for use on cavity walls.

work

€ face work jointing: struck* / flush / recessed / drip

Struck (half-round) joints are denser with better resistance to water penetration. Flush joints require careful cleaning of face work. Face work includes fair face work.

€ face work pointing shape, colour: ...

Pointing is the raking out of brickwork joints 20 mm deep, then filling with mortar, usually coloured. Joint faces can be left flush, projecting, or shaped in the same way as jointing.

€ multi-leaf wall bond: stretcher and brickforce / English bond (header course every second course) / collar-jointed bond

SANS 2001-CM1 specifies collar-jointed walls as default. Collar-jointed walls have a narrow cavity (<25 mm) between the leaves (the collar joint) which is filled solid with mortar or grout as the work progresses (not to be confused with *grouted cavity* construction where the cavity is wider and filled with concrete). Collar-jointing is intended for walls that require an effective thickness equal to the actual overall thickness of the wall. The success of this construction depends heavily on proper supervision. Collar-jointing is not mentioned in SANS 10249 Masonry Walling.

€ position of control and articulation joints: see drawings

additional requirements

€ wall type: see drawings

single leaf / multileaf / cavity / insulated cavity / grouted cavity / sealed multileaf

Sealed multileaf walls (outside face of inner leaf treated with a bitumen sealer) may be used in place of cavity walls in areas of prolonged, heavy, wind-driven rains, or where wall is faced with masonry-type facings (see *Masonry-type facings*)

€ special shape face bricks: see drawings

single bullnose / double bullnose / single cant / double cant

€ lintels in face work: see drawings

bed joint reinforced masonry / prestressed concrete lintels / galvanized steel / wood

For timber lintels see Section 4.

€ cavity reveals around windows/doors: open / closed / see drawings

In energy rated buildings, at cavity reveals around openings, cavity insulation should continue up to window or door frames to prevent thermal bridging, therefore "open".

A bituminous damp-proofing type may be required where bituminous waterproofing is to be bonded to damp-proofing – see Section 8.

3.2 Glass blockwork

glass blocks

€ nominal dimensions: …
€ surface pattern: …
€ opacity: …
€ colour: …

3.3 Stone masonry

Loadbearing stone masonry. For stone cladding see *Masonry-type facings.*

€ type: rubble / dimension stone

3.3.1 Rubble

Rubble (koppieklip) is stone with irregular faces as found in nature on or near surface.

€ bedding of stones: set in mortar / dry set, with smaller stones to achieve stability.

3.3.2 Dimension stone

€ stone type: freestone / granite / marble / slate / cast stone

Freestone (makklip) is building stone soft enough to be cut with tools and uniform enough to be carved in any direction, typically sandstone.

€ face dressing: plain / polished / rusticated / vermiculated / boasted / drafted margin
€ shape and size: square sawn in modular rectangular sizes / …
€ bond to homogenuous pattern: random coursed / regular coursed
€ jointing: flush / keyed
€ pointing colour: …

3.4 Masonry-type facings

SANS 10073 The Safe Application of Masonry-type Facings to Buildings was withdrawn in May 2011 and "replaced" by SANS 10400-K Walls which does not yet touch on this important subject.

Thin panel cladding, e.g. marble, should be rail-fixed, leaving a cavity between facing and backing. The advantages of this system are avoidance of staining of the stone face, more reliable support, faster erection, smaller joints and less dependency on skilled labour. Consult specialist stonework contractors.

Facings wholly dependent on fixing to the backing with proprietary adhesive only may lead to failure.

€ facing type: precast concrete / natural stone / burnt clay units / concrete units of design, size, colour and finish: …

Joints should be sealed to prevent ingress of water and to provide for thermal and structural movement.

Relevant standards

SANS 993Modular co-ordination

SANS 10021 The waterproofing of buildings (in the case of facings this depends on climatic region, facing material and backing).

SANS 10073 The safe application of masonry-type facings to buildings (withdrawn).

SANS 10145 Concrete masonry construction.

SANS 10164 The structural use of masonry.

SANS 10249 Masonry walling.

SANS 10400-H Foundations.

SANS 10400-K Walls.

SANS 10400-M Stairways.

SANS 10400-P Drainage.

4 Structural timberwork

4.1 Structural timberwork (flooring) (SANS 2001-CT1)

SANS 2001-CT1 covers the installation of suspended timber floors in buildings to be constructed for occupancy class H3 (domestic residence) and H4 (dwelling house) buildings, as described in SANS 10400-J Floors, and that have a distance that does not exceed 7 m between supports, and a beam/joist spacing that does not exceed 600 mm. Modify to make this part of SANS 2001 applicable for the installation of suspended timber floors designed for other occupancies or for greater dimensions between beams or supports.

For wood floors on solid substrates see Section 13.

Specification data:

softwood timber joists

- € type: solid / laminated
- € cross section: see drawings

Omit if default description (to SANS 10400-J) is acceptable.

hangers, masonry anchors

- € size/strength: …

Omit if default description in SANS 2001-CT1 (hangers: 4,0 kN; masonry anchors: 10 dia x 45 mm length, 2,5 kN) is acceptable.

softwood flooring boards

Omit this part if default description in SANS 2001-CT1 is acceptable. NOTE SANS 629 withdrawn 2012 without replacement. Most req'd data kept except marking.

- € softwood flooring boards:
  - € genus: Pinus / Cedrus / Podocarpus / Cupressus
  - € nature: solid / laminated
  - € grade: clear flooring / select flooring / flooring
  - € density group: light / heavy

Density group: light (400-550 kg/m^3); heavy (550 kg/m^3, for example squash court floor boards)

  - € cross section: see drawings

Omit if default (50 – 140 x ≥22 mm) is acceptable. Also 33 mm thickness.

  - € length: >1 800 mm when square sawn at ends, >600 mm when matched
  - € finger joints: not prominent

Omit if default (prominent) is acceptable.

hardwood strip flooring

NOTE SANS 281 Hardwood block and strip flooring withdrawn 2009 without replacement.

- € species: …
- € dimensions: ≥460 x 57 – 90 x ≥20 mm

additional requirements

- € hardwood species: …
- € hardwood prefinish: required / not required
- € exposed faces of sawn structural timber: planed, sandpapered, and arris rounded to 3 mm radius.

4.2 Structural timberwork (roofing) (SANS 2001-CT2)

SANS 2001-CT2 covers the construction of timber roof assemblies in buildings. It includes the manufacture of bolted trusses that are designed in accordance with the requirements of SANS 10400, the erection of prefabricated timber trusses, the erection of rafters and purlin rafters, the fixing of purlins and battens, and the fixing of brandering to roofing members to support ceilings that comprise gypsum plasterboard, fibre-cement board or similar boards

Specification data:

softwood roofing timber

€ type: solid / laminated

€ cross section, grade: see drawings / to SANS 10400-L Roofs / to standard ...

roofing poles ("fence poles" SANS 457)

"fence" poles are normally used for roofs. See also "transmission" poles below

€ roofing pole type: softwood SANS 457-2 / hardwood SANS 457-3 / to standard ...

€ top diameter (thin end, colour-coded) : see drawings

50-79 (red), 80-99 (yellow), 100-119 (blue), 120-139 (white), 140-159 (orange), 160-179 (green), 180-199 (black) mm; ditto posts: 145-174, 175-199, 200-230 mm.

hangers, clips, masonry anchors

€ size/strength: ...

Omit if default requirements (hangers: 4,0 kN; hurricane clips: 1,2 kN; masonry anchors: 10 dia x 45 mm length, 2,5 kN) are suitable.

additional clauses

€ truss type: monoplanar prefabricated rational design to SANS 10243 or SANS 1900 / lapped and bolted within scope of SANS 10400-L/10243

In case of lapped and bolted trusses, show all member sizes and connection details on drawings. SANS 10243 provides guidance on the manufacture, erection and bracing of timber roof trusses. SANS 1900 covers a rational design prepared by a *Competent Person* and inspected by such a person during installation.

€ "transmission" poles, diameter: softwood poles SANS 753 / hardwood poles SANS 754

Omit if "fence" poles to SANS 457 as required by SANS 2001-CT2 are acceptable. "Transmission" poles to SANS 753/754 should only be used when high strength is specifically required. See SANS 753 for lengths, minimum top diameter of poles.

€ gang planks: two 150 x 38 mm softwood grade S5, nailed onto tie beams where shown on drawings / nailed onto tie beams of two adjoining trusses on both sides of geysers

Gang planks for walking/crawling in roof space, when required.

€ timber lintels type and size: see drawings

softwood / hardwood / structural laminated timber / composite structural plywood web and solid timber flanges; grade: 5 / 7 / 10

4.3 Structural laminated timber (SANS 1460)

€ material: see drawings

softwood (Pinus) / hardwood (Eucalyptus) / board (fibreboard, plywood, composite board)

€ exposure class: 1 (exterior), 2 (semi-exterior), 3 (humid interior), 4 (dry interior)

€ type: G (stocklam) / C (customlam)

€ appearance and finish: rough-sawn (R), fine-sawn (F), planed (P), sanded (S), smoothed (G), coated (C), special (X)

€ stress grade: 5 / 7 / 10 / 14

€ fire retardant treatment: required / not required

€ cross section: see drawings.

Relevant standards:
SANS 1288 Preservative treated timber.
SANS 1900: Monoplanar prefabricated timber roof trusses (nail-plated).
SANS 10005: Preservative treatment of timber.
SANS 10043:The laying of wood floors.
SANS 10082: Timber buildings.
SANS 10096: Manufacturing of finger-jointed structural timber.
SANS 10163 The structural use of timber.
SANS 10243 The design, manufacture and erection of timber trusses.
SANS 10400-J Floors.
SANS 10400-L Roofs.
SANS 10400-M Stairways.
SANS 10400-T Fire Protection.

5 Structural steelwork

5.1 Structural steelwork (SANS 2001-CS1)

SANS 2001-CS1 covers structural steelwork for buildings and other structures, excluding bridges, offshore structures, mobile equipment (stackers, reclaimers, draglines, cranes, etc.), mine shaft steelwork (buntons and guides) and mining conveyances, but does not cover roof and side cladding, or the detailed aspects of sundry items such as handrails, ladders, steel flooring and the like, neither does it cover protection of steelwork against corrosion or fire.

Specification data:

€ class and grade of fasteners: ...

€ format of drawings: ...

State in which format and to which standards each category of drawings shall be prepared.

€ hole sizes for holding-down bolts in excess of 36 mm diameter: ...

€ connections to allow movement: ...

€ requirements for machining: ...

€ requirements for non-destructive tests on welds: ...

5.2 Sundry steelwork

5.2.1 Material

cold-formed structural steel (SANS 10162)

€ commercial quality steel: permitted if yield stress equals 200 MPa, tensile strength 365MPa; obtain proof.

Cold-formed profiles are often made from commercial quality steel of which the yield stress is seldom less than 210 MPa.

structural steel tubes SANS 657-1

€ coating: uncoated / hot dip galvanized coating SANS 32 quality B

€ size/profile: see drawings

Size/profile: 21, 27, 32, 34, 38, 42, 48, 51, 60, 76, 89, 102, 114, 127, 140, 152, 165, 178, 219 mm ø (general purpose); 20 x 20, 25 x 25, 30 x 30, 40 x 40, 50 x 50, 60 x 60, 70 x 70, 80 x 80, 90 x 90, 100 x 100, 115 x 115, 120 x 120, 135 x 135, 140 x 140, 150 x 150, 160 x 160, 175 x 175, 180 x 180 mm (square); 40 x 20, 50 x 30, 60 x 40, 80 x 40, 90 x 50, 100 x 50, 100 x 60, 120 x 60, 120 x 80, 140 x 90, 150 x 100, 160 x 80, 180 x 100, 200 x 100, 200 x 120, 220 x 140, 250 x 150 mm (rectangular)

corrosion resistant (weathering) steel

Corrosion resistant steel also known as COR-TEN, a registered trademark of USX Corporation. Corrosion resistant steel is weldable. Available in sheet (<2,0 mm) and strip (2,5 – 6,0 mm). Consult Mittal Steel.

€ grade: 1 / A

steel wire rope (cables)

€ class: 6 x 7 / 6 x 24 / 6 x 37 / 8 x 19 mm

€ diameter: 6 / 7 / 8 / 9 / 10 mm.

5.3 Coating

€ type: hot dip galvanising / prepainting / hot dip galvanising and prepainting (duplex system)

Other coating types on steel are vitreous enamel, plastic or protective tape.

SANS 121 provides for one set of coating thickness only – see NOTES at end of Section. Thicker (25%) coatings may be requested without affecting specification conformity. The primary influencer on hot dip galvanized coating is the steel composition. See SANS 14713 for design guidelines.

hot dip galvanising

The Hot Dip Galvanizers Association South Africa (HDGASA) is the industry representative body.

€ significant (architectural) surfaces: see drawings

NOTE on appearance of galvanized coatings

SANS 121:

"The primary purpose of the galvanized coating is to protect the underlying iron or steelwork against corrosion. Considerations related to aesthetics or decorative features should be secondary. Where these secondary features are also of importance it is highly recommended that the galvanizer and customer agree the standard of finish that is achievable on the work [in total or in part], given the range of materials used to form the article. This is of particular importance where the required standard of finish is beyond that set out in this section. It should be noted that 'roughness' and 'smoothness' are relative terms and the roughness of coatings on articles galvanized after fabrication differs from mechanically wiped products, such as galvanized sheet, tube and wire. It is not possible to establish a definition of appearance and finish covering all requirements in practice.

The occurrence of darker or lighter area (e.g. cellular pattern or dark grey areas) or some surface unevenness shall not be cause for rejection: also wet storage stain (white or dark corrosion product – primarily basic zinc oxide – formed during storage in humid conditions after hot dip galvanising) shall not be cause for rejection, providing the coating thickness remains above the specified minimum value."

€ sample: required / not required

€ special pre-treatments: …

€ special coating thickness: …

€ any after treatments: …

€ method of site repair and maximum allowable size of repair: …

Omit if default (repair by either zinc metal thermal spraying, zinc rich epoxy or a *suitable* zinc rich paint, provided that the repaired surface receive an additional 30 µm over and above that required in terms of the specification; HDGASA recommends a practical repair area of ± a R5 coin) is acceptable.

€ architectural work to be packaged: required / not required

paint or varnish

SANS 12944 covers the following suitable surfaces for painting: uncoated steel; thermally sprayed with zinc, aluminium or their alloys; hot dip galvanized; zinc-electroplated; sherardized; prefabrication primed; other painted surfaces. Part 2 deals with the principal environments and the corrosivity of these environments to which steel structures are exposed: atmospheric corrosivity category: C1 very low / C2 low / C3 medium / C4 high / C5-I very high (industrial) / C5-M (marine); immersed category for water and soil: Im1 (fresh water) / Im2 (sea or brackish water) / Im3 (soil). Part 5 deals with paint systems.

€ paint system: alkyd / chlorinated rubber / PVC / acrylic / epoxy / ethyl silicate / polyurethane / bitumen

Protective paint systems not covered: powder coating; stoving enamel; heat-cured paints; linings of tanks; products for the chemical treatment of surfaces.

5.4 Fire protection

The yield strength of steel is halved at temperatures exceeding 550°C. Consider placing columns outside building.

€ protection of structural steel against fire: see drawings

reinforced concrete grade 25 / solid masonry / sprayed vermiculite-cement/perlite-cement / metal lath and plaster

Relevant standards:

SANS 1921 Construction and management requirements for works contracts.

SANS 10094 The use of high-strength friction-grip bolts.

SANS 10162 The structural use of steel.

SANS 14713 Protection against corrosion of iron and steel in structures – zinc and aluminium coatings – guidelines.

HDGASA code of practice no 1-1990 The Surface Preparation and Application of Organic Coatings to New, Unweathered Hot Dip Galvanized Steel (Sheet and Section) Excluding In-line Coil Coatings.

HDGASA code of practice no 2-1990 Specification for the Performance Requirements of Coating Systems Applied to New Unweathered Hot Dip Galvanized Steel (Sheet and Section) excluding In-line Coil Coating (Duplex Systems).

NOTES on hot dip zinc coating thickness and service life:

Consult the Hot Dip Galvanizer's Association of South Africa (HDGASA) for determination of high corrosivity areas.

All hot dip galvanising specifications state the minimum *suitable* coating thickness and not average coating thickness. The thickness actually achieved varies with steel composition and thickness of steel, and can range from the minimum up to >50% greater. As life expectancy predictions are normally based on the minimum coating thickness, they are usually conservative.

Hot dip galvanized coating on structural steel should in most cases provide a service-free life of 40 – 50 years. This is determined by dividing the minimum achieved coating thickness taken on the thinnest steel component by the corrosion rate per year for the location in question (see table).

HDGASA uses *SANS ISO* 9223 to determine corrosivity categories, based on three factors:
1) Time of wetness, being the period that the zinc surface is covered by liquid containing the corrosive elements (electrolyte); 2) Airborne pollution containing sulphur dioxide (SO_2); 3) Airborne pollution containing salinity, usually in the form of chlorides carried on prevailing sea winds.

Estimated service life of hot dip galvanized steel complying with SANS 121				
Corrosivity Category ISO 9223	Zinc corrosion rate / yr	55 µm for steel 1.5 – 3mm thick	70 µm for steel 3 – 6 m m thick	85 µm for steel >6 mm thick
C 1 very low	<0.1 µm	>100 yrs	>100 yrs	>100 yrs
C 2 low	0.1 – 0.7	<78.5 yrs	>100 yrs	>100 yrs
C 3 medium	0.7 – 2.1	26 – 78.5 yrs	33 – 100 yrs	40 – >100 yrs
C 4 high	2.1 – 4.2	13 – 26 yrs	16 – 33 yrs	20 – 40 yrs
C 5 very high	4.2 – 8.4	6.5 – 13 yrs	8.3 – 16 yrs	10 – 20 yrs

Source: HDGASA Information sheet No 8.

Coating thickness in µm can be converted to approximate coating mass per unit area in g/m² by multiplying by the nominal density of the coating (7,2 g/cm³): thus 55 µm = 395 g/m²; 70 µm = 505 g/m²; 85 µm = 610 g/m²

Source: SANS 121 / SANS 14713.

Z275 is the designation for 275 g/m² zinc/surface area on both sides of steel sheet (for sheet that would mean 137.5 g/side) which equals a mean coating thickness of 19 µm. Similarly, Z450 equals 22 µm, and Z600 equals 43 µm).

6 Insulation, sealants, seals

6.1 Thermal insulation

6.1.1 Materials

Consider insulation materials with recycled content, e.g. polystyrene, glass fibre, cellulose and polyester fibre. Consult TIASA (Thermal Insulation Association of SA) or EPSASA (Expanded Polystyrene Ass. of SA).

€ type: bulk (rigid board, fibre matts or batts) / reflective (foil) / composite bulk / loose fill / pipe / spray foam

€ required R-value/thickness: SANS 204

Show all insulation thicknesses on drawings. Actual R-value test results may be obtained from the South African Fenestration and Insulation Energy Rating Association (SAFIERA).

€ required fire performance classification of thermally insulated building envelope systems: SANS 428

€ combustability: A / B

A (non combustible); B (combustible)

€ surface fire spread properties: 1 / 2 / 3 / 4 / 5 / 6

1 (no flame spread) / 2 – 6 (rapid flame spread)

€ application: vertical / horizontal / vertical and horizontal / see drawings

Consult SANS 10400-T for fire performance requirements.

rigid board

€ material: EPS / XPS / EPU

€ expanded polystyrene (EPS) grade: 16D-85 / 24D-170 / 32D-225

16D-85 (standard); 24D-170 (high); 32D-225 (extra high) (density kg/m³–compressive strength kPa)

EPS is combustible on its own but claimed to be fire-safe in a masonry cavity with closed reveals (see EPSASA leaflet *EPS Cavity Wall Insulation*). EPS will resist the passage of moisture. Panel width: 600 mm; thicknesses: 25, 30, 40, 50 (ex stock), 60, 70, 80 (to order)

€ face: plain / foil / …

€ edge: square / shiplap / tongue and groove

fibre mats/batts

€ form: mats (flexible) / batts (rigid)

€ face: plain / foil / …

Typical fibres are mineral (rock wool, glass wool), synthetic (polyester, polyethylene), and natural (wool). Fibre insulation is not recommended in partial fill masonry cavity construction – consult manufacturer.

reflective foil

€ reflective foil class: A / B / C / D

A (reinforced, both surfaces reflective), B (reinforced, one surface reflective), C (unreinforced, both surfaces reflective), D (unreinforced, one surface reflective). Foil may double as an effective vapour barrier. See additional notes on foil at end of this section.

The thermal resistance of reflective insulation varies with the direction of heat flow through it, i.e. vertical, horizontal or sloped, and the number and defined thicknes of air spaces it faces. It is important that bright surfaces facing air spaces remain untarnished on at least one surface.

The difference in direction of heat flow is generally marginal for bulk insulation but can be pronounced for reflective insulation. Reflective insulation is more effective at reducing summer heat gain than reducing winter heat loss.

Reflective foils are valuable when used in combination with bulk insulation for improved performance.

Composite bulk and reflective materials are available that combine some features of both types. Examples include foil bonded to bulk insulation, whether blankets, batts or boards, i.e. foil faced blankets, foil faced batts and foil faced boards.

metal faced insulation panels

For use in buildings, cold rooms and hot rooms, interior and exterior.

€ corrosion comparison index of panel-facing coating: 1 / 2 / 3 / 4

€ core insulation: calcium silicate / mineral fibre / polyisocyanurate / polyphen / polystyrene / polyurethane / rockwool

€ facing: chromadek / galvanized steel / PVC laminated galvanized steel / stainless steel / zincalume

Metal faced insulation panels are typically used in cold storage systems. Consult TPMA (Thermal Panel Manufacturer's Association).

loose fill

€ loose fill: pellets or granules / cellulose.

6.1.2 Installation

€ system: SANS 204 / rational design

masonry cavity wall insulation

€ type: full fill cavity / partial fill cavity / loose fill / see drawings

Insulation can be installed full fill in cavities in most areas where cavity walls are not required to prevent moisture migration, or where walls are plastered and painted or protected by roof overhangs of >750 mm.

Insulation should be installed partial fill in cavities where the cavity also serves as a moisture barrier against wind-driven rain, mostly in winter rainfall areas, but also in cases of exposed face brick walls in general (e.g. gable walls, walls without roof overhangs, high buildings).

In exposed walls, filling cavities with loose fill insulation may result in insulation becoming wet, losing its insulation value and causing dampness on the inner leaf.

Filling of concrete block cores with any type of insulation offers little energy savings since the majority of heat is conducted through the webs and mortar joints.

masonry wall external face insulation

€ masonry wall external face insulation: ...

Omit if default (patent system of EPS external insulation bonded and mechanically fixed to dry, sound and flat surface, finished with reinforced polymeric plaster) is acceptable, or specify alternative.

Installing insulation against internal face of envelope wall would result in losing capacitive insulation of internal leaf (thermal mass).

pitched roof/ceiling insulation

€ system: reflective foil under roof covering / bulk insulation on ceiling / foil + bulk / see drawings

flat roof insulation

€ material: rigid EPS insulation density 32D

€ flat roof insulation position: over waterproofing / under screed

Insulation on flat trafficable concrete roofs should be firm enough to support the waterproofing system and foreseeable loadings, i.e.under screed. See Section 8 for further particulars.

floor insulation

€ under floor slab insulation: required / not required

In case of in-slab heating as required by SANS 204.

6.2 Vapour barriers

€ type: …

€ position: see drawings

Clay brick and concrete block masonry is able to accommodate moisture migration (damp open), normally rendering a vapour barrier unnecessary. SANS 204 advises that designers should consider that interstitial condensation occurs in walling systems which are not able to prevent or accommodate moisture migration. Also, that artificial cooling of buildings in some climates can cause condensation to form inside the layers of the building envelope. Such condensation can cause significant structural or cosmetic damage to the envelope before it is detected. Associated mould growth may also create health risks to the occupants. Effective control of condensation is a complex issue. In some locations a fully sealed vapour barrier may need to be installed on the more humid, or generally warmer, side of the insulation.

6.3 Sound absorption

materials

€ structure-borne sound insulation: mineral fibre mats SANS 1381 / cork

€ airborne sound absorption: mineral fibre mats SANS 1381 + perforated 10 mm plywood / plasterboard / hardboard / metal / see drawings.

6.4 Joint fillers/sealants

€ joint filler/sealant colour: …

Industrial sealants compatible with bitumen may not be available in SA.

Two-part sealants are generally more effective and costly than one-part sealants.

See also SANS 2001-CC1 for specification of waterstops.

6.5 Architectural seals

€ type: patent extruded aluminium carriers with flexible seal inserts of synthetic rubber, rigid PVC, nylon brush filaments, polypropylene pile, or silicone rubber / patent PVC, pile or neoprene door and window frame seals / patent silicone intumescent seals (fire and smoke) / patent external extruded aluminium threshold plate seals

Architectural seals need careful study by the designer – consult supplier.

€ aluminium extrusion finish: mill / anodised / painted

€ intended use of seal: energy (draughts, dust, insects) / intumescent (fire and smoke) / acoustic (noise) / finger-pinch protection (schools, day-care centres) / threshold plate / access (mobility, disabled persons)

Intumescent seals are designed to expand when subjected to heat.

€ duty level: light / medium / heavy

Duty level: light (domestic); medium (commercial); heavy (hospitals, airports, shopping malls).

€ mounting: fully morticed / semi morticed / surface mounted / grooved.

NOTE: Additional notes on reflective foil thermal insulation:

The difference in direction of heat flow is generally marginal for bulk insulation but can be pronounced for reflective insulation. Reflective insulation is more effective at reducing summer heat gain than reducing winter heat loss.

The thermal resistance of reflective insulation varies with the direction of heat flow through it, i.e. vertical, horizontal or sloped, the number of air spaces and defined thicknesses of the air spaces. Furthermore, that the bright surfaces facing the air space/spaces remains untarnished on at least one surface.

Reflective foils are valuable when used in combination with bulk insulation for improved performance.

Composite bulk and reflective materials are available that combine some features of both types. Examples include foil bonded to bulk insulation, whether blankets, batts or boards, i.e. foil faced blankets, foil faced batts and foil faced boards.

7 Plaster, screeds, toppings, terrazzo

11.1 Plaster

€ type: see drawings

cement plaster / gypsum plaster / lime plaster / insulating plaster / barite plaster / waterproof plaster.

11.1.1 Cement plaster (SANS 2001 EM1)

SANS 2001- Construction Works Part EM1: Cement Plaster Admixtures are not permitted in cement plasters to improve workability or improve the properties of the finished plaster.

Specification data:

€ application: single coat / multicoat

€ finish to cement plaster: smooth / textured / roughcast / bagged / skimmed

Show in drawings: V-joints through full plaster thickness at dpc level and where different materials meet; metal lath strips over roof anchors on single leaf masonry walls, or across joints between different materials – see SANS 2001-EM1.

11.1.2 Gypsum plaster

Do not mix gypsum-based plaster with plaster made with common cement – the sulphate compound in gypsum attacks common cement paste.

11.1.4 Insulating plaster

€ low density aggregate density range: 60 – 160 / 120 – 240 / 450 – 720 kg/m³

60 – 160 (exfoliated vermiculite); 120 – 240 (perlite); 450 – 720 (foamed slag).

Omit if default (800 – 960 kg/m³ (clinker) covered in SANS 2001-EM1) is acceptable.

Barite plaster for use in X-ray rooms. Thickness for general diagnostic X-ray work normally between 15 and 30 mm. Check mix and thickness with requirements.

11.1.6 Accessories

€ expanded metal, type: sheet/plate / angle bead / base bead / corner mesh / plaster lath / plaster stop / rib lath / strip mesh

€ angle rounded corner protection: 1 500 x 1,0 x 35 mm girth strip, position: see drawings.

11.2 Screeds, toppings, terrazzo

To be published: SANS 2001-EM2 Screeds and toppings.

Screed is a layer of a well-compacted mixture of cement and fine aggregate applied to a concrete base, *suitable* for receiving a floor finish.

Topping is a layer of high-strength concrete designed to provide a dense, abrasion-resistant surface on a concrete base.

Terrazzo is a hard-wearing decorative concrete finish in which crushed or uncrushed aggregate like marble and pigments is used, and of which the surface is generally ground and polished.

Specify screed or topping only where a direct-finished one-course concrete floor is impracticable.

11.2.1 Materials

proprietary surface treatments

Treatments to harden or seal the surface of toppings are not normally required, provided a sufficiently high grade of properly finished concrete is used. They may however be useful in dust sensitive areas or where oil spills or mildly acidic solutions may occur. Expert advice should be sought from the manufacturer/supplier.

€ form: dry shake / coating / screed

€ to improve: abrasion resistance / chemical impact resistance / slip resistance / density / UV resistance

€ colour/finish: …

mesh reinforcement

€ mesh reinforcement: …

Mesh reinforcement may be required to restrain differential shrinkage stresses and control cracking on precast concrete elements – not normally required.

water

€ water: SANS 51008

Omit if default (drinking water) is acceptable.

11.2.2 Mix

topping

€ concrete grade: see drawings

20 / 30 / 40 / 50

Topping: 1 part cement to 1½ parts sand to 1½ parts stone would produce a concrete strength of 25 – 30 MPa. Use concrete of at least grade 20 where abrasion resistance is not a consideration; grade 30 for floors for light duty industrial and commercial purposes; 40 for ditto medium duty; 50 for heavy duty industrial, workshops, special commercial; very heavy duty engineering workshops would require a proprietary topping. Consult The Concrete Institute for advice.

11.2.4 Laying

Method of laying as described here is known as "separate bonded construction", where the topping or screed is laid on and bonded to a hardened base. For other methods, for example monolithic construction, and separate unbonded construction, consult SANS 10109 part 2.

Compaction of the mix is most important. Stiff semi-dry mixes not well compacted are a common cause of bond failure. Compact stiff mixes with power-operated equipment such as vibrating screed boards.

Joints in screeds should be minimal. Screeds laid in large areas may crack, but this is more acceptable than curling at edges of small panels.

€ screed thickness: see drawings

25 – 50 mm

€ topping thickness: see drawings

25 – 40 mm

€ edge/feature/dividing strips: see drawings.

11.2.5 Finishing

€ type of finish: ordinary / hard / colour pigmented / dry shake / surface ground and polished

Ordinary finish is *suitable* for surfaces that are to be covered by flooring. Hard finish is *suitable* for surfaces that are not to be covered with flooring and for toppings that require high resistance to wear (grade 30 and higher).

Hardwearing surfaces like toppings and terrazzo may be ground and polished – not recommended for sand:cement screeds. Grinding tends to create lower slip resistance. Grinding will affect appearance and will remove surface treatments such as dry shakes.

€ surface smoothness: smooth / non-slip

pigmentation

€ type: integral (mix with dry cement) / add to freshly laid surface as a dry shake / not required.

11.2.6 Joints

€ type: isolation joint / intermediate sawn contraction joint / patent movement joint

€ pattern: see drawings

€ seal joints: required / not required

€ patent movement joint system with flexible inserts: aluminium / stainless steel / PVC

Material depends on nature and intensity of traffic. Joints should be sealed when floor is subjected to liquids, hygiene.

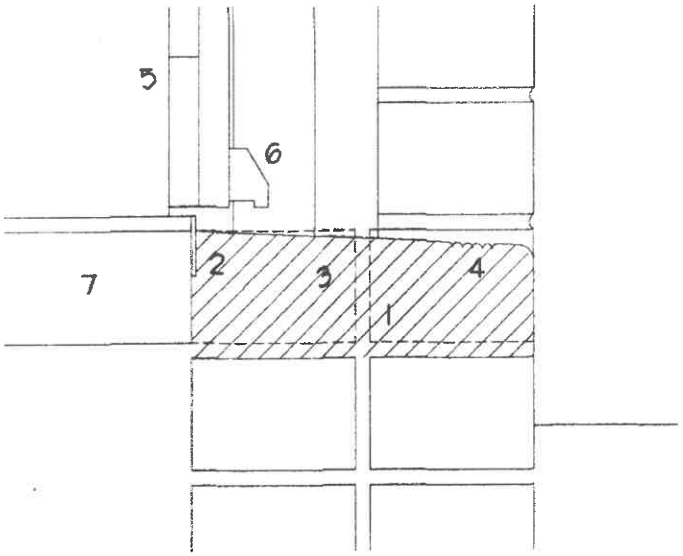
11.2.7 Surface regularity

€ degree of surface regularity: I (3 mm) / III (10 mm over 3 m in any direction)

Omit if default (II) is acceptable. Check with SANS 10155. In small rooms deviation should be less.

11.2.8 External thresholds

Placing the door in line with the inside wall face allows the join
under the door and adds a measure of rain protection to the d



1 break out bricks

2 metal edge strip

3 in situ or precast concrete threshold with slight fall

4 reeding

5 external door

6 weather bar

7 concrete surface bed

11.2.13 Surface sealing

€ seal floor surface with: one coat non-slip wax polish / epoxy / not required.

Relevant standards:
SANS 10109 Part 2 Finishes to Concrete Floors.
Concrete Basics for Building. 2004. Cement and Concrete Institute.

8 Drainage, sewerage, water and gas supply, fire equipment, sanitary plumbing

See SANS 10400-P for length formula, positioning, soil type, etc.

18.5 Water supply

18.5.1 Earthworks (SANS 2001-DP1)

SANS 2001-DP1 covers earthworks for trenches for all types and sizes of buried pipelines, ducts, cables and prefabricated culverts, including excavation, preparation of trench bottoms, bedding, backfilling and reinstatement of surfaces.

Specification data:

€ pipes that are to be encased in concrete: see drawings.

18.5.2 Below ground medium pressure pipelines (SANS 2001-DP2)

SANS 2001-DP2 covers the supply and installation of pipelines of diameter greater than 160 mm and up to 1 000 mm, complete with ancillary works (valves, strainers, hydrants, manholes, surface boxes, chambers) for transporting water and sewage under working pressures up to 2,5 MPa.

Erf or connections to buildings from mains are covered in SANS 2001-DP6.

Specification data:

€ type of pipe: steel / ductile iron / concrete / fibre-cement / GRP / PE / PP / contractor's choice)

glass-reinforced plastics (GRP); polyethylene (PE); polypropylene (PP)

€ nominal pipe sizes: see *drawings*.

225 / 300 / 375 / 450 / 525, 600 / 675 / 750 / 825 / 900 mm

18.5.3 Below ground water installation for buildings (SANS 2001-DP6)

SANS 2001-DP6 covers the construction of water pipelines having a nominal diameter of up to 160 mm from a water reticulation main to the boundaries of individual erven or other specified points on erven. It covers the installation of pipework and associated specials which provide water, meters and fire hydrants

SANS 2001-DP6 is suitable for construction of fire installations designed in accordance with the design rules provided in SANS 10400 W, Fire installations.

Specification data:

€ type of pipe and associated fittings: galvanised mild steel / fibre cement / GRP / PE / PP / PVC / PVC-U / PVC-M / PVC-O / copper / contractor's choice

Glass-fibre reinforced plastics (GRP) / polyethylene (PE) / polypropylene (PP) / polyvinyl chloride (PVC) / unplasticised polyvinyl chloride (PVC-U) / modified polyvinyl chloride (PVC-M) / oriented polyvinyl chloride (PVC-O).

€ nominal pipe size: see drawings

40 / 50 / 75 / 110 / 160 mm

€ meter type and size: …

18.5.4 Above ground water installation

€ pipe material: galvanised mild steel / PP / copper / contractor's choice

€ nominal pipe size: see drawings

8 / 10 / 12 / 15 / 18 / 22 / 28 / 35 / 42 / 54 / 67 / 76 / 108 mm (copper, check other pipe types)

€ fixing of pipes <20 mm: chased / surface fixed

Surface mounting may be a requirement from a maintenance point of view.

Chasing is prohibited in wall faces that are to receive roof flashing. Roof flashing is inserted in grooves sawn by a separate trade with disc cutters after pipes are installed, leading to unnecessary and costly pipe repair work when pipes are damaged.

18.5.5 Water storage tanks

- € tank material: tumbled polymer / pressed steel sections bolted and sealed together / corrugated steel
- € capacity or size: see drawings / ...L
- € stand for external tanks: ...

9 Electrical works

19.1 Earthworks (SANS 2001-DP1)

SANS 2001-DP1 covers earthworks for trenches for all types and sizes of buried pipelines, ducts, cables and prefabricated culverts, including excavation, preparation of trench bottoms, bedding, backfilling and reinstatement of surfaces.

Specification data:

€ areas where pipes are to be encased in concrete: see drawings

19.2 Cable ducts (underground) (SANS 2001-DP3)

SANS 2001-DP3 covers the supply, and the laying and bedding in trenches, of pipes of diameter not exceeding 160 mm as ducts for the protection of telephone and electric power cables.

Specification data:

€ type of pipe, associated fittings: pitch impregnated fibre / PVC-U / fibre cement / vitrified clay

Unplasticised polyvinyl chloride (PVC-U).

€ draw pits: see drawings.

19.3 Materials and installation

19.3.1 Wiring

conduits

Chasing is prohibited in wall faces that are to receive roof flashing. Roof flashing is inserted in grooves sawn with disc cutters after conduits are installed, leading to unnecessary and costly repair work.

conductors

See SANS 10198 The selection, handling and installation of electric power cables of rating not exceeding 33 kV.

distribution board, meter cabinets

€ position of DB's and meter cabinets: see drawings.

19.3.2 Fittings

luminaires

€ type: see drawings

surface mount / recessed / accent / downlighter / step / theatre / outdoor (pole, step, bollard)

stove, hob, oven, cooker hood

€ stoves, hobs, ovens, cooker hoods model, type: … / see drawings.

Relevant standards:
SANS 10114 Interior lighting.
SANS 10389 Exterior lighting.
SANS 10142 The wiring of premises.
SANS 10222 Electrical security installations.
SANS 10313: The protection of structures against lightning.
SANS 61024 Lightning protection of structures.

10 External works

A fall of 1:60 is regarded as an optimum fall. Gradients of 1:100 are less forgiving (workmanship, settlement).

21.1 Paving

21.1.1 Materials

precast concrete blocks / burnt clay pavers / in-situ concrete / precast concrete slabs

units

€ paving unit type: see drawings

Edge restraints along the perimeter of the paving is necessary to prevent lateral spread of the units and to retain the bedding course sand. See concrete culverts, kerbs etc. below.

Class 25 (MPa) concrete blocks should be specified for most uses.

Thickness of blocks depends on site conditions, design requirements and cost.

precast concrete segmental paving blocks

€ type: S-A (interlock) / S-B (semi-interlock) / S-C (rectangular)

PB (uniform), PA (highly uniform in shape and size).

€ class: 25 / 35

€ nominal thickness: 50 / 60 / 80 / 100 / 120 mm

See SANS 784 for guidance on tactile indicators for access and mobility.

€ top edges: chamfered / not chamfered

€ colour: …

The use of mine sand for jointing is generally accepted.

burnt clay paving units

€ class: PB / PA

€ colour and work size: …

precast concrete paving slabs

€ size: 295 / 445 / 595 x 295 / 445/295 / 595/455 x 50/65 mm

sand for bedding and jointing of flexible paving

21.1.2 Preparation

subgrade

€ subgrade levels and falls: see drawings

concrete sub-base for rigid paving

€ thickness, reinforcement: see Section 2

weed killer

€ treat area to be paved with *suitable* weed killer: required / not required

levels, falls, pattern

€ levels and falls: see drawings

€ pattern: see drawings / herringbone / basket weave / stretcher / waving

10.1.3 Laying

€ type of paving: see drawings / flexible block/brick / flexible slab / rigid block/brick / in situ concrete

Check soil and traffic conditions with a Competent Person. The sub-base thickness is a function of both the type and amount of traffic to be carried and the strength of the subgrade. See also SANS 1200 ME, MF, ML.

flexible block/brick paving

Flexible paving is paving laid on sand, with joints filled with sand. The surfaces of flexible paving usually bed down ±5 mm after trafficking.

Consider mixing filling sand with 10 – 15% cement depending on traffic, type of paver, and control of weed growth. Spray paving thus filled with a fine spray of water immediately after filling to clean off all cement.

€ concrete anchor beams across road on grades exceeding 8%: ...

Horizontal forces of motor traffic increase considerably on grades exceeding 8%, causing creep. This is avoided by casting concrete anchor beams across the road. On steeper grades the paving should preferably be rigid. See CMA technical note 6.2 1994.

flexible slab

€ joints: filled with mortar / to be left open

rigid block/brick paving

Rigid paving is paving units bedded in mortar on a concrete base. External paving is exposed to wide temperature and moisture fluctuation which can only be provided for by movement joints.

accuracy

Accuracy depends on experience of contractor and/or labourers, and importance of the contract.

21.2 Concrete culverts, kerbs, channels

€ type: see drawings

culvert / kerb / channel

21.2.1 Materials

€ precast concrete culvert class: 75S / 100S / 125S / 150S / 175S / 200S

Class depends on foundation conditions and fill.

€ dimensions (internal) : see drawings

span: 450 / 600 / 750, 90 / 120 / 150 / 180 / 240 / 3 000 mm; height: 300 / 450 / 600 / 900 / 1 200 / 1 500 / 1 800 / 2 400 / 3 000 mm

€ kerb type: see drawings

rectangular / half-battered / battered / mountable

€ edging type: see drawings

rectangular / half-round

€ channel type: see drawings

rectangular / tapered.

21.2.2 Laying

€ movement joints: leave open / fill with

Concrete retaining blocks are an economical, versatile and environmentally compatible method of retaining earth and be used for planting, steps, seats, pavilions, and for erosion and scour control.

polysulphide.

21.3 Concrete retaining blocks

blocks

€ shape, size and colour: ...

preparation

€ depth, level and type of foundation: see drawings

Foundations: also on sloping or gravel foundation. *Drawings* should show this. Compacted earth foundation is usually sufficient for structures not higher than 1,2m. Higher walls should be thicker, inclined towards the retained earth, anchored with a geogrid mesh, or by modifying the properties of the backfill. Consult the supplier of the blocks and/or Competent Person. Ensure building regulations are complied with.

€ width of foundation: see drawings

Show width of foundation if of concrete.

€ drain pipes, aggregate drain, geofabric drain behind retaining wall: required / not required

placing

€ stacking pattern: see drawings

€ geofabric reinforcement: required / not required.

SANS 207 gives recommendations for the application of reinforcement techniques to soils and other fills.

21.4 Gabions

materials

€ cage dimension: 4 x 1 x 1 / 6 x 2 x 0,5 m

€ mesh wire to be PVC-coated: required / not required.

C3.4: CIVIL ENGINEERING SPECIFICATION

C3.1 CONSTRUCTION SPECIFICATIONS

C3.1.1Applicable SANS 2001 standards for construction works

The following parts of SANS 2001 Construction works standards and associated specification data are applicable to the works:

SANS 2001-BE1: 2008

SANS 2001-BS1: 2008

SANS 2001-CC2: 2007

SANS 2001-CM2: 2011

SANS 2001-CS1: 2017

The abovementioned South African National Standards refer to the Specification Data for data, provisions and variations that make these standards applicable to this contract. The Specification Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and these standards.

Each item of Specification Data given below is cross-referenced to the clause in the standard to which it mainly applies.

Clause	Specification data, variations and additional clauses
	Part 1: General engineering and construction **Works: SANS 1921-1:2018**
4.2.1	Activity numbers 7/8/9 apply at the positions for the column bases. The activity number are described below: • 7: The breaking up and complete removal of all pavement layers and concrete haunching, which would normally entail the use of mechanical break-out equipment. • 8: The breaking up and complete removal of sidewalks, ramps, parapets, paving slabs, blocks, slate paving, brick paving, and the like. • 9: The breaking up and removal of kerbs and channels or haunching (or both).
4.4.1	Materials from clearing and grubbing operations and the demolition of structures shall be disposed of as follows: Suitable and acceptable dumpsite identified by the Contractor.
4.4.2	Tree trunks shall be disposed of as follows: Suitable and acceptable dumpsite identified by the Contractor.
4.4.3	Fencing material shall be stacked in the Contractor's storage yard/shed.

Clause	Specification data, variations and additional clauses
4.4.4	The material to be reused shall be stacked in the Contractor's storage yard/shed.
4.7	The following turf, plants, bushes and shrubs shall be conserved: As indicated on the drawings.
4.9	Topsoil together with any grass and other suitable vegetation shall be removed and placed ±1m from the excavation.
Clause	**Specification data, variations and additional clauses**
	Earthworks (general): SANS 2001-BE1:2008
4.1.5.1	Topsoil shall be conserved.
4.2.1.1	All areas in which excavation is to take place or that are to be covered by terraces, banks or structures, shall be cleared in terms of SANS 2001-BS1 and stripped of all remaining vegetation to a depth of 150 mm.
4.2.1.2	Topsoil shall be conserved for later use in the following manner: in terms of SANS 2001-BS1.
4.2.1.3	The overburden shall be stripped and removed to a depth of 300 mm.
4.2.2.1.4	A working space of 1,0 m shall be provided.
4.2.2.1.8	The formation width of private sidings shall be as shown in the drawings.
4.2.2.1.9	The slopes of cuttings shall not be trimmed.
4.2.3	Surplus and unsuitable material shall be disposed of in terms of the environmental specification
4.2.4	All timbering and sheeting shall remain in the excavation.
4.2.5.1.6	The layers shall be compacted to ……
4.2.5.2.5	The density close to structures shall be not less than …….
4.2.6.2	Topsoiling of the following areas shall be required: ……..
4.2.6.3	The following vegetation shall be planted
	after topsoiling in the following areas: ……..
5.2.1	A degree of accuracy ….. is required in respect of position, dimensions, levels, etc.
5.2.2	A degree of accuracy …… is required in respect of moisture content and density.

Clause	Specification data, variations and additional clauses
Clause	**Specification data, variations and additional clauses**
	Concrete works (minor works): SANS 2001-CC2:2007
4.2.3.1	The nominal size of aggregate shall be 13 mm.
4.2.6	The concrete shall be as follows:……..
4.7.11.2	Exposed surfaces shall have non-skid surfaces.
Clause	**Specification data**
	Strip footings, pad footings and slab-on-the-ground foundations for masonry walling: SANS 2001-CM2:2011
4.1.1	Material placed beneath surface beds shall be….
4.4.3.2	
4.2.1	Clearance of the site shall be in accordance with SANS 2001-BS1.
4.2.4	The site class designation in accordance with the requirements in table 1 is ……..
4.3	Terraces for buildings shall be in accordance with the requirements of ……..
4.4.1	The foundations shall be constructed in accordance with the relevant drawings listed in the scope of work
	or
	The foundations shall be in accordance with the requirements of SANS 10400-H for strip footings, slab-on-the-ground foundations or modified normal construction for category of expected damage 1 or 2.
4.4.2.3	The requirements for the construction of steps in foundations in excess of 400 mm can be found in drawing ……..
	Variations
4.4.1	The minimum founding depth shall be ……...
	Additional clauses
Clause	**Specification data, variations and additional clauses**

Clause	Specification data, variations and additional clauses
	Structural steelwork: SANS 2001-CS1:2017
4.1.1	The grade of steel for the following assemblies shall be .....
4.1.5	Structural fasteners are of the following grades and types:
4.2.1.3	The format of drawings shall be as follows:
4.2.4.2	Attachments to facilitate erections may not remain part of the permanent structure.
4.4.4.5	
4.2.4.4	Hole sizes for holding-down bolts in excess of 36 mm diameter shall be as follows:
4.2.4.7	Connections to allow movement shall be as follows:
4.2.4.8	The requirements for machining are as follows:
4.3.1.1	All steel elements shall be marked so as to be traceable to a specific cast or heat of steel.
4.3.1.2	The following assemblies may not be hard stamped:
4.4.4.3	Tack welds are not to be incorporated into final welds.
4.5.1.3	The maximum protrusion beyond the nut shall be ..... mm.
4.5.1.4	Washers under nuts and bolt heads on flat surfaces are required.
4.6.1.4	Cladding may commence when .....
4.6.2.1	The pressure or loading permitted on the hard standing is .....
4.6.3.2	The reference temperature is .... °C.
5.3.4	Ultrasonic or radiographic examination is required.
5.3.5	The requirements for non-destructive tests are as follows:
4.2.4.2 and	1 All attachments to facilitate erection shall be removed and holes shall be closed up after erection.
4.4.4.5	
4.3.3.1 and	2 Cut edges to the following assemblies shall be ground to achieve a smooth and straight surface:
4.3.3.2	
4.4.4.3	3 All tack welds shall be removed before welding.
5.2	4 Properly documented evidence of previous qualification of welders shall be acceptable.

Clause	Specification data, variations and additional clauses
4.6.2.2 and	5 The following temporary restraints shall be installed:
4.6.2.3	
	6 Site welding is not permitted.

C3.1.2Applicable national and international standard
Identify all applicable national and international standards together with all values pertaining to specific attributes relating thereto

C3.1.3Bespoke or generic specifications
Health and safety specification

C3.1.4Certification by recognized bodies
All materials incorporated into the works shall be SABS approved or otherwise as indicated in the applicable specification.

C3.1.5Agreement certificates
State requirements for the use of alternative materials which are the subject of an Agreement certificate. State requirements for providing Agreement certifi9cates

C3.1.6Samples
State requirements for samples of workmanship, samples of materials for testing, etc.

C3.1.7Condition surveys
State requirements for condition surveys which need to be carried out prior to the commencement of the works or portions thereof

C3.1.8Inspection of adjoining properties
State requirements for the inspection with the owners of adjacent buildings and properties and representatives of local authorities before commencing works that have the potential to damage surrounding buildings and property

C3.1.9Site cleanliness
Establish requirements for keeping the site clean and tidy

C3.1.10 Waste and surplus materials
Establish requirements for the removal of waste and surplus material including restrictions on the disposal of such waste and recycling

C3.1.11 Materials, samples and shop drawings
State requirements for proof of compliance with materials specifications, samples of materials and finishes, shop drawings required to amplify the designs of aspects of the works, use of proprietary materials, etc.

C3.1.12 Construction equipment
State minimum requirements for equipment e.g. type, capacity, capability and condition

C3.1.13 Advertising rights
Establish the rights relating to advertisements

C3.1.14 Notice boards
State requirements for notice boards, e.g. size, content, placement, design, timing for removal, etc., including those in respect of all types of subcontractors

C3.1.15 Facilities provided by the contractor
State requirements for facilities to be provided by the contractor, such as construction camps, offices and workshop facilities and those facilities for use by the employer and his agents. Also state what should happen to these facilities upon completion of the contracts

C3.1.16 Storage and laboratory facilities
State requirements for storage and laboratory facilities

C3.1.17 Other facilities and services
State requirements for all other temporary facilities necessary for providing the works which are not provided by the employer, including power, water, telecommunications, security services, medical facilities, fire protection, sanitation and toilets, and waste disposal

C3.1.18 Vehicles and equipment
State requirements for vehicles, computers, survey and testing equipment, office furniture, etc. provided by the contractor for the use of the employer and his agents

C3.1.19 Apparatus, equipment and instruments
State requirements for the calibration of the contractor's apparatus, equipment and instruments

C3.1.20 Alterations, additions, extensions and modifications to existing works
State requirements for the contractor to satisfy himself that the dimensional accuracy, alignment, levels and setting out of existing structures or components thereof are compatible with the proposed works, and the procedures for notifying the employer and his agents where this is not the case

Establish procedures for dealing with the detection of defects in work previously executed that can impact on the works

C3.1.21 Survey control and setting out of the works
Provide information on survey controls and reference levels established by the employer and state requirements for survey control and the setting out of the works

C3.1.22 Existing services

General

State requirements for locating, marking and recording known services identified in the site information

Treatment of existing services

State requirements for the treatment of existing services, i.e. their termination, diversion or continued use, either temporarily or permanently, and set out the procedures relating thereto

Use of detection equipment for the location of underground services

State requirements, as necessary, for the use and availability of detection equipment for the location of underground services

Damage to services

State responsibility for damage to services, known and unknown, and requirements for working in close proximity to services, etc.

Reinstatement of services and structures damaged during construction

State requirements and reinstatement procedures for the notification and repair of damage to services, etc.

C3.1.23 Water for construction purposes

State arrangements for procuring, transporting, storing, distributing and applying the water needed for construction purposes where not made available to the contractor by the employer

C3.5 ELECTRICAL ENGINEERING SPECIFICATION

public works & infrastructure

Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

NATIONAL DEPARTMENT OF PUBLIC WORKS AND INFRASTRUCTURE

ELECTRICAL ENGINEERING SERVICES

MDANTSANE LABOUR CENTRE
SUPPLY AND INSTALLATION OF WATER TANKS
(WCS 056632)

PROJECT ELECTRICAL SPECIFICATIONS

DATE : 18TH OCTOBER 2024

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INDEX

PART 1 – GENERAL SPECIFICATION

CONTENTS

PART 1 – GENERAL SPECIFICATIONS

1.1. INTRODUCTION

1.1.1. These General Specifications cover the general technical requirements for the equipment, materials, installation, testing, commissioning and maintenance of electrical installations for the Department. These requirements must be read in conjunction with the Documents as specified below as well as the other sections of this document.

1.1.2. The source documents used for the incorporation of this document are the Standard specifications PW 354 part A, B and C and the South African National standards. The Standard Specifications can be located on the departmental website, consultant guidelines section. www.publicworks.gov.za.

1.1.3. Unless otherwise stated the description on of each item shall be deemed to include manufacturing, conveying and delivering, unloading, storing, unpacking, hoisting, setting, fitting and fixing in position, cutting, waste, patterns, templates, plant, temporary works, return of packings, establishment charges, profit and other obligations arising out of the conditions of contract.

1.2. DEFINITIONS

1.2.1. The table below provide a description of the main terms in the document but are not limited to:

No.	Term	Description
1.	**General Specification**	The general specifications provide a broad description of work and materials that is required for a project.
2.	**Standard Specification**	The standard specifications are pre-established guidelines that are widely used and accepted on projects, they ensure consistency and quality by setting uniform standards for material, methods and practices.
3.	**Project specification**	The project specification are specific to a particular project and detail the requirements for that project, they include all the necessary information to complete the project according to the client's need and the project conditions. It is the combination of the General, Standard and detailed specifications.
4.	**Detailed Specification / Detail Specification**	The detailed specifications provide an in-depth description of every aspect of works, including the quality of materials, workmanship and methods implemented.
5.	**Particular Specification**	The particular specification are tailored information to address a specific requirements or conditions of a project that are not covered by the general, standard or detailed specifications. The focus is on unique aspects for further detail.
6.	**Supplementary Specification**	The supplementary specifications modify the general or detailed specifications, they address specific conditions or requirements that arise during the project and are not covered by the original project specifications.
7.	**Contractor**	"Contractor" shall mean the person, partnership, company or firm appointed for the supply, installation, testing, commissioning and maintenance of the Electrical Installation. In the case of the Electrical Installation being a sub-contract, nominated in terms of the Main Contract or otherwise, the word "Contractor" shall also mean "Sub-Contractor" in terms

		of the Sub-Contract Conditions for the specific installation. Where applicable the Builder or Principal Contractor shall be referred to as "Main Contractor".
8.	**Accredited / Competent Person**	A person who has the necessary knowledge, training, experience, and qualifications specific to the work being performed. This person must be capable of identifying potential hazards and taking appropriate measures to mitigate them. Additionally, they must be authorized to take corrective actions to ensure a safe working environment by a statutory body.
9.	**Quality Specification**	Department Standard Specification Part C.
10.	**Wiring Code**	SANS 10142
11.	**Earthing**	Connection of the exposed-conductive-parts of an installation to the main earth terminal of that installation
12.	**Equipotential Bonding**	Electrical connection maintaining various exposed-conductive-parts and extraneous-conductive-parts at substantially the same potential.
13.	**Departments Authorised representative**	The department Authorised representative may be the Project manager, Engineer, Principal agent, Employer's Representative, or Engineer's representative.
14.	**Department**	The Department in the context of this document refers to the Department of Public works and Infrastructure.
15.	**Documents**	The complete set of contract documents, including the Department's Tender Conditions, Tender Qualifications, the Standard Specification and the Detailed Specification including all drawings and variation orders issued in terms of the contract and all other contract documents of the contract
16.	**Submittals**	Documents, shop drawings, datasheets, samples, Mock-ups or other items that a contractor submits to the professional team for approval prior to manufacture, purchase or installation.
17.	**Reputable Brand**	A reputable brand in construction is one that is widely recognized for its quality, reliability, and trustworthiness. These brands have established a strong reputation over time through consistent delivery of high-quality products and services, excellent customer service, and adherence to industry standards.

1.3. INSTALLATION WORK

1.3.1. The complete installation shall comply with the requirements of all parts of the specifications and laws of the Republic of South Africa. Should any discrepancies or contradictions exist between the general/standard specifications and the detailed specification for the specific installation, then the detailed specifications will take precedence.

1.3.2. In the event of discrepancies between the drawings, specifications and bill of quantities then the Department shall decide whether the work as executed shall be remeasured on site or whether remeasurement shall be effected from the working drawings only. The decision must be provided in writing before the commencement of any works.

1.3.3. The Department's authorised representative will inspect the installation from time to time during the progress of the work. Discrepancies of the contract will be pointed out to the Contractor and these must be remedied at the contractor's expense in accordance with the

contract. Under no circumstances will these inspections relieve the Contractor of his obligations in terms of the Documents and Contract.

1.3.4. The Contractor must notify the Department timeously (Minimum 7 days) when the installation reaches important stages of completion (e.g. before closing cable trenches, before casting concrete, etc.) so that the Department's authorised representative may schedule his inspections in the best interest of all parties concerned.

1.4. COMPLIANCE WITH REGULATIONS

1.4.1. The installation must be erected and tested in accordance with the South African Acts, Department's quality specifications and Regulations or IEC/EN regulations where applicable.

1.4.2. The entire installation must be carried out in accordance with SANS Regulations, by-laws, and the Occupational Health and Safety Act.

1.4.3. No claims for extras in respect of failure by the Contractor to comply with any regulations will be considered.

1.4.4. Where conflict exists between regulations, specifications or drawings, the said conflict must be referred to the Department's authorised representative in writing for his ruling.

1.5. CODES OF PRACTICE OR STANDARD SPECIFICATION

1.5.1. Where reference is made to any Regulations, Code of Practice or Standard specification in this document, the latest edition or amendment will be applicable.

1.6. NOTICES AND FEES

1.6.1. The Contractor must give all notices required by and pay all necessary fees, including any inspection fees, which may be due to the local Supply Authority.

1.6.2. On production of the official account, only the net amount of the fee charged by the Supply Authority for connection of the installation to the supply mains, will be refunded to the Contractor by the Employer.

1.6.3. The Contractor must issue all notices and pay all of the required fees in respect of the installation to the authorities, and shall exempt the Department from all losses, claims, costs or expenditures which may arise as a result of the Contractor's negligence in complying with the requirements of the regulations.

1.6.4. It is the responsibility of the Contractor to make the necessary arrangements with the local Supply Authority at his own cost and to supply the labour, equipment and means to inspect, test and commission the installation to the satisfaction of the Local and Supply Authorities.

1.6.5. The Contractor must supply and install all notices and warning signs that are required by the relevant laws, regulations and/or the Documents.

1.7. SITE CONDITIONS

1.7.1. Tenderers are advised to visit the site and acquaint themselves with all local conditions pertaining to the execution of the installation before tender closing date or as indicated on the tender document with the permission of the department. No claims from the contractor which may arise from insufficient knowledge of site access, type of site, labour conditions,

establishment space, transport and loading/unloading facilities, power and water supply, etc. will be considered after submission of tenders.

1.7.2. For services where prior permission is required before contractors can visit the site, a visit will be arranged for all interested parties at the request of the Department.

1.8. COMPETENCE OF PERSONNEL, WORKMANSHIP AND STAFF

1.8.1. All work must be executed and supervised by suitably qualified staff. Only "ACCREDITED/COMPETENT PERSONS" will be permitted to carry out and supervise electrical work on site. Copies of all qualifications, certifications and registration must be issued to the Department's authorised representative prior to the commencement of works.

1.8.2. Except in the case of electrical installations supplied by a single-phase electricity supply at the point of supply, an accredited person must exercise general control over all electrical installation work being carried out.

1.8.3. The workmanship must be of the highest grade and to the satisfaction of the Department's authorised representative.

1.8.4. All inferior work will that is not in accordance with the Department's Quality specifications, SANS regulations, on indication by the Department's authorised representative, must immediately be removed and rectified by and at the expense of the Contractor.

1.8.5. The Contractor must at all times have an adequate number of employees available during the construction period to ensure that the electrical works does not delay the construction programme.

1.9. ELECTRICAL EQUIPMENT AND QUALITY OF MATERIALS

1.9.1. Only materials of first class quality must be used and all materials must be subject to the approval of the Department's authorised representative. Departmental specifications for various materials to be used on this Contract are attached to, referred to and form part of this specification.

1.9.2. Wherever applicable the material is to comply with the relevant South African Bureau of Standards, South African National Standards, specifications, or to IEC cpecifications, where no SANS exist.

1.9.3. All equipment and fittings supplied must be in accordance with the specifications, suitable for the relevant supply voltage and frequency and must be approved by the Department's authorised representative.

1.9.4. Materials and equipment used in this Contract must, where possible, comply with the specifications. Proof of compliance must be submitted prior to installation of any materials or equipment in the form of submittals.

1.9.5. The Contractor must submit samples of all materials or equipment for approval by the Engineer and Employer before installation, unless prior approval to the contrary has been obtained in writing from Department's authorised representative. Such samples must be labelled, documented and held for purposes of comparison with equipment and materials installed and will be released on satisfactory completion of the Contract.

1.9.6. All apparatus, components, fittings and materials supplied and/or installed, whether expressly specified herein or not, must conform in respect of quality, tests and performance as indicated in the detailed and quality specification.

1.9.7. Where a certain manufacturer's material or apparatus is mentioned in the drawings or specifications, such materials or apparatus shall be provided as specified, except where an alternative to this condition is allowed in the specifications. Where a detailed specification for material or apparatus is not provided, it must be understood that all normal requirements for the use of such materials or equipment will apply.

1.9.8. Where certain products of a specified manufacturer are unobtainable, substitutes may be offered, but only be supplied after written consent by the Department's authorised representative.

1.10. MAINTENANCE OF INSTALLATIONS

1.10.1. With effect from the date of the Practical completion/completion certificate dependent on the type of contract, the contractor must at his own expense undertake the regular servicing of the installation during the maintenance period stipulated by the contract and must make all adjustments necessary for the correct operation thereof.

1.10.2. If during the said period the installations is not in working order for any reason for which the Contractor is responsible, or if the installations develops defects, the contractor must immediately upon being notified thereof take steps to remedy the defects and make any necessary adjustments.

1.10.3. Should such stoppages be so frequent as to become troublesome, or should the installations otherwise prove unsatisfactory during the said period the Contractor must, if called upon by the Department's authorised representative, at his own expense replace the whole of the installations or such parts thereof as the Department's authorised representative may deem necessary with apparatus specified by the Department's authorised representative.

1.11. SCHEDULE OF FITTINGS

1.11.1. In all instances where schedule of light fittings, socket outlet, electronic equipment and power points are attached to or included on the drawings, these schedules are to be regarded as forming part of the specification.

1.12. SWITCHES AND SOCKET OUTLETS

1.12.1. All switches and switch-socket outlet combination units must conform to the Department standard specifications Part C (Quality Specification) and relevant SANS regulations, which form part of this specification.

1.12.2. All socket outlets must be in accordance with SANS 164, unless other types are distinctly specified or indicated on the drawings or detailed specifications.

1.12.3. All light switches and socket outlets must be installed in accordance with SANS 10400-S or otherwise indicated.

1.12.4. 5A Socket outlets are only permitted to supply power to light fittings in accordance with SANS 10142-1.

1.12.5. The following sample labelling shall be used for socket outlets, switches, isolators etc:

a) DB-NAME CIRCUIT BREAKER NUMER CIRCUIT TAG

eg. DB-GG CB4 P2

1.13. SWITCHGEAR

1.13.1. Switchgear, which includes circuit breakers, iron-clad switches, interlocked switch-socket outlet units, contactors, time switches, etc. are to be in accordance with the Departmental Quality Specifications which form part of this specification and shall be equal and similar in quality to such brands as may be specified.

1.13.2. For uniform appearance of switchboards and protection coordination, only one approved make of each of the different classes of switchgear mentioned in the Quality Specifications shall be used throughout the installations. All switchgear to be SABS approved or have an ASTA diamond mark or CE markings.

1.14. DISTRIBUTION BOARDS

1.14.1. All distribution boards must be in accordance with the types as specified, be constructed according to the shop or type drawings and must be approved by the Department's authorised representative prior to manufacture or installation.

1.14.2. In all instances where provision is to be made on boards for the supply authority's main switch and/or metering equipment the contractor must ensure that all requirements of the authorities concerned in this respect are met.

1.14.3. Any construction or standard type board proposed, as an alternative to that specified must have the prior approval of the Department's authorised representative.

1.14.4. All busbars, wiring, terminals, etc., are to be adequately insulated and all wiring is to enter the switchgear from the back of the board. The switchgear must be mounted within the boards to give a flush front panel. Cable and boxes and other ancillary equipment must be provided where required.

1.14.5. Each unoccupied opening of a distribution board must be fitted with a blanking plate.

1.14.6. There must be labelling for the internal bars, termination points and identification of incoming and outgoing circuits to allow for ease of tracing, isolation, testing and debugging.

1.14.7. Clearly engraved labels are to be mounted below every switch. The working of the labels in English, is to be according to the layout drawings or as directed by the Department's authorised representative and must be confirmed on site. Flush mounted boards to be installed with the top of the board 2,0m above the finished floor level.

1.14.8. The distribution boards must have a danger notice on or near it.

1.14.9. All distribution boards 10kA or above are to be provided with a type test certificate.

1.14.10. Distribution boards with alternative supply must have a notice to indicate the type of alternative supply feed and a power-on indicator.

1.15. CONDUIT AND ACCESSORIES

1.15.1. The type of conduit and accessories required for the service, i.e. whether the conduit and accessories shall be of the screwed type, plain-end type or of the non-metallic type and whether metallic conduit shall be black enamelled or galvanised, is specified in the detailed specification section of this specification.

1.15.2. Unless other methods of installation are specified for certain circuits, the installation shall be in conduit throughout. No open wiring or mechanically unprotected wiring in roof spaces or elsewhere will be permitted.

1.15.3. The conduit and conduit accessories shall comply fully with the applicable SANS as set out below and the conduit shall bear the mark of approval of the South African Bureau of Standards.

a) Screwed metallic conduit and accessories: SANS 61386-1 and 21.

b) Plain-end metallic conduit and accessories: SANS 61386-1 and 21.

c) Non-metallic conduit and accessories: SANS 61386-1 and 21.

1.15.4. All conduit fittings except couplings, shall be of the inspection type. Where cast metal conduit accessories are used, these shall be of malleable iron. Zinc base fittings will not be allowed.

1.15.5. Bushes used for metallic conduit shall be brass and shall be provided in addition to locknuts at all points where the conduit terminates at switchboards, switch-boxes, draw-boxes, etc.

1.15.6. Draw-boxes are to be provided in accordance with the "Wiring Code" and wherever necessary to facilitate easy wiring.

1.15.7. For light and socket outlet circuits, the conduit used shall have an external diameter of 20mm. In all other instances the sizes of conduit shall be in accordance with the "Wiring Code (SANS 10142)" for the specified number and size of conductors, unless otherwise directed in the detailed specification or indicated on the drawings.

1.15.8. Only one manufactured type of conduit and conduit accessories will be permitted throughout the installation to ensure uniformity.

1.15.9. Running joints in screwed conduit are to be avoided and all conduit systems shall be set or bent to the required angles. The use of normal bends must be kept to a minimum with exception of larger diameter conduits where the use of such bends is essential.

1.15.10. All metallic conduit shall be manufactured of mild steel with a minimum thickness of 1,2mm for plain-end conduit and 1,6mm in respect of screwed conduit.

Under no circumstances will conduit having a wall thickness of less than 1,6mm be allowed in screed laid on top of concrete slabs.

1.15.11. Bending and setting of conduit must be done with special bending apparatus manufactured for the purpose and which are obtainable from the manufacturers of the conduit systems. Damage to conduit resulting from the use of incorrect bending apparatus or methods applied must on indication by the Department's authorised representative, be completely removed and rectified and any wiring already drawn into such damaged conduits must be completely renewed at the Contractor's expense.

1.15.12. Conduit and conduit accessories used for flame-proof or explosion proof installations and for the suspension of luminaires as well as all load bearing conduit shall in all instances be of the metallic screwed type.

1.15.13. All conduit and accessories used in areas within 50 km of the coast shall be galvanised to SANS 32 and SANS 121.

1.15.14. Tenderers must ensure that general approval of the proposed conduit system to be used is obtained from the local electricity supply authority prior to the submission of their tender.

Under no circumstances will consideration be given by the Department to any claim submitted by the Contractor, which may result from a lack of knowledge in regard to the supply authority's requirements.

1.16. CONDUIT IN ROOF SPACES

1.16.1. Conduit in roof spaces shall be installed parallel or at right angles to the roof members and shall be secured at intervals not exceeding 1,5m by means of suitable saddles screwed to the roof timbers.

1.16.2. Nail or crampets will not be allowed.

1.16.3. Where non-metallic conduit has been specified for a particular service, the conduit shall be supported and fixed with saddles with a maximum spacing of 450 mm. The Contractor shall supply and install all additional supporting timbers in the roof space as required.

1.16.4. Under flat roofs, in false ceilings or where there is less than 0,9m of clearance, or should the ceilings be insulated with glass wool or other insulating material, the conduit shall be installed in such a manner as to allow for all wiring to be executed from below the ceilings.

1.16.5. Conduit runs from distribution boards shall, where possible terminate in fabricated sheet steel draw-boxes installed directly above or in close proximity to the boards.

1.16.6. All conduits are to be supplied with draw wires.

1.17. SURFACE MOUNTED CONDUIT

1.17.1. Wherever possible, the conduit installation is to be concealed in the building work; however, where unavoidable or otherwise specified in the detailed specifications, conduit installed on the surface must be plumbed or levelled and only straight lengths shall be used.

1.17.2. The use of inspection bends is to be avoided and instead the conduit shall be set uniformly and inspection coupling used where necessary.

1.17.3. No threads will be permitted to show when the conduit installation is complete, except where running couplings have been employed.

1.17.4. Running couplings are only to be used where unavoidable, and shall be fitted with a sliced couplings as a lock nut.

1.17.5. Conduit is to be run on approved spaced saddles rigidly secured to the walls.

1.17.6. Alternatively, fittings, tees, boxes, couplings etc., are to be cut into the surface to allow the conduit to fit flush against the surface. Conduit is to be bedded into any wall irregularities to avoid gaps between the surface and the conduit.

1.17.7. Crossing of conduits is to be avoided, however, should it be necessary purpose-made metal boxes are to be provided at the junction. The finish of the boxes and positioning shall be in keeping with the general layout.

1.17.8. Where several conduits are installed side by side, they shall be evenly spaced and grouped under one purpose-made saddle.

1.17.9. Distribution boards, draw-boxes, industrial switches and socket outlets etc., shall be neatly recessed into the surface to avoid double sets.

1.17.10. In situations where there are no ceilings the conduits are to be run along the wall plates and the beams.

1.17.11. Painting of surface conduit shall match the colour of the adjacent wall finishes, there should be no flaking or peeling of paint from the conduit after it is painted. The preparation and painting must be in accordance with guidelines from the paint manufacturer or the architect.

1.17.12. Only approved plugging materials such as aluminium inserts, fibre plugs, plastic plugs, etc., and round-head screws shall be used for fixing saddles, switches, socket outlets, etc., to walls, wood plugs and the plugging in joints in brick walls are not acceptable.

1.17.13. All surface conduit to be galvanised unless otherwise indicated in the detailed specifications.

1.17.14. All conduits are to be supplied with draw wires.

1.18. CONDUIT IN CONCRETE SLABS

1.18.1. In order not to delay building operations the Contractor must ensure that all conduits and other electrical elements which are to be cast in the concrete columns and slabs are installed timeously.

1.18.2. The Contractor shall have a representative in attendance at all times when the casting of concrete takes place with the sign off of all embedded electrical elements prior to the casting.

1.18.3. Draw-boxes, expansion joint boxes and round conduit boxes are to be provided where necessary. Sharp bends of any nature will not be allowed in concrete slabs.

1.18.4. Draw and/or inspection boxes shall be grouped under one common cover plate, and must preferable be installed in passages or male toilets.

1.18.5. All boxes, etc., are to be securely fixed to the shuttering to prevent displacement when concrete is cast. The conduit shall be supported and secured at regular intervals and installed as close as possible to the neutral axis of concrete slabs and/or beams.

1.18.6. Before any concrete slabs are cast, all conduit droppers to switchboards shall be neatly spaced and rigidly fixed.

1.18.7. All conduits are to be supplied with draw wires.

1.19. CHASES AND BUILDER'S WORK

1.19.1. Except where otherwise specified the Builder or Main Contractor shall be responsible for the builder's work related to the installation of conduits, outlet boxes, switchboard trays, bonding trays and other wall outlet boxes and will undertake the necessary chasing and cutting of walls and the provision of openings in ceilings and floors for luminaries and other electrical outlets. The Contractor shall notify the Builder or Main Contractor of his requirements and the responsibility lies with the Contractor to ensure that all builder's work is clearly indicated or marked in accordance with his requirements prior to chasing.

1.19.2. Electrical materials to be built in must be supplied, placed and fixed in position by the Contractor when required to do so by the Builder or Main Contractor. The Contractor shall also ensure that these materials are installed in the correct positions and a quality checklist must be signed confirming the fixing and position before plastering.

1.19.3. Where no Builder or Main Contractor is available, the Contractor must provide all chases and is required to cover conduits installed. Chases shall be deep enough to ensure that the top of conduits are at least 12 mm below the finished surface of the plaster.

1.19.4. Where the Contractor is responsible for the cutting of chases or the building in of conduits and other equipment, he will be held responsible for all damage as a result of this work and will be required to make good to the satisfaction of the Department.

1.19.5. Under no circumstances shall face brick walls or finished surfaces be chased or cut without the written permission of the Department. Where it is necessary to cut or drill holes in the concrete structure, the prior permission of the Department shall be obtained.

1.19.6. Chases must be made by means of a cutting machine and not using a chisel and hammer, this ruling is particularly applicable but not exclusively to the rewiring and renewal of existing installations.

1.20. FLEXIBLE CONNECTIONS FOR CONNECTING UP OF STOVES, MACHINES, ETC.

1.20.1. Flexible tubing connections shall be of galvanised steel construction, and in damp situations of the plastic sheathed galvanised steel type. Other types may only be used subject to the prior approval of the Department's site electrical representative.

1.20.2. Connectors for coupling onto the flexible tubing shall be of the gland or screw-in types, manufactured of either brass or cadmium or zinc plated mild steel, and the connectors after having been fixed onto the tubing, shall be durable and mechanically sound.

1.20.3. Aluminium and zinc alloy connectors will not be acceptable.

1.21. WIRING

1.21.1. Except where otherwise specified in the detailed specification and drawings, wiring shall be carried out in conduit throughout. Only one circuit per conduit will be permitted.

1.21.2. No wiring shall be drawn into conduit until the conduit installation has been completed and all conduit ends provided with bushes. All conduits to be clear of moisture and debris before wiring is commenced.

1.21.3. Unless otherwise specified in the detailed specification or indicated on the service drawings, the wiring of the installation shall be carried out in accordance with the "Wiring Code". Further to the requirements concerning the installation of earth conductors to certain light points as set out in the "Wiring Code", it is a specific requirement of this document that where plain-end metallic conduit or non-metallic conduit has been used, earth conductors must be provided and drawn into the conduit with the main conductors to all points, including all luminaires and switches throughout the installation.

1.21.4. Minimum wiring sizes for lighting circuits is to be carried out with 2,5mm² conductors and a 2,5mm²-earth conductor. For socket outlet circuits the wiring shall comprise 4mm² conductors and a 2,5mm²-earth conductor. In certain instances, as will be directed in the detailed specification, the sizes of the aforementioned conductors may be increased for specified circuits. Sizes of conductors to be drawn into conduit in all other instances, such as feeders to distribution boards, power points etc., shall be as specified elsewhere in this specification or indicated on the drawings. Sizes of conductors not specified must be determined in accordance with the "Wiring Code".

1.21.5. The loop-in system shall be followed throughout, and no joints of any description will be permitted.

1.21.6. The wiring shall be done in PVC insulated to SANS 1507 or unless otherwise specified in the detailed specifications.

1.21.7. Where wiring ends connect onto switchgear, switches, luminaires etc., the end strands must be lugged and firmly secured. Cutting away of wire strands of any cable will not be allowed.

1.21.8. No exposed copper on conductor at the point of termination will be accepted.

1.21.9. All wiring to be terminated and labelled in accordance with SANS 10142-1.

1.22. EARTHING OF INSTALLATION

1.22.1. The Earthing and Bonding must be done in accordance with SANS 10313 and SANS 10292.

1.22.2. The Earthing system objectives are to protect persons against direct and indirect contact with the electrical system elements and equipment. Another objective is to provide a short path for any fault to return to earth.

1.22.3. The earthing system utilised in South Africa is generally but not limited to the TN-C-S and TN-S.

1.22.4. To avoid differences of potential between circuits, which can arise with many earthing systems, a common earth will be installed either for power, IT and communication equipment.

1.22.5. The earthing and bonding system will comprise:

a) Earth grid with earth electrodes
b) Main earth terminal located in Substation/LV Room
c) Earth terminal in each distribution board
d) Protective conductor for the MV/LV transformer
e) Protective conductors for circuits
f) Equipotential Bonding conductors

1.22.6. Main earthing

1.22.6.1. The type of main earthing must be as required by the supply authority if other than the Employer, and in any event as directed by the Department's authorised representative, who may require additional earthing to meet test standards.

1.22.6.2. In order to achieve the desired resistance of less than 10Ω, interconnected electrodes would have to be installed in the form of an earth grid.

1.22.6.3. The earth grid shall consist of a number of electrodes buried to a specified depth (quantity and depth are dependent on soil resistivity tests to be done by specialist) and interconnected in a linear array with bare copper earth wire.

1.22.6.4. The earth mat resistance for the transformers, generators and sensitive equipment should be less than 1Ω.

1.22.6.5. Where required an earth mat shall be provided, the minimum size, unless otherwise specified, being 1,0m x 1,0m and consisting of hard-drawn bare copper wires at 250mm centres, brazed at all intersections.

1.22.6.6. Alternatively or additionally earth rods or trench earths may be required as specified or

directed by the Department's authorised representative.

1.22.6.7. Installations shall be effectively earthed in accordance with the "Wiring Code" and to the requirements of the supply authority. All earth conductors shall be stranded copper with or without green PVC installation dependent on the application.

1.22.6.8. Connection from the main earth bar on the main board must be made to the cold water main, the incoming service earth conductor, if any and the earth mat or other local electrode by means of 12mm x 1,60 mm solid copper strapping or 16 mm² stranded (not solid) bare copper wire or such conductor as the Department's authorised representative may direct. Main earth copper strapping where installed below 3m from ground level, must be run in 20 mm diameter conduit securely fixed to the walls. If metallic conduit is used then it needs to be bonded accordingly.

1.22.6.9. All other metallic hot and cold water pipes shall be connected with 12mm x 0,8mm perforated for solid copper strapping (not conductors) to the nearest switchboard. The strapping shall be fixed to the pipework with brass nuts and bolts and against walls with brass screws at 150-mm centres. In all cases where metal water pipes, down pipes, flues, etc., are positioned within 1,6m of switchboards an earth connection consisting of copper strapping shall be installed between the pipework and the board. In vertical building ducts accommodating both metal water pipes and electrical cables, all the pipes shall be earthed at each distribution board.

1.22.7. Roofs, gutters and down pipes

1.22.7.1. Where service connections consist of overhead conductors, all metal parts of roofs, gutters and down pipes shall be earthed. One bare 10mm² copper conductor shall be installed over the full length of the ceiling void, fixed to the top purlin and connected to the main earth conductor and each switchboard. The roof and gutters shall be connected at 15m intervals to this conductor by means of 12mm X 0,8mm copper strapping (not conductors) and galvanised bolts and nuts. Self-tapping screws are not acceptable. Where service connections consist of underground supplies, the above requirements are not applicable.

1.22.8. Sub-distribution boards

1.22.8.1. A separate earth connection shall be supplied between the earth busbar in each sub-distribution board and the earth busbar in the Main Switchboard. These connections shall consist of a bare or insulated stranded copper conductors installed along the same routes as the supply cables or in the same conduit as the supply conductors. Alternatively armoured cables with earth continuity conductors included in the armouring may be utilised where specified or approved.

1.22.9. Sub-circuits

1.22.9.1. The earth conductors of all sub-circuits shall be connected to the earth busbar in the supply board in accordance with SANS 10142. If earth continuity cables are used for motor loads then an additional earth cable will still be required for additional safety.

1.22.9.2. The minimum standard for the earthing protective conductor as follows:

a) For phase cables cross sectional area less than 16mm², the protective conductor will be the same as for the phase cable.

b) For phase cables between 16 and 35mm² the protective conductor will be 16mm².

c) For phase cables larger than 35mm², the protective conductor will be half the phase cable with the minimum of 16mm².

1.22.10. Ring Mains

1.22.10.1. Common earth conductors may be used where various circuits are installed in the same wire way in accordance with SANS 10142. In such instances the sizes of earth conductors shall be equivalent to that of the largest current carrying conductor installed in the wire way, alternatively the size of the conductor shall be as directed by the Department's authorised representative. Earth conductors for individual circuits branching from the ring main shall by connected to the common earth conductor with T-ferrules or soldered. The common earth shall not be broken.

1.22.11. Non-metallic Conduit

1.22.11.1. Where non-metallic conduit is specified or allowed, the installation shall comply with the Department's standard quality specification for "conduit and conduit accessories".

1.22.11.2. Standard copper earth conductors shall be installed in the conduits and fixed securely to all metal appliances and equipment, including metal switch boxes, socket-outlet boxes, draw-boxes, switchboards, luminaires, etc. The securing of earth conductors by means of self-threading screws will not be permitted.

1.22.12. Flexible Conduit

1.22.12.1. An earth conductor shall be installed in all non-metal flexible conduit. This earth conductor shall not be installed externally to the flexible conduit but within the conduit with the other conductors. The earth conductor shall be connected to the earth terminals at both ends of the circuit.

1.22.13. Connection

1.22.13.1. Under no circumstances shall any connection points, bolts, screws, etc., used for earthing be utilised for any other purpose. It will be the responsibility of the Contractor to supply and fit earth terminals or clamps on equipment and materials that must be earthed where these are not provided.

1.22.13.2. Unless earth conductors are connected to proper terminals, the end shall be tinned and lugged.

1.23. LIGHTNING PROTECTION SYSTEM

1.23.1. The lightning protection risk assessment must be done by the specialist to validate the assumptions of the design engineer in the concept design.

1.23.2. The lightning protection system must be installed by a Lightning Protection System Specialist. Prior to carrying out the installation, the specialist must test the soil resistivity of the site and report to the Department's authorised representative on the sufficiency of the concept design for the site conditions.

1.23.3. The lightning protection is the primary protection against direct or indirect strikes that induce overvoltage. The secondary protection will consist of surge arrestors in the distribution boards.

1.23.4. The Lightning protection system must be done in accordance with SANS 62305, 62561 and SANS 10313.

1.23.5. The lightning protection system will consist of an aerial conductor system, down conductor system, test points and an earthing systems that consists of earth rods, spikes or plates.

1.23.6. The specialist must test the resistance to earth of each earth electrode and of the complete lightning protection system. This resistance must be less than 10Ω.

1.24. MOUNTING AND POSITIONING OF LUMINAIRES

1.24.1. The contractor is to note that in the case of board and acoustic tile ceilings, i.e. as opposed to concrete slabs, coordination with the building contractor is necessary to ensure that as far as possible the luminaires are symmetrically positioned with regard to the ceiling pattern.

1.24.2. The layout of the luminaires as indicated on the drawings must be adhered to as far as possible and must be confirmed with the Department's authorised representative. The contractor is responsible to ensure that the luminaries are free of damage, debris and is installed in an aesthetic manner. The contractor is to ensure that the fixing of suspended luminaire are correct and safe to prevent the falling of fittings, there should be an additional safety wire connection in accordance with the manufacturer's requirements to ensure additional safety.

1.24.3. Incandescent and Fluorescent luminaires are not permitted to be installed in any installation in accordance with the requirements of SANS 204, 10400 XA and Green building policy.

1.25. INSPECTION, TESTS AND COMMISSIONING

1.25.1. On completion of the erection and installation of works and before practical completion is achieved, a full test will be carried out on the installation for a period of sufficient duration to determine the satisfactory working thereof. During this period the installations will be inspected and the Contractor shall make good, to the satisfaction of the Department's authorised representative, any defects which may arise.

1.25.2. The contractor to inspect and test the services installation in accordance with the Wiring Code, the Regulations of the Supplier of Electricity and the Occupational Health and Safety Act 85. Record test results on printed test sheets and submit to the Department's authorised representative.

1.25.3. The Contractor must provide all instruments and equipment required for testing and any water, power and fuel required for the commissioning and testing of the installations at completion.

1.25.4. The following tests should be conducted in accordance with regulation but are not limited to the following unless otherwise indicated:

a) Ensure correct polarity, verify polarity and phase identification.
b) Continuity and resistance of earth conductor including all bonding conductors.
c) Continuity of ring circuit.
d) Earth electrode resistance.
e) Insulating resistance of the cable.
f) Earth fault loop impedance test.
g) Operation of earth leakage protection devices and circuit breakers.
h) Earthing and lightning protection
i) Luminosity test
j) Equipment test
k) Generator and UPS testing
l) Electronic system testing
m) ICT system testing

1.25.5. After inspection and testing, timeously arrange for any inspection and test by the Supplier of electricity if required, and assist as necessary the Inspector of the Supplier of electricity by providing access, tools, instruments and attendance.

1.25.6. Replace any portion of the services installation that does not comply with the Wiring Code or the Specification. Such replacement shall be done at the Contractor's expense.

1.25.7. Submit a "Certificate of Compliance by an accredited person" Annexure 1 in terms of the Occupational Health and Safety Act 85, Electrical Installation Regulation 1992, to the Client and forward a copy to the Engineer.

1.25.8. Timeously (at least 14 days) advise the Department's authorised representative of all inspections and tests as the Department's authorised representative reserves the right to witness such inspections and tests. The Department's authorised representative shall have the power at any time to examine any part of the works or materials intended for use in or on the works either on site, or at the place of manufacture or storage.

1.25.9. On completion of the works, the contractor shall submit three indexed volumes of operation and maintenance manuals to the Department's authorised representative.

1.25.10. All information must be recorded and provided in electronic format with DWG drawings formats to the Department.

1.25.11. Approval of the final Operations and Maintenance Manuals should be a prerequisite for issuing of a Certificate of Practical Completion of the installation.

1.25.12. The Manuals should contain the following information if applicable:

a) Cover Page
b) Contact Personnel & Emergency contact personnel
c) Scope of Work
d) Operating Instructions
e) Normal Operation
f) Safety Measures
g) Fault Finding Guide
h) Equipment Information
i) Schedule of Information
j) List of Spares and Agents
k) Design Data
l) Factory acceptance and site acceptance certificates
m) As Commissioned Data
n) Maintenance Requirements & Checklists
o) Manufacturers Service Recommendations
p) Manufactures Literature
q) Equipment Brochures
r) Approved Shop Drawings, Exploded Views and Wiring Diagrams
s) As Built Drawings for all systems
t) Electrical Drawings
u) System Layouts (General arrangement layouts) and Schematics
v) Certificate of compliance
w) Signed QCP(Quality control plan) documentation
x) Training Certificates/Register

1.26. VERIFICATION AND CERTIFICATION OF ELECTRICAL INSTALLATION (CERTIFICATE OF COMPLIANCE AND TEST REPORT

1.26.1. On completion of the installation, a certificate of compliance must be issued to the Department's authorised representative in terms of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).

1.26.2. Certificate of completion must also be issued for Earthing and lightning protection installation and all applicable Electronic installation in accordance with South African National Standards and Occupational Health and Safety Act.

PART 2: DETAILED SPECIFICATIONS

CONTENTS

PART 2: DETAILED SPECIFICATIONS

2.1. INTENT OF SPECIFICATION

2.1.1. The objective is the supply and installation of water tanks at Mdantsane Labour center for Department of Employment and Labour in Mdantsane, Eastern Cape, South Africa.

2.2. EXTENT OF SCOPE

2.2.1. This Contract covers the manufacture, supply, factory testing, insurance, delivery, transport, handling, storing, erection, site welding and making good coatings, aligning, fixing, supporting, connecting, adjusting, guaranteeing, site testing, painting, commissioning, handing over in complete working order, providing as-built drawings, operating and maintenance instructions in triplicate, instructing staff and attending to defects for the electrical works as described in greater detail in this document and/or shown on the drawings and/or set out in the Bills of Quantities and as briefly described below:

2.2.2. The works covered by this Contract will include but not be limited to the following:

a) Supply and install of 20A, 5kA curve D circuit breaker in the essential section of distribution board SDB-HALL.
b) Supply and install conduit and sleeve from Hall building to pump set.
c) Supply and install approximately 40m 2,5 sqmm x 2C PVC ECC 600V/1000V low voltage cable with glands and accessories.
d) Supply and install IP67 socket outlet dependent on the required receptacle electrical input of the pump set, mounted within 1m of the pump sets.
e) Terminate power point to pump sets.
f) Earthing and lightning protection for the metal tank area.
g) Certificate of compliance to be provided for complete installation.

2.3. COMPLIANCE WITH REGULATIONS AND STANDARDS

2.3.1. The entire installation shall be carried out in accordance with the latest revision and amendments of the following but not limited to:

a) The Occupational Health and Safety Act
b) The Basic Conditions of Employment Act
c) The Local Fire Office Regulations.
d) Electricity Regulations Act
e) Occupational Health and Safety Act with all regulations
f) Department of Public Works: General Electrical Specifications part A, B and C.
g) SANS 10400 – The National Building Regulations
h) SANS 10142-1 – The Code of Practice for the Wiring of Premises
i) SANS 62305 – Protection against lightning
j) SANS 10292 – Earthing of low voltage installation
k) SANS 1973 - Low voltage switchgear and control gear assemblies.
l) All relevant regulations and bylaws.

2.4. NOTICES AND FEES

2.4.1. There are no notices or fees required to be paid to the supply authority due to sufficient capacity of the existing supply on site.

2.5. DRAWINGS

2.5.1. The drawings generally show the scope and extent of the proposed work and shall not be held as showing every minute detail of the work to be executed, further clarity of the drawings are indicate in the specifications or BOQ.

2.5.2. The position of distribution boards, power points, switches and light points that may be influenced by built-in furniture must be established on site, prior to these items being installed.

2.5.3. Two copies of shop drawings shall be submitted to the Department's authorised representative for approval and to demonstrate compliance with contract Documents. Shop drawings are drawings, diagrams, illustration, schedules, performance charts, brochures and other data which are prepared by the contractor, manufacturer, supplier or distributor and which illustrate some portion of the work.

2.5.4. The Department's authorised representative's approval of shop drawings or samples shall not relieve the contractor of responsibility for any deviation from the requirements of this contract unless the contractor has informed the Department's authorised representative in writing of such deviation at the time of submission of shop drawings or samples and the Department's authorised representative has given written approval for the specific deviation, nor shall the Department's authorised representative's approval relieve the contractor of responsibility for errors or omissions in the shop drawings or samples.

2.5.5. A complete set of the drawings shall be issued to the contractor after installation to be marked up by the contractor to indicate the "As-Built" installation as a prerequisite to completion.

2.5.6. **Schedule of Drawings**

No.	Title	Drawing Number
1	There are no drawings required.	
2		
3		
4		
5		

2.6. CLIMATIC CONDITIONS

2.6.1. All equipment offered must be de-rated for the conditions below, the climate conditions must be validated by the contractor.

Location	Design Condition	Design Condition Value
981 Mdantsane Access-Weg,		
Mdantsane Unit 1, Mdantsane	Altitude	255,27 m
5219, Eastern Cape, South Africa	Maximum ambient temperature	40 °C
	Minimum ambient temperature	-2 °C
	Maximum ambient humidity	52 %

2.7. MAINTENANCE OF ELECTRICAL SUPPLY

2.7.1. All interruptions of the electrical supply that may be necessary for the execution of the work, will be subject to prior arrangement between the contractor, client and the Department's authorised representative.

2.8. SUPPLY AND CONNECTION

2.8.1. The power supply is existing on site and will not be upgraded for this installation. The connection to the pump set will be from an existing distribution board located in the hall building.

2.9. BALANCING OF LOAD

2.9.1. The Contractor is required to balance the load as equally as possible over the multiphase supply.

2.10. DISTRIBUTION BOARDS

2.10.1. There are no new distribution boards required for this installation since there is an existing distribution board but testing and labelling will be required in accordance with the extent of scope.

2.10.2. **General**

a) In all instances where provision is to be made on boards for the supply authority's main switch and/or metering equipment the contractor must ensure that all requirements of the authorities concerned in this respect are met.

b) All busbars, wiring, terminals, etc., are to be adequately insulated and all wiring is to enter the switchgear from the back of the board. The switchgear shall be mounted within the boards to give a flush front panel. Cable and boxes and other ancillary equipment must be provided where required.

c) The Contractor shall supply and install the distribution boards as indicated on the drawings and listed in the Distribution board schedule. All distribution boards shall be equipped in accordance with the Single Line Diagrams and must be approved by the Department's authorised representative prior to installation.

d) The doors and architrave of the Distribution Boards shall be painted as per the schedule.

e) All distribution boards shall have a minimum of 30% spare space. Where circuit breaker sizes are shown for spare ways on the single line diagrams, these circuit breakers shall be fitted at time of manufacture.

2.10.3. **Internal wiring**

a) Standard 600/1000 V grade PVC-insulated stranded annealed copper conductors to SANS 1507 shall be used for the internal power wiring of switchboards. The smallest conductor size to be used for power wiring in switchboards shall be 2.5mm². Flexible cord of minimum size 1,0mm² may be used for control wiring.

b) Where heat generating equipment is present and the internal temperature of the board is likely to exceed 50°C, silicon-rubber insulated stranded conductors shall be used.

c) Wiring shall be arranged in horizontal and vertical rows and shall be bound with suitable plastic straps or installed in PVC wiring channels. Under no circumstances may PVC adhesive tape be used for the bunching of conductors or for the colour identification of conductors.

d) Bunched conductors shall be neatly formed to present a uniform appearance without

twisting or crossing the conductors. Conductors leaving the harnesses shall be so arranged that they are adjacent to the chassis.

e) All wiring between different panels within the same switchboard shall be installed in wiring channels.

f) Grommets shall be installed in each hole in the metal work through which conductors pass.

g) All wiring shall be installed away from terminals, clamps or other current carrying parts. Wiring shall also be kept away from exposed metal edges or shall be protected where they cross metal edges.

h) Where conductors change direction, smooth bends shall be formed with a radius of at least 5 times the outside diameter of the conductor or harness.

i) Where neutral connections are looped between the terminals of instruments, it is essential that the two conductor ends be inserted into a common lug or ferrule and are crimped or soldered together in order that the neutral connection is not broken when the conductors are removed from one of the instruments.

j) Wiring should as far as possible be confined to the front portions of switchboards for ease of access. This requirement is important for wiring between smaller circuit-breakers and the associated main circuit-breaker as well as the wiring from circuit-breakers to lighting and socket-outlet circuits.

k) A maximum of two conductors will be allowed per equipment terminal. In the event of more conductors being connected to the same equipment terminal (e.g. a main circuit-breaker feeding other circuit-breakers), stub bus-bars shall be provided for the various conductors.

2.10.4. **Load End Connections**

a) The supply end connections to all equipment shall under all circumstances be at the top and the load end connections at the bottom.

2.10.5. **Wiring to Circuit-breakers**

a) Equipment with a rating exceeding the current rating of 70mm² conductors shall be connected by means of bus-bars to the main bus-bars. Looped connections may only be installed for a maximum of two outgoing circuits. Where there are more than two outgoing circuits, busbars shall be used and equipment connected individually to the bus-bars. Where miniature circuit-breakers are mounted in continuous rows and supplied by bus-bars connected to each MCB. each busbar shall be supplied by a separate conductor. This conductor shall be connected to the busbar by means of a separate lug and not via an MCB terminal.

2.10.6. **Identification**

a) The colour of the conductors for all 220/250 V circuits shall correspond to the colour of the supply phase for that circuit. Neutral conductors shall be black.

b) All other conductors in the board, supplying control circuits, etc. shall be coded in colours other than those specified above. A colour code shall be devised for each board and the colour code shall be shown on the wiring diagrams.

c) All conductors that terminate at wiring terminals and all conductors used for the internal wiring of the switchboard shall further be identified at both ends by means of durable cable marking ferrules. PVC or other tape is not acceptable.

d) The numbers on the markers shall be shown on the wiring diagrams.

2.10.7. **Labelling**

a) All distribution boards shall be provided with a legend card and holder. The legend card shall be typed and laminated, and shall indicate as a minimum the circuit breaker number, the circuit type (e.g. Lighting, Power, Air Conditioning, etc), the Circuit Number as shown on the drawings, and a brief description of the circuit. For example, a lighting circuit shown as L1 on the drawings and fed by circuit breaker number 1 shall be labelled as follows:

CB1 L1 - Lighting Area

b) All distribution boards shall be labelled with an engraved label, detailing the distribution board name, where the distribution board is fed from, the cable size, the Fault Level and the phase rotation, e.g.

DB Name: DB 2
Fed from: DB 1
Size of phase cable: 16 mm² x 4C PVC/ECC/SWA
Size of earth cable: 10 mm²
Fault Level: 5kA
Phase Rotation: Clockwise

c) Cascading labels shall be used for all sub-distribution boards with a nominal fault level of over 5kA, as well as on the Main LV Board.

2.10.8. **Schedule of Distribution Boards**

a) There are no new distribution boards required.

2.11. CABLES

2.11.1. The Contractor shall supply and completely install all distribution cables as indicated on the drawings, and listed in the Schedule of Cables.

2.11.2. The storage, transportation, handling and laying of the cables shall be according to first class practice, and the contractor shall have adequate and suitable equipment and labour to ensure that no damage is done to cables during such operations.

2.11.3. The cable-trenches shall be excavated to a depth of 0,9m deep below ground level and shall be 450mm wide for one to three cables, and the width shall be increased where more than three cables are laid together so that the cables may be placed at least two cable diameters apart throughout the run. The bottom of the trench shall be level and clean and the bottom and sites free from rocks or stones liable to cause damage to the cable.

2.11.4. The Contractor must take all necessary precautions to prevent the trenching work being in any way a hazard to the personnel and public and to safeguard all structures, roads, sewage works or other property on the site from any risk of subsidence and damage.

2.11.5. In the trenches the cables shall be laid on a 75mm thick bed of river sand and be covered with a 150-mm layer of earth before the trench is filled in.

2.11.6. All joints in underground cables and terminations shall be made either by means of compound filled boxes according to the best established practice by competent cable jointers using first class materials or by means of approved epoxy-resin pressure type jointing kits. Epoxy-resign joints must be made entirely in accordance with the manufacturer's instructions and with materials stipulated in such instructions. Low tension PVCA cables are to be made off with sealing glands and materials designed for this purpose which must be of an approved make. Where cables are cut and not immediately made off, the ends are to be sealed without delay.

2.11.7. The laying of cables shall not be commenced until the trenches have been inspected and approved. The cable shall be removed from the drum in such a way that no twisting, tension or mechanical damage is caused and must be adequately supported at intervals during the whole operation. Particular care must be exercised where it is necessary to draw cables through pipes and ducts to avoid abrasion, elongation or distortion of any kind. The ends of such pipes and ducts shall be sealed to approval after drawing in of the cables.

2.11.8. Backfilling (after bedding) of the trenches is to be carried out with a proper grading of the material to ensure settling without voids, and the material is to be tamped down after the addition of every 150mm. The surface is to be made good as required.

2.11.9. On each completed section of the laid and jointed cable, the insulation resistance shall be tested to approval with an approved "Megger" type instrument of not less that 500 V for low tension cables.

2.11.10. Earth continuity conductors are to be run with all underground cables constituting part of a low tension distribution system. Such continuity conductors are to be stranded bare copper of a cross-sectional area equal to at least half that of one live conductor of the cable, but shall not be less than 4mm² or more than 70mm². A single earth wire may be used as earth continuity conductor for two or more cables run together, branch earth wires being brazed on where required.

2.11.11. **Laying, jointing and making off of electrical cables**

2.11.11.1. No cable is to be laid before the cable trench is approved and the soil qualification of the excavation is agreed upon by the Contractor and Department's authorised representative.

2.11.11.2. After the cable has been laid and before the cable trench is back-filled the inspector must ensure that the cable is properly bedded and that there is no undesirable material included in the bedding layer.

2.11.11.3. All cable jointing and the making off of the cables must only be carried out by qualified experienced cable jointers. Helpers of the jointers may not saw, strip, cut, solder, etc. The cable and other work undertaken by them must be carried out under the strict and constant supervision of the jointer.

2.11.11.4. Before the Contractor allows the jointer to commence with the jointing work or making off of the cable (making off is recognized as half a joint) he must take care and ensure:

a) That he has adequate and suitable material available to complete the joint properly and efficiently. Special attention must be given to ensure the cable ferrules and cable lugs are of tinned copper and of sufficient size.
b) That the joint pit is dry and that all loose stones and material are removed,
c) That the walls and banks of the joint pit are reasonable firm and free from loose material which can fall into the pit.
d) That the necessary coffer-dams or retaining walls are made to stop the flow of water into the joint pit.
e) That the joint pit is provided with suitable groundsheets so that the jointing work is carried out in clean conditions.
f) That the necessary tents or sails are installed over the joint pit to effectively avert unexpected rainfall and that sufficient light or lighting is provided.
g) That the necessary means are available to efficiently seal the jointing or cable end when an unexpected storm or cloudburst occurs, regardless of how far the work has progressed.
h) That the cables and other materials are dry, undamaged and in all respects are suitable for the joint work or making off.
i) That the heating of cable oil, cable compound, plumbers metal and solder is arranged that they are at the correct temperature when required so that the cable is not unnecessary exposed to the atmosphere and consequently the ingress of moisture (care must be taken of overheating).
j) Flow temperatures of cable oil and compound must be determined with suitable thermometers. Cable oil and compound must not be heated to exceed the temperatures given on the containers and precaution must be taken to ensure that the tin is not overheated in one position. The whole mass must be evenly and proportionally heated.
k) Temperatures of solder and plumbers metal may be tested with brown paper (testing time: 3 seconds). The paper must colour slightly - not black or burnt).

2.11.11.5. Before the paper-insulated cables are joined, they must be tested for the presence of moisture by the cable jointers test. This consists of the insertion of a piece of unhandled insulated impregnated paper tape in warm cable oil heated to a temperature of 130 ± 5°C.

2.11.11.6. Froth on the surface of the oil is an indication that moisture is present in the impregnated insulation and the amount of the froth gives an indication of the moisture present.

2.11.11.7. If the cable contains moisture or is found to be otherwise unsuitable for jointing or making of the inspector is to be notified immediately and he will issue the necessary instruction to cope with the situation.

2.11.11.8. The joint or making off of paper insulated cables must not be commenced during rainy weather.

2.11.11.9. Once a joint is in progress the jointer must proceed with the joint until it is complete and before he leaves the site.

2.11.11.10. The jointer must ensure that the material and his tools are dry at all times, reasonably clean and absolutely free from soil.

2.11.12. **Relating to the jointing of the cable the following requirements apply:**

a) All jointing must be carried out in accordance with recognized and tried techniques and comply strictly with the instructions given by the supplier of the jointing kit.
b) The cables must be twisted by hand so that the cores can be joined according to the core numbers. If necessary the cable is to be exposed for a short distance to accomplish this. Under no circumstances may the cores in a joint be crossed so as to

enable cores to be joined according to the core numbers. If it is not possible to twist the cables so that the preceding requirements can be met, then cores are to be joined in the normal way without any consideration of the core numbers.

c) Normally the cables will have profile conductors. The conductors shall be pinched with gas pliers to form a circular section, bound with binding wire so that they do not spread, and then tinned before jointing.
d) Jointing ferrules, the length of which are at least 6 times the diameter of the conductors, must be slid over the conductor ends to be joined and pinched tightly. Then they are soldered by means of the ladle process whilst being pinched further closed.
e) Use resin only as a flux. The slot opening in the ferrule must be completely filled, including all depressions.
f) Remove all superfluous metal with a cloth dipped in tallow. Work during the soldering process must be from top to bottom. Rub the ferrule smooth and clean with aluminium oxide tape after it has cooled down to ensure that there are not any sharp points or edges.
g) The spaces between the conductor strands must be completely filled by soldering process and must be carried out quick enough to prevent the paper insulation from burning or drying out unnecessarily.
h) After the ferrules have been rubbed smooth and clean, they and the exposed cores must be treated with hot cable oil (110°C) to remove all dust and moisture. These parts are to be thoroughly basted with the oil.
i) The jointer must take care that his hands are dry and clean before the joint is insulated. Also the insulating tape which is to be used must first be immersed in warm cable oil (110°C) for a sufficient period to ensure that no moisture is present.
j) After the individual cores have been installed they must be well basted with hot cable oil and again after the applicable separator and/or belt insulation tape is applied before the lead joint sleeve is placed in position.
k) The lead joint sleeve must be thoroughly cleaned and prepared before it is placed on the cable and must be kept clean during the whole jointing process. Seal the filling apertures of the sleeve with tape until the sleeve is ready for compound filling.
l) The plumbing joints employed to solder the joint sleeve to the cable sheath, must be cooled off with tallow and the joint sleeve is to be filled with compound while it is still warm. Top up continuously until the joint is completely filled to compensate for the compound shrinkage.
m) The outer joint box must be clean and free from corrosion. After it has been placed in position it must be slightly heated before being filled with compound. Top up until completely full.

2.11.13. **Schedule of cables, conduit and wiring**

a) Supply, install and connect the following feeder and sub-feeder cables, conduit and wiring which are indicated in detail on the single line diagram:

No.	FROM	TO	SIZE AND TYPE	ESTIMATE LENGTH (m)	LOAD (kVA)	CURRENT (A)	VOLT DROP (%)
1	SDB – HALL	PUMP SET	2,5mm² 2-core ECC cable	40	1,3	5,65	3,49

2.12. SWITHCHGEAR

2.12.1. All circuit breakers shall be of the same manufacture throughout.

2.12.2. An additional 20A curve D circuit breaker will be required to be installed in the existing distribution board SDB-HALL.

2.13. SWITCHES, SOCKET OUTLETS AND POWER POINTS

2.13.1. All socket outlets will be euro socket outlets to comply with the requirements in accordance with SANS 10142-1 and SANS 164.

2.13.2. The installation of switches and socket outlets must conform to clause of the general specifications, SANS 10142, SANS 164, SANS 10400-S and the following Schedule:

2.13.3. **Schedule of power points**

No.	Type	Description	Area	Picture
1.	External	IP67 weather proof socket outlet for pump set	External within 1m of the pump set	

2.13.4. Weather proof socket outlet to be mounted within 1m of the pump set, socket outlet to be mounted on unistrut or pedestal.

2.13.5. Switches shall have protected terminals for safe wiring.

2.14. LIGHT FITTINGS AND LAMPS

2.14.1. There is no lighting included in this installation.

2.15. WIRE WAYS, WIRING CHANNELS AND POWER SKIRTING

2.15.1. **General**

2.15.1.1. All wire ways will be designed to ensure conformity with SANS 10142 and the following percentage of utilisation will not be exceed:

a) 40% for conduit
b) 35% for ducting
c) 45% for trunking

2.15.1.2. In accordance with SANS 10198-4 the minimum burial depth of cables to the centre of the cable or sleeve at an ambient temperature of 30^0C , soil temperature of burial depth of 25^0C and a thermal resistivity of 1,2K.m/W as follows:

a) 500mm for 600/1000V cables
b) 800mm for greater 1000V Medium voltage cables

2.15.1.3. The bedding will be a minimum of 75mm thick for all sleeves and cables.

2.15.2. **Sleeves**

2.15.2.1. Where cables cross under roadways, other services and where cables enter buildings, the cables shall be installed in earthenware or high-density polyethylene pipes.

2.15.2.2. The ends of all sleeves shall be sealed with a non-hardening watertight compound after the installation of cables. All sleeves intended for future use shall likewise be sealed.

2.15.2.3. Installation of 32mm PVC sleeve between the building to the power point of the pump set.

2.15.3. **Conduit**

2.15.2.4. Installation of 32mm galvanized conduit from the distribution board then surface on the building, coupled to the 32mm PVC sleeve through a junction to the pump set.

2.16. EARTHING AND LIGHTNING PROTECTION SYSTEM

2.16.1. Earthing and Equipotential Bonding System

2.16.1.1. The Earthing and Bonding shall be done in accordance with SANS 10313 and SANS 10292.

2.16.1.2. All accessible extraneous conductive parts associated with a water pump motor shall be bonded to the earth continuity conductor. These parts include the suction pipe, delivery pipe and pump casing accordance with SANS 10142-1.

2.16.2. Lightning Protection System

2.16.2.1. The provision of a lightning protection system is mandatory for this installation based on the risk assessment.

2.16.2.2. The Lightning Protection System shall be done in accordance with SANS 62305, 62561 and SANS 10313 by a specialist after providing a soil resistivity report and design to ensure an overall resistance of less than 1Ω.

PART 3: ELECTRICAL WORK MATERIAL SCHEDULE & DATASHEETS

3.1. The Contractor shall complete the following schedules, provide datasheets and submit them to the Department's authorised representative within 21 days of the date of the acceptance of the tender.

3.2. The schedules will be scrutinised by the Electrical Engineer and should any material offered not comply with the requirements contained in the specification, the contractor will be required to supply material in accordance with the contract at no additional cost.

NB: **Only one manufacturer's name to be inserted for each item.**

Item	Material	Make or trade name	Country of origin
1.	Circuit breakers 1P, 2P, 3P		
2.	Conduit		
3.	Conduit boxes		
4.	16A weatherproof socket outlets		
5.	Sleeves		
6.	Cables		
7.	Earth Rods		
8.	Earth clamps		
9.	BCEW		
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PART C4: SITE INFORMATION

C4: SITE INFORMATION
PG-03.2 (EC)

PG-03.2 (EC) SITE INFORMATION – JBCC 2000 PRINCIPAL BUILDING AGREEMENT (EDITION 6.2 OF MAY 2018)

Project title:	**EASTERN CAPE: GQEBERHA: MDANTSANE LABOUR CENTRE: DEPARTMENT OF EMPLOYMENT AND LABOUR: SUPPLY AND INSTALLATION OF WATER TANKS.**				
Tender no:	GQEQ-2025/2026-063	**WCS no:**	056632	**Reference no:**	*14/1/3/1/1/6464/5050*

C4 Site Information

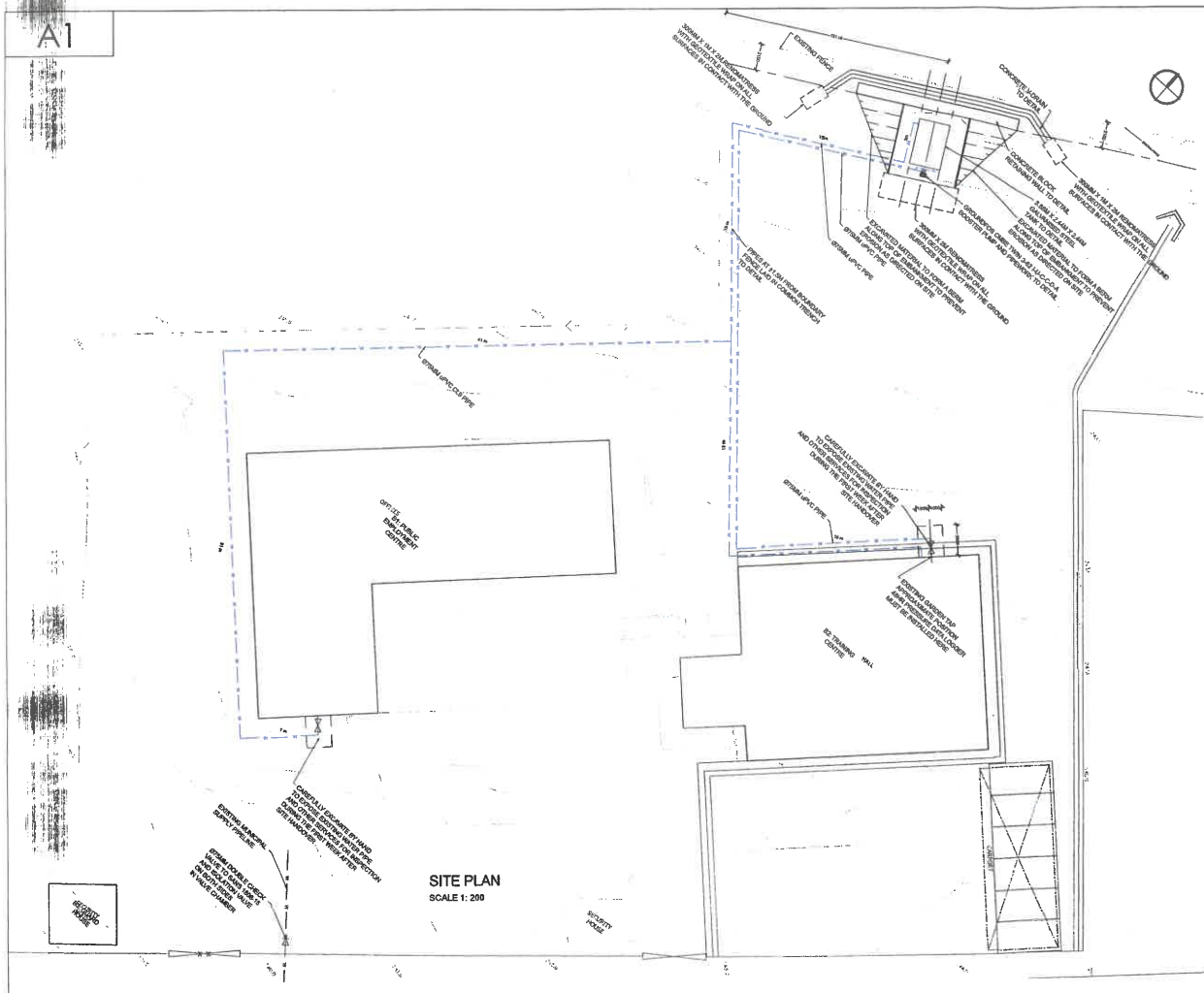
The site is located in Mdantsane Unit 1, and is approximately 18 km from East London. The position of the proposed water tank is at a higher level than the buildings. There are existing underground services that the contractor need to take note of when excavating and laying pipes.

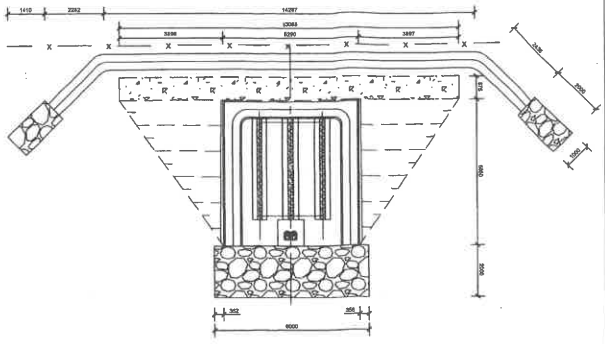
Figure 1: Site Plan

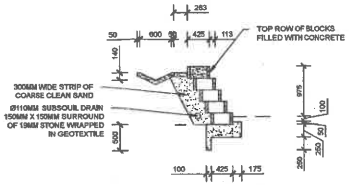
PART C5: DRAWINGS

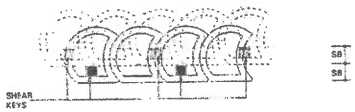
C5.2: CIVIL AND STRUCTURAL ENGINEERING DRAWINGS

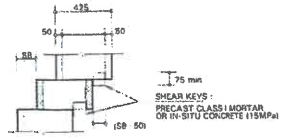
A1

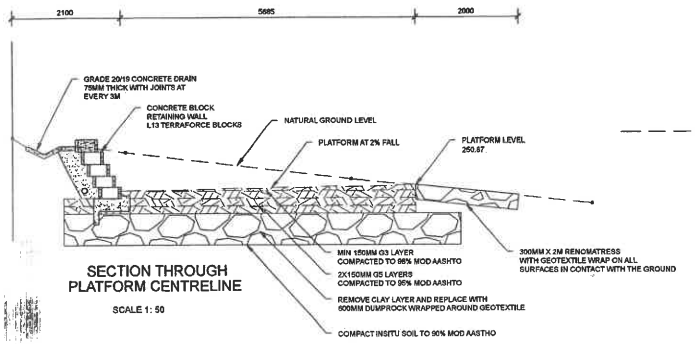


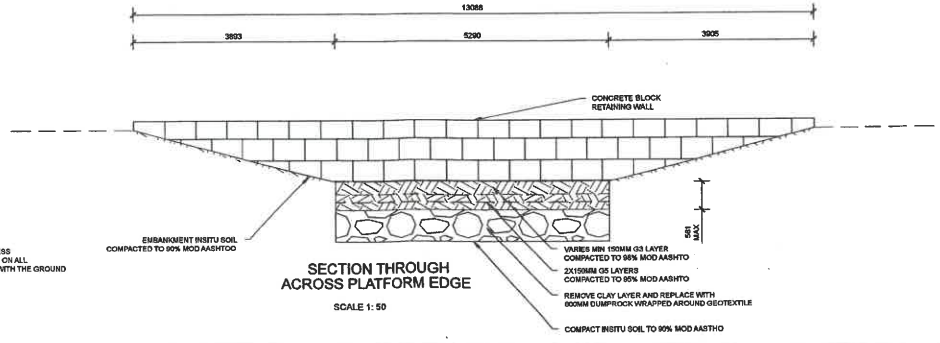












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DRAWING NOTES

1 GENERAL
1.1 THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE PROJECT SPECIFICATIONS AND OTHER ASSOCIATED DRAWINGS
1.2 ALL WORK MUST BE COORDINATED WITH OTHER DISCIPLINES AND THE ARCHITECTS DRAWINGS TAKES PRECEDENCE OVER THIS DRAWING
1.3 ALL WORK MUST BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS
1.4 ANY DISCREPANCIES ON THE DRAWING MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER BEFORE THE WORK IS DONE
1.5 ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED
1.6 ONLY FIGURED DIMENSIONS MUST BE USED FOR CONSTRUCTION
1.7 NO WORK MUST BE COVERED WITHOUT THE ENGINEERS CONSENT
1.8 SHORING OF EXCAVATIONS MUST BE PROVIDED WHERE THE TRENCH IS WITHIN 1.5M AWAY AND IS PARALLEL TO THE BUILDING, AND EXTENDS BELOW THE FOUNDATION FOOTING
1.9 ALL WORK SHALL BE SUBJECT TO ACCEPTANCE TESTS AS REQUIRED IN TERMS OF THE SPECIFICATIONS
1.10 ALL CONCRETE WORKS SHALL BE GRADE 20/19 IN ACCORDANCE WITH SANS 2001: CC2 UNLESS OTHERWISE NOTED
1.11 MINIMUM COVER TO UNDERGROUND PIPES 900MM UNLESS OTHERWISE INSTRUCTED

2 WATER
ALL WORK MUST BE CARRIED IN STRICT ACCORDANCE WITH SANS 2001-DP6
2.1 PIPES BELOW GROUND:
2.1.1 NOT EXCEEDING Ø75MM SHALL BE HDPE PE 63 PN 16 COMPLYING WITH SANS 4427 UNLESS OTHERWISE NOTED
2.2.2 EXCEEDING Ø75MM SHALL BE uPVC CLASS 9 COMPLYING WITH SANS 966-1 UNLESS OTHERWISE NOTED
2.2 PIPES ABOVE GROUND:
2.2.1 NOT EXCEEDING Ø150MM SHALL BE HOT DIP GALVANISED STEEL MEDIUM CLASS COMPLYING WITH SANS 62 UNLESS OTHERWISE NOTED
2.2.2 EXCEEDING Ø150MM SHALL BE 4.5MM HOT DIP GALVANISED STEEL GRADE 5 COMPLYING WITH SANS 719 UNLESS OTHERWISE NOTED
2.2.3 HOT DIP GALVANISED STEEL PIPES MUST BE QUALITY DESIGNATION A.1 (FOR PORTABLE WATER) COMPLYING WITH SANS 32
2.2.4 ALL FLANGES SHALL BE DRILLED TO SANS 1123 VALVES
2.2.5 ALL VALVES SHALL BE RESILIENT SEAL GATE VALVES TO SANS 664

3 SEWER
3.1 ALL WORK MUST BE CARRIED IN STRICT ACCORDANCE WITH SANS 2001-DP7
3.2 ALL PIPES AND FITTINGS BELOW GROUND SHALL BE CLASS 34 UPVC PIPES COMPLYING WITH SANS 791
3.3 ALL PIPES AND FITTINGS ABOVE GROUND SHALL MINIMUM Ø110MM UPVC PIPES COMPLYING WITH SANS 967
3.4 THE SPACING BETWEEN A SEWER AND ANY CROSSING SERVICES (CABLE OR PIPE) SHALL BE AT LEAST 300MM

4 PAVING AND STORMWATER
4.1 ALL WORK SHALL BE IN ACCORDANCE WITH SANS 2001 DP5, SANS 1200 AG, SANS 1200DK AS AMENDED BY THE PROJECT SPECIFICATIONS
4.2 THE PAVERS SHALL BE CLASS 30/2.0 COMPLYING WITH SANS 1058
4.3 THE KERBS AND CHANNELS SHALL BE IN ACCORDANCE WITH SANS 927

No.	DATE	AMENDMENT	CLRK
D	16/10/24	STEEL TANKS AND GRAVITY FEED	DS
PRELIM	16/10/24	STEEL TANKS AND GRAVITY FEED	DS
A		ISSUED FOR APPROVAL	DS

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location
MDANTSANE LABOUR CENTRE
SUPPLY AND INSTALLATION OF WATER TANKS

DEPARTMENT OF PUBLIC WORKS AND INFRASTRUCTURE
public works & infrastructure
Department: Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

discipline CIVIL ENGINEERING
client DEPARTMENT OF EMPLOYMENT AND LABOUR
employment & labour
Department: Employment and Labour
REPUBLIC OF SOUTH AFRICA

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drawing title CIVIL SERVICES LAYOUT PLAN
ref.no. 11/3/2/1/10/12/1
scale AS SHOWN
date
designed DS
drawn DS
checked
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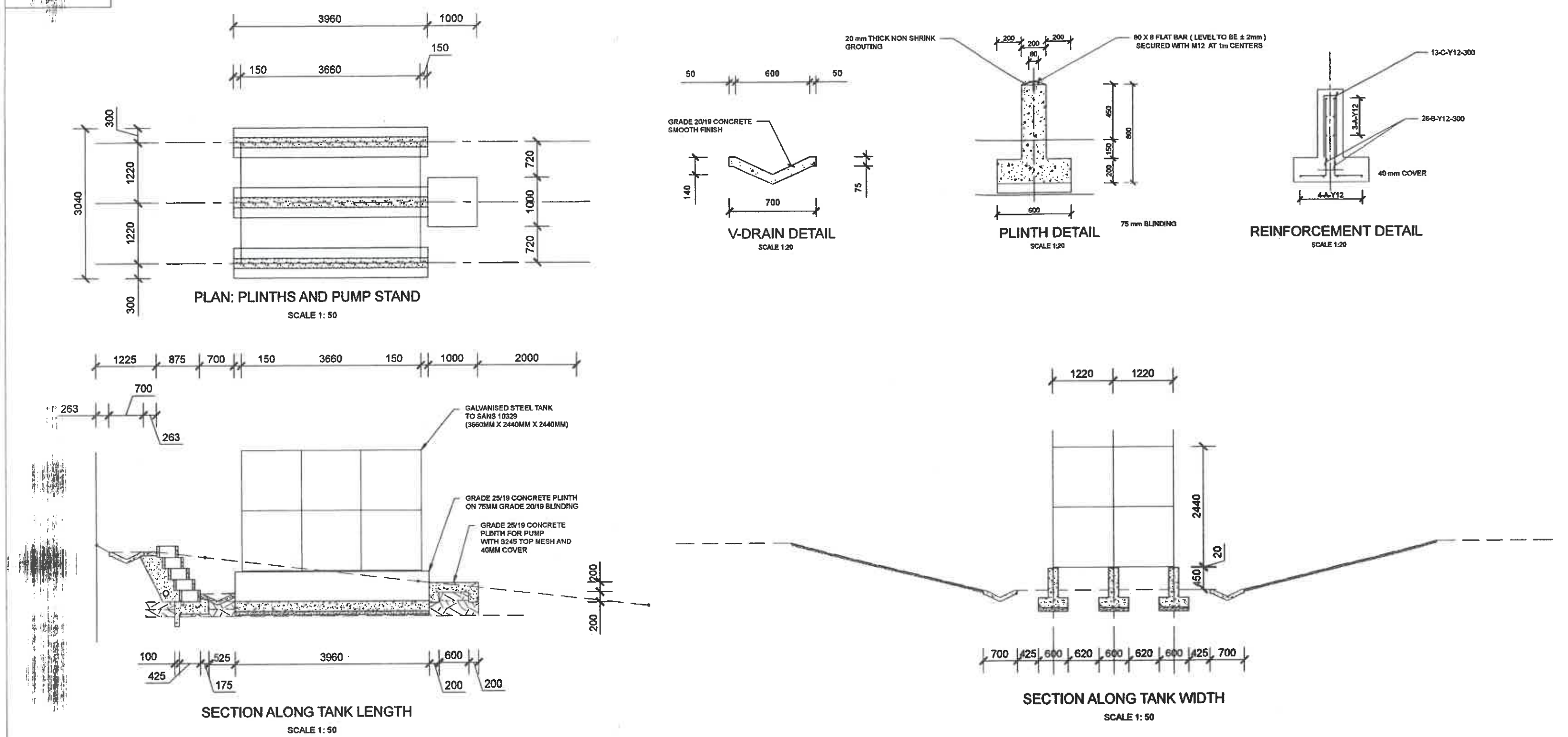
Revision B



MEMBER	No OF MBRS	No IN EACH	TYPE & SIZE	BAR MARK	TOTAL No	LENGTH OF EACH BAR(mm)	SHAPE CODE	BENDING DIMENSIONS A (mm)	B (mm)	C (mm)	D (mm)	E/R (mm)
DWARF WALLS	3	4	Y12	A	12	3610	20					
		26	Y12	B	78	900	37	200				
		13	Y12	C	39	1200	38	550	120			

BENDING SCHEDULE

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DRAWING NOTES

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1.1 THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE PROJECT SPECIFICATIONS AND OTHER ASSOCIATED DRAWINGS
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1.3 ALL WORK MUST BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS
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1.5 ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED
1.6 ONLY FIGURED DIMENSIONS MUST BE USED FOR CONSTRUCTION
1.7 NO WORK MUST BE COVERED WITHOUT THE ENGINEER'S CONSENT
1.8 SHORING OF EXCAVATIONS MUST BE PROVIDED WHERE THE TRENCH IS WITHIN 1.5M AWAY AND IS PARALLEL TO THE BUILDING, AND EXTENDS BELOW THE FOUNDATION FOOTING
1.9 ALL WORK SHALL BE SUBJECT TO ACCEPTANCE TESTS AS REQUIRED IN TERMS OF THE SPECIFICATIONS
1.10 ALL CONCRETE WORKS SHALL BE GRADE 20/19 IN ACCORDANCE WITH SANS 2001: CC2 UNLESS OTHERWISE NOTED
1.11 MINIMUM COVER TO UNDERGROUND PIPES 800MM UNLESS OTHERWISE INSTRUCTED

2 WATER
ALL WORK MUST BE CARRIED IN STRICT ACCORDANCE WITH SANS 2001-DP6
2.1 PIPES BELOW GROUND:
2.1.1 NOT EXCEEDING Ø75MM SHALL BE HDPE PE 63 PN 10 COMPLYING WITH SANS 4427 UNLESS OTHERWISE NOTED
2.2.2 EXCEEDING Ø75MM SHALL BE UPVC CLASS 9 COMPLYING WITH SANS 966-1 UNLESS OTHERWISE NOTED
2.2 PIPES ABOVE GROUND:
2.2.1 NOT EXCEEDING Ø150MM SHALL BE HOT DIP GALVANISED STEEL MEDIUM CLASS COMPLYING WITH SANS 62 UNLESS OTHERWISE NOTED
2.2.2 EXCEEDING Ø150MM SHALL BE 4,5MM HOT DIP GALVANISED STEEL GRADE 8 COMPLYING WITH SANS 719 UNLESS OTHERWISE NOTED
2.2.3 HOT DIP GALVANISED STEEL PIPES MUST BE QUALITY DESIGNATION A.1 (FOR PORTABLE WATER) COMPLYING WITH SANS 32
2.2.4 ALL FLANGES SHALL BE DRILLED TO SANS 1123 VALVES
2.2.5 ALL VALVES SHALL BE RESILIENT SEAL GATE VALVES TO SANS 664

3 SEWER
3.1 ALL WORK MUST BE CARRIED IN STRICT ACCORDANCE WITH SANS 2001-DP7
3.2 ALL PIPES AND FITTINGS BELOW GROUND SHALL BE CLASS 34 UPVC PIPES COMPLYING WITH SANS 791
3.3 ALL PIPES AND FITTINGS ABOVE GROUND SHALL MINIMUM Ø110MM UPVC PIPES COMPLYING WITH SANS 967
3.4 THE SPACING BETWEEN A SEWER AND ANY CROSSING SERVICES (CABLE OR PIPE) SHALL BE AT LEAST 200MM

4 PAVING AND STORMWATER
4.1 ALL WORK SHALL BE IN ACCORDANCE WITH SANS 2001 DP5. SANS 1200 MJ, SANS 1200DK AS AMENDED BY THE PROJECT SPECIFICATIONS
4.2 THE PAVERS SHALL BE CLASS 30/2.0 COMPLYING WITH SANS 1058
4.3 THE KERBS AND CHANNELS SHALL BE IN ACCORDANCE WITH SANS 927

No.	DATE	AMENDMENT	D.P.W.
B	21/10/24	STEEL TANKS AND GRAVITY FEED	DS
A	14/10/24	ISSUED FOR APPROVAL	DS

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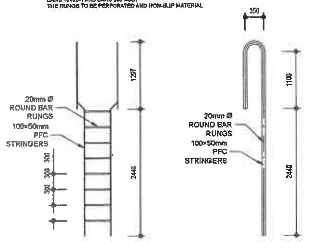
DEPARTMENT OF PUBLIC WORKS AND INFRASTRUCTURE
public works & infrastructure
Department: Public Works and Infrastructure REPUBLIC OF SOUTH AFRICA

discipline CIVIL ENGINEERING
client DEPARTMENT OF EMPLOYMENT AND LABOUR
employment & labour
Department: Employment and Labour REPUBLIC OF SOUTH AFRICA

WCS number WCS 056632
drawing title EMERGENCY WATER SUPPLY DETAILS
ref.no. 11/3/2/1/10/12/1 designed DS
scale AS SHOWN drawn DS
date checked —
DPW drawing number WCS 05532 / 2 Revision B

A1

NOTE:
ALL DIMENSIONS TO BE VERIFIED ON SITE BEFORE MANUFACTURING OF CAT LADDER CAN COMMENCE.
ALL WELDING TO BE 6mm FILLET UNLESS OTHERWISE NOTED. ALL WELDING TO BE AS SPECIFIED IN SANS 10162-1 AND SANS 2001-CS1
THE RUNGS TO BE PERFORATED AND NON-SLIP MATERIAL



ACCESS LADDER DETAILS
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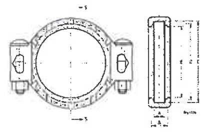
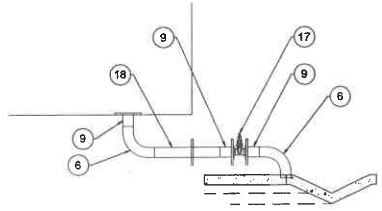


SANS 815-2 CAST IRON COUPLING



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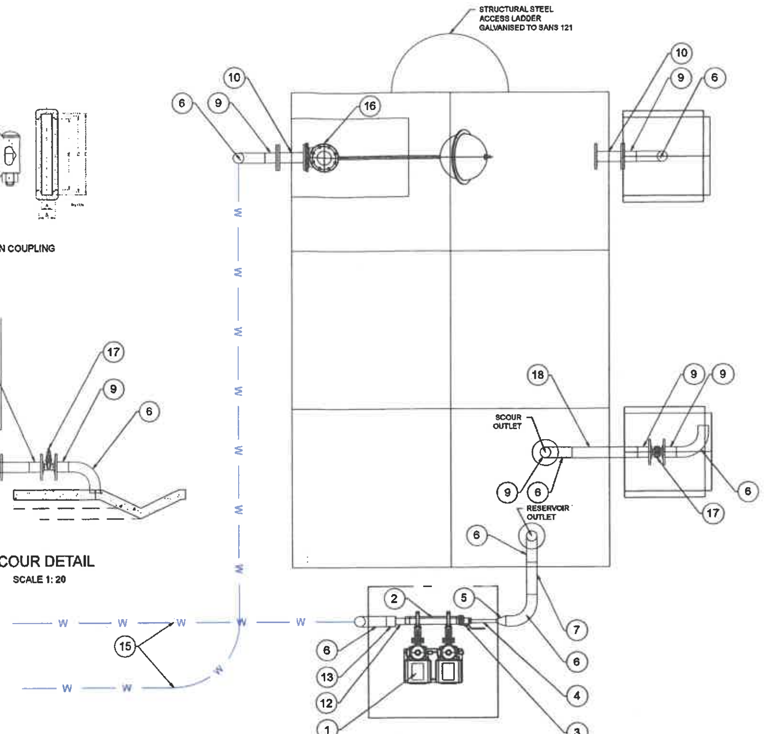

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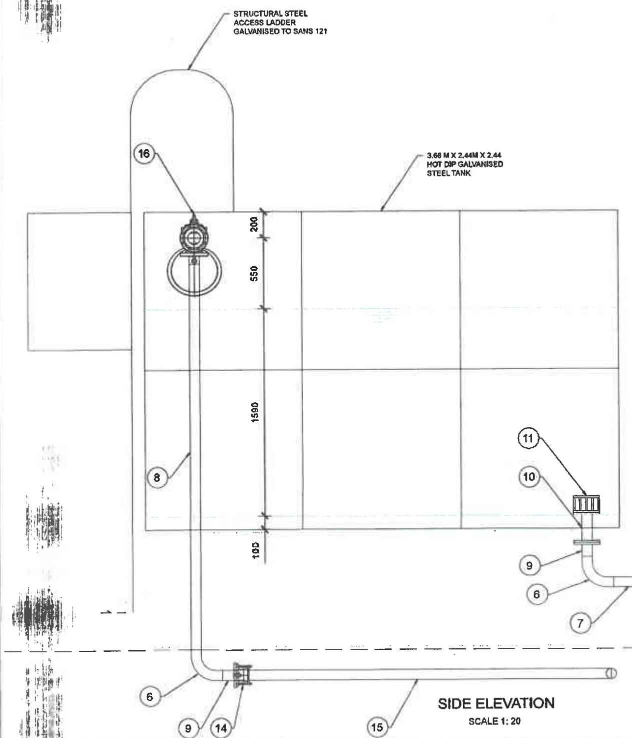

SIDE ELEVATION
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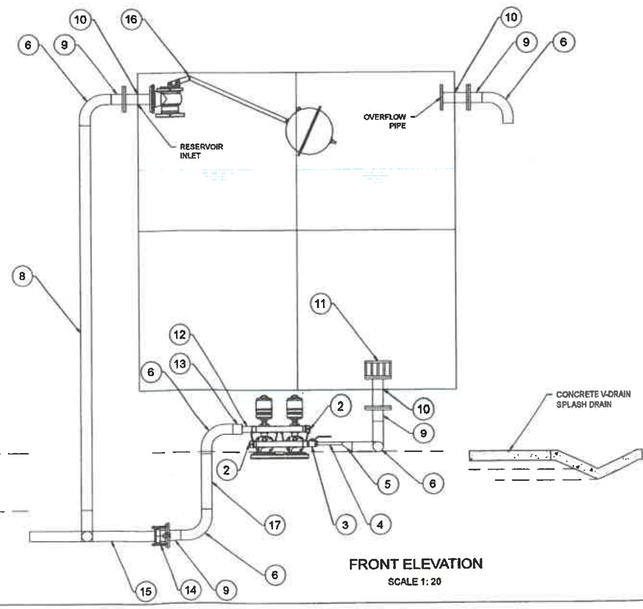

FRONT ELEVATION
SCALE 1:20

GENERAL NOTES FOR MECHANICAL SCOPE .
CONTRACTOR TO SUBMIT SHOP DRAWING FOR APPROVAL BEFORE MANUFACTURING
UNLESS OTHERWISE NOTED, ALL PIPES TO BE SANS 62 MEDIUM GRADE GROOVED TO SANS 815-2 AND HOT DIP GALVANISED TO SANS 121
ALL GROOVED PIPES TO BE CONNECTED WITH CAST IRON COUPLINGS AS PER FIG 18(a) OF SANS 815-2 WITH SUITABLE GASKETS
UNLESS OTHERWISE NOTED, ALL FITTINGS TO BE SANS 815-2, ALL PIPE FLANGES TO SANS 1123 FOR PN16, ALL PIPE THREADS TO SANS 1109-1

ITEM NO.	DESCRIPTION	NO. OFF
1	TWIN BOOSTER PUMP COMPLETE WITH VARIABLE SPEED DRIVE (1.1kW, 2.5-7.5 M³/H AND 30M) COMPLETE WITH BOLTS AND VIBRATION DAMPERS	1
2	Ø25MM PIPE MANIFOLD COMPLETE WITH 2 BALL VALVES CONNECTED TO THE PUMP	2
3	Ø25MM FULLWAY ISOLATING BALL VALVE WITH PLASTIC COATED STAINLESS STEEL LEVER, BSP FEMALE CONNECTION ENDS SANS 1056-3	1
4	Ø25MM X 200MM PIPE WITH EXTERNAL THREADS BOTH SIDES	1
5	SPECIAL ECCENTRIC REDUCER 80MM TO 25MM, 25MM INTERNAL THREAD AND 80MM GROOVE	1
6	Ø80MM 90° BEND GROOVED BOTH ENDS	8
7	Ø80MM X 250MM PIPE GROOVED BOTH ENDS	1
8	Ø80MM X 3M PIPE GROOVED BOTH ENDS AND PIPE SUPPORTS AT 1.5M INTERVALS	3
9	Ø80MM GROOVED-TO-FLANGED ADAPTOR	8
10	Ø80MM X 200MM PIPE FLANGED BOTH ENDS	4
11	ANTIVORTEX PLATE / VORTEX INHIBITOR	1
12	Ø80MM x 50MM REDUCER GROOVED BOTH ENDS	1
13	Ø50 x Ø25MM REDUCER GROOVED Ø50MM END AND EXTERNAL THREADED ON Ø25MM END	1
14	Ø75MM FLANGE ADAPTOR TO SANS 966-1	2
15	Ø75MM UPVC PIPE CLASS 9 TO SANS 966-1	SEE LAYOUT
16	Ø80MM FLOAT VALVE FLANGED, STAINLESS STEEL VALVE TRIM. SANS 1808-32	1
17	Ø80MM RESILIENT SEATED GATE VALVE RISING SPINDLE TYPE TO SANS 664-1 FLANGED BOTH ENDS	1
18	Ø80MM X 500MM PIPE WITH PUDDLE FLANGE AND GROOVED BOTH ENDS	1

DRAWING NOTES

1 GENERAL
1.1 THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE PROJECT SPECIFICATIONS AND OTHER ASSOCIATED DRAWINGS
1.2 ALL WORK MUST BE COORDINATED WITH OTHER DISCIPLINES AND THE ARCHITECT'S DRAWINGS TAKES PRECENCE OVER THIS DRAWING
1.3 ALL WORK MUST BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS
1.4 ANY DESCREPENCIES ON THE DRAWING MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER BEFORE THE WORK IS DONE
1.5 ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED
1.6 ONLY FIGURED DIMENSIONS MUST BE USED FOR CONSTRUCTION
1.7 NO WORK MUST BE COVERED WITHOUT THE ENGINEER'S CONSENT
1.8 SHORING OF EXCAVATIONS MUST BE PROVIDED WHERE THE TRENCH IS WITHIN 1.5M AWAY AND IS PARALLEL TO THE BUILDING, AND EXTENDS BELOW THE FOUNDATION FOOTING
1.9 ALL WORK SHALL BE SUBJECT TO ACCEPTANCE TESTS AS REQUIRED IN TERMS OF THE SPECIFICATIONS
1.10 ALL CONCRETE WORKS SHALL BE GRADE 20/19 IN ACCORDANCE WITH SANS 2001: CC2 UNLESS OTHERWISE NOTED
1.11 MINIMUM COVER TO UNDERGROUND PIPES 600MM UNLESS OTHERWISE INSTRUCTED

2 WATER
ALL WORK MUST BE CARRIED IN STRICT ACCORDANCE WITH SANS 2001-DP6
2.1 PIPES BELOW GROUND:
2.1.1 NOT EXCEEDING Ø75MM SHALL BE HDPE PE 63 PN 10 COMPLYING WITH SANS 4427 UNLESS OTHERWISE NOTED
2.2.2 EXCEEDING Ø75MM SHALL BE UPVC CLASS 9 COMPLYING WITH SANS 966-1 UNLESS OTHERWISE NOTED
2.2 PIPES ABOVE GROUND:
2.2.1 NOT EXCEEDING Ø150MM SHALL BE HOT DIP GALVANISED STEEL MEDIUM CLASS COMPLYING WITH SANS 62 UNLESS OTHERWISE NOTED
2.2.2 EXCEEDING Ø150MM SHALL BE 4.5MM HOT DIP GALVANISED STEEL GRADE B COMPLYING WITH SANS 719 UNLESS OTHERWISE NOTED
2.2.3 HOT DIP GALVANISED STEEL PIPES MUST BE QUALITY DESIGNATION A.1 (FOR PORTABLE WATER) COMPLYING WITH SANS 32
2.2.4 ALL FLANGES SHALL BE DRILLED TO SANS 1123 VALVES
2.2.5 ALL VALVES SHALL BE RESILIENT SEAL GATE VALVES TO SANS 664

3 SEWER
3.1 ALL WORK MUST BE CARRIED IN STRICT ACCORDANCE WITH SANS 2001-DP7
3.2 ALL PIPES AND FITTINGS BELOW GROUND SHALL BE CLASS 34 UPVC PIPES COMPLYING WITH SANS 791
3.3 ALL PIPES AND FITTINGS ABOVE GROUND SHALL MINIMUM Ø110MM UPVC PIPES COMPLYING WITH SANS 967
3.4 THE SPACING BETWEEN A SEWER AND ANY CROSSING SERVICES (CABLE OR PIPE) SHALL BE AT LEAST 200MM

4 PAVING AND STORMWATER
4.1 ALL WORK SHALL BE IN ACCORDANCE WITH SANS 2001 DP5, SANS 1200 MJ, SANS 1200DK AS AMENDED BY THE PROJECT SPECIFICATIONS
4.2 THE PAVERS SHALL BE CLASS 30/2.0 COMPLYING WITH SANS 1058
4.3 THE KERBS AND CHANNELS SHALL BE IN ACCORDANCE WITH SANS 927

No.	DATE	AMENDMENT	D.P.W.
A	11/10/24	ISSUED FOR APPROVAL	DS

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MDANTSANE LABOUR CENTRE SUPPLY AND INSTALLATION OF WATER TANKS

DEPARTMENT OF PUBLIC WORKS AND INFRASTRUCTURE
public works & infrastructure
Department: Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

discipline CIVIL ENGINEERING
client DEPARTMENT OF EMPLOYMENT AND LABOUR
employment & labour
Department: Employment and Labour
REPUBLIC OF SOUTH AFRICA

WCS number WCS 056632
drawing title EMERGENCY WATER SUPPLY DETAILS
ref.no. 11/3/2/1/10/12/1
scale AS SHOWN
date
designed DS
drawn DS
checked –
DPW drawing number WCS 05532 / 3
Revision A

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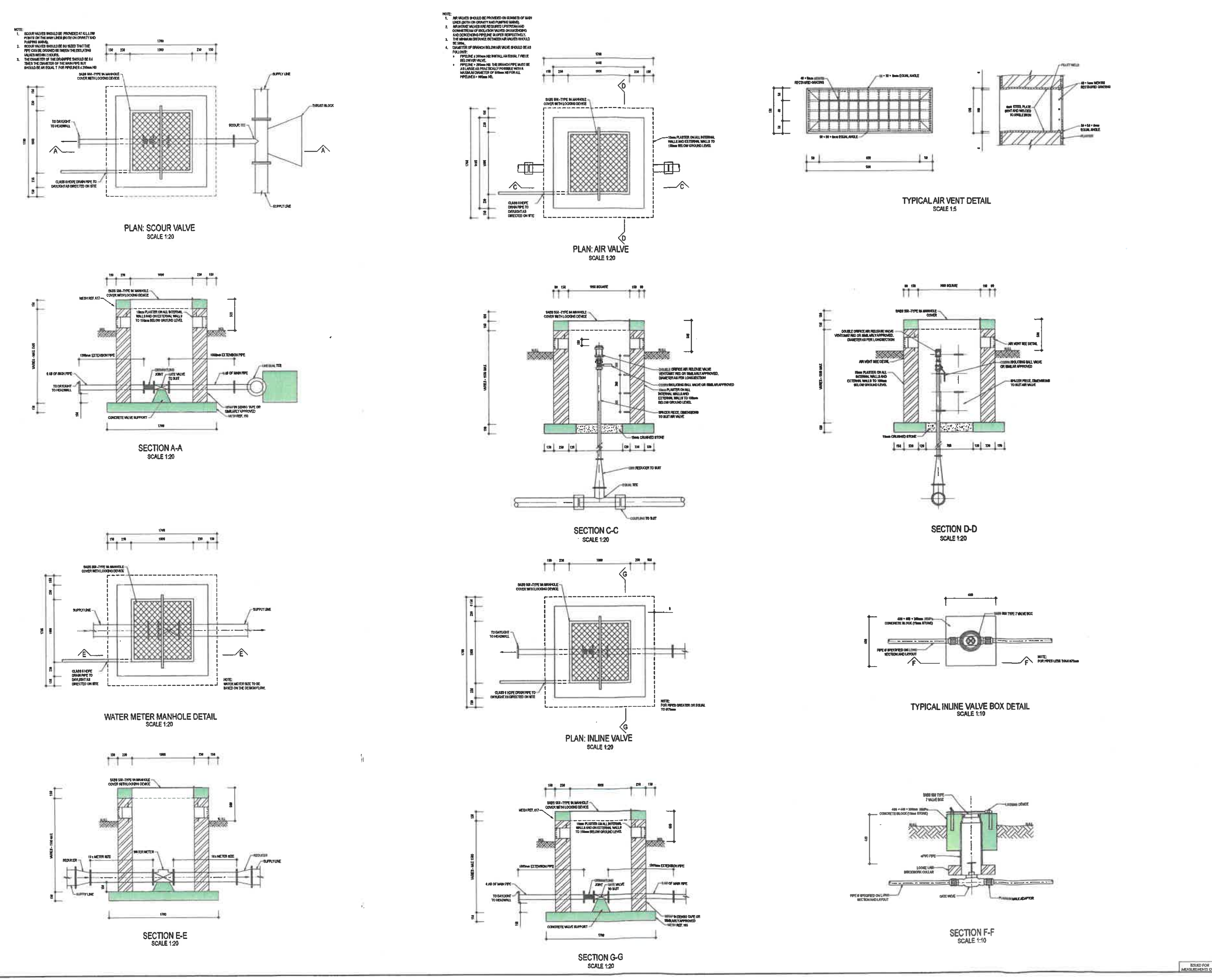
A0



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MDANTSANE LABOUR CENTRE SUPPLY AND INSTALLATION OF WATER TANKS

DEPARTMENT OF PUBLIC WORKS AND INFRASTRUCTURE

public works & infrastructure
Department: Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

CIVIL ENGINEERING

DEPARTMENT OF EMPLOYMENT AND LABOUR

employment & labour
Department: Employment and Labour
REPUBLIC OF SOUTH AFRICA

WCS 056632

TYPICAL WATER DETAILS 1

11/3/2/1/10/12/1

AS SHOWN

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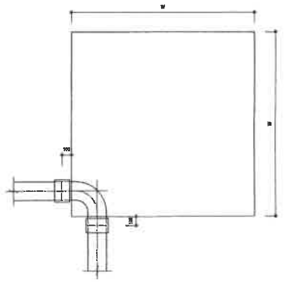
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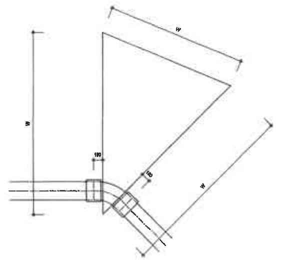
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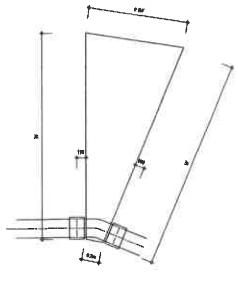
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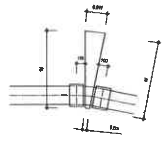
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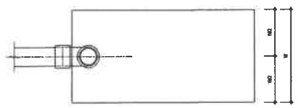
90° BEND
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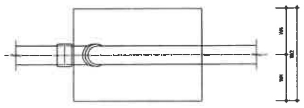
45° BEND
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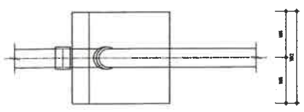
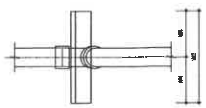

22.5° BEND
SCALE 1:20


11.25° BEND
SCALE 1:20

OPERATING PRESSURE Mpa	0.3				0.6				0.9				1.2				1.6				1.8				2				2.5				3.4			
BENDS	90	45	22.5	11.25	90	45	22.5	11.25	90	45	22.5	11.25	90	45	22.5	11.25	90	45	22.5	11.25	90	45	22.5	11.25	90	45	22.5	11.25	90	45	22.5	11.25	90	45	22.5	11.25
NOMINAL DIAMETER OF PIPE IN mm.	VALUE OF "W" IN METRES																																			
50	0.43	0.43	0.40	0.30	0.52	0.55	0.50	0.30	0.61	0.66	0.55	0.33	0.80	0.74	0.56	0.30	0.87	0.78	0.60	0.30	0.89	0.80	0.62	0.30	0.70	0.53	0.42	0.25	0.80	0.58	0.45	0.25	0.95	0.75	0.57	0.41
75	0.55	0.59	0.50	0.30	0.70	0.71	0.70	0.30	0.88	0.81	0.60	0.35	0.84	0.84	0.63	0.40	0.96	0.86	0.65	0.50	0.98	0.93	0.70	0.55	1.10	0.75	0.57	0.30	1.20	0.82	0.63	0.35	1.30	1.02	0.78	0.58
90-110	0.67	0.69	0.65	0.35	0.85	0.84	0.75	0.40	0.97	0.85	0.75	0.45	1.06	0.83	0.80	0.50	1.17	1.20	0.85	0.55	1.20	1.22	0.90	0.60	1.30	0.86	0.70	0.37	1.45	0.95	0.75	0.42	1.67	1.35	1.04	0.79
125	0.70	0.70	0.67	0.40	0.95	0.95	0.85	0.42	1.20	1.05	0.90	0.50	1.30	1.10	0.95	0.62	1.40	1.30	1.05	0.65	1.55	1.45	1.10	0.70	1.80	1.15	0.95	0.50	2.00	1.25	1.00	0.56	2.00	1.46	1.14	0.87
150	0.86	0.90	0.80	0.45	1.10	1.14	1.00	0.50	1.30	1.20	1.05	0.55	1.45	1.30	1.10	0.65	1.58	1.47	1.20	0.70	1.65	1.60	1.25	0.75	2.10	1.31	1.05	0.60	2.40	1.45	1.15	0.63	2.40	1.66	1.30	1.00
200	1.06	1.10	1.00	0.50	1.44	1.37	1.05	0.55	1.57	1.50	1.10	0.60	1.81	1.72	1.15	0.70	2.10	1.90	1.25	0.75	0.23	2.00	1.35	0.80	2.75	1.65	1.32	0.75	3.00	1.82	1.45	0.82	3.00	2.03	1.60	1.24
250	1.35	1.00	0.80	0.50	1.70	1.40	0.89	0.55	1.90	1.50	1.10	0.60	2.10	1.80	1.20	0.70	2.35	1.98	1.50	0.80	2.41	2.05	1.50	0.83	3.40	2.15	1.58	0.92	3.70	2.30	1.72	1.00	3.70	2.36	1.86	1.45
300	1.40	1.20	0.80	0.50	1.90	1.40	1.10	0.55	2.15	1.65	1.20	0.75	[illegible]	1.85	1.40	0.80	2.65	2.10	1.60	0.90	2.80	2.20	1.70	0.95	4.00	2.25	1.80	1.10	4.35	2.45	2.00	1.15	4.35	2.68	2.12	1.66
350	2.00	1.35	1.00	0.70	2.65	1.75	1.30	0.75	3.25	2.00	1.55	0.85	3.63	2.25	1.70	1.00	4.15	2.60	1.90	1.10	4.30	2.75	2.00	2.15	4.50	2.80	2.10	1.20	5.00	3.00	2.25	1.30	5.00	2.97	2.35	1.85
400	2.20	1.50	1.10	0.80	3.00	1.95	1.45	0.85	3.60	2.25	1.70	1.00	4.10	2.50	1.85	1.10	4.60	2.75	2.10	1.25	4.85	2.90	2.20	1.30	5.10	3.10	2.30	1.35	5.65	3.30	2.45	1.45	5.65	3.25	2.60	2.04
450	2.45	1.60	1.20	0.90	3.35	2.10	1.55	0.90	4.00	2.50	1.85	1.10	4.50	2.75	2.10	1.20	5.20	3.10	2.30	1.35	5.50	3.20	2.40	1.40	5.80	3.40	2.50	1.50	[illegible]	3.60	2.70	1.60	6.20	3.52	2.80	2.20

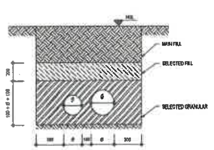
THRUST BLOCK SIZE TABLE

MATERIALS	DESCRIPTION	COMPACTION
SELECTED GRANULAR	GRANULAR NON COHESIVE MATERIAL 90% PASSING (5mm SIEVE)	100% MOD AASHTO DENSITY
SELECTED BACKFILL	GRANULAR NON COHESIVE MATERIAL 90% PASSING (12mm SIEVE)	IN 150mm LAYERS a. 95% MOD AASHTO UNDER ROADS b. 90% MOD AASHTO IN FIELDS
BACKFILL	EXCAVATED MATERIAL MAXIMUM SIZE 150mm	IN 150mm LAYERS a. 95% MOD AASHTO
CONCRETE BEDDING	MIX 15	

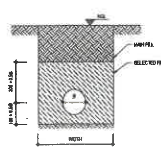
TABLE: BACKFILL AND BEDDING

TRENCH WIDTH	
PIPE Ø(mm) O.D.	SIDE ALLOWANCE ON EACH SIDE (mm)
- TO 125	300
125 TO 700	300
700 TO 1000	400
1000 TO 2000	500
2000 TO -	600

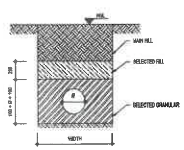
NOTES:
1. A FLEXIBLE PVC MEMBRANE TO BE INSERTED ON THE CONTACT FACE BETWEEN THE PIPE OR FITTING AND THE CONCRETE THRUST BLOCK.
2. CONCRETE MIX 20MPa.



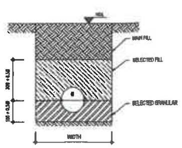
SECTION THROUGH TRENCH
TWO PIPES IN SAME TRENCH
SCALE 1:20



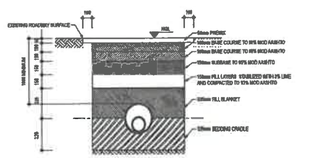
DUCTILE IRON PIPE



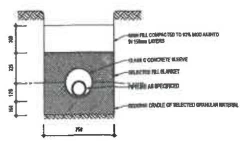
FLEXIBLE PIPE
SECTION THROUGH TRENCH
SCALE 1:20



CONCRETE PIPE



TYPICAL SECTION THROUGH SLEEVE
PIPE IN ROAD RESERVE
SCALE 1:20


TYPICAL SECTION THROUGH SLEEVE
PIPE IN ROAD RESERVE
SCALE 1:20

DRAWING NOTES
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1.10 ALL CONCRETE WORKS SHALL BE GRADE 20/19 IN ACCORDANCE WITH SANS 2001 CC2 UNLESS OTHERWISE NOTED
1.11 MINIMUM COVER TO UNDERGROUND PIPES 600MM UNLESS OTHERWISE INSTRUCTED

2 WATER
ALL WORK MUST BE CARRIED IN STRICT ACCORDANCE WITH SANS 2001-DP6
2.1 PIPES BELOW GROUND:
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2.2.3 EXCEEDING Ø75MM SHALL BE UPVC CLASS 9 COMPLYING WITH SANS 966-1 UNLESS OTHERWISE NOTED
2.2 PIPES ABOVE GROUND:
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2.2.5 ALL VALVES SHALL BE RESILIENT SEAL GATE VALVES TO SANS 664

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3.1 ALL WORK MUST BE CARRIED IN STRICT ACCORDANCE WITH SANS 2001-DP7
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3.3 ALL PIPES AND FITTINGS ABOVE GROUND SHALL MINIMUM Ø110MM UPVC PIPES COMPLYING WITH SANS 967
3.4 THE SPACING BETWEEN A SEWER AND ANY CROSSING SERVICES (CABLE OR PIPE) SHALL BE AT LEAST 300MM

4 PAVING AND STORMWATER
4.1 ALL WORK SHALL BE IN ACCORDANCE WITH SANS 2001 DP8, SANS 1200 MJ, SANS 1200DK AS AMENDED BY THE PROJECT SPECIFICATIONS
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4.3 THE KERBS AND CHANNELS SHALL BE IN ACCORDANCE WITH SANS 927

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WCS number: WCS 056632
drawing title: TYPICAL WATER DETAILS 2
ref. no. 11/3/2/1/10/12/1
scale: AS SHOWN
designed: DS
drawn: DS
checked: --
DPW drawing number: WCS 05532 / 5
Revision: A

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