PROVINCIAL ADMINISTRATION OF KWAZULU-NATAL
DEPARTMENT OF PUBLIC WORKS

KWAZULU-NATAL PROVINCE
PUBLIC WORKS & INFRASTRUCTURE
REPUBLIC OF SOUTH AFRICA

BILLS OF QUANTITIES

with GCC for Construction Works - Second Edition 2010

CONTRACTUAL SECTION

ONE VOLUME APPROACH

VOLUME 4 OF 4 (DRAWINGS / ANNEXURES)

NEW 28 BEDDED MALE & FEMALE INPATIENT & OUTPATIENT MENTAL HEALTH UNIT

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Regional Manager
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X54336
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Tender Number: **ZNTD 02753W**
CIDB Grading: 8GB or Higher
ECDP Number: **N/A**

Project Code: **048152**
Document Date: **As Per Tender Advert**

Contracting Party: _____
CIDB Registration number: _____
Central Suppliers Database Registration Number: _____

NEW 28 BEDDED MALE & FEMALE INPATIENT & OUTPATIENT MENTAL HEALTH UNIT

KWAZULU-NATAL PROVINCE
PUBLIC WORKS & INFRASTRUCTURE
REPUBLIC OF SOUTH AFRICA

THE CONTRACT

1. PART C3: SCOPE OF WORKS

2. PART C4: SITE INFORMATION

3. PART C5: DRAWINGS/ANNEXURES

IMPORTANT NOTICE TO TENDERERS

1. Any reference to words Tender or Tenderer herein and/or in any other documentation shall be construed to have the same meaning as the words Tender or Tenderer. These forms are for internal and external use for the KZN Department of Public Works, Provincial Administration of KwaZulu-Natal.

2. With regards to the provision of electronic Bills of Quantities, it must be noted that DPW SCM is against the issue of electronic Bills of Quantities.

3. The fully priced Bills of Quantities to be submitted at tender closing.

4. Where documents were not provided at the tender office, the Tenderers to provide proof of payment before date and time of the relevant briefing session to DPW to facilitate the issue of the tender documents. Additional tender documents will be copied. However, all tender documents to be collected from the **KZN Department of Public Works, 455A King Cetshwayo Highway, Mayville, Durban, 4001**. No tender documents will be issued from the Consultants office or at the tender briefing.

5. "**Quality**" shall mean totality of features and characteristics of a product of service that bears on the ability of the product or service to satisfy stated or implied needs.

6. The **Total (Including Value Added Tax) on the Final Summary of the Bills of Quantities** must be carried to the **"Offer" part only of the Form of Offer and Acceptance - T2.21**

7. **"Enterprise"** shall mean the legal Tendering Entity or Tenderer who, on acceptance of the Offer, would become the **"Contractor".**

8. **No alternative tenders will be accepted.**

9. The tender box is generally open during official working hours.

10. Tenderers should ensure that tenders are delivered timeously to the correct address. If the tender is late, it will not be accepted for consideration.

11. The requirements in respect of the application of either 80/20 and 90/10 preference points scoring system, is contained in part T2.34 - Functionality Criteria.

12. All tenders must be submitted on the official forms - (Not to be re-typed).

13. A SANAS approved current certified copy of B-BBEE status level verification certificate must be submitted in order to qualify for preference points for B-BBEE or an original current sworn affidavit in respect of SMME/QSE in the prescribed DTI format for the latest completed financial year of the bidding entity must be submitted. Tenderers to note that any certified copies of sworn affidavits must be stamped by the commissioning authority, must have the full particulars of the commissioner and if commissioned by SAPS must have the SAPS stamp as well as rank, initials, surname in printed letters and signature of the official on the document.

14. The **CIDB Contractor Participation goals and CIDB Build programme** will be implemented on these works and Tenderers must familiarise themselves with the requirements of this programme and desired implementation goals thereof and should refer to guide in the Annexures.

15. **Tenders will be evaluated in the following sequence:**

Phase 1: Administrative Compliance

a. Form of Offer and Acceptance (Bound into section 1 of 4) (T2.21) to be fully and correctly completed.

b. Attendance of the compulsory pre-tender briefing meeting, where a **physical or in person meeting is held**, Site inspection Certificate (T2.10) is to be completed and signed in full.

c. Attendance of the compulsory pre-tender briefing meeting, where a **virtual meeting** is to be held, **a link to join the compulsory briefing session must be requested as stipulated in the tender advertisement on or before the date stipulated in the tender advertisement. Tenderers to note that the accepted tenderer's email for the briefing session will be the one that the Tenderer has registered with Central Supplier Database (CSD).**

d Central Supplier Database Registration: All bidders must be registered on the Central Supplier Database (T2.26).

e Appropriate active CIDB registration of bidding entity as per the requirements of this bid (T2.27).

f. For Joint Venture combinations the following will be applicable: Three Grade 7 contractors within the class of work of the works or One Grade 8 lead partner within the class of work with any grade combination within the class of work of the works.

g. Completion and submission of all returnable documents as contained in this bid document in full (T2.1 to T2.35).

Phase 2: Special Conditions: Quality Criteria (All the appropriate and requested information to be submitted in full)

a. Full priced Bills of Quantities. The Bills of Quantities must be fully priced and submitted with the contractual section of this tender document at the closing date of the tenders.

b. Experience: Firms experience in Building Projects of CIDB Grade 7GB or Higher verified with an Award letter or Purchase Order AND Practical Completion certificate or Final Completion certificate.

c. Competency: Team member's experience and qualifications - certified copies of qualifications and CV with tracable references (For tracable references the proforma to be used can be found as Appendix A in Vol 1 of 4).

d. Financial standing: Provide financial ability of the company to fund the project by providing company financials that reflect cash availability.

e. Proposed Methodology, Approach and Programme: Verified by a detailed method statement and programme to be submitted.

f. Specific Goal 1: Ownership by Black people.

FAILURE TO SUBMIT ANY OF THE ABOVE DOCUMENTATION IN THE PRESCRIBED FORMAT WILL, LEAD TO IMMEDIATE DISQUALIFICATION.

KWAZULU-NATAL PROVINCE
PUBLIC WORKS & INFRASTRUCTURE
REPUBLIC OF SOUTH AFRICA

NEW 28 BEDDED MALE & FEMALE INPATIENT & OUTPATIENT MENTAL HEALTH UNIT

ANNEXURE 3 - CIVIL WORKS SPECIFICATIONS

KWAZULU-NATAL PROVINCE
PUBLIC WORKS & INFRASTRUCTURE
REPUBLIC OF SOUTH AFRICA

WIMS 048152 : eThekwini Region : Stanger

Department of Public Works and Infrastructure

General Justice Gizenga Mpanza Regional Hospital

New 28-Bedded Male and Female Inpatient and Outpatient Mental Health Unit

Stage 4 - Specifications Document – Civil Engineering Works

New Location 268340 – Rev B

2025.01.24

COMPILED FOR:

Department of Public Works and Infrastructure

Province of KwaZulu-Natal

COMPILED BY:

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Disclaimer

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PROJECT 268340 (2021) - WIMS 048152 : DEPARTMENT OF PUBLIC WORKS AND INFRASTRUCTURE

REV	DESCRIPTION	ORIG	REVIEW	IX ENGINEERS APPROVAL	DATE	CLIENT APPROVAL	DATE
B	SUBMISSION TO HIAC (STAGE 4)	JC BOHLER	MJ RICHMOND		2025-01.24		
A	SUBMISSION TO DPW (STAGE 4.1)	JC BOHLER	MJ RICHMOND		2024-12-12		

iX engineers

Infrastructure Excellence

DEPARTMENT OF PUBLIC WORKS AND INFRASTRUCTURE
WIMS 048152 : ETHEKWINI REGION : STANGER
GENERAL JUSTICE GIZENGA MPANZA REGIONAL HOSPITAL
NEW 28-BEDDED MALE AND FEMALE INPATIENT AND OUTPATIENT MENTAL HEALTH UNIT
CIVIL SPECIFICATION DOCUMENT (HIAC STAGE 4)

CONTENTS

LIST OF TABLES

1 INTRODUCTION

iX engineers were appointed as civil and structural engineers by the KZN Department of Works for the development of the New 28-Bedded Male and Female Inpatient and Outpatient Mental Health Unit at General Justice Gizenga Mpanza Regional Hospital. This document details the specifications for the Civil Engineering portion of the works and is to be read in conjunction with the design reports and specification documents prepared by the project team.

2 SCOPE OF WORKS

The scope of works to be undertaken as part of the civil engineering works:

- Bulk earthworks
  - Platforms for buildings
  - Formation areas for roads and parking
  - Trimming and shaping of batters and open areas
  - Topsoiling and grassing
  - Subsoil drains
- Buildings works
  - Concrete walkways and apron slabs
- Roads & paving
  - Reclamation of pre-cast pavers from existing roads
  - Road layers
  - Kerbs and edge restraints
  - Pedestrian and vehicle scoops
  - Surfacing with pre-cast concrete pavers or cast-in-situ concrete
- Stormwater
  - Removal of existing stormwater infrastructure
  - Stormwater pipes (pre-cast concrete or uPVC)
  - Manholes / inlets / gulleys
  - Retention structure
  - Gabion protection to outlets
  - Roof drainage / downpipes

- Sewer
  - Removal of existing sewer infrastructure
  - Sewer pipes (uPVC)
  - Manholes
- Water supply
  - Water pipes (for domestic and fire) external to the building
- Ancillary works
  - Road markings
  - Road signs
  - Dry-stack retaining walls

3 EXISTING SERVICES AND INFRASTRUCTURE

- The following underground services are present on site and where known, have been shown on the drawings. Where indicated, these will need to be removed. The services that are to remain will need to be protected during the works:
  - Water pipes
  - Stormwater
  - Sewer
- Other underground services
  - It is likely that there are unknown services (including the types listed above) and care will need to be taken to locate / prove these prior to any excavations commencing.
  - The location and proving of the services is to be done in conjunction with the hospital's maintenance staff and the civil engineer.
- Visible services
  - All above ground services (including buildings and manhole covers visible at ground level) will be considered as known
  - Relocation or removal of the services is to only be done on instruction from the project manager's team
  - Protection of all services is to be done for the duration of the works
- Records of services
  - All services encountered (whether indicated on drawings or not) are to be surveyed and the location, type and size are to be add to the as-built records
  - These survey records are to be submitted timeously to the project manager to allow for redesign or relocations to be instructed as required.

4 ADDITIONAL INFORMATION

The following additional information will be provided to the Contractor on request:

- Topographical survey of existing site
- Geotechnical investigation report

5 ACCOMMODATION OF TRAFFIC (VEHICULAR AND PEDESTRIAN)

- The site falls within an active hospital facility
- The contractor shall in no-way impede or prevent access to parts of the hospital where this is required by staff, patients or visitors.
- Where existing roads / walkways pass through the site, the contractor shall:
    - Provide appropriate signage and barriers to prevent un-authorised access to the site
    - Provide alternative routes and/or signage to direct traffic or pedestrians as required
- Accommodation of traffic, where applicable, shall comply with SANS 1921-2: 2004: Construction and Management Requirements for Works Contracts, Part 2: Accommodation of Traffic on Public Roads occupied by the Contractor.

    Clause 4.10.4 of SANS 1921-2: 2004 shall be replaced with the following:

    "*Road signs and markings shall comply with the requirements of "The South African Road Traffic Signs Manual - Volume 2: Roadworks Signing".*

6 SPECIFICATIONS

The following specifications and guides are applicable:

- SANS 10400 The Application of The National Building Regulations
- SANS 10252 Water Supply and Drainage for Buildings – Parts 1 and 2
- SANS 1200 Standardized Specification for Civil Engineering Construction
- SANS 2001 – Construction Works
- SANS ISO 4427 – Plastic Piping Systems
- The Neighbourhood Planning and Design Guide [2019]
- Technical Recommendations for Highways
    - TRH4: Structural Design of Urban and Rural Roads (1996)
- Urban Transport Guidelines
    - UTG2: Design of Segmental Block Pavements
    - UTG 4 Guidelines for Urban Stormwater Management
    - UTG7 Geometric Design of Urban Local Residential Streets (1989)
- Technical Methods for Highways
    - TMH16 Vol. 2 Traffic Impact and Site Traffic Assessment Standards and Requirements Manual
- Southern African Development Community - Road Traffic Sign Manual (SADC RTSM)

7 AMENDMENTS TO STANDARD SPECIFICATIONS

Apart from amendments indicated elsewhere in this document, there are no amendments to standard specifications.

8 DRAWINGS

This document is to be read in conjunction with the following drawings:

Table 1 - Drawings

Drawing Number	Title
DD001 268340-C-LA-002-01	CIVIL SERVICES LAYOUT
DD002 268340-C-LA-002-02	ROOF DRAINAGE LAYOUT
DD003 268340-C-LA-002-03	ROADS AND SIGNAGE LAYOUT
DD004 268340-C-LS-003-01	ROAD AND RETAINING WALL LONGITUDINAL SECTIONS
DD006 268340-C-LS-004-01	SEWER LONGITUDINAL SECTIONS
DD007 268340-C-LS-005-01	STORMWATER LONGITUDINAL SECTIONS
DD008 268340-C-DT-002-01	CIVIL SERVICES: SEWER CONSTRUCTION DETAILS
DD009 268340-C-DT-002-02	CIVIL SERVICES: STORMWATER CONSTRUCTION DETAILS
DD010 268340-C-DT-002-03	CIVIL SERVICES: WATER CONSTRUCTION DETAILS
DD011 268340-C-DT-003-01	CIVIL SERVICES: ROADS AND PAVING CONSTRUCTION DETAILS
DD012 268340-C-DT-003-02	CIVIL SERVICES: ROADS AND PAVING CONSTRUCTION DETAILS
DD013 268340-C-DT-002-04	CIVIL SERVICES: STORMWATER CONSTRUCTION DETAILS
DD014 268340-C-DT-002-05	CIVIL SERVICES: STORMWATER CONSTRUCTION DETAILS - RETENTION MANHOLE
DD015 268340-C-LA-002-05	SETTING OUT LAYOUT
DD016 268340-C-SO-001-01	SETTING OUT INFORMATION

KWAZULU-NATAL PROVINCE
PUBLIC WORKS & INFRASTRUCTURE
REPUBLIC OF SOUTH AFRICA

NEW 28 BEDDED MALE & FEMALE INPATIENT & OUTPATIENT MENTAL HEALTH UNIT

ANNEXURE 4 - ELECTRICAL WORKS SPECIFICATIONS

PW 354

KWAZULU-NATAL PROVINCE

PUBLIC WORKS & INFRASTRUCTURE
REPUBLIC OF SOUTH AFRICA

GENERAL JUSTICE GIZINGA MPANZA REGIONAL HOSPITAL NEW 28 BEDDED MALE AND FEMALE INPATIENT AND OUTPATIENT MENTAL HEALTH UNIT

ELECTRICAL INSTALLATION

SECTION 1: STANDARD ELECTRICAL SPECIFICATIONS

TABLE OF CONTENTS

DESCRIPTION **PAGE NO.**

SECTION A

A.1 PRE-AMBLE TO STANDARD SPECIFICATIONS FOR ELECTRICAL INSTALLATION

GENERAL

1. INTRODUCTION

(a) These Standard Specifications cover the general technical requirements for the equipment, materials, installation, testing, commissioning and maintenance of electrical installations for the Department. These requirements shall be read in conjunction with the Documents as specified below.

(b) "Document" shall mean the complete set of contract documents, including the Department's Tender Conditions, Tender Qualifications, the Standard Specification and the Detail Technical Specification including all drawings and variation orders issued in terms of the contract.

(c) "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".

2. INSTALLATION WORK

(a) The complete installation shall comply with the requirements of this Specification. Should any discrepancies or contradictions exist between this specification and the Detail Technical Specification for the specific installation, then the latter shall take precedence.

In the event of discrepancies between the drawings, specifications and bill of quantities 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.

(b) The Department's authorised representative will inspect the installation from time to time during the progress of the work. Discrepancies will be pointed out to the Contractor and these shall be remedied at the Contractor's expense. Under no circumstances shall these inspections relieve the Contractor of his obligations in terms of the Documents.

(c) The Contractor shall notify the Department timeously 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.

3. REGULATIONS

(a) The installation shall be erected and tested in accordance with the Acts and Regulations as indicated in PW 379 or PW 379 (Civil) – "Standard Conditions in respect of the Supply-, Delivery and Installation of Electrical-, Mechanical-, Pneumatic- and Vacuum Operated Equipment, Control Systems, Plant and Materials".

(b) The Contractor shall 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.

(c) It shall be assumed that the Contractor is conversant with the above-mentioned requirements. Should any requirement, by-law or regulation, which contradicts the requirements of this Document, apply or become applicable during erection of the Installation, such requirement, by-law or regulation shall overrule this Document and the Contractor shall immediately inform the Department of such a contradiction. Under no circumstances shall the Contractor carry out any variations to the installation in terms of such contradictions without obtaining the written permission to do so from the Department.

4. SITE CONDITIONS

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. 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.

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

5. ARRANGEMENTS WITH THE SUPPLY AUTHORITY

(a) The contractor shall give all notices required by and pay all necessary fees, including any inspection fees, which may be due to the local Supply Authority unless specified to the contrary.

(b) It shall be 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.

(c) The Contractor shall supply and install all notices and warning signs that are required by the relevant laws, regulations and/or the Documents.

6. MATERIAL AND EQUIPMENT

(a) All material and equipment shall conform in respect of quality, manufacture, tests and performance, with the requirements of the South African Bureau of Standards or where no such standards exist, with the relevant current Specification of the British Standards Institution.

(b) All material and equipment shall be of high quality and suitable for the conditions on site. These conditions shall include weather conditions as well as conditions under which materials are installed, stored and used. Should the materials not be suitable for use under temporary site conditions then the Contractor shall at his own cost provide suitable protection until these unfavourable site conditions cease to exist.

(c) The Contractor shall, where requested to do so, submit samples of equipment and material to the Department for approval prior to installation. Samples may be retained in the Department's possession until the contract is completed after which they will be returned.

7. CONNECTIONS INVOLVING ALUMINIUM (CABLES AND TRANSFORMERS)

As a result of the fact that aluminium flows when subjected to pressure and electrical connections based on this principle thus loses proper contact during the course of time, it should be noted that bolted connections between aluminium and copper or any other metal is not acceptable to this Department.

8. CODES OF PRACTICE OR STANDARD SPECIFICATION

Where reference is made to any Code of Practice or Standard Specification in this document the latest edition or amendment shall be applicable, except where specified to the contrary.

SECTION B.1

B.1 INSTALLATION AND TERMINATION OF CONDUITS AND CONDUIT ACCESSORIES

1. GENERAL

1.1 SCOPE

1.1.1 This section covers the installation of conduits and conduit accessories in buildings and other structures under normal environmental conditions and for system voltages up to 600 V.

1.1.2 The following types of conduit installations are included:

(a) Non-metallic conduit.

(b) Flexible conduit.

1.1.3 Conduits may be installed as follows:

(a) In open roof spaces.

(b) Cast in concrete.

(c) Surface mounted against walls, concrete slabs, etc.

(d) In wall chases.

1.1.4 Where conduits are to be installed in concrete, this shall be undertaken while the building work is still in progress. Conduits may only be surface mounted where specified or where the Department has given its written consent.

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

1.1.6 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 inspectorate staff, be completely removed and rectified and any wiring already drawn into such damaged conduits must be completely renewed at the contractor's expense.

1.1.7 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.

1.1.8 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" for the specified number and size of conductors, unless otherwise directed in part 2 of this specification or indicated on the drawings.

1.2 OTHER SERVICES

Conduits may not be installed closer than 150 mm to pipes containing gas, steam, hot water or other materials, which may damage the conduits or conductors.

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

2. SCREWED METALLIC CONDUIT

2.1 GENERAL

2.1.1 In general, screwed steel conduit shall not be used in the wiring of this building.

2.1.2 If used the installation shall comply with SANS 10142.

3. PLAIN-END METALLIC CONDUIT

As an alternative to the screwed conduit, plain-end conduit complying with the Department's standard specification for "CONDUITS AND CONDUIT ACCESSORIES", par. 7 of Section CI, may not be installed for this building:

4. NON-METALLIC PVC CONDUITS

4.1 INSTALLATION CONDITIONS

No-metallic PVC conduit shall be installed under the following conditions:

4.1.1 All non-metallic conduit shall comply fully with SANS 950 and shall be installed in accordance with Appendix C of the same specification as well as SANS 10142.

4.1.2 Insulated heat-resistant boxes shall be used for outlets of totally enclosed luminaries and other fittings where excessive temperatures are likely to occur.

4.1.3 Luminaries and other fittings shall not be supported by non-metallic conduit or conduit boxes. These fittings shall be secured to the surrounding structure in a way that is acceptable to the Department. Refer to the Department's standard specification for "INSTALLATION OF LUMINAIRES", Section B9.

4.1.4 The conduit shall be supported and fixed with saddles with a maximum spacing of 1 m, even in roof spaces. (Refer to SANS 10142.) The Contractor shall supply and install all additional supporting timbers required.

4.1.5 It shall be possible to rewire the completed installation in the future without undue difficulty.

4.1.6 Non-metallic conduit and fittings shall not be used under the following conditions:

(a) Outside building, wall surface mounted exposed to the weather (unless protected, or sheltered under eaves).

(b) For mechanical load bearing.

(c) Where they may be subjected to temperatures below -10°C or above 70°C for prolonged periods.

(d) As primary electrical insulation.

(e) In areas where they may be subject to mechanical damage.

(f) For applications other than those for which they are designed.

4.2 PAINTING OF CONDUITS

Exposed conduit may be painted with normal oil or PVA paints, but care must be taken to ensure that the paint used does not contain any component that will soften or have any other detrimental effect on the materials from which the conduit and fittings are manufactured.

4.3 CONNECTING OF CONDUIT TO METAL EQUIPMENT/COMPONENTS

When any part of a non-metallic conduit system has to be connected to metal equipment or components (e.g. switchboard, surface socket-outlet or switch box, existing metallic conduit system, etc.) fittings and joints manufactured specifically for this purpose must be used. Non-metallic conduit must not be threaded to fit metallic connectors.

4.4 BENDS

In conduit of nominal size not exceeding 25 mm, bends may be made in accordance with par. 4.5. In all other cases bends must be achieved by the use of accessories that are introduced into the conduit run. Bends shall comply with SANS 10142.

4.5 BENDING

Conduit of nominal size up to and including 25mm may be cold bent by hand provided that the radius of the bend is greater than six times the nominal size of the conduit, and that the external angle of the bend does not exceed 90°. The procedure (which involves the use of a bending spring) should be as follows:

(a) Determine the angle through which the conduit is to be bent.

(b) Warm the cold conduit over the length to be bent by rubbing with hands.

(c) Select a bending spring which matches the conduit size and insert in to the conduit at the point where the bend is required.

(d) Bend the conduit slowly with one motion (either with the hands alone approximately 1 m apart, or across the knee) to double the required angle, release the conduit and, when its position is stable, withdraw the bending spring (turning it in an anti-clockwise direction to reduce its diameter) and gently correct the angle.

(e) Install and secure the conduit immediately following bending.

4.6 ADHESIVE JOINTS

All adhesive joints must be made in a clean dry area. The surfaces of all components to be bonded must be dry and clean.

The insertion depth should be marked on the conduit end and the adhesive applied (by means of a soft clean brush) as quickly as possible to the surfaces to be bonded by brushing lengthwise along the conduit, ensuring that a thin coating of uniform thickness is formed. The joint must be made immediately after the application of the adhesive by pushing the prepared parts squarely together with a twisting motion to the full insertion depth. Care must be taken to avoid squeezing adhesive into the cableway and all excess adhesive must be wiped off.

NOTE: Solvent adhesives contain highly volatile liquids and their containers should not be left open.

4.7 Cutting

A fine-tooth hacksaw should be used to cut conduit to the required length. Each cut end should be square and free from swarf, burrs and loose material. When determining the length of conduit to be cut, allowance must be made for the length of couplings or accessories attached to the conduit. Incorrect determination will cause bulging of the conduit or insufficient joint length.

5. FLEXIBLE CONDUIT

5.1 In installations where the equipment has to be moved frequently to enable adjustment during normal operation, for the connection of motors or any other vibrating equipment, for the connection of thermostats and sensors on equipment, for stove connections and where otherwise required by the Department, flexible conduit shall be used for the final connection to the equipment.

5.2 The installation shall comply with SANS 10142.

5.3 Flexible conduit shall preferably be connected to the remainder of the installation by means of a draw-box. The flexible conduit may be connected directly to the end of a conduit if an existing draw-box is available within 2 m of the junction and if the flexible conduit can easily be rewired.

5.4 Flexible conduit shall consist of metal-reinforced plastic conduit or PVC-covered metal conduit with an internal diameter of at least 15mm, unless approved to the contrary. In false ceiling voids, flexible conduit of galvanised steel construction may be used. connectors for coupling to the flexible conduit shall be of the gland or screw-in type, manufactured of either brass or mild steel plated with either zinc or cadmium.

6. INSTALLATION REQUIREMENTS

6.1 POSITIONS OF OUTLETS

All accessories such as boxes for socket-outlets, switches, lights, etc. shall be accurately positioned. It is the responsibility of the Contractor to ensure that all outlets are installed level and square, at the correct height from the floor, ceiling or roof level and in the correct position relative to building lines and equipment positions as specified. It shall be the responsibility of the Contractor to determine the correct final floor, ceiling and roof levels in conjunction with the Main Contractor. Draw-boxes shall not be installed in positions where they will be inaccessible after completion of the installation. Draw-boxes shall be installed in inconspicuous positions to the approval of the Department's representative and shall be indicated on the "as built" drawings.

6.2 COVER PLATES

All draw-boxes and outlets shall be fitted with cover plates, either as part of the switch or socket assembly or with blank cover plates if unused. Blank cover plates shall match other cover plates in the same area. Flush mounted cover plates in both ceilings and walls shall overlap the draw-box and edges of the recess. If the fixing lugs are substantially deeper than the finished wall surfaces, suitable coiled steel wire or tubes shall be used as spacers.

6.3 DRAW-WIRES

Galvanised steel draw-wires shall be installed in all unwired conduits e.g. conduits for future extensions, telephone installations and other services.

6.4 BENDS

A maximum of two 90 bends or the equivalent displacement will be allowed between outlets and/or boxes.

Draw-boxes shall be installed at maximum intervals of 15 m in straight runs. All bends shall be made without heating the conduit or without reducing the diameter of the conduit. The inside radius of a bend shall not be less than five times the outside diameter of the conduit. (Refer to SANS 10142,

6.5 WALL SOCKET-OUTLETS

Where more than one socket-outlet is connected to the same circuit, the conduit shall be looped from one outlet box to the following on the same circuit. Where a metal channel is used, the conduit may be installed from the channel directly to the outlet box on condition that the conductors can be looped from one outlet to the next without making any joints in the wires.

6.6 LUMINAIRES

Where the conduit end is used to support luminaries, a ball-and socket type lid shall be fitted to the pendant box in all cases where the conduit is longer than 500 mm. In all other cases a dome lid may be used. Where luminaries are specified which are fixed directly to the pendant box, the pendant box shall be fixed independently of the conduit installation except where the pendant box is cast into concrete.

6.7 FLUSH MOUNTED OUTLET BOXES

The edges of flush mounted outlet boxes shall not be deeper than 10 mm from the final surface. Spacer springs shall be used under screws where necessary.

6.8 EXCESS HOLES

All excess holes in draw-boxes or other conduit accessories shall be securely blanked off by means of brass plugs to render the installation vermin proof.

6.9 DEBRIS

Care shall be taken to prevent debris or moisture from entering conduits during and after installation. Conduit ends shall be sealed by means of a solid plug which shall be screwed to the conduit end. Conduits shall be cleaned and swabbed to remove oil, moisture or other debris that may be present before conductors are installed. Swabs shall not be attached to the conductors.

6.10 Defects

Each length of conduit shall be inspected for defects and all burrs shall be removed. All conduits that are split, dented or otherwise damaged or any conduits with sharp internal edges shall be removed from site. The Contractor shall ensure that conduits are not blocked.

6.11 WITHDRAWAL OF CONDUCTORS

To ensure that all electrical conductors are easily withdrawable from conduits and to ensure that there are no joints in the conductors, the Department's representative will have the right to have the conductors of any circuit removed at his discretion. If the conductors are found to be in a satisfactory condition after having been withdrawn, the Department shall bear the cost of withdrawing and re-installing such conductors. If the conductors are found to have been damaged during installation or removal or if joints are found, they shall be replaced and the cost shall be borne by the Contractor.

7. INSTALLATION IN CONCRETE

7.1 TIMEOUS INSTALLATION

In order not to delay building operations, the Contractor shall ensure that all conduits and accessories which are to be cast in concrete are placed in position in good time. The Contractor or his representative shall be in attendance when the concrete is cast.

7.2 DRAW-BOXES

Draw-boxes, expansion joints and round ceiling boxes shall be installed where required and shall be neatly finished to match the finished slab and wall surfaces. Ceiling draw-boxes shall be of the deep type. In hollow block slabs, rear-entry draw-boxes shall be used. In columns where flush mounted draw-boxes are installed, the conduits shall be offset from the surface of the column immediately after leaving the draw-box.

7.3 ELBOWS

Elbows for conduits of 32mm dia. and smaller and sharp bends will not be allowed in concrete slabs.

7.4 COVER PLATES

Draw-boxes and/or inspection boxes shall, where possible, be grouped together under a common approved cover plate, and must preferably installed in passages or male toilets. The cover plate shall be secured by means of screws.

7.5 NEUTRAL AXIS

All conduits shall be installed as close as possible to the neutral axis of concrete beams, slabs and columns. The conduits shall be rigidly secured to the reinforcing to prevent movement towards the surface of the concrete.

7.6 FIXING TO THE SHUTTERING

All conduits, draw-boxes etc. shall be securely fixed to the shuttering to prevent displacement when concrete is cast. Draw-boxes and outlet boxes shall preferably be secured by means of a bolt and nut installed from the back of the box through the shuttering. Fixing lugs may also be used to screw the boxes to the shuttering. Wire will not be accepted for securing boxes to the shuttering where off-shutter finishes are required. Where fibreglass shuttering is used by the Builder, the equipment shall be fixed to the steel only and no holes shall be drilled or made in shuttering. All draw-boxes and outlet boxes shall be plugged with wet paper before they are secured to the shuttering.

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

7.7 CONCRETE FLOOR SLABS

Conduits will not be allowed in concrete floor slabs of boiler rooms (or boiler houses), laundries or other damp areas. All socket outlets and three phase outlets in damp areas shall be supplied from above with conduit and accessories.

7.8 EXPANSION JOINTS

As far as possible, conduits shall not be installed across expansion joints. Where this is unavoidable a conduit expansion joint shall be provided. (Refer to par. 10)

7.9 SCREEDS

The installation of conduits in floor screeds shall be kept to a minimum. Where conduits are installed in screeds, the top of the conduit shall be at least 20 mm below the surface of the screed. Where the screed is laid directly on the ground, galvanised conduits shall be used. This ruling will always be applicable to the lowest floor of a building. A minimum distance of twice the outside diameter of the conduit shall be left free between adjoining conduits. Conduits shall be secured to the concrete slab at intervals not exceeding 2 m. The Contractor shall ensure that conduits are not visible above the screed where the conduits leave the screed.

7.10 INSPECTION

All draw-boxes, conduits, etc. which are installed in concrete shall be cleaned with compressed air and provided with draw-wires two days after removal of the shuttering. Errors that occurred during the installation of the conduits, or any lost draw-boxes, or blocked conduits shall be immediately reported to the Department by telephone and confirmed in writing in order that an alternative route can be planned and approved by the Department before the additional concrete is cast. Any additional cost shall be for the Contractor's account.

8. SURFACE INSTALLATIONS AND INSTALLATIONS IN ROOF SPACES

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

8.1 APPEARANCE

(a) All conduits shall be installed horizontally or vertically as determined by the route and the Contractor shall take all measures to ensure a neat installation.

(b) Where conduits are to be installed directly alongside door frames, beams, etc. that are not true, conduits shall be installed parallel to the frames, beams, etc.

(c) All labels shall be removed from surface mounted conduit.

8.2 SADDLES

Conduits shall be firmly secured by means of saddles and screws and in accordance with SANS 10142. Where saddles are used to secure vertical lengths of conduit connected to surface mounted switch boxes or socket

outlet boxes, the saddles shall be spaced so that the intervals between the box and the first saddle, between any two successive saddles and between the last saddle and the ceiling or roof are equidistant. Conduits shall be secured within 150 mm before and after each 90° bend and within 100mm of each outlet box.

8.3 JOINTS

Joints will only be allowed in surface conduit lengths exceeding 3,5 m. Threads shall not be visible at joints of completed installations, except where running joints are used. Running joints will be allowed only when absolutely necessary. All running joints shall be provided with locknuts and shall be painted with red lead immediately after installation.

8.4 ACCESSORIES

Inspection bends or tee pieces shall not be used. Non-inspection type bends may be used in the case of 32mm or 50 mm diameter conduits. All draw-boxes supporting luminaries or other equipment shall be fixed independently of the conduit installation.

8.5 OFFSETS

Where an offset is required at conduit terminations or crossovers, the conduit shall be saddled at the offset.

8.6 CROSS-OVER

Conduit routes shall be carefully planned to avoid crossovers. Where a crossover is inevitable, one conduit only shall be offset to cross the other. Crossovers shall be as short as possible and shall be uniform. Alternatively, crossovers shall be installed in purpose-made boxes. This method shall be employed on face brick walls and in other circumstances where required by the Department.

8.7 PARALLEL CONDUIT

Parallel conduit runs shall be equidistant and saddles shall be installed in line. Alternatively, a special clamp may be used to secure all conduits in unison. In the case of conduits of different diameters, the latter method shall only be used if a purpose-made clamp designed to accommodate the various conduit sizes, is provided.

8.8 PAINTING OF CONDUIT

All surface mounted conduits and accessories shall be painted with two coats of a high quality enamel paint or as otherwise specified. The colour shall comply with the colour code specified for the installation or where no code has been specified, shall match the colour of the surrounding finishes.

8.9 CONDUIT IN ROOF SPACES

8.9.1 In open roof spaces (no ceiling) conduits shall run along the wall plates and the rafters. The installation of conduits suspended between the rafters is not acceptable.

8.9.2 Conduit in roof spaces shall be installed parallel or at right angles to the roof members and shall be secured at intervals not exceeding 1,5 m by means of saddles screwed to the roof timbers for metallic conduit and 1m for non-metallic conduit.

8.9.3 Nails or crampets will not be allowed.

8.9.4 Under flat roofs in false ceilings or where there is less than 900 mm clearance, or in instances where the ceilings are insulated with glass-wool or other insulating material impeding access, the conduit shall be installed in a manner which allows for wiring from below the ceilings.

8.9.5 Conduit runs from switchboards shall terminate in fabricated sheet steel draw-boxes installed directly above or in close proximity to the boards. Refer to the Department's standard specification for "CONNECTIONS TO SWITCHBOARDS", par. 2 of Section B10.

8.9.6 Spare conduits covering the total number of spare ways on switchboards, shall be provided between the boards and the roof draw-box.

8.9.7 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 450mm throughout the installation. The contractor shall supply and install all additional supporting timbers in the roof space as required.

8.10 FIXING TO WALLS

Only approved plugging materials such as aluminium inserts, fibre plugs or plastic plugs, etc., and round-head screws shall be used when fixing saddles, switches, plugs etc. to walls. Wood plugs are not acceptable nor should plugs be installed in joints in brick walls.

9. FUTURE EXTENSIONS

9.1 OPEN ROOF SPACES

Conduits intended for future switches and socket outlets, shall terminate 40 mm above the tie beams in roof spaces with more than 900 mm free space. The conduit ends shall be threaded and fitted with a coupling and brass plug.

9.2 CONCRETE SLABS

Conduit ends shall protrude 150 mm from the concrete to facilitate the installation of future extensions above, below or to the side of the concrete slabs. All these conduits shall be connected to a draw-box, which is cast into the concrete within 2 m of the end of the concrete. Conduit ends shall be threaded and fitted with a coupling and brass plug. In cases where holes cannot be drilled through the shuttering to accommodate the conduit end, a deep draw-box with rear entry may be placed over the conduit end.

9.3 COVER PLATES

Unused boxes for switches and socket-outlets shall be covered with cover plates. Unused boxes for luminaries shall be covered with round cover plates, which fit tightly against the finished surface. The cover plate shall overlap the outlet box and recess.

10. EXPANSION JOINTS

10.1 Where conduits cross expansion joints in the structure, approved draw-boxes which provide a flexible connection in the conduit installation shall be installed. Refer to the Department's standard drawing No EE3/136/139.

10.2 The draw-box shall be installed adjacent to the expansion joint of the structure and a conduit sleeve, one size larger than that specified for the circuit, shall be provided on the side of the draw-box nearest the joint. The one end of the sleeve shall terminate at the edge of the joint and the other shall be secured to the draw-box by means of locknuts.

10.3 The circuit conduit passing through the sleeve shall be terminated 40 mm inside the draw-box and in the case of metallic conduit, the conduit end shall be fitted with a brass bush. The gap between the sleeve and the conduit at the joint shall be sealed with 'Pratley Tic-Tac' or equal sealing compound, to prevent the ingress of wet cement. In the case of metallic conduit, an earth clip shall be fitted to the conduit projection inside the draw-box and the conduit bonded to the box by means of 2,5mm2 bare copper earth wire and a brass bolt and nut.

10.4 The end of the other circuit conduit shall be secured to the draw-box by means of locknuts and a brass bush in the case of screwed metallic conduit or a standard bushed adaptor for other conduit types.

10.5 In the case of metallic conduit, a 2,5mm^2 bare copper wire shall be installed between the first conduit boxes on either side of the joint, in addition to an earth wire, which may be specified for the circuit. The conduit boxes shall be drilled and tapped and the earth wire shall be bonded to the boxes by means of lugs and brass screws.

10.6 Suitable steel cover plates shall be screwed to draw-boxes installed along the expansion joint. The cover plates shall be installed before the ceilings are painted.

10.7 Where a number of conduits are installed in parallel they shall cross the expansion joint of the structure via a single draw-box. A number of draw-boxes adjacent to each other will not be allowed.

11. CHASES AND BUILDER'S WORK

11.1 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.

11.2 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.

11.3 Where no Builder or Main Contractor is available, the Contractor must provide all chases and is required to cover conduits installed in chases by a layer of 4:1 mixture of coarse sand and cement, finished 6 mm below the face of the plaster and roughened. Chases shall be deep enough to ensure that the top of conduits are at least 12 mm below the finished surface of the plaster.

11.4 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.

This ruling is particularly applicable but not exclusively to the rewiring and renewal of existing installations. Chases shall be made by means of a cutting machine.

11.5 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.

SECTION B2

B2. INSTALLATION OF WIRING CHANNELS, UNDERFLOOR DUCTING AND POWER SKIRTING

1. RESPONSIBILITY OF THE CONTRACTOR

The Contractor shall supply and install all wiring channels, underfloor ducting and power skirting as specified or as required for the cable, socket outlet and wiring installation including the necessary supports, hangers, fixing materials, bends, angles, junctions, T-pieces, etc. He shall further liaise with the Main contractor to verify the position of holes and access routes through the structure and finishes.

(Refer to the Department's quality specification for "WIRING CHANNELS, UNDERFLOOR DUCTING AND POWER SKIRTING", Section C2 to determine which types are acceptable).

2. WIRING CHANNELS

2.1 FIXING

The Contractor shall supply and install all hangers, supports or fixings for the channels. Channels up to and including 76 x 76 mm shall be supported at maximum intervals of 600 mm and larger channels at maximum intervals of 1 m. Channel runs shall be carefully planned to avoid clashes with other services and to ensure that all covers can be removed after completion of the entire installation. Purpose made clamps, hangers, etc. shall be used as required. Where it is not possible to support the channels at the specified intervals, they shall be supported in a sound manner to the satisfaction of the Department.

2.2 INSTALLATION IN CONCRETE

Where channels are cast into concrete, the insert type shall be used. Additional spacer blocks shall be used where necessary to prevent ducts from being deformed while the concrete is cast. Channels shall be filled with polystyrene or other suitable fillers to prevent the ingress of concrete and shall be securely fixed in position to the shuttering.

2.3 COVER PLATES

All channels up to and including 127mm width shall have snap-in cover plates of metal. Cover plates for wider channels shall be of metal and shall be fixed by means of screws at suitable intervals to prevent warping. Cover plates shall be installed over the full length of the channels. Flush mounted wiring channels shall be fitted with overlapping metal cover plates with plastic edge trim to cover irregularities in the wall recess.

2.4 JOINTS

Adjoining lengths shall be aligned and securely joined by means of fishplates fixed by mushroom bolts, washers and nuts or connection pieces that are pop-riveted to both adjoining sections. All adjoining sections shall be rectangular and shall butt tightly. Covers shall fit tightly across the joints.

Where channels cross expansion joints in the structure, suitable expansion joints shall be provided in the channels by means of fishplates pop-riveted or screwed to the channel on one side of the expansion joint and floating freely in the channel on the other side of the expansion joint.

2.5 SUPPORT FOR CONDUCTORS

All conductors in inverted cable channels shall be retained by means of metal clips or metal spacer bars at not more than 1m centres. Where vertical duct lengths exceed 5m, conductors installed in the channels shall be secured at intervals not exceeding 5m to support the weight of the conductors. Clamps shall be provided in suitable draw-boxes for this purpose.

2.6 CONDUIT CONNECTIONS

Conduit connections shall be terminated by means of two locknuts and a brass female bush. Where the channel is wide enough, conduit connections may be made by means of a conduit box and hole through the back or side of the channel. All holes through which conductors pass shall be fitted with bushes or grommets or shall be sleeved.

2.7 INTERNAL FINISHES

Bends and T-joints shall be constructed to ensure compliance with the allowable bending radii specified in SANS 10142, Appendix D in the case of PVC-insulated cables and conductors and shall comply with the relevant specification in the case of other cables. Burrs and sharp edges shall be removed and the inside edges of the joints shall be lined with rubber cement or other suitable rubberised or plastic compound to prevent laceration of the conductor insulation.

2.8 VERMIN PROOFING

All cable channels shall be vermin proofed after installation. Holes shall be covered by means of screwed metal plugs or by means of metal strips, which are bolted, or pop-riveted to the channel. Wooden or other plugs which are driven into holes or other temporary plugs or covers are not acceptable.

2.9 SERVICES

Multiple duct runs or internal metal partitions shall be used where conductors for power, control, communication and other services are present.

3. UNDERFLOOR DUCTING

3.1 GENERAL

3.1.1 Two or three compartment underfloor ducting as specified shall be supplied and installed in the positions and according to the layouts indicated on the drawings.

3.1.2 Three compartment ducting shall have a cross-section of approximately 200 x 32mm, subdivided into three approximately equal compartments, of which the centre compartment shall be used for electrical power distribution with the two outer compartments for telephone and other light current services respectively.

3.1.3 Unless specified to the contrary in the Detail Technical Specification or on the drawings, each compartment shall be provided with openings (occurring in line) at 1,5 m centres to permit installation of pedestals or recessed outlets in accordance with the design of the system. The openings shall have removable, flush, cover plates and shall have prepared fixing holes for future installation of pedestals or recessed outlets. The centre of the openings shall be offset a distance of 200 mm from the building nodule lines.

3.2 JUNCTIONS

The underfloor ducting installation shall be provided with flush cross-over, T-junction and right angle bend draw-boxes installed in the runs of ducting, generally as indicated on the drawings. The junction boxes shall be complete with cross-over of services. The junction boxes shall have nominal 300 x 300mm removable cover plates secured by means of four countersunk screws.

3.3 PEDESTAL UNITS

Where the system accommodates floor pedestal units, these shall consist of pressed steel or die cast aluminium units, suitable for either two or three services, as specified in the Detail Technical Specification. Where the pedestals are installed on vinyl tiled or similar floors which will be subject to washing, a matching waterproofing gasket shall be supplied below each pedestal to render the junction waterproof.

3.4 INSTALLATION

The underfloor ducting, junction boxes, pedestals, outlets and other accessories shall be installed strictly in accordance with the manufacturer's instructions and according to the following procedure:

a) The underfloor ducting shall be installed on a mortar bed, provided by the Plasterer for purposes of levelling the channel to the final floor screed level. The Contractor shall assist the Plasterer in marking out the layout of the ducting to enable the mortar bed to be laid. Final height of the underfloor ducting shall be determined in close liaison with the Builder.

b) After installation of the mortar bed, the components of the underfloor ducting shall be assembled and installed by the Contractor, following which the screeding will be completed.

3.5 TERMINATIONS

Up bends manufactured by the supplier of the underfloor ducting shall be supplied and installed wherever the ducting is terminated at a switchboard, telephone duct or telephone distribution box or where the ducting terminates behind power skirting.

3.6 WIRING

3.6.1 Power circuit wiring shall be installed in the centre compartment of the underfloor ducting. Sufficient slack shall be provided to allow for the installation of a floor pedestal outlet at each opening in the ducting, whether an outlet is specified at that position or not. This provision shall take the form of loops in the wiring, including the earth wire, wherever the openings occur. The loops shall be pushed back into the channel and the cover plates replaced. In the instances where pedestals/outlets are not installed, these provisions shall of necessity only be made for the area covered by the circuit and not for the run from the switchboard.

3.6.2 The entire underfloor ducting installation shall be effectively earthed and bonded together.

3.6.3 Galvanised draw-wires shall be supplied and installed along the entire length of the telephone and light current service compartments of the underfloor ducting. The draw-wires shall be interrupted at the junction boxes, with enough slack left coiled up to facilitate the drawing in of cables by others.

3.7 EXPANSION JOINTS

Where expansion joints in the buildings are crossed by underfloor ducting, expansion joints shall be provided as detailed in par. 2.4 of this section.

4. POWER SKIRTING

4.1 GENERAL

4.1.1 Two or three compartment power skirting as specified shall be supplied and installed in the positions and according to the layouts indicated on the drawings.

4.1.2 The top compartment shall be used for power wiring and switched socket outlets, whilst the bottom compartments shall be for telephone and other light current services.

4.2 MODULE

4.2.1 The power skirting shall be manufactured from 1mm (minimum) thick sheet hot dip galvanised steel or aluminium (as specified) in approximately 2,5m lengths.

4.2.2 The covers shall be manufactured in modular lengths, as specified in the Detail Technical Specification or otherwise in 1 m lengths and shall be secured to the wall channel by means of toggle or swivel nuts. Snap-in covers are also acceptable.

4.2.3 At the building module lines, covers of specified length or otherwise in 250 mm lengths shall be installed, against which partition walls may be installed, thereby trapping these covers. The removable modular covers shall be installed between these "fixed" covers.

4.2.4 Each modular cover associated with the power compartment shall be punched and prepared for the installation of either a 13A or a 16A, 3-pin standard flush switched socket outlet, whether any is specified or indicated for that module or not. Where socket outlets are not installed, the punched holes shall be blanked off with a metal blanking plate, painted the same colour as the power skirting and installed at the back of the covers. These blanking plates shall be easily removable to permit future installation of socket outlets.

4.2.5 Unless otherwise specified, no provision shall be made on the covers of the telephone or light current services compartments for the installation of sockets.

4.2.6 Factory-made end covers shall be installed at the ends of all runs of power skirting. All internal and external bends or offsets shall be factory-made and shall be installed to provide a neat and workmanlike appearance.

4.3 PAINTING

The power skirting shall be painted in a colour as specified in the Detail Technical Specification. The painting of steel power skirting shall comply with the Department's "STANDARD PAINT SPECIFICATION", Section C39. Aluminium power skirting shall be anodised. The power skirting channels and covers shall be individually wrapped or packed to protect them against damage in transit and before installation.

4.4 SOCKET-OUTLETS

4.4.1 Standard 13 A or 16 A, 3-pin flush switched socket outlets (100 x 50 mm nominal size) shall be supplied and installed in the positions indicated on the drawings and as specified in the Detail Technical Specification.

4.4.2 The switched socket outlets shall be secured to the channel by means of suitable brackets.

4.4.3 After installation of the modular front covers, they shall be screwed to the socket outlets to ensure proper alignment between the two components. Separate standard covers need not be provided for the socket outlets.

4.5 CONDUIT FEEDERS

4.5.1 Conduits for the circuit wiring to the power skirting shall be installed in the floor slab and shall terminate in flush conduit or boxes, behind the power skirting and installed to match the height of the power, telephone and light current services compartments of the skirting.

4.5.2 The wiring/cables shall pass through large diameter holes cut in the rear of the power skirting. The holes shall be suitably bushed or trimmed to prevent damage to the wiring or cables.

4.5.3 Alternatively conduits feeding to the telephone compartment may be terminated in boxes facing upwards in the floor slab immediately below the power skirting, with suitable bushed or trimmed openings being provided through the bottom of the power skirting duct for the cables to pass through. (Applicable only where the power skirting occurs at floor level).

4.6 POWER SKIRTING AT DOORWAYS

Where a section of power skirting is interrupted by a doorway, bridging conduits shall be installed to interconnect the power skirting sections. Where conduits are not specifically indicated, a minimum of 1 x 32mm bridging conduit shall be installed for each of the power, light current and telephone compartments.

4.7 CLEANING

Prior to fitting front covers, the power skirting shall be thoroughly cleaned to remove all dust and rubble and damage to paintwork where this has occurred, shall be repaired.

SECTION B3

B.3 INSTALLATION OF CABLE TRAYS AND LADDERS

1. GENERAL

Cable trays and cable ladders complying with the Department's standard specification for "CABLE TRAYS AND LADDERS", Section C3 shall be supplied and installed where specified and/or where generally suitable for cable distribution.

2. RESPONSIBILITY OF THE CONTRACTOR

The Contractor shall supply and install all cable trays and/or ladders as specified or as required by the cable routes including the necessary supports, clamps, hangers, fixing materials, bends, angles, junctions, reducers, T-pieces etc. He shall further liaise with the Main Contractor for the provision of holes and access through the structure and finishes.

3. SUPPORTS

Cable tray supports shall consist of two steel hangar rods, at least 8mm in diameter, on both sides of the tray with a substantial steel cross-member on the underside of the tray and bolted to the rods. Alternatively, cable trays may be cantilevered from walls on suitable brackets.

4. SPACING OF HORIZONTAL SUPPORTS

4.1 Horizontal trays shall be supported at the following maximum intervals:

(a) 1,2 mm to 1,6 mm thick metal with 12mm to 19 mm return trays. 1m maximum spacing

(b) 2,5 mm thick metal trays with 76 mm return 1,5m spacing.

(c) Cable ladders with 76mm side rail of 2mm thickness and with crossrungs. 1,5m spacing

(d) Metal cable ladders other than c) above, including site manufactured angle iron types 1m spacing

(e) 3 mm thick PVC trays with 40mm return. 1m maximum spacing

(f) 4 mm thick PVC trays with 60mm return 1,5m maximum spacing

4.2 In addition to the above spacing on the longitudinal run, trays and ladders shall be supported at each bend, offset and T-junction.

5. JOINTS

5.1 Joints shall be smooth and without projections or rough edges that may damage the cables. The Contractor will be required to cover joints with rubber cement or other non-hardening rubberised or plastic compounds if in the opinion of the Department joints may damage cables.

5.2 Joints shall as far as possible be arranged to fall on supports. Where joints do not coincide with supports, joints shall be made by means of wrap-around splices of the same material as the tray and at least 450mm long. The two cable tray ends shall butt tightly at the centre of the splice and the splice shall be bolted to each cable tray be means of at least 8 round head bolts, nuts and washers. Splices shall have the same finish as the rest of the tray.

5.3 Splices as described above shall be provided at joints, which do coincide with supports if the loaded tray sags adjacent to the joint due to the interruption of the bending moment in the tray.

6. FIXING TO SUPPORTS

Trays shall be bolted to supports by at least two round head bolts per support. Bolts shall be securely tightened against the tray surface to avoid projections which might damage cables during installation.

7. FIXING TO THE STRUCTURE

7.1 Where installed on concrete or brick, the supports for cable trays and ladders shall be securely fixed by means of at least 2 heavy duty, expansion type anchor bolts. Cantilevered trays shall be supported by a minimum of two 6mm diameter expansion bolts per support.

7.2 It is the responsibility of the Contractor to ensure that adequate fixing is provided since cable trays and ladders that work loose shall be rectified at his expense. The fixing shall take into account site conditions that prevail during installation.

7.3 Where installed on vertical steelwork, cable trays and ladders shall be fixed by means of 6mm diameter bolts and nuts.

7.4 On horizontal steelwork, use may alternatively be made of "CADDY" type fasteners.

7.5 Horizontal trays and ladders shall in general be installed 450 mm below slabs, ceilings, etc. to facilitate access during installation of cables.

7.6 Multiple runs shall be spaced at least 300 mm apart unless a different spacing is specified in the Detail Technical Specification.

8. INSTALLATION OF CABLES

Cables shall be installed adjacent and parallel to each other on the trays with spacings as specified in the Department's standard specification for "INSTALLATION OF CABLES", Section B6, and snaked slightly to allow for expansion. Cables shall present a neat appearance and shall under no circumstances be bunched. Cables shall be clamped at maximum intervals of 3 m when installed on horizontal trays and at maximum intervals of 600 mm when installed on vertical trays.

9. EARTHING

Metal trays and ladders shall be bonded to the earth bar of the switchboard to which the cables are connected. Additional bare copper stranded conductors or copper tape shall be bolted to the tray or ladder where the electrical continuity cannot be guaranteed. These additional conductors or tapes shall always be installed in outdoor applications and in coastal regions.

10. CORROSION

PVC trays shall be used in corrosive atmospheres. All supports shall be adequately protected against corrosion, preferably with a powder coated paint finish in accordance with the Department's "STANDARD PAINT SPECIFICATION", Section C39.

SECTION B4

B.4 FIXING MATERIALS

1. RESPONSIBILITY

It is the responsibility of the Contractor to position and securely fix conduits, ducts, cables and cable channels, switchboards, fittings and all other equipment or accessories as required for the Installation. The Contractor shall provide and fix all supports, clamps, brackets, hangers and other fixing materials.

2. FINISHING

All unpainted supporting steelwork installed by the Contractor shall be wire brushed and given one coat of rust-resisting primer, followed by one coat of high quality enamel paint before any other equipment is fixed.

3. STRUCTURAL STEEL

Supports, brackets, hangers, etc. may only be welded to structural steel members where prior permission of the Department has been obtained. "CADDY" or similar fasteners may be used to fix equipment to structural steel members.

4. SCREWS AND BOLTS

Where holes exist in equipment to be fixed, bolts and fixing screws as specified shall be used. Where sizes are not specified, the largest bolt or screw that will fit into the hole shall be used.

5. WALL PLUGS

Where the fixing holes in brick or concrete walls are smaller than 10mm dia. and where the mass of the equipment is less than 10kg, wall plugs may be used to fix conduits, cables and other equipment. Fibre or plastic plugs shall be used. Wooden Plugs are not acceptable. Aluminium plugs may be used in face bricks. Plugs installed in joints between bricks are not acceptable. A masonry drill of the correct size shall be used to drill holes for plugs. Round-headed screws of the correct diameter to match the specific plug shall be used throughout.

6. ANCHOR BOLTS

Where the fixing holes are 10mm and larger or where the mass of the equipment is 10kg, equipment shall be fixed by means of expanding anchor bolts or by means of bolts cast into the concrete or built into walls.

7. GALVANISED EQUIPMENT

Brass screws bolts and nuts shall be used to fix galvanised equipment.

8. SHOT-FIRED FIXING

8.1 Materials such as metal cable ducts or channels may be fixed against walls and concrete slabs by means of the shot-fired fixings.

8.2 The Contractor shall ascertain whether this method of fixing will carry the weight of the material including conductors, cables and other items of equipment to be installed later. Should it be found that the method of fixing is inadequate and supports tend to loosen, the Contractor will be required to fix the material by an alternative method to the satisfaction of the Department.

8.3 Where the shot-fired method is used, warning signs shall be placed at all entrances leading to the area where this work is in progress. The Contractor shall take all reasonable precautions to prevent accidents. Refer also to The Occupational Health and Safety Act.

8.4 Nails and explosive charges recommended by the manufacturer shall be used throughout.

9. CLAMPS AND BRACKETS

Clamps and brackets used to fix or support equipment such as cable trays, ducts, etc. shall be of a purpose-made type suitable for the specific application. Refer also to the Department's standard specification for "CABLE TRAYS AND LADDERS", Section B3 and "INSTALLATION OF WIRING CHANNELS", Section B2.

SECTION B5

B.5 WIRING

This section covers wiring in approved wire-ways for electrical installations in buildings or other structures under normal environmental conditions for 50 Hz systems not exceeding 600 V.

1. TYPE OF CONDUCTORS

PVC-insulated or equivalent, stranded copper conductors and bare stranded or green PVC-insulated copper earth conductors complying with the Department's quality specification for "PVC-INSULATED CABLES", Section C4, shall be used exclusively. Only where cables are specified or in instances where the exceptions stipulated in SANS 10142 are applicable, may the Contractor deviate from this requirement.

2. WIRE-WAYS

2.1 All unarmoured conductors shall be installed in conduits, cable channels (trunking) or power skirting and shall under no circumstances be exposed. Cable channels and power skirting shall be of metal construction unless specifically approved to the contrary.

2.2 Tenderers must note that common wire-ways will only be permitted for relatively light current-carrying conductors such as lighting and socket-outlet circuits. Refer also to par. 4 below. Heavy current-carrying conductors such as feeders to distribution boards and large power points, must be installed in separate conduits or wire-ways.

3. ORDER OF WORK

Wiring shall only be carried out after the wire-way installation has been completed, but before painting has commenced. Debris and moisture shall be removed from the wireways prior to the installation of the conductors.

4. CIRCUITS

Conductors that are connected to different switchboards, shall not be installed in the same wireway. The wiring of one circuit only will be allowed in a 20 mm dia. conduit with the exception of the wiring from switchboards to fabricated sheet metal boxes close to switchboards in which case more than one circuit will be allowed. For larger conduit sizes the requirements of SANS 10142, shall be met.

5. LOOPING AND JOINTS

A loop-in wiring system where conductors are looped from outlet to outlet, shall be employed. Joints in conductors shall be avoided as far as possible but where it becomes unavoidable, joints will be accepted in cable channels only and not in conduits. Joints shall be soldered or shall alternatively consist of approved ferruling, properly covered with heat-shrink sleeves. The use of PVC insulation tape is not acceptable.

6. GROUPING OF CONDUCTORS

In cases where the conductors of more than one circuit are installed in the same wireway, the conductors of each separate circuit (including earth conductor) shall be taped at intervals of 1m with PVC insulation tape. The conductors of different circuits shall however remain separate in order that any given circuit can be withdrawn. Conductors entering switchboards or control boards shall be grouped and bound by means of plastic or metal bands (not tape).

7. CABLE TRAYS

Conductors may only be installed directly on cable trays if specifically approved by the Department. In these cases cable trays shall be at least 2m above walkways or working areas. Conductors of the same circuit shall be grouped in the same manner as described in the previous paragraph. All the conductors on the cable tray

shall then be tied down securely to the cable tray at intervals of 2m or less by means of plastic or metal bands (not tape).

8. DRAWING-IN OF CONDUCTORS

When conductors are drawn through conduit, care shall be taken that they are not kinked or twisted. Care shall also be taken that the conductors do not come into contact with materials or surfaces that may damage or otherwise adversely affect the durability of the conductor.

9. THREE-PHASE OUTLETS

9.1 With the exception of three-phase outlets, circuits connected to different phases shall not normally be present at lighting, switch or socket outlet boxes. Where this is unavoidable, barriers shall be provided between terminals or connections of the various phases and the box shall be suitably labelled internally to indicate the presence of three phase voltages.

9.2 A neutral conductor shall be installed to all three phase outlets intended for equipment connection, whether sockets or isolators, irrespective of whether the particular equipment normally requires a neutral or not.

10. VERTICAL CONDUIT INSTALLATION

Conductors installed in vertical wire-ways shall be secured at intervals not exceeding 5m to support the weight of the conductors. Clamps shall be provided in suitable drawboxes for this purpose.

11. CONNECTIONS

The insulation of conductors shall only be removed over the portion of the conductors that enter the terminals of switches, socket outlets or other equipment. When more than one conductor enters a terminal, the strands shall be securely twisted together. Under no circumstances shall strands be cut off.

12. EARTHING CONDUCTORS

12.1 When earth continuity conductors are looped between terminals of equipment, the looped conductor ends shall be twisted together and then soldered or ferruled to ensure that earth continuity is maintained when the conductors are removed from a terminal.

12.2 The installation shall be earthed to comply with SANS 10142.

12.3 The installation shall be bonded to comply with SANS 10142.

13. COLOURS

The colours of conductor insulation shall comply with SANS 10142. The colours of conductors for sub-circuits shall as far as possible correspond with the colour of the supply phase. The colours of conductors for wiring to two-way and intermediate switches shall preferably differ from the colour of phase conductors.

14. SINGLE-POLE SWITCHES

Single-pole switches shall be connected to the phase conductor and not to the neutral conductor.

15. SIZE OF CONDUCTORS

Where conductor sizes are not specified, the following minimum conductor sizes shall be used:

Lighting circuits:	1,5mm² and 2.5mm² copper earth conductor
Socket-outlet circuits:	2,5mm² and 2,5mm² copper earth conductor.
Bell circuits:	1,5mm²
Stove circuits:	10mm² and 6mm² copper earth conductor

Clock circuits: 1,5mm²

16. PARTITIONS

16.1 When wiring is installed in removable partitions, the vertical and/or horizontal metal supports of the walls may be utilised for wiring on condition that:

(a) the conductors are not exposed,

(b) the metal supports are properly earthed,

(c) a separate bare earth continuity conductor is drawn in together with the current carrying conductors and is earthed to the metal parts of the switches and/or the socket-outlets, and

(d) conductors are installed in the metal and non-inflammable sections of the partitions.

16.2 Conductors enclosed in a copper braiding (harness wiring) may be installed in removable partitions. The braiding can be used as earth continuity conductor. The wiring shall be joined to the conduit (or cable) installation by interconnecting the conductor and the earth conductors in a draw-box using suitable ferrules and heat-shrink sleeves or screwed terminals.

SECTION B6

B.6 INSTALLATION OF CABLES

This section covers the installation of cables for the distribution of power in buildings, other structures and in ground for system voltages up to 11 kV, 50 Hz.

1. GENERAL

1.1 CABLE TYPES

(a) All cables and jointing and termination accessories used for power distribution shall comply with the Department's Quality Specifications, Section C.

(b) Cables with copper conductors shall be used throughout unless otherwise specified or approved.

(c) All unarmoured cables shall be installed in metal trunking, sleeves or conduit unless clearly specified to the contrary.

(d) XLPE Cables shall only be used in exceptional circumstances with the written permission of the Department.

1.2. COMPETENCE OF PERSONNEL

It is a definite requirement that the Contractor shall only employ personnel fully conversant with cable manufacturer's recommendations for joining and terminating cables.

2. IDENTIFICATION OF CABLES

2.1 Cables shall be identified at all terminations by means of punched metallic bands or marked with labels or tags. (Refer also to SANS 10142).

2.2 The use of PVC tape with punched characters is not acceptable.

2.3 The identification numbers of cables shall be shown on "as built" drawings of the Installation.

3. TRENCHING

3.1 GENERAL

3.1.1 The Contractor shall be responsible for all trenching excavations unless specified to the contrary.

3.1.2 The Contractor shall, before trenching commences, familiarise himself with the routes and site conditions and the procedure and order of doing the work shall be planned in conjunction with the general construction programme for other services and building requirements.

3.1.3 The Contractor shall acquaint himself with the position of all the existing services such as stormwater pipes, water mains, sewer mains, gas pipes, telephone cables, etc. before any excavations are commenced. For this purpose he shall approach this Department's representative, the local municipal authority and any other authority which may be involved, in writing.

3.1.4 The Contractor will be held responsible for damage to any existing services brought to his attention by the relevant authorities and shall be responsible for the cost of repairs.

3.1.5 The Contractor shall take all the necessary precautions and provide the necessary warning signs and/or lights to ensure that the public and/or employees on site are not endangered.

3.1.6 The Contractor shall ensure that the excavations will not endanger existing structures, roads, railways, other site constructions or other property.

3.2 MECHANICAL EXCAVATORS

3.2.1 Power driven mechanical excavators may be used for trenching operations provided that they are not used in close proximity to other plant, services or other installations likely to be damaged by the use of such machinery.

3.2.2

3.2.2 The use of power driven mechanical excavators shall be subject to the approval of the Department. Should the excavator produce trenches that exceed the required dimensions, payment based on volumetric excavation rates will be calculated on the required dimensions only.

3.3 BLASTING

3.3.1 No guarantee is given or implied that blasting will not be required.

3.3.2 Should blasting be necessary and approved by the Department, the Contractor shall obtain the necessary authority from the relevant Government Departments and Local Authorities. The Contractor shall take full responsibility and observe all conditions and regulations set forth by the above authorities.

3.4 ROUTES

3.4.1 Trenches shall connect the points shown on the drawings in a straight line. Any deviations due to obstructions or existing services shall be approved by the Department beforehand. Refer also to par. 10.4.

3.4.2 The Department reserves the right to alter any cable route or portion thereof in advance of cable laying. Payment in respect of any additional or wasted work involved shall be at the documented rates.

3.4.3 The removal of obstructions along the cable routes shall be subject to the approval of the Department.

3.5 SHORING AND WATERLOGGING

3.5.1 The Contractor shall provide shoring for use in locations where there is a danger of the sides of the trench collapsing due to waterlogging or other ground conditions. Refer to the The Occupational Health and Safety Act.

3.5.2 The strength of shoring must be adequate for site conditions prevailing and the shoring must be braced across the trench.

3.5.3 The Contractor shall provide all pumps and equipment required to remove accumulated water from trenches. Water or any other liquid removed shall be disposed of without any nuisance or hazard.

3.6 TRENCHING

3.6.1 Trenching shall be programmed in advance and the approved programme shall not be departed from except with the consent of the Department.

3.6.2 Trenches shall be as straight as possible and shall be excavated to the dimensions indicated in this specification.

3.6.3 The bottom of the trench shall be of smooth contour, and shall have no sharp dips or rises which may cause tensile forces in the cable during backfilling.

3.6.4 The excavated material shall be placed adjacent to each trench in such a manner as to prevent nuisance, interference or damage to adjacent drains, gateways, trenches, water furrows, other works, properties or traffic. Where this is not possible the excavated materials shall be removed from site and returned for backfilling on completion of cable laying.

3.6.5 Surplus material shall be removed from site and disposed of at the cost of the Contractor.

3.6.6 Trenches across roads, access ways or footpaths shall not be left open. If cables cannot be laid immediately the Contractor shall install temporary "bridges" or cover plates of sufficient strength to accommodate the traffic concerned.

3.6.7 In the event of damage to other services or structures during trenching operations the Contractor shall immediately notify the Department and institute repairs. (Refer to par. 3.1.3 and 3.1.4)

3.6.8 Prior to cable laying the trench shall be inspected thoroughly and all objects likely to cause damage to the cables either during or after laying shall be removed.

3.6.9 Where ground conditions are likely to reduce maximum current carrying capacities of cables or where the cables are likely to be subjected to chemical or other damage or electrolytic action, the Department shall be notified before installing the cables. The Department will advise on the course of action to be taken.

3.6.10 Extreme care shall be taken not to disturb surveyor's pegs. These pegs shall not be covered with excavated material. If the surveyor's pegs are disturbed, they shall be replaced by a person qualified to do so.

3.7 DIMENSIONS OF TRENCHES

3.7.1 Cable trenches for one or two cables shall not be less than 300 mm wide and need not be more than 450 mm wide. This dimension shall be valid for the total trench depth.

3.7.2 The width shall be increased where more cables are installed to allow for the spacings stipulated in par. 4.2.

3.7.3 Where trenches change direction or where cable slack is to be accommodated, the Contractor shall ensure that the requirements of the relevant SANS Specification regarding the bending radii of cables are met when determining trench widths.

3.7.4 Trench depths shall be determined in accordance with cable laying depths and bedding thickness.

3.7.5 Payment will be made on a volumetric excavation rate calculated on the basis of the given maximum dimensions or the actual dimensions, whichever is the lesser. Refer also to par. 3.2.2 and 3.7.1 above.

3.8 JOINT HOLES

Where cable joints are required to be made in the course of a cable run, a joint hole shall be excavated of sufficient size to enable the cable jointer to work efficiently and unimpeded.

3.9 BEDDING

3.9.1 The bottom of the trench shall be filled across the full width with a 75mm layer of suitable soil sifted through a 6mm mesh and levelled off.

3.9.2 Only sandy clay or loam soil with a satisfactory thermal resistivity (not exceeding 1,5°C m/W) may be used for this purpose. Sea or river sand, ash, chalk, peat, clinker or clayey soil shall not be used. The use of crusher sand is acceptable.

3.9.3 Where no suitable soil is available on site, the Contractor shall import fill from elsewhere and make all the necessary arrangements to do so. The cost of importing soil for bedding purposes shall be included in the unit rates for excavations.

3.9.4 After cable laying a further layer of bedding shall be provided to extend to 75 mm above the cables.

3.9.5 The bedding under joints shall be fully consolidated to prevent subsequent settling.

3.10 CABLE SLEEVES

3.10.1 Where cables cross under roads, railway tracks, other service areas, etc. and where cables enter buildings, the cables shall be installed in Polyethylene (6mm thickness), asbestos cement pipes or earthenware pipes. Pitch fibre and PVC pipes are not acceptable because of the adhesion that occurs after a period of time between the pipe and the sheathing or outer serving of the cables.

3.10.2 Pipes shall be joined in accordance with the manufacturer's instructions.

3.10.3 Sleeves shall cross roads and railway tracks at right angles.

3.10.4 Sleeves shall have a minimum diameter of 100mm. They shall extend at least 2m beyond the tracks of a railway line or of the outermost tracks where there is more than one line. In the case of roads, the sleeves shall extend at least 1m beyond the road edge or kerb on both sides of the road.

3.10.5 All sleeves shall be graded 1:400 for water drainage.

3.10.6 Cable sleeves shall be installed to the spacings and depths stated in paragraph 4 below.

3.10.7 Galvanised metallic sleeves up to and including 76mm dia. shall be supplied and installed by the contractor.

3.10.8 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.

3.11 BACKFILLING

3.11.1 The Contractor shall not commence with the backfilling of trenches without prior notification to the Department so that the cable installation may be inspected. Should the Contractor fail to give a timeous notification, the trenches shall be re-opened at the Contractor's cost. Such an inspection will not be unreasonably delayed.

3.11.2 For high voltage cables (1 kV to 11 kV) a coloured plastic marking tape shall be installed 400 mm above the cable. The tape shall be yellow, marked with the words "ELECTRIC CABLE/ELEKTRIESE KABEL" in red. These markings shall not be more than 1m apart from centre to centre.

3.11.3 Backfilling shall be undertaken with soil suitable to ensure settling without voids. The maximum allowable diameter of stones present in the backfill material, is 75mm.

3.11.4 The Contractor shall have allowed in his tender for the importation of suitable backfill material if required.

3.11.5 The backfill shall be compacted in layers of 150mm and sufficient allowance shall be made for final settlement. The Contractor shall maintain the refilled trench at his expense for the duration of the contract. Surplus material shall be removed from site and suitably disposed of.

3.11.6 On completion, the surface shall be made good to match the surrounding area.

3.11.7 In the case of roadways or paved areas the excavations shall be consolidated to the original density of the surrounding material and the surface finish reinstated.

3.12 CABLE MARKERS (FOR HV CABLES ONLY, EXCEPT WHERE OTHERWISE SPECIFIED)

3.12.1 Cable markers shall be provided along all HV cable routes but need only be provided along LV cable routes where specified.

3.12.2 Cable markers shall consist of concrete blocks in the shape of truncated pyramids, approx. 300mm high, 150 x 150mm at the top and 250 x 250mm at the bottom.

3.12.3 Brass plates shall be cast into the tops of the blocks in such a manner that they cannot be prised loose. The wording "ELECTRIC CABLE/ELEKTRIESE KABEL" shall be stamped on the brass plates as well as direction arrows and the cable voltage rating.

3.12.4 Cable markers shall be installed on the surface along all the underground routes and shall project 35 mm above normal ground level unless the projected markers could be a hazard to pedestrian or other traffic in which case they shall be installed flush with the surface.

3.12.5 Cable markers shall be installed at the beginning and end of a cable run (e.g. where a cable enters a substation or building), at all changes of direction, above all joints, above cable pipe entries and exits and at intervals not exceeding 50 m along the cable route.

3.12.6 The position of cable markers shall be indicated on the "as built" drawings.

3.13 TRANSNET, PROVINCIAL ADMINISTRATION OR NATIONAL ROAD CROSSINGS

3.13.1 The Contractor shall not trench beneath any railway tracks without the TRANSNET Administration's supervision. The Contractor shall request the Department timeously to arrange for the necessary supervision. The cost of such supervision will be paid for by the Department.

3.13.2 The Department will arrange for the necessary wayleave and permission to cross TRANSNET property and railway tracks, or Provincial or National road reserves and TELKOM Authority approval of proposed cable routes.

3.13.3 The Contractor shall carry out the crossing installation in strict accordance with the TRANSNET and Provincial Administration's requirements and stipulations. Where these requirements are in contradiction with this specification, the Department's ruling shall be sought.

3.13.4 The Contractor shall ensure that he will comply with the various Administration's requirements regarding crossing of Provincial and National roads, especially with regard to the safeguarding of the public. The Contractor shall also provide proof of adequate insurance cover against any claim from any accident as a result of work done by the Contractor during the crossing operation. The Department shall also be indemnified from all liability in this regard.

3.13.5 The Contractor shall liaise with the various Administrations well in advance regarding the intended dates, times and expected duration of the crossing operations and obtain their approval of the programme and method of operation before commencing with the work.

4. INSTALLATION OF UNDERGROUND CABLES

4.1 INSTALLATION DEPTHS

4.1.1 Cables shall be installed at the following minimum depths below final ground level :

Up to 11kV : 800mm

4.1.2 All cable depth measurements shall be made to the top of the cable when laid directly in ground or to the top of the duct or sleeve where these are provided.

4.1.3 The above depths shall apply to the top layer where cables are installed in layers.

4.1.4 The Contractor may only deviate from the above depths provided prior authority in writing has been obtained from the Department. In this event the cables shall be protected with a suitable concrete covering.

4.1.5 The depth of cable pipes or ducts beneath railway lines or roads shall be not less than 1,1 m below the formation level.

4.2 CABLE SPACINGS

4.2.1 Cables installed in the same trench shall be laid parallel to each other with the following spacings between cables (LV: up to 1 kV; HV: 1 kV to 11 kV):

LV/LV	:	2 cable diameters
LV/HV	:	150mm minimum

HV/HV	:	150mm minimum
LV/HV/PILOT	:	1 cable diameter

4.2.2 Where HV and LV cables have to be installed in the same trench, both shall be laid at a depth of 800 mm and then covered with 200mm of soil. The soil shall then be compacted, and then backfilled layer by layer and compacted until the trench is completely backfilled.

4.2.3 Cables for telephones, communication systems and other low voltage systems (less than 50 V) shall be separated from power cables by at least 1m. All control or pilot cables without a lead sheath and steel armouring shall be laid at least 300mm from power cables.

4.2.4 Cables shall not be buried on top of each other unless layers are specified. The minimum spacing between layers shall be 200mm.

4.3 CABLE LAYING

4.3.1 Except where ducts, tunnels or pipes are provided, cables shall be laid directly in the ground.

4.3.2 The cable shall be removed from the drum in such a manner that the cable is not subjected to twisting or tension exceeding that stipulated by the cable manufacturer.

4.3.3 Cable rollers shall be used as far as possible to run out cables. Rollers shall be spaced so that the length of cable in the trench will be totally suspended during the laying operation and sufficiently close to prevent undue sagging and the cable from touching the ground. Rollers shall also be placed in the trench in such a manner that they will not readily capsize.

4.3.4 Cable rollers shall have no sharp projecting parts liable to damage the cables.

4.3.5 Where cables have to be drawn around corners, well-lubricated skid plates shall be used. The skid plates shall be securely fixed between rollers and shall constantly be examined during cable laying operations.

4.3.6 Where cables have to be drawn through pipes or ducts, a suitable cable sock shall be used and particular care shall be exercised to avoid abrasion, elongation or distortion of any kind. In the case of oil filled cables, a cable sock may never be used. Special eyes giving access to the interior of the cable, must be utilised.

4.3.7 The maximum allowable tension when pulling a cable, is 70 N/mm2 of conductor area.

4.3.8 It will be assumed that the price or rates contained in the tender includes for the installation of cables in pipes and ducts or below existing or newly installed services.

4.3.9 The Department shall be informed timeously of the intention to carry out all cable laying operations to allow an inspection of the works by the Department if so required.

5. INSTALLATION OF CABLES IN CONCRETE TRENCHES

5.1 GENERAL

This paragraph covers the installation of cables in building trenches, service ducts, etc. The trenches, ducts, etc. inside buildings will be constructed and installed by others.

5.2 INSTALLATION

Cables shall be installed in one of the following ways:

(a) On horizontal cable trays.

(b) On horizontal metal supports with suitable clamps.

(c) On vertical cable trays or metal. supports fixed to the side of the trench. The cables shall be clamped in position.

Cables shall not be bunched and laid on the floor of the building trenches.

5.3 COVERS

5.3.1 The covering of concrete trenches shall as a rule fall outside the scope of the electrical installation. The Contractor shall however be responsible for the cutting or drilling and smoothing of holes for cables through chequer plates, concrete or other coverings as required.

5.3.2 Cables shall enter and exit the trench through sleeves protruding 300mm beyond the covering. The sleeves shall be permanently secured in position and the open space between the cable and sleeves shall be sealed with a non-hardening, watertight compound.

5.4 FILLED TRENCHES

5.4.1 Where specified, floor trenches shall be filled with fine crusher sand (no river or see sand).

5.4.2 If a sand filling is specified, the cables shall be fixed to non-corroding supports.

5.4.3 Sand-filled trenches other than in substations shall be covered in one of the following ways:

(a) Reinforced concrete covers.

(b) Sand and cement screed.

(c) Removable chequer plates.

5.4.4 Method (a) above shall be used where vehicular traffic may be encountered over trenches. Unless otherwise specified allowance for a mass of 2 tons shall be made.

5.4.5 Cable trenches in substations, switch rooms and generator rooms shall be covered in accordance with the Department's standard specification for "COVERING AND SEALING OF CABLE TRENCHES", Par. 9 of Section B13.

6. FIXING OF CABLES TO TRAYS OR STRUCTURES

6.1 INSTALLATION

Cables may be installed in one of the following ways:

(a) On horizontal cable trays.
(b) Against vertical cable trays with suitable clamps.
(c) Against horizontal or vertical metal supports or brackets with suitable clamps.
(d) On clamps which are fixed to the structure.

6.2 CLAMPS

Suitable clamps (cleats) which will secure cables without damage shall be used. Metal clamps or drilled hard wood blocks shall be used. Clamps shall consist of adjustable metal wings which clamp to a metal support, or consist of two halves that are bolted together. The correct clamp size to fit the cable shall be used. Cables of different sizes nay only be fixed by a common clamp when the clamp is specially made to accommodate the various cables.

6.3 SPACING OF SUPPORTS

Two methods of supporting cables are found in practice. The most generally known method is the restrained installation where the distance between supports is small enough to prevent any noticeable sag in the cable. The alternative method is the unrestrained installation where the distance between supports should be great enough to ensure that there will be obvious sag in each span between supports.

6.4 SPACING OF SUPPORTS OF UNRESTRAINED CABLES

Large single core cables shall always be installed according to this method. Generally, single core cables with conductors exceeding a cross sectional area of 185mm² should be supported at spacings in excess of 2m since the sag between supports will safely accommodate any thermal expansion.

Reducing the spacing between the supports to 1,5m or less shall be avoided at all costs, as expansion cannot be taken up by a change of sag and chances of sheath failure become considerable.

6.5 SPACING OF SUPPORTS OF RESTRAINED CABLES

Additional cleats shall be installed at each bend or offset in the cable run. The maximum distance between supports or cleats for multi-core control cables shall be 20 times the outside diameter of the cable with a maximum spacing of 550mm for unarmoured cables and 30 times the outside diameter of the cable with a maximum spacing of 900mm for armoured cables. Spacing of supports for cables for high voltage lighting shall be in accordance with Table 8 of SANS 10142. A minimum of 20mm ventilation clearance shall be maintained between cables and the wall to which they are cleated.

7. GROUPING AND SPACING OF CABLES IN BUILDINGS AND STRUCTURES

7.1 SPACING CORRECTION FACTORS

Cables shall as a rule be spaced two cable diameters apart, for which no grouping correction factor need be applied.

7.2 CABLES ON DIFFERENT LEVELS

Where parallel cable runs are installed at different levels (e.g. on parallel cable trays) and where the spacing of the layers is not specified, a minimum spacing of 300mm shall be maintained.

7.3 SINGLE CORE CABLES

Where single core cables are installed along a three-phase circuit, the cables shall be installed in trefoil formation and bound together at 300mm intervals.

7.4 HIGH VOLTAGE CABLES

High voltage cables shall be separated from other cables and services throughout the installation and shall as far as possible be installed in separate floor trenches, pipes or metal channels. Where this is not feasible a minimum spacing of 500 mm shall be maintained.

7.5 CABLES FOR OTHER SERVICES

Cables for telephones, communication systems and other low voltage systems (less than 50 V) shall be separated from power cables. In building ducts a physical barrier shall be provided between power cables and cables for other services. Where armoured cables are used for such other services, they shall be installed on separate cable trays or shall otherwise be at least 1m away from power cables. Where unarmoured cables are used for these other services, they shall be installed in separate conduits or metal channels.

TABLE B6.1

Cross-Sectional Area of Cable Conductors (mm^2)	MAXIMUM SPACING OF SUPPORTS (CLEATS) (mm) FOR RESTRAINED CABLES			
	Wire Armoured Cables		Other than Wire Armoured Cables and Unarmoured Cables	
	Horizontal Cable Routes	Vertical Cable Routes	Horizontal Cable Routes	Vertical Cable Routes
1,5	450	750	300	400
2,5	450	750	300	400
4,0	600	750	300	400
6,0	600	750	300	400
10,0	750	900	400	450
16,0	750	1000	400	550
25,0	900	1000	450	550
35,0	900	1000	450	550
Bigger than 35,0	900	1000	450	550

For larger cables the spacing shall be 10 x outside diameter of the cable.

8. TERMINATION AND JOINTING OF CABLES

8.1 GENERAL

8.1.1 Cable ends shall be terminated with glands or in cable boxes with the associated accessories such as clamps, shrouds, etc. complying in all respects with the Department's quality specifications, Section C.

8.1.2 Connection of cables to switchgear shall always be effected in such a way that the various phases, seen from the front of the switchgear will be in the following positions:

No. 1 conductor : left (red) (A)
No. 2 conductor : centre (white) (B)
No. 3 conductor : right (blue) (C)

8.1.3 Exposed armouring shall be covered with bitumen-base paint.

8.1.4 All cable ends shall be supplied with the necessary earth connection.

8.1.5 A channel or other approved means of support shall be provided to remove mechanical stress from the glands.

8.1.6 Cable cores shall be marked with heat-shrunk sleeves where necessary to identify the phases. Refer to SANS 10142.

8.1.7 The current-carrying capacity and breakdown voltage of the cable end shall be the same as for the complete cable.

8.1.8 Cables shall be terminated in accordance with the recommendations laid down by the manufacturers of the cables and glands employed.

8.2 TERMINATION OF PAPER-INSULATED CABLES

8.2.1 The ends shall be terminated in cable end boxes filled with bituminous, cold filling or resin oil semi-fluid compound or heat-shrinkable terminations in accordance with the Department's standard specification for "CABLE END BOXES AND COMPOUND", Section C8 or "CABLE TERMINATIONS AND JOINTS", Section C6.

8.2.2 Heat-shrinkable materials shall only be used in exceptional circumstances with the written permission of the Department.

8.2.3 Before terminating or jointing paper-insulated cables, a test to establish the presence of moisture must be carried out.

The following procedure may be followed:

(a) Place an adequate quantity of cable impregnating oil in a suitable container and heat up to 130 C ± 5 C.

(b) Cut a small length (± 300mm) of the cable concerned and remove the armouring and sheath, taking care not to handle the dielectric in any way.

(c) Dip a section of the outer insulating impregnated paper (belt paper) in the heated oil, taking care not to contaminate the tapes with moisture from the hands. If frothing appears on the surface of the oil, this is a clear indication of the presence of moisture in the paper.

(d) The same procedure should then be repeated on the insulating impregnated paper around the conductors (especially those layers closest to the conductors). Frothing will also indicate the presence of moisture.

(e) Should only a small number of bubbles appear on the surface of the oil, this is an indication of air bubbles on the paper and not moisture since the presence of moisture will result in a series of bubbles rising to the surface of the oil for a number of seconds, until all moisture has been removed.

8.2.4 The armouring shall be bonded to the main earth bar of the switchgear or transformer, but the bond shall be easily removable for testing purposes.

8.2.5 The lead sheath shall be wiped against the conical wiping gland.

8.2.6 All cut cable ends which will be exposed to the atmosphere for more than two hours shall be sealed and wiped to prevent penetration of moisture.

8.3 TERMINATION OF XLPE CABLES

8.3.1 These cables shall only be used in exceptional circumstances and only with the written permission of the Department.

8.3.2 Cross-linked polyethylene cables (XLPE) shall be terminated in accordance with the Department's standard specification for "CABLE TERMINATIONS AND JOINTS", Section C6 unless a pre-fabricated system based on pre-moulded slip-on EPR stress cones is used.

8.3.3 The copper tapes of the earth screen on the cable shall be bonded to the main earth bar of the switchgear or transformer, but the bond shall be easily removable for testing purposes.

8.3.4 The cable shall be firmly secured on the switchgear by means of a clamp to prevent mechanical stress on the cable and terminations.

8.4 TERMINATION OF PVC-INSULATED CABLES

8.4.1 Cable ends shall be terminated by means of adjustable glands in accordance with the Department's standard specification for "GLANDS FOR PVC-INSULATED CABLES", Section C5.

8.4.2 The glands shall be fitted in accordance with the cable and gland manufacturers instructions.

8.4.3 The correct size and type of gland shall be used for the particular cable and application.

8.5 CONNECTION OF CABLE CONDUCTORS

8.5.1 Suitable lugs shall be used, preferably solidly sweated to the cable conductor ends. Lugs may be crimped, using mechanical or pneumatic tools designed for this purpose, on condition that evidence is submitted that the method used complies with the performance requirements of BS 4579, Part 1 : "COMPRESSION JOINTS IN COPPER".

8.5.2 Contact surfaces shall be thoroughly cleaned and smoothed and fixing bolts shall match the hole size of the lug.

8.5.3 Cables that are connected to clamp type terminals where the clamping screws are not in direct contact with the conductor, need not be lugged but the correct terminal size shall be used.

8.5.4 Ferrules shall be used as far as possible where cable conductors are connected directly to equipment with screws against the conductor strands.

8.5.5 When cutting away insulation from cable conductors to fit into lugs, care shall be taken that no strands are left exposed. Under no circumstances may any of the conductor strands be cut away to fit into lugs.

8.6 JOINTS

8.6.1 Joints in cable runs will not be allowed unless specified in the Detail Technical Specification or authorised by the Department.

8.6.2 Jointing shall be carried out strictly in accordance with the manufacturer's instructions and by personnel competent in jointing the types of cables used.

8.6.3 During outdoor jointing operations, the joint bays shall be adequately covered by tents of waterproof material suitably supported. Where necessary a trench shall be excavated around the bay to prevent the ingress of moisture. The sides of the hole shall be draped with small tarpaulin or plastic sheeting to prevent loose earth from falling in during jointing operations.

8.6.4 The joint shall not impair the anti-electrolysis characteristics of the cable.

8.6.5 The Contractor shall notify the Department timeously of the day on which jointing is to be carried out in order than an inspection may be arranged if so required. Any cable joint not inspected by the Department because of insufficient notice being given, shall be opened for inspection and redone at the discretion of the Department at the cost of the contractor.

8.6.6 HV cable joints on paper insulated cables shall be of the compound cast type and the compound used shall comply with the Department's standard specification for "CABLE END BOX FILLING COMPOUND", par. 2 of Section C8.

8.6.7 HV cable joints on XLPE-insulated cables shall be of the heat shrinkable type and shall comply with the Department's standard specification for "CABLE TERMINATIONS AND JOINTS" Section C6, or shall be based on a prefabricated system utilising pre-moulded slip-on stress cones.

8.6.8 LV cable joints shall be of the epoxy-resin type.

8.6.9 Joints shall be fully water and air tight and shall be free of voids and air pockets.

8.6.10 The crossing of cores in joints will not be permitted under any circumstances.

9. TESTING

9.1 Each cable shall be tested after installation in accordance SANS 1507 (up to 1 kV) and SANS 97 (up to 11 kV) as well as the requirements of the Local and Supply Authorities.

9.2 LV Cables shall be tested by means of a suitable megger at 1 kV and the insulation resistance shall be tabulated and certified.

TABLE B6.2

Cable Rating (kV)	TEST VOLTAGE (Applied for 15 minutes) (kV)				
	Paper-insulated cables				XLPE-insulated cables
6,6 11	Between conductors		Conductors to sheath		Conductors to screen
	AC (r.m.s)	DC	AC (r.m.s)	DC	DC
	12 20	18 30	12 20	18 30	11 18

* High Voltage test with DC to 2kV for 1 minute only. Discharge cable slowly via discharge stick (1 minute). Clamp all conductors to earth for 24 hours.

9.3 HV Cables shall be high voltage tested in accordance with Table B6.2 and the exact leakage current shall be tabulated and certified.

9.4 The Contractor shall make all arrangements, pay all fees and provide all equipment for these tests. The cost of testing shall have been included in the tender price.

9.5 The Contractor shall notify the Department timeously so that a representative of the Department may witness the tests.

9.6 On completion of the tests on any cable, the Contractor shall without delay, submit three copies of the certified Test Reports to the Department.

10. MEASUREMENTS

10.1 All measurements for payments shall be made jointly by the representatives of the Department and the Contractor and the Contractor shall obtain the signature of the Department's representative including approval of such measurements.

10.2 No allowance shall be made for the breaking away of the trench sides, other earth movements or for trenches excavated in excess of the stipulated dimensions. Refer also to par. 3.7.5 above.

10.3 The classification shall be as follows:

Very hard rock shall mean rock that can only be excavated by means of explosives.

Hard rock shall mean granite, quartzitic sandstone, slate and rock of similar or greater hardness, solid shale and boulders in general requiring the use of jack hammers and other mechanical means of excavations.

Soft rock and earth shall mean rock and earth that can be loosened and removed by hand-pick and shovel.

10.4 Where very hard rock and hard rock are encountered, the prior approval of the Department shall be obtained before proceeding with the excavation. This requirement is stipulated in order to afford the Department the opportunity to determine whether an alternative cable route is justified.

10.5 All cable lengths indicated in the Detail Technical Specification and/or shown in the cable route drawings shall be regarded as estimates and are given for tendering purposes only. The successful tenderer shall measure actual cable lengths on site before ordering.

10.6 The final price for the supply and installation of all cables will be adjusted, on the basis of the actual lengths of installed cables, in accordance with the unit rates quoted at the time of tendering. Cable lengths shall be measured on site to the nearest 500mm for this purpose and surplus cable will not be paid for.

11. COMPLETION

11.1 The Department reserves the right to inspect the installation at any stage during the course of construction. Such inspections will however not deem the portions inspected as being complete or accepted and the Contractor shall remain responsible for completing the installation fully in accordance with the Contract Documents.

11.2 The Contractor shall carry out a final "as built" survey of the cable routes and present to the Department "as built" route plans of the complete installation. The following information shall be reflected on the plans or submitted as separate schedules with the plans :

(a) Overall length of each cable.

(b) Locations of all joints (if any) in relation to permanent reference points. Dimensions shall be shown and the method of triangulation i.e. two dimensions to each joint, shall be used.

(c) Identification of each cable.

11.3 The works will be deemed to be incomplete until all tests have been conducted successfully and all "as built" drawings and schedules have been handed to the Department.

SECTION B7

B.7 INSTALLATION OF LIGHT SWITCHES AND SOCKET-OUTLETS

1. GENERAL

1.1 STANDARDS

Light switches and socket-outlets shall comply with the Department's quality specification for "LIGHT SWITCHES", Section C10 and UNSWITCHED AND SWITCHED SOCKET-OUTLETS", Section C11. Surface or flush mounted boxes and cover plates, complying with the Department's quality specification for "CONDUIT AND CONDUIT ACCESSORIES", Section C1, shall be provided.

1.2 POSITION OF OUTLETS

Switches and socket-outlets shall be accurately positioned in accordance with the drawings. It is the Contractor's responsibility to ensure that all outlets are installed level and square, at the correct height from the floor and at the correct position relative to building lines and equipment positions as specified. It is the Contractor's responsibility to determine the correct final floor level and ceiling level in conjunction with the Main Contractor.

1.3 COVER PLATES

All switches and socket-outlets shall be fitted with standard cover plates. The colour of cover plates shall be as specified or shall otherwise match the surrounding finishes as closely as possible. Unless specified to the contrary, ivory cover plates shall be installed on painted walls. Cover plates in the same area shall have the same colour. Flush mounted cover plates shall overlap the draw-box and edges of the recess. Cover plates shall under no circumstances be cut unless authorised by the Department.

1.4 ESCUTCHEON PLATES

Where flush mounted switches or socket-outlets are installed in special wall finishes e.g. wood or board panels, acoustic tiles or other cladding, etc. and where the wall finishes must be cut to accommodate the switch, it may be necessary to fix an escutcheon plate to the wall to cover the cut-outs. The escutcheon plate shall fit closely around the outlet boxes and shall be fixed independently of the boxes and cover plates. Bevelled cover plates shall be fixed to the outlet boxes and shall fit firmly against the escutcheon plate.

1.5 APPEARANCE

The sides of adjacent switches, plugs, push-buttons etc. shall be parallel or perpendicular to each other and uniformly spaced. A common escutcheon plate shall be placed around flush mounted outlets and accessories where the standard cover plates do not cover the cut-outs in the finishes.

1.6 DEEP BOXES

Where switch or socket-outlet boxes have been set deep, spiral type steel wire spacers shall be used to fix the yoke of the switch or socket.

2. INSTALLATION OF SOCKET-OUTLETS

2.1 MOUNTING HEIGHT

Unless specified to the contrary, socket-outlets shall be installed at the following heights above finished floor level, measured to the centre of the outlet:

Flush mounted in general:	300mm
Showrooms, shops, servants quarters:	1,4m
Domestic kitchens, tea kitchens:	1,05m
Commercial kitchens:	1,4m
Factories, workshops, garages:	1,4m

2.2 WALLS

In cases where socket-outlets must be mounted at a nominal height of 300mm and where the lower portion of the wall consists of face bricks and the upper portion is plastered, the outlets shall be installed in the plastered portion of the wall. If however the plastered portion of the wall commences 500mm or more above floor level the outlets shall be installed in the face bricks. Where a wall has different surface finishes the outlets shall be installed within the same finish and not in the dividing lines between the different wall finishes. All outlets shall be installed at least 150mm away from door frames.

3. INSTALLATION OF LIGHT SWITCHES

3.1 MOUNTING

Light switches shall be installed 1,4m above finished floor level unless specified to the contrary. Mounting heights given shall be measured from the finished floor level to the centre of the switch. All single switches shall be installed with the long side of the toggle vertical.

3.2 DOORS

Unless specified to the contrary, switches adjacent to doors shall be installed on the side containing the lock. If the position of the lock is not shown on the drawings, the position shall be verified before the switch-box is installed. Switch boxes in brick or concrete walls shall be installed 150mm from the door frame. Light switches installed in partitions or door frames shall be of the type designed for that purpose.

3.3 WALLS

Where the lower portion of a wall is face brick and the upper portion plastered, light switches shall be installed wholly in the plaster provided that the lower edge of the plaster is not higher than 1,6m above the finished floor level. In general where different wall finishes are used in the same area. Switches shall be installed within the same finish and not on the dividing lines between finishes.

3.4 PARTITIONS

Light switches installed in partitions shall preferably be of the type designed to be accommodated in the partition construction. Switches installed in the metal supports do not require switch boxes. Switches may not be flush mounted in partition walls without switch boxes.

3.5 WATERTIGHT SWITCHES

Switches that are exposed to the weather or are installed in damp areas, shall be of the watertight type complying with the Department's quality specification for "WATERTIGHT SWITCHES", par. 3 of Section C1O.

3.6 MULTIPLE SWITCHES

Where several switches are required in one position, multi-lever switches in a common switch box shall be provided wherever possible. All circuits wired into this box shall be on the same phase in order that voltages in excess of 250 V are not present in the box. Where it is not possible or practical to do this, barriers shall be installed and a label shall be prominently displayed within the box stating that voltages in excess of 250 V are present.

SECTION B8

B.8 PHOTO-ELECTRIC DAYLIGHT SENSITIVE SWITCH FOR OUTSIDE LIGHTING

1. INSTALLATION

1.1 The outside lighting of each individual building i.e. light circuits marked on the drawings, shall be controlled by photo-electric daylight sensitive switches.

1.2 The positions of the switches as indicated on the drawings are provisional and the exact positions shall be confirmed with the representative of the Department on site.

1.3 Individual outside lighting circuits on a building may be connected directly to the daylight sensitive switch.

1.4 Where two or more lighting circuits are to be controlled by a single daylight sensitive switch, a contactor actuated by the unit shall be provided in the switchboard.

1.5 A by-pass switch enabling the lights to be turned on at any time, shall be provided.

1.6 Standard control circuits are indicated in fig. B8.1 and B8.2.

2. CONSTRUCTION

2.1 The unit shall comprise a photo cell, thermal actuator and change-over switch. The cover of the unit shall be manufactured from a tough, durable material providing protection against tampering. The cover shall have good weathering properties. It shall be ultraviolet-resistant and shall not deteriorate when exposed to sunlight for prolonged periods.

2.2 The unit shall be of the wall mounting type and shall be supplied complete with a suitable bracket.

2.3 The operational level shall be factory preset for "ON" at a light level of approximately 54 lux and "OFF" at approximately 108 lux. Voltage variations shall not materially affect the operational levels.

2.4 A time delay of not less than 15 seconds shall be provided to prevent the unit from functioning due to short period changes in illumination.

2.5 The unit shall be effectively safeguarded against voltage surges by means of a suitable surge protector which shall preferably form an integral part of the unit.

SECTION B9

B.9 INSTALLATION OF LUMINAIRES

1. POSITIONS

The mounting positions of luminaries shall be verified on site. All luminaries shall be placed symmetrically with respect to ceiling panels, battens, beams, columns or other architectural features of the space unless otherwise indicated. The layout as shown in the Documents shall generally be adhered to but any discrepancies or clashes with structural or other features must be referred to the Department, before commencing erection of the installation.

2. COVER PLATES

Cover plates shall be fitted over all draw-boxes and outlets intended for luminaries that are not covered by the luminaries canopy, lamp-holder, ceiling rose or similar accessories.

3. FIXING TO DRAW-BOXES

Where an outlet box or draw-box provides the necessary support for a luminaries, all luminaries with the exception of fluorescent luminaries mounted against ceilings, shall be fixed directly to the box. Fluorescent luminaries and luminaries with a mass in excess of 10kg shall however be suspended independently of the outlet box.

4. HANGERS AND SUPPORTS

Where provision has not been made for the fixing of luminaries, the Contractor shall supply the necessary supports, hangers, conduit extensions, angle brackets or any other fixing method approved by the Department.

5. SUSPENDED LUMINAIRES

The necessary hangers shall be provided where luminaries which are of the non-suspension type have to be fixed below false ceilings or roof slabs. The use of 20mm conduits fixed to the roof slab or ceiling is preferred. Provision shall be made for adjustments to enable the levelling of luminaries. Suspended conduits shall be fixed to the ceiling by means of screwed dome lids, bolts and nuts. Ball-and-spigot type domelids shall be used where conduit lengths exceed 600mm. Wiring shall be installed in the conduit hangers.

6. SUSPENDED WIRING CHANNELS

Luminaries (especially fluorescent luminaries) may also be suspended from ceilings by means of suspended metal channels. The metal channel may be supported by conduits or threaded rods. Should metal rods be utilised, these shall be screwed to anchor bolts fixed in the roof slab. Wiring shall either be installed in conduits fixed to the metal channel or in the metal channels and covered with a suitable cover plate. Purpose-made clamps shall be used to fix the luminaries to the cable channel.

7. CEILING BATTENS

Where wooden blocks are used to suspend luminaries, ceiling battens shall not be cut. The wooden blocks shall be cut to fit around battens and shall be screwed to the ceiling. Battens may however be cut where fluorescent or incandescent luminaries with metal canopies have to be installed against a false ceiling.

8. GLASS-BOWL LUMINAIRES

Unless specified to the contrary, suspended glass-bowl luminaries shall be installed with the underside at least 2,1 m above finished floor level.

9. LUMINAIRES FIXED TO CONCRETE SLABS

Luminaries to be installed directly against concrete slabs or walls shall be securely fixed to the outlet box and at two additional points. Shot-fired fixings are not acceptable. Where approved, luminaries may be installed against metal wiring channels in which the wiring is housed. The channel fixing may in this case be shot-fired. Purpose-made fluorescent fixing adaptors shall be used to fix luminaries to cable channels.

10. LUMINAIRES FIXED TO CEILINGS

10.1 In all cases where luminaries are fixed to false ceilings, the Contractor shall ensure that the ceiling is capable of carrying the weight of the luminaries before commencing installation. Should any doubt exist in this regard, the matter shall be referred to the Department.

10.2 In cases where the weight of the luminaire is not carried by the ceiling but by a support or other suspension method, provision shall be made to prevent relative movement between the ceiling and luminaire, ceiling rose or connection point.

10.3 Surface mounted luminaries shall fit firmly against the ceiling brandering without leaving gaps between luminaire and ceiling. The luminaire shall be fixed directly to the ceiling by means of brass plated round-head wood screws and washers.

10.4 In the case of tiled ceilings with exposed or concealed T-section supports, surface mounted luminaries shall be fixed only to the tiles by means of butterfly screws or bolts with nuts and washers. The tiles shall be suitably reinforced.

10.5 Luminaries may alternatively be fixed to metal cross-pieces resting in the ceiling tees.

10.6 Drilling of holes in ceiling tees to support luminaries will not be allowed.

10.7 Luminaries shall be fixed in neat relation to the ceiling lay-out.

11. CONTINUOUS ROWS OF LUMINAIRES

In cases where luminaries are installed in tandem, only one connection outlet need be supplied per circuit. All luminaries shall be coupled to one another by means of nipples or brass bushes and locknuts to ensure that wiring is not exposed and that earth continuity is maintained. Luminaries on the same circuit may be wired through the channel formed by the luminaire bodies. In this case silicon-rubber insulated conductors shall be used and internal connections shall be made at porcelain terminal blocks. "SCREW-IT" or similar connectors may only be used if prior permission is obtained from the Department. The wiring for any other circuits or outlets, even though these may be in the same row, may not be installed through the luminaire bodies. The Contractor shall ensure that continuous rows are straight and parallel to the relevant building lines.

12. RECESSED LUMINAIRES

12.1 Where recessed luminaries are specified, the Contractor shall maintain close liaison with the ceiling Contractor. In the case of tiled ceilings, the luminaries shall preferably be installed while the metal supports are being installed and before the tiles are placed in position. The Electrical Contractor shall be responsible for the co-ordination of the cutting of ceiling tiles with the other contractors concerned.

12.2 All mounting rings and other accessories shall fit closely into cut-outs to ensure a proper finish.

12.3 In all false ceilings where wiring channels are used, recessed luminaries shall be connected to the wiring channels by means of unswitched 5 A socket-outlets.

12.4 The following requirements shall be adhered to:

(a) Socket-outlets used shall comply with the Department's quality specification for "UNSWITCHED AND SWITCHED SOCKET-OUTLETS", par. 4 of Section 11 and shall be of 5 A minimum rating.

(b) The connector cord attached to the luminaire may not exceed 3m in length and shall consist of 1,5mm² minimum, 3-core, PVC-insulated flexible cord.

(c) The 5A socket-outlets shall be positioned such that they are not more than 600mm above the false ceiling.

13. SPECIAL CEILINGS

In cases where special ceilings e.g. aluminium strips, decorative glass, metal leaves, etc. are to be installed, the Contractor and the Manufacturer of the ceiling shall agree upon the method of fixing of luminaries in the ceiling.

14. BULKHEAD LUMINAIRES

Surface mounted bulkhead luminaries shall not be screwed directly to conduit ends. The conduit shall terminate in a round draw-box at the top or rear of the luminaire. The PVC-insulated conductors shall terminate in a porcelain terminal strip in the draw-box. Silicon-rubber-insulated conductors shall be installed from the terminal strip to the luminaire lamp-holder. "SCREW-IT" or similar connectors may only be used if prior permission is obtained from the Department.

15. TYPE OF CONDUCTOR

PVC-insulated conductors, unless protected by an approved heat-resistant sheathing, shall not be used where the temperature of the insulation is likely to exceed 70°C. In unventilated luminaries or luminaries capable of housing incandescent lamps over 60W, the interconnecting wiring from the lamp-holder to the circuit wiring shall consist of silicon-rubber insulated conductors. Silicon-rubber insulated conductors shall be used exclusively in the case of high bay fittings. Refer also to the provisions of SANS 10142.

16. WIRING OF LAMPHOLDERS

The central terminal of Edison Screw (E.S.-type) LAMP-HOLDERS shall be connected to the phase conductor and the screwed housing to the neutral conductor.

17. HIGH BAY LUMINAIRES

17.1 High bay luminaries shall be securely suspended from the roof structure.

17.2 The luminaries nay be fixed to suspended wiring channels containing the wiring on condition that:

(a) rigid channels with a maximum width of 42 mm be used,

(b) the channels are supported at intervals that will prevent sag or warp and

(c) the channels are large enough to accommodate the wiring.

17.3 Luminaries may be suspended from metal roof trusses with the aid of "CADDY" or similar fasteners.

17.4 Luminaries shall preferably be connected to unswithed 5A socket outlets. Silicon-rubber insulated flexible cord shall be used exclusively to connect the luminaire to the outlet.

17.5 A safety chain to keep the luminaire from falling when loosened shall be provided.

SECTION B10

B.10 CONNECTIONS TO EQUIPMENT

1. GENERAL

This section covers the final electrical connections to switchboards and various equipment in general electrical installations under normal environmental conditions for system voltages up to 600 V. Refer also to the Department's standard specifications for "WIRING", Section B5 and "INSTALLATION OF CABLES", Section B6.

2. CONNECTIONS TO SWITCHBOARDS

2.1 CONDUIT ENTRIES

2.1.1 Where sufficient space for conduit entries as well as adequate space for future conduit entries is available, conduits may be terminated directly on the switchboard.

2.1.2 Alternatively, conduits connected to switchboards shall terminate in a common fabricated sheet steel draw-box installed in the vicinity of the switchboard. In open roof spaces this draw-box shall be placed in a roof space of not less than 900mm clearance.

2.1.3 Lighting and socket-outlet circuits may be separately grouped in common conduits or metal ducts (trunking) from the distribution board to the draw-box. The drawbox shall be of sheet steel with a minimum thickness of 1,6mm and shall be fitted with a removable cover plate.

2.2 FLUSH MOUNTED SWITCHBOARDS

Where flush mounted switchboards are required, the recessed switchboard tray shall be built into the brick or concrete wall. All conduits from the floor or roof shall be fully recessed and shall be bonded directly to the tray by means of locknuts on both sides and the ends of the conduits fitted with a brass bush.

2.3 SURFACE MOUNTED SWITCHBOARDS

Where surface mounted switchboards are specified but where the conduits can be fully recessed, the conduit shall be connected to a recessed connection box installed behind the switchboard. An opening with the same dimensions as the connection box shall be cut in the back of the switchboard and fitted with a suitable grommet.

2.4 SPARE CONDUITS

Where conduits from a switchboard run into a false ceiling space above the board, a minimum of two 25mm and two 20mm spare conduits shall be installed into the ceiling space immediately above the board.

2.5 CABLE CONNECTIONS

2.5.1 Where underground cables are to be connected to switchboards, it shall be the responsibility of the Contractor to ensure that metal, earthenware, asbestos-cement or other approved sleeves are built in correctly to enable installation and connection of the cable to the switchboard.

2.5.2 PVC or pitch fibre sleeves are not acceptable - refer to par. 3.10 of the Department's standard specification for "INSTALLATION OF CABLES", Section B6.

2.5.3 Sleeves shall tie installed with a fall from inside to outside of the building to facilitate drainage. The sleeves shall be sealed with a non-hardening compound after installation of the cables to render the installation vermin proof and waterproof.

2.5.4 A metal cable channel with removable metal cover plate shall be installed by the Contractor and shall extend from the switchboard to the floor or into the ceiling void as required. The channel shall coincide with the position of sleeves. The channel shall be flush mounted except in the case of surface mounted switchboards and then only with the permission of the Department's representative.

2.5.5 The cable channel shall be large enough to permit the installation of cable glands and future cables, particularly where spare sleeves have been provided.

2.5.6 The colour of the channel cover shall match that of the associated switchboard.

2.6 CABLE TRENCHES

Where cables in floor trenches have to be connected to wall mounted switchboards, approved sleeves or conduits shall be installed from the side of the trench to the bottom of the switchboard. These sleeves shall be positioned and fixed before the concrete is cast.

3. CONNECTIONS TO MOTOR DRIVEN EQUIPMENT.

3.1 An isolator or starter containing an isolator shall be installed within 2m of motor driven equipment. The requirements of SANS 10142 shall be met. If this isolator cannot be installed on a wall, switchboard or other suitable place, an approved free-standing pedestal shall be provided. The pedestal shall be 1m high and outside normal walkways, access routes, etc.

3.2 The connection to the equipment shall be carried out as follows:

(a) Metal reinforced plastic or PVC-covered flexible metal conduits with individual conductors or a multi-core PVC insulated cable and separate bare earth conductor installed inside the conduit may be used. The flexible conduit shall not exceed 600mm. Screwed conduit shall be used from the end of the flexible conduit to the isolator and/or starter. Refer to the department's standard specification for "FLEXIBLE CONDUIT", Section B1, par. 5.

(b) Multi-core armoured PVC- or rubber-insulated cable and earth conductor. The installation and termination of the cables shall comply with the Department's specification for "INSTALLATION OF CABLES, Section B6.

(c) Cables and flexible conduits shall be provided with sufficient slack to allow positional adjustment of the equipment.

3.3 Supply cables to equipment may not be installed across floors which are for general use.

4. CONNECTIONS TO WATER HEATERS

4.1 Each water heater shall be connected to a separate circuit with a separate earth conductor.

4.2 The conduit from the switchboard to the water heater shall terminate in a draw-box within 1 m of the water heater terminals. The connection from the draw-box shall be conductors in conduit or PVC-insulated cable. Only in instances where heaters are mounted out of normal reach may flexible conduit and round boxes with dome lids be used for the final connection.

4.3 Three-phase supplies to fixed storage water heaters shall be in accordance with the wiring diagram, Fig. B10.1.

4.4 The mounting of the water heater and the provision of the water connections will be undertaken by others. The Contractor shall ensure that the elements and thermostats can easily be replaced.

4.5 Before testing a water heater, the Contractor shall confirm with the Plumbing Contractor that the unit is filled with water.

4.6 Unless otherwise specified in the Detail Technical Specification, the wiring of hot water heater circuits not exceeding 4 kW shall consist of 4mm² conductors and 2,5mm² earth conductor.

4.7 Unless it is specified that isolators for water heaters shall be provided in the switchboard, a local isolator shall be provided for each water heater. In the case of water heaters not exceeding 4 kW, a 30 A double-pole metal-clad isolator shall be surface mounted over the flush conduit outlet box.

5. CONNECTIONS TO HEATERS, FANS AND AIRCONDITIONING UNITS

5.1 ISOLATORS

A flush mounted suitably rated double-pole isolator shall be provided within 1m of the unit. Where the equipment is mounted out of reach, the isolator shall be installed at 1,5m above floor level. Only where units are mounted in easily accessible positions and where an isolating switch is incorporated in the unit, may this isolator be omitted. Where flush isolators are used, flush conduit shall be installed to link with the equipment outlet point. Flexible cords of sufficient rating may be used for the final connection to the equipment.

5.2 WIRING

The minimum conductor size to be used shall be 4 mm^2. Each fan, heater or air-conditioning unit shall be on a separate circuit.

5.3 FLUSH MOUNTED CONVECTION HEATERS

The heater frame or tray shall be built or cast into the wall at a height such that the underside of the heater is at 250mm above floor level. Conduits shall terminate on the frame near the terminals.

5.4 SURFACE MOUNTED EQUIPMENT

5.4.1 Connections to surface mounted equipment shall consist of a draw-box located in the vicinity of the terminals of the unit. In workshops and industrial areas the connections shall be made by means of flexible conduit connected to dome lids on the draw-box. Conductors shall be connected directly to the unit.

5.4.2 In non-industrial applications PVC-insulated 3-core flexible cables may be used for the connection.

5.4.3 Where flexible cables are used, a bush shall be provided at the rear of the unit for cable entry and a bush and clamp (or gripper gland) at the draw-box. The clamp shall tightly grip the outer insulation of the cable to prevent tension on the connections between cable and conductors in the draw-box.

5.4.4 Where heaters or air-conditioning units are situated above power skirting, the isolator shall be installed in the power skirting and the flexible cable or cord to the unit shall be installed in the power skirting through a gripper or compression gland. The cable shall be made as short as practical and shall be neatly saddled to the surface of the wall.

5.5 RADIANT HEATERS

The installation of radiant heaters and asbestos heaters, where specified, shall comply with the requirements of paragraph 5.4, with the exception that they shall be mounted on spacers, 25mm away from the mounting surface.

5.6 FAN HEATERS

5.6.1 The contractor shall allow for the supply, installation and electrical connection of the fan heaters as indicated on the drawings. The fan heaters shall be rated at 3 kW and shall be complete with control units.

5.6.2 The heaters shall be secured by means of approved expansion bolts at 2,4m above floor level in positions as shown, with the control units at 1,5m above floor level, directly below the unit.

5.6.3 The fan heater shall be installed on a box directly behind the unit.

5.6.4 Each connection shall be protected by means of a single-pole circuit-breaker on the associated switchboard.

5.6.5 Brass bushes shall be provided to protect the wiring at the rear cable entries to the control unit and fan connection box.

6. CONNECTIONS TO UNDERFLOOR HEATING

6.1 Where underfloor heating cable is specified, the Contractor shall supply the cable and thermostats which shall be purchased from a specialist supplier. The cable shall be laid by the specialist supplier and connected by the Contractor. The Contractor shall also be responsible for testing of the cables prior to their being covered by the screed and immediately thereafter. Details of circuit wiring and control of underfloor heating will be specified in the Detail Technical Specification.

6.2 PVC-insulated heating cable with a rating of not higher than 13 W per linear metre shall be used. Thermal insulation will be provided by the Builder.

6.3 The capacity of the heating cable shall he sufficient to give a 20°C temperature rise with an outside ambient temperature of 5°C.

6.4 The total heating load shall, however, not he more than 135 W/m².

7. CONNECTIONS TO INCINERATORS

7.1 GENERAL

This section covers connections to incinerators used for domestic purposes in buildings. Unless specified to the contrary, the supply and installation of incinerators will form part of the electrical installation and shall comply with the Department's quality specification, "INCINERATORS", SECTION C14.

7.2 FLUSH MOUNTED INCINERATORS

Where flush mounted incinerators have been specified, the Contractor shall supply the mounting tray to the Builder in good time for it to be built into the structure.

7.3 MOUNTING HEIGHT

Unless specified to the contrary, incinerators shall be installed with the bottom 1m above finished floor level.

7.4 ISOLATOR

A flush mounted 30 A double-pole isolator shall be installed approximately 1,5m above the finished floor level adjacent to each incinerator. The isolator cover plate shall wholly fall within either the tiled or plastered surface of the wall. Unless specified to the contrary, the cover plate shall be finished in white baked enamel. An engraved label shall be provided at each isolator marked as follows:

"SWITCH OFF TO CLEAN AND REMOVE ASH"
"SKAKEL AF VIR SKOONMAAK EN ASVERWYDERING"

7.5 FLUES

The Contractor shall supply flue pipes to the Builder for installation. Two bends and an "H" piece exhaust canopy shall be allowed for each flue pipe.

7.6 EXHAUST FANS

Where more than 5 incinerators are connected to the same flue or where more than two 90° bends are used in the flue, an exhaust fan shall be installed at the flue outlet. In addition a small fan must be provided at each incinerator.

7.7 WIRING

Single incinerators shall be connected by means of 2 x 4mm² PVC insulated conductors and a 2,5mm² bare copper earth conductor in a 20mm conduit. Each incinerator shall be connected to a separate circuit where a common exhaust fan is not used. Where a common exhaust fan is needed, the following applies:

(a) All fans and incinerators connected to the same flue shall be on the same circuit.

(b) The current rating of the circuit-breaker shall be sufficient to allow the simultaneous operation of all the fans and 50 % of the incinerators.

(c) A 30 A double-pole isolator shall be flush mounted adjacent to each incinerator as described in paragraph 7.4. However if the current rating of the circuit-breaker protecting the circuit is larger than 15A, a 15A fuse and fuse holder shall be installed at each incinerator in addition to the isolator. The draw-box and cover plate for the isolator shall be large enough to accommodate the isolator and fuse. Alternatively, a 15A circuit-breaker may be installed adjacent to each incinerator in lieu of the isolator and fuse.

(d) The circuitry shall be arranged to ensure that all the fans will operate when any one of the incinerators is switched on.

(e) Earth leakage protection shall be installed on all incinerator circuits.

8. CONNECTIONS TO COOKING APPLIANCES

8.1 Unless specified to the contrary, the circuit connection to each cooking appliance shall consist of:

(a) 2 x 10mm² PVC-insulated conductors and 6mm² bare copper earth conductor for single phase connections, or

(b) 4 x 4mm² PVC-insulated conductors and 2,5mm² bare copper earth conductor for three phase connections.

8.2 A 60A double pole or 30A triple pole micro-gap isolator flush mounted in a wall outlet box, shall be installed 1,5m above floor level to the left or right of the appliance in accordance with SANS 10142. A white baked enamel cover plate shall be provided, situated wholly on the tiled or plastered surface as applicable.

8.3 The conduit shall terminate 450mm above floor level behind the appliance position. The conduit end shall be approximately 75mm long and shall face downwards. Connections from the conduit end to the appliance shall be installed in accordance with SANS 10142. Sufficient slack shall be provided in the flexible connection to move the appliance 600mm away from its normal position for cleaning or maintenance.

8.4 Alternatively a 45A, 3-pin socket-outlet may be mounted on a round draw-box 450mm above floor level. The connection to the appliance shall consist of a plug and 10mm², rubber-insulated and sheathed cable in accordance with SANS 1520. The cable shall be long enough to enable the appliance to be moved 600mm from its normal position for cleaning or maintenance.

8.5 Crimped or soldered lugs shall be provided on all conductors intended for connection to cooking appliances.

8.6 Each appliance shall be connected to a separate circuit. A separate earth wire shall be provided for each appliance.

SECTION B11

B.11 EARTHING

This section covers the earthing of electrical installations in buildings or other structures. The total earthing system of any electrical installation shall be in complete accordance with SANS 10142.

1. GENERAL RECOMMENDATIONS ON THE PRACTICAL INSTALLATION OF EARTH ELECTRODES

1.1 REQUIREMENTS OF AN EFFECTIVE EARTH

1.1.1 An effective earth must prevent dangerous over voltages arising between metallic structures, frames, supports or enclosures of electrical equipment and the ground during fault conditions.

1.1.2 An effective earth must be able to permit fault currents of sufficient magnitude to flow so as to operate protective devices to isolate the fault before damage can occur.

1.1.3 The ohmic resistance of an effective earth must be low enough to ensure that the step potential on the ground in the vicinity of the earthing point is within safe limits under fault conditions i.e. a voltage gradient not exceeding 40 V/m for fault durations exceeding 1s.

1.2 TYPES OF EARTH ELECTRODES

Three types of earth electrodes are suitable:

1.2.1 Trench Earths

Trench earths comprise a bare copper or galvanised iron conductor laid at a minimum of 800mm below ground level, usually when underground cables are installed. This type of earth electrode provides a relatively large contact area between electrode and surrounding ground, makes contact with a variety of types of soil and soils of varying moisture content en route and is economical to install.

1.2.2 Spike Earths

Spike earths comprise rods of bare copper, copper-coated steel, stainless steel or galvanised steel designed for the purpose of penetrating ground to depths of up to several metres. A low resistance earth may sometimes be obtained by driving multiple spikes at some distance from each other in order to provide parallel paths.

In hard or rocky ground, it is usually necessary to drill holes into which earth spikes are inserted and then packed with soft soil.

1.2.3 Foundation Earths

Foundation earths comprise bare copper or galvanised iron conductors laid under the foundations of buildings, miniature substations, distribution pillars, bases of wooden, concrete or steel poles and structures. Because soil under foundations usually retains moisture, foundation earths are located to take advantage of this favourable condition. Furthermore, they are economical to install.

1.3 MATERIALS FOR EARTH ELECTRODES

1.3.1 Bare copper, either in stranded, strip or rod form, is considered the most suitable general purpose material for earth electrodes. Its main disadvantage is its cost and susceptibility to theft.

1.3.2 Bare galvanised iron and steel, either in stranded, strip or rod form, has a satisfactory record of survival in non-aggressive soils and is more economical than copper.

1.3.3 Bare aluminium is unsuitable as electrode material.

1.4 CORROSION

Because galvanised ferrous metals corrode sacrificially to copper, galvanised iron and steel electrodes should not be buried in close proximity to bare copper.

2. TECHNICAL REQUIREMENTS OF NEUTRAL EARTHING

The following relevant aspects have been extracted from the "AMEU CODE OF PRACTICE FOR THE APPLICATION OF NEUTRAL EARTHING ON LOW VOLTAGE DISTRIBUTION SYSTEMS."

2.1 DISTRIBUTION SYSTEMS

Multiple Earthed Neutral (MEN) and Protective Multiple Earthing (PME) systems.

Distribution equipment associated with transformer substations that are either ground mounted or pole mounted and fed by underground cable or overhead line, with or without an earth continuity conductor, (ECC), should be installed, connected and earthed in accordance with the following requirements:

(a) Where the resistance to earth of the HV equipment earth is 1 ohm or less, it is permissible to earth the LV neutral to the HV earth electrode.

(b) Where the HV equipment earth exceeds 1 ohm the LV neutral shall be earthed at a minimum distance of 6m from the HV equipment earth (i.e. 6m from the HV electrode/s and also from any earthed metalwork connected thereto).

(c) Notwithstanding the requirements of (a) above, where transformers are associated with HV overhead lines, it is considered good practice to separate the HV and LV earth electrodes. The minimum earth separation should be 6m or one LV span.

(d) The overall resistance to earth of the neutral of an LV distributor or distribution system must not exceed 10 ohms.

(e) The LV neutral may be connected to other supply neutrals, earth electrodes, cable sheaths and armouring and these connections used to obtain the required earthing value of 10 ohms or less specified in par. (d). above.

(f) The neutral of underground and overhead LV distributors must be earthed at the remote ends of each distributor.

(g) Where the overall resistance to earth of the neutral of the distribution system exceeds 10 OHMS, the neutral shall be earthed at intermediate positions on the distributor/s to reduce its resistance to earth to below this limit.

(h) The cross-sectional area of the neutral of all LV distributors must not be less than that of a phase conductor.

(i) No circuit-breakers, isolators, fuses, switches or removable links shall be installed in the neutral between the transformer star point and the remote end of any LV distributor or service connection.

(j) All metallic sheathing and armouring of cables and all metalwork associated with meter cabinets, fuse pillars, etc., supporting or enclosing LV cables shall be bonded to the distributor neutral conductor.

(k) Where a Separate Neutral Earth (SNE) cable is part of an MEN or PME system, the armouring and/or metallic sheath and any ECC shall be bonded to the neutral at the supply end of the cable.

(l) To ensure the integrity of the neutral, it is recommended that all connections and joints on or to overhead line conductors be made by compression fittings or, alternatively double bolted connectors.

(m) MEN or PME may be applied to any single LV distributor without alterations to other LV distributors supplied from the same transformer.

2.2 PROTECTIVE NEUTRAL BONDING (PNB) SYSTEM

Since the neutral is earthed at one point only, the question of multiple earthing does not arise and there is therefore no necessity to meet the MEN/PME technical requirements.

2.3 SERVICE CONNECTIONS

2.3.1 MEN System

The following conditions apply to consumers' service connections as well as service connections to traffic signals, road signs, street lighting and other power-consuming equipment installed in public places:

(a) All service connections must be by means of cable with an insulated phase, an insulated neutral conductor and an ECC.

(b) A single phase service connection comprises a live, a neutral and an ECC.

(c) A polyphase service connection comprises two or three phase conductors, a neutral and an ECC.

(d) The service neutral and ECC must be solidly and separately connected to the distributor neutral at the tee-off point.

(e) The consumer's earthing lead is connected to the Supply Authority's earth terminal which is in turn connected to the ECC in the service cable at the consumer's supply point.

(f) The neutral must not be connected to earth at the consumer's supply point.

(g) If required by the Supply Authority, and earth electrode must be installed at the consumer's supply point.

(h) In a service connection to traffic signals, street light and other power-consuming equipment installed in public places, such equipment is earthed to the ECC of the service connection.

2.3.2 PME System

(a) All service connections must be by means of a cable with an insulated phase and an insulated neutral conductor.

(b) A single phase service comprises a live conductor and a neutral.

(c) A polyphase service connection comprises two or three phase conductors and a neutral.

(d) The consumer's earthing lead is connected to the supplier's neutral and to a mandatory earth electrode at the consumer's supply point.

(e) A label must be attached at the consumers supply point on his premises indicating that the installation is part of a PME system.

Note: It is not recommended that the PME system be applied to supply traffic signals, street signs or other power-consuming equipment installed in public places, because the PME system is inherently unsafe under "broken-neutral" conditions.

3. SUBSTATION EARTHING

In order to comply with the requirements of par. 1 and 2 above, an earth resistivity measurement shall be undertaken at the site of a new substation or miniature substation, preferably be a specialist firm. The contractor shall then submit to the Department details of a proposed substation earth indicating whether a trench earth, spike earth or foundation earth is intended and the proposed interconnections with the installation.

4. FENCES OF OUTDOOR SUBSTATIONS

In cases where substations contain transformers or switchgear installed outdoors, the compulsory fence shall be earthed as follows, if no other method is specified :

(a) A 70mm² earth wire shall be installed 400mm below ground level and 500mm from the fence on the outside of the sub-station along the entire length of the fence. This earth wire shall be earthed at each corner by means of a 1,8m earth rod and the rod and earth wire bonded to the fence. The earth wire shall also be bonded, at least at two points, to the main earthing system.

(b) A 70mm² earth wire shall also be buried at a depth of 400mm around each transformer and switch and bonded to the main earthing system.

5. EARTHING OF A GENERAL ELECTRICAL INSTALLATION

5.1 GENERAL

All earth conductors shall be stranded copper with or without green PVC insulation. The conductors shall comply with the Department's quality specification for "PVC-INSULATED CABLES", Section C4. All earth conductor sizes shall be determined in accordance with SANS 10142, par. 4.6 where the earth does not form an integral part of the cable.

5.2 SWITCHBOARDS

A separate earth connection shall be supplied between the earth busbar of the main switchboard and the earth busbar of every sub-switchboard. These connections shall consist of 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.

5.3 SUB-CIRCUITS

The earth conductors of all sub-circuits shall be connected to the earth busbar in the supply switchboard in accordance with SANS 10142.

5.4 RING MAINS

Common earth conductors may be used where various circuits are installed in the same wiring channel in accordance with SANS 10142. In such instances the sizes of earth conductors shall be specifically approved by the Department. Earth conductors for individual circuits branching from the ring main shall be connected to the common earth conductor with T-ferrules or soldered. The common earth shall not be broken.

5.5 CONNECTIONS

Under no circumstances shall 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. Unless earth conductors are connected to proper terminals, the ends shall be tinned and lugged. Lugs may be crimped, using mechanical or pneumatic tools designed for this purpose, on condition that evidence is submitted that the method used complies with the performance requirements of BS 4579, Part 1: "COMPRESSION JOINTS IN COPPER."

5.6 NON-METALLIC CONDUIT

Where non-metallic conduit is specified or allowed, stranded copper earth conductors shall be installed in the conduits and fixed securely to all metal appliances and equipment, including switch boxes, socket-outlet boxes, draw-boxes, switchboards, luminaries, etc. The securing of earth conductors by means of self-threading screws will not be permitted.

5.7 FLEXIBLE CONDUIT

An earth conductor shall be installed in all non-metallic flexible conduit. This earth conductor shall not be installed external 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.

5.8 WATER PIPES

Metal cold water mains shall be bonded to the earth busbar in the Main Switchboard by solid 15 x 2mm copper strapping. All other hot and cold water pipes shall be connected by 12 x 0,8mm perforated or solid copper strapping (not conductors) to the nearest switchboard. The strapping shall be fixed to the pipe work by brass nuts and bolts and against walls be brass screws at 150mm centres. In all cases where metal water pipes, down pipes, flues, etc. are positioned within 1,6 m of switchboards, an earth connection consisting of copper strapping shall be installed between the pipe work and the board. In vertical building ducts accommodating both metal water pipes and electrical cables, all the pipes shall be earthed at each switchboard.

5.9 ROOFS

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 of each switchboard. The roof and gutters shall be connected at 15m intervals to this conductor by means of 12 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.

SECTION B12

B.12 PROVISION FOR TELEPHONE INSTALLATION

1. CONTRACTOR'S RESPONSIBILITY

The Contractor shall only supply and install outlet points, wiring channels and/or conduits for telephones. The telephone installation will be carried out by others.

2. REGULATIONS

All provisions for telephones in buildings shall comply with the latest issue of "FACILITIES FOR TELECOMMUNICATION SERVICES IN BUILDINGS" as issued by the Department of Posts and Telecommunications.

3. SEPARATION OF SERVICES

3.1 Cables or conductors for telephone services shall be separated from all other services by:

(a) providing separate metal channels or conduits, or

(b) installing power cables, conductors and accessories at a minimum distance of 300mm from routes reserved for telephone cables, or

(c) an earthed metal barrier installed in such a manner to ensure that the minimum distance through free air space between the telephone cables and other services is at least 300mm.

3.2 In cases where high voltage cable runs are parallel to telephone cable runs for more than 50m, the correct spacing shall be determined by conferring with the Department of Posts and Telecommunications.

3.3 Conduits or wiring channels provided for telephone services may not be used for any other purpose. Where non-metallic channels are used, the separation stated in par. 3.1 (b) shall he maintained throughout the installation.

4. MAIN TELEPHONE DISTRIBUTION BOARD

4.1 The size and position of the Main Telephone Distribution Board, where required, shall be in accordance with the requirements of the Detail Technical Specification.

4.2 The board shall consist of a metal tray, architrave frame and hinged doors and shall be flush mounted in the position shown on the drawing(s).

4.3 A 20mm thick soft wooden panel (fine grade pine to SANS 1359, without knots) shall be installed in the main telephone distribution board and shall cover the entire back of the board. Chipboard or similar materials are not acceptable.

4.4 All conduits and sleeves to telephone outlets or sub-distribution boards in the buildings or on the site as well as the main incoming sleeves, shall terminate at the main telephone distribution board as indicated on the drawing(s).

4.5 Where 100 x 100 x 50mm draw-boxes are specified as main or sub-distribution boards, the boxes shall be flush mounted and provided with a cover plate. A wooden panel need not be provided in these cases.

5. VERTICAL BUILDING (SERVICE) DUCTS

5.1 If the telephone cables are to be installed in the same duct as power cables the separation of services described in par. 3 shall be maintained.

5.2 Conduits and metal channels to and from building duct(s) shall be installed from the section containing the telephone cables to obviate telephone cables crossing power cables or other services in the duct.

5.3 Where more than one vertical building duct is provided in the structure, the ducts shall be interconnected by at least 2 x 32mm dia. conduits at each floor level unless otherwise specified or indicated on the drawings.

6. TELEPHONE OUTLETS

6.1 Blank cover plates shall be fitted to all telephone outlets.

6.2 Telephone outlets in walls shall consist of flush mounted 100 x 100 x 50mm draw-boxes.

6.3 Telephone outlets in floors shall be of the same type as floor outlets for power socket-outlets. These provisions also apply to underfloor ducting. If the type of floor outlet is not specified, 100 x 100 x 50mm flush mounted draw-boxes shall be provided in the floor at the positions indicated on the drawings. The cover plates for these draw-boxes shall be of the diecast type.

6.4 Where twin underfloor ducts are provided and where the one duct is intended for telephone cables, the separation between the ducts shall be maintained throughout the underfloor ducting installation.

6.5 Where power skirting is specified for telephone installations, the Contractor need only install the skirting with covers since the telephone socket will be fixed directly to the cover. Where multiple power skirting is provided containing other services, no other cables may be installed in the section intended for telephone cables and the separation between the sections shall be maintained throughout the installation.

6.6 Refer also to the Department's standard specification for the "INSTALLATION OF WIRING CHANNELS, UNDERFLOOR DUCTING AND POWER SKIRTING", Section B2.

7. CONNECTION OF TELEPHONE OUTLETS

7.1 Telephone outlets shall be inter-connected and connected to the telephone distribution boards as shown on the drawings.

7.2 If the inter-connecting conduits are not specified, conduit sizes shall be determined as follows:

Inter-connection of 10 outlets maximum - 25mm dia. conduit.

Inter-connection of 20 outlets maximum - 32mm dia. conduit.

7.3 Metal channels or power skirting installed on the same floor level on opposite walls of the same area as well as parallel runs of underfloor ducting intended for the installation of telephone cables, shall be interconnected at intervals of 6m. Conduit may be used for these inter-connections.

7.4 All conduits and all ducts or channels which do not have removable covers, shall be provided with galvanised steel draw-wires.

7.5 Conduit connections to power skirting or surface mounted metal channels, shall consist of a 100 x 100 x 50mm draw-box which is flush mounted immediately behind the duct or channel in which the telephone cables are to be installed. A hole shall be cut in the back of the duct or channel, immediately opposite the draw-box. The edges of the hole shall be grommeted. The draw-box shall be accessible from the front when the cover is removed.

7.6 Purpose-made accessories for the connection of conduits to underfloor ducts shall be used. Where these are not available, a 100 x 100 x 50mm draw-box shall be installed below the underfloor duct opposite a floor telephone outlet. Inter-connecting conduits shall terminate at the draw-box. The edges of the hole shall be grommeted. The draw-box shall be accessible from the top via the floor outlet.

7.7 Exposed conduit ends intended for future extensions shall be terminated by means of a coupling and screwed brass plug. Only galvanised conduit shall be used in these instances.

SECTION B13

B.13 SUBSTATIONS SWITCH ROOMS AND GENERATOR ROOMS

This section covers the general building arrangement and special requirements for high and low voltage switch rooms, transformer rooms and generator rooms.

1. STANDARD BUILDINGS

The following list indicates the standard substation designs and corresponding standard departmental drawing number which are available.

1.1 High voltage room, transformer room for one transformer up to 800kVA, low voltage room and a generator room for one emergency generator set from 200 to 500kVA ..... EE/136/131A.

1.2 High voltage room, transformer room for one transformer up to 800kVA, low voltage room and a generator room for one emergency generator set from 80 to 200kVA ..... EE3/136/131B.

1.3 High voltage room, transformer room for one transformer up to 800kVA, low voltage room and a generator room for one emergency generator set up to 30kVA ..... EE3/136/131C.

1.4 High voltage room, transformer room for one transformer up to 800kVA and low voltage room ..... EE3/136/131D.

1.5 High voltage room, transformer room for one transformer up to 800kVA, low voltage room and a generator room for two emergency generators up to 200kVA each ..... EE3/136/131E.

1.6 Large high voltage room, transformer room for one transformer up to 800kVA and low voltage room..... EE3/136/131F.

1.7 High voltage room, transformer room for two transformers of up to 800kVA each, large low voltage room and a store room ..... EE3/136/131G.

1.8 Emergency generator buildings..... EE3/136/118.

2. OTHER BUILDINGS

If the standard buildings cannot accommodate the equipment required, suitable substation rooms complying with the following constructional details shall be provided:

2.1 The rooms shall have a ceiling height of at least 2,8 m above finished floor level.

2.2 A concrete roof slab shall be provided or alternatively a roof consisting of corrugated iron, or clay or cement tiles with an asbestos ceiling.

2.3 The rooms shall be waterproof, vermin proof and fireproof.

2.4 Door openings shall be 1,85 m wide by 2,5 m high with steel louvered ventilation openings over at least 60 % of the door area. Doors shall open outwards and it shall be possible to readily open them from the inside. Provision shall be made for a night latch and a padlock.

2.5 The floor and transformer base shall be on the same level. Each transformer base shall be able to support a mass of 5 tons on castors.

2.6 Vermin proof steel louvered ventilation openings shall be provided with an area of at least 20 % of the total floor area for transformer and generator rooms and 10 % for switch rooms if not specified to the contrary. 50 % of the ventilation openings shall be installed in the lower part of the walls, not more than 300 mm above floor level and the other 50 % of the ventilation openings shall be installed in the upper part of the walls, not more than 300 mm below ceiling level to achieve good cross and convection

ventilation. Louver's contained in the doors can normally be considered to provide the 50 % required in one of the walls.

2.7 Where possible, windows with an area equal to 5 % of the floor area shall be included to provide natural lighting. It shall not be possible to open these windows. The windows shall be in the upper portion of the walls, as high as possible.

2.8 Corners of transformer bases and cable ducts shall be cut off at an angle of 45° with the splay at least 100mm wide.

2.9 Cable entrance openings shall be at least 600mm wide x 500mm deep and level with the bottom of the cable trenches. Alternatively a separate sleeve for each cable and at least one spare sleeve, shall be provided.

2.10 Cable trenches shall be 600mm wide and 800mm deep unless specified to the contrary.

2.11 The floors of cable trenches shall have a fall of 1:100 to make provision for the natural draining of water.

2.12 At least one light with a switch adjacent to the entrance and one standard 16A 3-pin earth leakage protected socket outlet shall be provided in each room. The illumination level in the substations shall not be less than 200 lux. If a battery supply is available one incandescent light per substation room shall be connected to this supply and the switch in the circuit marked "EMERGENCY LIGHT"/"NOODLIG".

2.13 The floors shall be floated to a smooth finish with a steel trowel.

2.14 Any one of the following interior wall finishes is acceptable:

(a) Plastered and painted white.

(b) Unpainted face brick (preferably light colour brick).

(c) Off-shutter concrete painted white.

3. NOTICES

The following notices in both official languages shall be exhibited at all entrances to and suitable places within premises in which are situated generating plant and transforming, switching or linking apparatus:

A notice showing the "Lightning" sign with the wording: Danger-Ingozi-Gevaar.

3.1 A notice prohibiting unauthorised persons from entering such premises.

3.2 A notice prohibiting any unauthorised persons from handling or interfering with electrical apparatus.

3.3 A notice detailing procedure in case of fire.

3.4 A notice containing directions for resuscitation of persons suffering from the effects of electric shock.

4. HIGH VOLTAGE SWITCH ROOMS (ABOVE 1 KV)

4.1 The equipment shall be installed and secured to the floor in accordance with the manufacturer's specification.

4.2 Sufficient space shall be provided between the switchboard and the walls of the switch room to allow for the installation, maintenance and operation of the switchboard.

4.3 In the case of switchboards with uninsulated conductors accessible from the back, a clear space of at least 1,2 m shall be provided between the back and sides of the board and the wall.

4.4 In the case of switchboards which are of a totally enclosed construction the minimum clear space between the back and sides of the board and the wall shall be at least 900mm.

4.5 A space of at least 1,2 m shall be provided in front of a switchboard for operating and maintenance personnel. If the circuit breakers are of the withdrawable carriage type this space shall be at least 900 mm when the breaker carriages are in the fully withdrawn position.

4.6 The access door into the room shall be in front of the switchboard.

4.7 The tools and earthing and operating devices for the switchgear shall be contained in a purpose-made sheet metal cupboard secured to the wall of the substation.

4.8 A reticulation diagram displaying sufficient detail to be able to assess problems and trace faults (both on the HV and LV sides of the system) shall be mounted against a wall in the HV switch room behind clear plastic.

5. LOW VOLTAGE SWITCH ROOMS (BELOW 1 KV)

5.1 The equipment shall be installed and secured firmly to the floor or wall of the switch room.

5.2 Sufficient space shall be provided between the switchboard and the walls of the switch room to allow for the installation, maintenance and operation of the switchgear. In general this space shall be 900mm at the back and sides of the board and 1,2 m in front of the switchboard.

5.3 In the case of switchboards with uninsulated conductors which are exposed and accessible from the back a clear space of at least 1,2 m shall be provided at the back.

5.4 A LV reticulation diagram displaying sufficient detail of at least the main LV reticulation in order to be able to assess problems shall be mounted against a wall in the LV switch room behind clear plastic.

6. TRANSFORMER ROOMS OTHER THAN IN STANDARD BUILDINGS

6.1 Transformer rooms shall be large enough to accommodate the transformer with a 900mm clear space between the walls and the transformer. The minimum dimensions of a transformer room shall in any case be not less than 3,5m wide and 4,0m long.

6.2 The dimensions of the room shall be determined by using the transformer dimensions of TABLE 2 of SANS 780.

6.3 Where natural cross ventilation of the transformer room is not possible, adequate forced ventilation shall be provided to dispose of the transformer's losses and to prevent the air temperature in the transformer room from exceeding 40 C.

6.4 The cable entrances to the transformer room shall be sealed off after the cables have been installed.

7. GENERATOR ROOMS OTHER THAN IN STANDARD BUILDINGS

7.1 The ventilation of generator rooms shall be sufficient to dispose of the heat radiated from the engine while delivering full power.

7.2 The heat from the radiator shall be released outside the building via a ventilation duct or an external heat exchanger.

7.3 The exhaust emission shall be released outside the building and shall comply with the local environmental control regulations.

7.4 The fuel storage tank shall be installed in compliance with SANS 10131 and the position shall be approved by the local Fire Department. When the storage tank must be located outdoors, it should be underground to insulate the fuel from severe temperature variations which may impede fuel flow.

7.5 An electrical schematic diagram indicating mains supply and change-over arrangement as well as all standby plant electrical control circuitry, shall be mounted on a wall behind clear plastic.

7.6 An emergency light with automatically rechargeable Nickel-Cadmium batteries shall be installed above the generator set to facilitate manual starting or fault tracing in the event that the set does not start during a power failure.

8. CABLES

8.1 Cables shall be installed in cable trenches which shall be provided for this purpose. The installation shall comply with the Department's standard specification for "INSTALLATION OF CABLES", par. 5 of Section B6.

8.2 Under normal circumstances cables shall not be installed directly on the floor.

9. COVERING AND SEALING OF CABLE TRENCHES

9.1 All the cable trenches shall be covered with steel chequer plate or a compound wood, bound with a water resistant binder, or an approved fibreglass grating. The following types of compound wood coverings are acceptable:

(a) Five ply marine ply, 12 mm thick.

(b) Exterior grade particle board, 22mm thick.

(c) Tempered hardboard, 12,7mm thick.

9.2 The trench coverings shall be ridged and shall not sag more than 5 mm with two normal persons standing on one section.

9.3 The trench covering shall be in sections not exceeding 1,25 m.

9.4 The trench coverings shall be provided with holes or recessed handles to make it possible to remove and replace the covers easily.

9.5 The trench coverings shall be neatly cut where necessary to accommodate cables.

9.6 The covers shall overlap the trench on both sides and shall be recessed to fit flush with the surface of the floor.

9.7 The cable entrances in the trenches of the switch rooms, transformer rooms and generator rooms shall be closed and sealed after the cables have been installed to prevent the backfill material and water from entering the trenches in the building.

9.8 The cable entrances shall be closed with bricks, without mortar, in such a way as to prevent the weight of the bricks from resting on the cables. These bricks shall be plastered on the inside with a 10:1 ratio of sand and cement.

9.9 If the cables enter the trenches via sleeves, these sleeves shall be plugged on both sides with weak mortar, an asbestos and cement mixture or a non-hardening compound.

SECTION B15

B.15 INSPECTIONS, TESTING, COMMISSIONING AND HANDING OVER

1. PHYSICAL INSPECTION PROCEDURE

1.1 Once the Contractor has completed the installation, written notice shall be given to the Department in order that a mutually acceptable date can be arranged for a joint inspection.

1.2 During the course of the inspection, the representative of the Department will compile a list of items (if any) requiring further attention. A copy of this list will be provided to the Contractor who will have a period of 7 days in which to rectify the offending items of the installation.

1.3 The Contractor shall then provide written notice that he is ready for an inspection of the remedial work to the offending items.

1.4 This procedure will continue until the entire installation has been correctly completed to the satisfaction of the Department.

2. TESTING AND OPERATIONAL INSPECTION PROCEDURE

2.1 In addition to the above the Contractor shall have the complete installation tested and approved by the local authorities where applicable.

2.2 Subsequent to the above testing and approval, the Contractor shall in the presence of the representative of the Department test all circuits with respect to:

(a) Phase balance.

(b) Insulation level.

(c) Polarity.

2.3 Upon completion of the installation and within 3 months of the handover date, the Contractor shall provide and make available a recording voltmeter to record the voltage at three locations in the complex over a period of 48 hours each. These locations will be nominated by the Department.

3. "AS BUILT" DRAWINGS

3.1 As each portion of the work is completed, the Contractor shall provide the Department with as-built drawings showing the exact location measured from fixed points of all cables, transmission lines, each outlet point, etc.

3.2 In addition a complete reticulation diagram showing all supply cables and switchboards shall be provided behind a plastic cover in the substation or adjacent to the Main Switchboard if not located in a substation.

3.3 The installation will not be regarded as complete until all of the above requirements listed in 1, 2 and 3 above have been met.

KWAZULU-NATAL PROVINCE

PUBLIC WORKS & INFRASTRUCTURE

REPUBLIC OF SOUTH AFRICA

GENERAL JUSTICE GIZINGA MPANZA REGIONAL HOSPITAL NEW 28 BEDDED MALE AND FEMALE INPATIENT AND OUTPATIENT MENTAL HEALTH UNIT

ELECTRICAL INSTALLATION

SECTION 2: PROJECT SPECIFICATIONS

SECTION TWO

PROJECT SPECIFICATIONS FOR ELECTRICAL INSTALLATIONS

TABLE OF CONTENTS

1. **GENERAL**

This Project Specification must be read together with the General Electrical Specification for electrical works. In case of conflict, the project specification shall take preference.

This Project Specification together with the drawings and bills of quantities describe the scope of works to be executed in terms of this documentation and takes precedence over the General Electrical Specification.

2. **PROPRIETARY MATERIALS, SYSTEMS, ETC.**

Any reference in these Bill of Quantities to trade or brand names (and catalogue numbers, etc.,) shall be deemed to be followed by the words "or other approved". Refer to Clause 15 on page GA3 for definition of "approved" and for procedure to be followed.

The Tenderer's special attention is drawn to the fact that in connection with the aforementioned where ever any wording with meanings equating with similar to, equal to, equivalent to, etc, are used in combination with a trade or brand names (and catalogue numbers, etc.,) they shall be deemed to be omitted and entirely replaced by the trade or brand names (or catalogue numbers, etc.,) followed by the words "OR OTHER APPROVED". This will take precedence over any contradictory clause or note appearing anywhere on these Bills of Quantities.

3. **REGULATIONS, FACTORIES ACT AND BY-LAWS**

3.1 The latest issue of the SANS 10142 "Code of Practice for the Wiring of Premises", hereafter called the "Wiring Code".
3.2 The Machinery and Occupational Safety Act No. 85 of 1993.
3.3 The Municipal By-Laws and any special requirements of the local Supply Authorities.
3.4 The local Fire Office Regulations.

4. **NOTICES AND FEES**

The Contractor shall give all notices required by and pay all necessary fees, including any inspection fees, which may be due to the local Supply Authority. The fee charged by the Supply Authority for connection of the installation to the supply mains, will be arranged and paid by the Contractor.

5. **QUALITY OF MATERIALS**

Only materials of first-class quality shall be used, and all materials shall be subject to the approval of the Engineer.

Wherever applicable, material is to comply with the relevant South African Bureau of Standards Specifications, or to British Standard Specifications, where no SANS Specifications exist.

Materials, wherever possible, must be of South African manufacture.

6. **SITE**

The Tenderers must, before submitting their tenders, acquaint themselves with the local conditions, accessibility of the sites, soil conditions, availability of labour and labour conditions, transport, off-loading, store and custody conditions for materials and equipment necessary for the completion of the total contract. No claim based on ignorance in this regard shall be considered.

7. **SCOPE OF CONTRACT**

The sub-contract comprises the supply, delivery, off-loading, storage, installation, commissioning, testing, handing over and maintenance for the period stated in the tender document and applicable drawings for the GJG hospital new psychiatric ward.

The facility comprises of single double storey building block with the following areas:

Administration and Reception area
Out patient Department area
Male Ward Clinical area
Female ward Clinical Area
Clinical supporting staff area
Pharmaceutical area
Basement parking area

This installation consists of the following:

- Supply and installation of distribution kiosk.
- Supply and installation of low voltage cable reticulation.
- Supply and installation of low voltage distribution boards.
- Supply and installation of complete lighting layout.
- Supply and installation of complete small power layout.
- Supply and installation of Data, Telephone and PABX
- Supply and installation of Alarm and CCTV System
- Fire Detection and Public Address System
- Supply and installation of Lightning Protection and Earthing System.
- Supply and installation of roof top solar systems
- Supply and installation of MV mini-substation
- Supply and installation of MV cable reticulation
- Standby emergency generator connection

The tenderer's attention is drawn to the fact that they must include in their tender price for all equipment, material, labour and additional costs, in order to carry out the installation in its entirety and to complete it in accordance with the Specification and applicable drawings and to the satisfaction of the Engineer.

8. **ELECTRICITY SUPPLY**

The supply authority to the area is Kwadukuza Municipality. Allowance have been catered in the bill of quantities for a new mini substation to supply power to the new ward. The Contractor is required to liaise and arrange in good time with the hospital electricians for the conection of the new mini substation to the existing hospital MV network

9. **"AS BUILT" DRAWINGS**

The Contractor is to prepare the "as-built" paper prints in strict accordance with this specification. These drawings are to be kept in the site office. The "AS BUILT" drawings shall be handed over to the Engineer at First Delivery. Retention money normally due before commencement of the maintenance period will not be released until "as-built" drawings have been prepared to the satisfaction of the Engineer.

10. **SUPERVISION**

Work must under all circumstances be supervised by a qualified and experienced representative of the Contractor who must be the holder of an electrical installation certificate. The representative must be authorised by the Contractor and must be able to receive instructions on behalf of the Contractor.

11. CERTIFICATE OF COMPLIANCE BY AN ACCREDITED PERSON

On completion of the electrical installation, the Contractor shall complete the Certificate of Compliance for the electrical installation in the form of Annexure 1 as described in the Occupational Health and Safety Act No. 85 of 1993, as amended, and obtainable from the Electrical Contracting Board of South Africa. This form must be handed to the Engineer at first delivery.

12. ELECTRICAL EQUIPMENT

All fittings, material and equipment and component parts thereof are to be in accordance with the Specification and must have the approval of the Engineer. In addition, all equipment shall be designed, manufactured and tested in accordance with the relevant South African Bureau of Standards Specification, or otherwise, the relevant British Standard Specification.

All material and equipment must be suitable for the supply voltage 400/230V, and the necessary precautions shall be taken against corrosion, i.e. exposed metal shall be anti-rust treated to approval and all metalwork to be galvanised or painted.

13. CABLES

13.1 General

Supply, install and terminate all the low voltage cables specified in this document. See schedule of cables below in paragraph 13.2.

Bare hard drawn copper earth continuity conductors are only to run with the underground cables if cables used are not ECC cables. The earth conductors must be bound to the cables at intervals not exceeding 1 meter.

Conductor isolation, which is colour coded by a line only, will not be accepted. The total isolation must have the phase colour.

13.2 Cable Schedule

The following cables must be supplied and installed by the Contractor:

From	To	Cable Size	Bare Earth Conductor Size
Existing 500KVA generator Emergency LV Panel	MEDB	185mm² x 4 core	25mm²
New Mini Substation No4	MDB	185mm² x 4 core	25mm²
MDB	DB13	95mm² x 4 core	25mm²
MDB	DB12	35mm² x 4 core	16mm²
MEDB	EDB1	25mm² x 3 core	16mm²
MEDB	EDB2	35mm² x 3 core	16mm²
MEDB	EDB3	16mm² x 3 core	10mm²
MEDB	EDB4	16mm² x 3 core	10mm²
MEDB	EDB5	35mm² x 3 core	16mm²
MEDB	EDB6	16mm² x 3 core	10mm²
MEDB	EDB7	16mm² x 3 core	10mm²
MEDB	EDB8	25mm² x 3 core	16mm²
MEDB	EDB9	16mm² x 3 core	10mm²
MEDB	EDB10	25mm² x 3 core	16mm²
MEDB	EDB11	25mm² x 3 core	16mm²
MEDB	EDB12	25mm² x 3 core	16mm²
MEDB	EDB13	25mm² x 3 core	16mm²
EDB1	UPSDB4	10mm² x 3 core	6mm²
EDB5	UPSDB1	10mm² x 3 core	6mm²
EDB6	UPSDB2	10mm² x 3 core	6mm²
EDB7	UPSDB3	10mm² x 3 core	6mm²

13.3 **Installation**

(a) **Testing**

All low voltage cables must be tested on site, in the presence of the Engineer. All test results must be submitted to the Engineer.

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

(b) **Marking Tape**

Yellow PVC marking tape, 150mm wide, must be supplied and installed above all cables as indicated on the cable reticulation drawing. The wording "Electric Cable Below – Caution" and "Elektriese Kabel Hieronder – Gevaar" must be provided on the marking tape.

(c) **Cable Lengths**

Tenderers must base their tender price on the preliminary lengths specified in the Bills of Quantities. After installation, the exact lengths shall be determined on site. Adjustments to the contract price shall then be calculated tariffs in the Bills of Quantities.

It shall be the responsibility of the Electrical Contractor to establish the correct lengths of cable on site, before placing an order. The Contractor shall not be

reimbursed for any surplus cable.

(d) **Cable Laying**

Cables must be removed from the drums in such a manner that the cable is not subjected to mechanical damage, twisting or tension exceeding that stipulated by the cable manufacturer.

The laying of cables shall not commence until the trenches have been inspected and approved. The cables 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.

13.4 **Cable Sleeves**

Sleeves must be supplied and installed as indicated on the drawings and in accordance with SANS 1200 LC.

110mm diameter cable sleeves are to be installed from the main distribution board position underground and routed to a 600 x 600 x 600mm deep manhole. There shall be 75mm diameter cable sleeves exiting the manhole laid underground and routed to the distribution boards as indicated on the drawings. The cable sleeves will be used to accommodate the electrical cables and the Data cabling. The cable sleeves shall enter into the distribution boards.
32mm diameter cable sleeves are to be used for supply power, telephone, and Data cables.
90° Bends will not be permitted; this shall be overcome by the use of two 45° slow bends. The drawings show the conduits, sleeves, boxes, etc. that are required for the installation. The final details are not available at tender stage and these details will be provided at a later stage. Provisional quantities covering this installation have been included in the Bills of Quantities. Galvanised steel draw wires shall be installed in all these conduits and sleeves.

The Contractor should note that he remains responsible to ensure that all conduits and sleeves are open and accessible. Where these are blocked, he shall be responsible to repair them.

In all cases conduits for telephone and Data services shall be linked back to the main telephone and Data wire mesh baskets.

13.5 **Cable Markers**

Cable markers must be provided on all cable runs at 50m intervals on straight runs and at all bends. The position of cable markers must be confirmed on site.

The cable markers must protrude 25mm above ground level.

13.6 **Joints**

Joints in cable runs shall not be allowed unless specified or authorised by the Engineer.

Where cable joints are to be made, a joint hole must be excavated of sufficient size to enable the cable joiner to work efficiently and unimpeded.

Each cable end must be left in a loop of 0,9m to prevent any tension on the joint.

During backfilling the section supporting the joint must be compacted to the extent that no movement will take place after the trenches have been backfilled.

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 joiners using first class materials, or by means of approved epoxy-resin pressure type jointing kits, such as "Scotch cast". Epoxy-resin joints must be made entirely in accordance with the manufacturer's instructions and with materials stipulated in such instructions.

Where cables are cut and not immediately made off, the ends are to be sealed without delay.

13.7 **Cable Trenches**

(a) **General**

Tenderers must base their tariffs for cable trenches in soil, soft rock and hard rock on the quantities given in the Bills of Quantities. The actual quantities shall be determined on site. Adjustments to the contract price shall be calculated using the tariffs in the Bills of Quantities, after completion of the installation.

The provision of trenches for the lying of cables and the installation of cable sleeves forms part of this contract. All cables and sleeves shall be laid at a depth of 600mm except that sleeves below the building may be laid at a lesser depth provided that the Engineer is satisfied that no damage to the sleeves can occur.

The bottom of the trenches shall be of smooth contour and shall have no sharp dips or rises, which may cause tensile forces in the cable during backfilling.

Prior to cable lying, the trench shall be inspected thoroughly and all objects likely to cause damage to the cables, either during or after lying, shall be removed.

"Soil" shall mean hand pickable soil and includes loose gravel, clay, backfilled soil, loose or soft shale, loose ouklip and boulders less than 75mm diameter.

"Intermediate material" shall mean rock which is hand pickable including hard shale, compact ouklip and boulders exceeding 75mm in diameter to 0,03 cubic metres volume; and

"Hard rock" shall mean granite, quartz sandstone, slate and stone of similar hardness as well as rocks exceeding 0,03 cubic meter volume.

No guarantee can be given that explosives will not be necessary for excavations. However, should explosives be necessary, and the Contractor receives permission to use explosives, the Contractor shall remain responsible for all work done with the explosives and shall comply with all conditions, regulations, requirements, etc. imposed by the governing bodies.

Mechanical excavators may be used for trenching operations provided that they are not used in close proximity to other plant, services or other installations likely

to be damaged by the use of such machinery. The use of mechanical excavators shall be subject to the approval of the Engineer.

Should excavations be done in close proximity of existing services, extreme care must be taken. Only labourers with experience of these conditions may be utilised.

The Contractor shall be responsible to take the necessary precautions where excavations may be dangerous (refer to the Machinery and Occupational Safety Act 1983, Reg. D16). The Contractor must ensure that all buildings, sewers, etc. are protected against caging.

The cable trenches shall be excavated as indicated on the cable reticulation drawing.

Payment will be made on a cubic excavation rate based on the basis of the given maximum dimensions or the actual dimensions, whichever is the lesser. The only exception shall be in cases of additional excavations caused by obstructions such as water pipes, drains, large rocks, etc. in which case the length of the additional excavation must be agreed upon on site by the Engineer.

(b) **Dimension of Trenches**

Cable trenches for one or two cables or sleeves shall not be less than 300mm wide and need not be more than 450mm wide. This dimension shall be valid for the total trench depth.

Where trenches change direction or where cable slack is to be accommodated, the contractor shall ensure that the requirements of the relevant SANS Specification regarding the bending radii of cables are met when determining trench widths.

Trench depths shall be determined in accordance with cable laying depths and bedding thickness.

(c) **Trenches: Bedding**

The bottom of the trench shall be filled across the full width with a 75mm layer of suitable soil sifted through a 6mm mesh and levelled off.

Only sandy clay or loam soil with a satisfactory thermal resistivity (not exceeding 1,5 C m/W) may be used for this purpose. Sea or river sand, ash, chalk, peat, clinker or clayey soil shall not be used. The use of crusher sand is acceptable.

Where no suitable soil is available on site, the Contractor shall import fill from elsewhere and make all the necessary arrangements to do so. The cost of importing soil for bedding purposes shall be included in the unit rates for excavations.

After cable laying a further layer of bedding shall be provided to extend to 75mm above the cables.

(d) **Backfilling**

The Contractor shall not commence with the backfilling of trenches without prior notification to the Engineer so that the cable installation may be checked. Should the Contractor fail to give a timeous notification, the trenches shall be re-opened

at the Contractor's cost. Such an inspection will not be unreasonably delayed.

Backfilling shall be undertaken with soil suitable to ensure settling without voids. The maximum allowable diameter of stones present in the backfill materials is 75mm.

The Contractor shall have allowed in his tender for the importation of suitable backfill material if required and such costs shall be priced separately.

The backfill shall be compacted in layers of 150mm and sufficient allowances shall be made for final settlement for the first layer of 150mm, sifted soil of which 75mm must be below and 75mm must be above the cable, must be used. The Contractor shall maintain the refilled trench at his expense for the duration of the contract. Surplus material shall be removed from site and suitably disposed of. On completion of the contract the surface shall be made good to match the surrounding area.

In the case of roadways or paved areas the excavations shall be consolidated to the original density of the surrounding material and the surface finish reinstated.

(e) **Trenches: Measurement**

Trench excavations shall be measured and paid for as per the unit rate included by Tenderers for excavations. In all cases the cost of excavations shall include separately the total cost of excavating, bedding, backfilling and making good and keeping excavations free from water (except subterranean water) and risk of collapsed to trench sides.

Definitions for the different type of excavations are as follows:

Refer to SP 3 Preambles to All Trades.

14. **DISTRIBUTION BOARDS**

All boards shall be of the totally enclosed metal clad, metal frame type with semi-flush mounted instruments and switch gear complete with all cable connections, external wiring, busbars, etc. which might be required. Surge arrestors must be installed in each of the electrical distribution boards.

The board shall receive an undercoat and two final coats of "Biscuit" colour B64 or "Light Stone" colour C37 of SANS 1091.

The boards shall be of type as specified, with hinged doors, complete with press lock catches. All boards shall be installed in positions as indicated on the schedules.

All switchgear shall be labelled with engraved ivorene labels to indicate circuits, lights or plugs. The board shall be marked on the outside as follows:

a) Number of the distribution board,
b) Source from which this particular board is fed,
c) The cable size e.g.
   i) Distribution boards: EDB1
   ii) Fed from MEDB
   iii) Cable sizes 3 core 25mm^2 cable plus 16 mm^2 earth wire.

In general, the surface distribution boards shall consist of a sheet bonding tray fitted with a removable architrave and a door unit as detailed below.

a) Bonding Tray

The bonding tray shall be of pressed and welded construction using mild steel sheet. The outside lip shall be flanged out from and knock-outs shall be provided at both top and bottom of the tray. These knock-outs shall mainly be 20mm dia. But at least two 25 mm dia. Knock-outs shall be provided at each end. The total number of 20mm knock-outs on each end shall not be less than the number of circuit breakers (including spares carried on the board.

The back of the tray shall be fitted with diamond mesh spot welded to the tray to facilitate plastering.

Frame and Chassis

An architrave frame formed from mild steel sheet with bevelled edges, which shall accommodate panel, chassis and door(s). Frame to be fixed to tray in a suitable manner as to allow for adjustment for depth out of plumb, and for wall finish in-equalities, and shall overlap the tray by not less than 25 mm all round. Frames shall house the following:

(i) Chassis for mounting of equipment fixed to the architrave frame shall be of rigid construction provided with the necessary means for fixing of circuit breakers, isolators, etc.

(ii) Panels of flat mild steel with machine punched slots to allow for flush mounting of circuit breakers and isolators.

Semi-flush boards must be provided within architrave extension frames.

c) Doors

Doors of smooth flat finish steel sheet suitably braced to ensure stiffness shall be recessed flush in the architrave. Catches shall be flush mounted. Single doors shall not exceed a width of 610 mm.

All steelwork to be pacified, smooth finished and covered with hard baked enamel paint. Final finish of boards shall be beige or as indicated by the Engineer.

d) Busbars

Copper busbars, provided for each phase and neutral shall be mounted on isolators of fixed directly to the terminals of single pole miniature circuit breakers only. All busbars shall be tinned. Boards shall be suitably sized to accommodate without undue cramping, the equipment specified.

A substantial brass earth bar, solidly bonded to the metal work of the board, is to be provided with connectors for the incoming earth conductors and the earth wires of outgoing circuits.

e) Two spare 20 mm and two spare 25 mm conduits respectively must be installed from the distribution boards into roof spaces.

Drawings for Comment

A set of three prints of the shop drawings for the switchboards shall be submitted to the Engineer for comment before the boards are manufactured. The following information shall be presented.

1) A complete wiring diagram of the equipment on the boards.

2) A complete layout of the arrangement of the switchboards, indicating all equipment dimensions and the construction of the boards.

3) The make, catalogue number and capacity of all equipment such as isolators, circuit-breakers, fuses, contractors, etc.

14.1 Labelling

Clearly legible labels, in English, are to be mounted below each circuit breaker and light switches to show the type of circuit each supplies using plastic labels fixed to the boards and not dymo taped labels. The name of the distribution board, e.g. EDB1, shall be fixed on to the door.

In addition, a label, e.g. (Fed from MEDB), of lettering one size smaller than the main label shall be fixed below the main label.

14.2 Installation

The distribution boards must be placed in the position shown on the drawings and must be installed level with the top most circuit breaker 2,0 m above the finished floor level.

15. MOUNTING OF EQUIPMENT

The mounting of equipment shall comply with SANS 1180, where applicable. Equipment to be mounted on the chassis shall be mounted by bolts, washers and nuts or by bolts screwed into tapped holes in the chassis plate.

In the latter case, the minimum thickness of the chassis plate shall be 2,5mm. The latter method shall not be used where boards will be subject to vibration or mechanical shocks. Self-tapping screws will not be accepted.

16. **DISTRIBUTION BOARD SCHEDULE**

All DBs to be made out of 1.6mm galvanised steel sheets

16.1 MAIN DB (MDB)

The main distribution board is to be partially type tested assembly

Name:	MDB
Dimensions	400mm x 1962mm x 600m (WxHxD)
Mounting:	Free standing
Doors:	Yes
Meters:	Metering Cubicle for Statistical Metering
Colour:	White, Colour B26 of SABS 1091
Supply:	Bottom entry
IP Rating	40
Busbars rating:	300A
Fault Level:	15kA
Voltage:	415/240V
Surge Arrestors:	Yes
Spare space:	30%
1 x 300A 4P MCB 10kA	Main Switch
1 x 250A 4P MCB 10kA	Feed to DB13 (Mechanical Plant Room)
1 x 150A 4P MCB 10kA	Feed to DB12 (Mechanical Plant Room)
2 x 20A SP MCB 6kA	Feed to (Control Panel)

The above section is fed from a Municipality Mini substation with a 185mm² 4 Core PVC/SWA ECC/PVC Copper Cable.

16.2 Distribution Board –DB12.

The Distribution Board is to be partially type tested assembly.

Name:	DB12
Dimensions	800mm x 1000mm x 200m (WxHxD)
Mounting:	Semi-Recess mounted
Doors:	Yes with concealed hinges

Meters:	Metering Cubicle for Statistical Metering
Colour:	White, Colour B26 of SABS 1091
Supply:	Top/Bottom entry
Busbars rating:	200A
Fault Level:	10kA
Voltage:	415/240V
Surge Arrestors:	Yes
Spare space:	30%
1 x 150A 4P MCB 10Ka	Main Switch
2 x 50A TP MCB 6kA	Mechanical HVAC AC1-2
3 x 10A SP MCB 6kA	Spare
1 x 63A SP MCB 6kA	Feed to Earth Leakage Units
1 x 63A DP Earth Leakage Unit 30mA 6kA supplying.	
1 x 20A SP MCB 6kA	Normal Plug Circuits P1
3 x 20A SP MCB 6kA	Spare

The above section is fed from MDB with a 35mm² 4 Core PVC/SWA ECC/PVC Copper Cable

16.3 Distribution Kiosk –DB13.

The Distribution Kiosk is to be partially type tested assembly.

Name:	DB13
Mounting:	Free Standing
Dimensions	1000mm x 1000mm x 600m (WxHxD)
Doors:	Yes
Meters:	Metering Cubicle for Statistical Metering
Colour:	Orange, Colour B26 of SABS 1091
Supply:	Bottom entry
Busbars rating:	300A
Fault Level:	20kA
Voltage:	415/240V

Surge Arrestors:	Yes
Spare space:	30%
1 x 300A 4P MCB 10kA	Main Switch
4 x 60A TP MCB 6kA	Mechanical HVAC, AC1-4
2 x 10 SP MCB 6kA	Spare
2 x 10A SP MCB 6kA	Light Circuits L2 to L2

The above section is fed from MDB with a 185mm² 4 Core PVC/SWA ECC/PVC Copper Cable

16.4 Distribution Board –MEDB

The Distribution Board is to be partially type tested assembly.

Name:	MEDB
Mounting:	Free Standing
Dimensions	1000mm x 1962mm x 600m (WxHxD)
Doors:	Yes
Meters:	Metering Cubicle for Statistical Metering
Colour:	Signal Red, colour A11 of SABS 1091.
Supply:	Bottom entry
Busbars rating:	300A
Fault Level:	20kA
Voltage:	415/240V
Surge Arrestors:	Yes
Spare space:	30%
1 x 250 TP MCB 10kA	Main Switch
2 x 60A TP MCB 6kA	Feed to EDB2 - 5
6 x 40A TP MCB 6kA	Feed to EDB1, 8, 10, 11, 12, 13
5 x 30A TP MCB 6kA	Feed to EDB3, 4, 6, 7, 9
2 x 10 SP MCB 6kA	Exterior Light Circuit L5, L6
4 x 10A SP MCB 6kA	Light Circuits L1 to L4
1 x 63A SP MCB 6kA	Feed to Earth Leakage Units

1 x 63A DP Earth Leakage Unit 30mA 6kA supplying.

3 x 20A SP MCB 6kA	Normal Plug Circuits P1 to P3
1 x 20A SP MCB 6kA	Spare
2 x 10A SP MCB 6kA	Spare

The above section is fed from existing Essential LV Panel with a 185mm² 3 Core PVC/SWA ECC/PVC Copper Cable

16.5 Distribution Board –EDB1

The Distribution Board is to be partially type tested assembly.

Name:	EDB1
Mounting:	Semi recess mounted
Dimensions	900mm x 1000mm x 200m (WxHxD)
Doors:	Yes with concealed hinges
Meters:	No
Colour:	Signal Red, colour A11 of SABS 1091.
Supply:	Top/Bottom entry
Busbars rating:	60A
Fault Level:	6kA
Voltage:	415/230V
Surge Arrestors:	Yes
Spare space:	30%
1 x 40A TP IMCB 6kA	Main Switch
1 x 30A DP MCB 6kA	Feed to UPSDB4
2 x 15 SP MCB 6kA	Feed to Mechanical AC1-2
5 x 10A SP MCB 6kA	Light Circuits L1 to L5
3 x 63A SP MCB 6kA	Feed to Earth Leakage Units

3 x 63A DP Earth Leakage Unit 30mA 6kA supplying.

10 x 20A SP MCB 6kA	Normal Plug Circuits P1 to P10
1 x 20A SP MCB 6kA	Spare
2 x 10A SP MCB 6kA	Spare

The above section is fed from MEDB with a 25mm² 3 Core PVC/SWA ECC/PVC Copper Cable

16.6 Distribution Board –EDB2

The Distribution Board is to be partially type tested assembly.

Name:	EDB2
Mounting:	Semi recess mounted
Dimensions	1000mm x 1000mm x 200m (WxHxD)
Doors:	Yes with concealed hinges
Meters:	No
Colour:	Signal Red, colour A11 of SABS 1091.
Supply:	Top/Bottom entry
Busbars rating:	80A
Fault Level:	10kA
Voltage:	415/230V
Surge Arrestors:	Yes
Spare space:	30%
1 x 60A TP IMCB 6kA	Main Switch
1 x 30A TP MCB 6kA	Feed to Mechanical AC3
2 x 15 SP MCB 6kA	Feed to Mechanical AC1-2
4 x 10A SP MCB 6kA	Light Circuits L1 to L4
1 x 10A SP MCB 6kA	External Light Circuits L5
4 x 63A SP MCB 6kA	Feed to Earth Leakage Units

4 x 63A DP Earth Leakage Unit 30mA 6kA supplying.

15 x 20A SP MCB 6kA	Normal Plug Circuits P1 to P15
1 x 20A SP MCB 6kA	Spare
2 x 10A SP MCB 6kA	Spare

The above section is fed from MEDB with a 35mm² 3 Core PVC/SWA ECC/PVC Copper Cable

16.7 Distribution Board –EDB3

The Distribution Board is to be partially type tested assembly.

Name:	EDB3
Mounting:	Semi recess mounted
Dimensions	600mm x 1000mm x 200m (WxHxD)
Doors:	Yes with concealed hinges
Meters:	No
Colour:	Signal Red, colour A11 of SABS 1091.
Supply:	Top/Bottom entry
Busbars rating:	40A
Fault Level:	6kA
Voltage:	415/230V
Surge Arrestors:	Yes
Spare space:	30%
1 x 30A TP IMCB 6kA	Main Switch
1 x 30A TP MCB 6kA	Feed to Mechanical AC1
2 x 10A SP MCB 6kA	Light Circuits L1 to L2
1 x 63A SP MCB 6kA	Feed to Earth Leakage Units

1 x 63A DP Earth Leakage Unit 30mA 6kA supplying.

3 x 20A SP MCB 6kA	Normal Plug Circuits P1 to P3
1 x 20A SP MCB 6kA	Spare
2 x 10A SP MCB 6kA	Spare

The above section is fed from MEDB with a 16mm² 3 Core PVC/SWA ECC/PVC Copper Cable

16.8 Distribution Board –EDB4

The Distribution Board is to be partially type tested assembly.

Name:	EDB4
Mounting:	Semi recess mounted

Dimensions	900mm x 1000mm x 200m (WxHxD)
Doors:	Yes with concealed hinges
Meters:	No
Colour:	Signal Red, colour A11 of SABS 1091.
Supply:	Top/Bottom entry
Busbars rating:	40A
Fault Level:	6kA
Voltage:	415/230V
Surge Arrestors:	Yes
Spare space:	30%
1 x 30A TP IMCB 6kA	Main Switch
1 x 30A TP MCB 6kA	Feed to Mechanical AC2
1 x 15A DP MCB 6kA	Feed to Mechanical AC1
4 x 10A SP MCB 6kA	Light Circuits L1 to L4
3 x 63A SP MCB 6kA	Feed to Earth Leakage Units
3 x 63A DP Earth Leakage Unit 30mA 6kA supplying.	
9 x 20A SP MCB 6kA	Normal Plug Circuits P1 to P9
3 x 20A SP MCB 6kA	Spare
2 x 10A SP MCB 6kA	Spare

The above section is fed from MEDB with a 16mm² 3 Core PVC/SWA ECC/PVC Copper Cable

16.9 Distribution Board –EDB5

The Distribution Board is to be partially type tested assembly.

Name:	EDB5
Mounting:	Semi recess mounted
Dimensions	1000mm x 1000mm x 200m (WxHxD)
Doors:	Yes with concealed hinges
Meters:	No
Colour:	Signal Red, colour A11 of SABS 1091.
Supply:	Top/Bottom entry

Busbars rating:	80A
Fault Level:	6kA
Voltage:	415/230V
Surge Arrestors:	Yes
Spare space:	30%
1 x 60A TP IMCB 6kA	Main Switch
1 x 30A DP MCB 6kA	Feed to UPSDB1
1 x 30A TP MCB 6kA	Feed to Mechanical AC1
2 x 30A DP MCB 6kA	Feed to Mechanical AC2 to AC3
2 x 15 DP MCB 6kA	Feed to Mechanical AC4
4 x 10A SP MCB 6kA	Light Circuits L1 to L4
1 x 10A SP MCB 6kA	External Light Circuits L5
4 x 63A SP MCB 6kA	Feed to Earth Leakage Units
4 x 63A DP Earth Leakage Unit 30mA 6kA supplying.	
14 x 20A SP MCB 6kA	Normal Plug Circuits P1 to P14
2 x 20A SP MCB 6kA	Spare
2 x 10A SP MCB 6kA	Spare

The above section is fed from MEDB with a 35mm² 3 Core PVC/SWA ECC/PVC Copper Cable

16.10 Distribution Board –EDB6

The Distribution Board is to be partially type tested assembly.

Name:	EDB6
Mounting:	Semi recess mounted
Dimensions	900mm x 1000mm x 200m (WxHxD)
Doors:	Yes with concealed hinges
Meters:	No
Colour:	Signal Red, colour A11 of SABS 1091.
Supply:	Top/Bottom entry
Busbars rating:	40A

Fault Level:	6kA
Voltage:	415/230V
Surge Arrestors:	Yes
Spare space:	30%
1 x 30A TP IMCB 6kA	Main Switch
2 x 15A DP MCB 6kA	Feed to Mechanical AC1 to AC2
5 x 10A SP MCB 6kA	Light Circuits L1 to L5
3 x 63A SP MCB 6kA	Feed to Earth Leakage Units

3 x 63A DP Earth Leakage Unit 30mA 6kA supplying.

9 x 20A SP MCB 6kA	Normal Plug Circuits P1 to P9
3 x 20A SP MCB 6kA	Spare
2 x 10A SP MCB 6kA	Spare

The above section is fed from MEDB with a 16mm² 3 Core PVC/SWA ECC/PVC Copper Cable

16.11 Distribution Board –EDB7

The Distribution Board is to be partially type tested assembly.

Name:	EDB7
Mounting:	Semi recess mounted
Dimensions	700mm x 1000mm x 200m (WxHxD)
Doors:	Yes with concealed hinges
Meters:	No
Colour:	Signal Red, colour A11 of SABS 1091.
Supply:	Top/Bottom entry
Busbars rating:	40A
Fault Level:	6kA
Voltage:	415/230V
Surge Arrestors:	Yes
Spare space:	30%
1 x 30A TP IMCB 6kA	Main Switch
1 x 30A DP MCB 6kA	Feed to UPSDB3

5 x 10A SP MCB 6kA	Light Circuits L1 to L5
2 x 63A SP MCB 6kA	Feed to Earth Leakage Units
2 x 63A DP Earth Leakage Unit 30mA 6kA supplying.	
6 x 20A SP MCB 6kA	Normal Plug Circuits P1 to P6
2 x 20A SP MCB 6kA	Spare
2 x 10A SP MCB 6kA	Spare

The above section is fed from MEDB with a 16mm² 3 Core PVC/SWA ECC/PVC Copper Cable

16.12 Distribution Board –EDB8

The Distribution Board is to be partially type tested assembly.

Name:	EDB8
Mounting:	Semi recess mounted
Dimensions	900mm x 1000mm x 200m (WxHxD)
Doors:	Yes with concealed hinges
Meters:	No
Colour:	Signal Red, colour A11 of SABS 1091.
Supply:	Top/Bottom entry
Busbars rating:	60A
Fault Level:	6kA
Voltage:	415/230V
Surge Arrestors:	Yes
Spare space:	30%
1 x 40A TP IMCB 6kA	Main Switch
1 x 30A DP MCB 6kA	Feed to Mechanical AC4
4 x 15A DP MCB 6kA	Feed to Mechanical AC1 to AC3 & AC5
4 x 10A SP MCB 6kA	Light Circuits L1 to L4
1 x 10A SP MCB 6kA	External Light Circuits L5
3 x 63A SP MCB 6kA	Feed to Earth Leakage Units
3 x 63A DP Earth Leakage Unit 30mA 6kA supplying.	

8 x 20A SP MCB 6kA	Normal Plug Circuits P1 to P8
3 x 20A SP MCB 6kA	Spare
2 x 10A SP MCB 6kA	Spare

The above section is fed from MEDB with a 25mm² 3 Core PVC/SWA ECC/PVC Copper Cable

16.13 Distribution Board –EDB9

The Distribution Board is to be partially type tested assembly.

Name:	EDB9
Mounting:	Semi recess mounted
Dimensions	700mm x 1000mm x 200m (WxHxD)
Doors:	Yes with concealed hinges
Meters:	No
Colour:	Signal Red, colour A11 of SABS 1091.
Supply:	Top/Bottom entry
Busbars rating:	40A
Fault Level:	6kA
Voltage:	415/230V
Surge Arrestors:	Yes
Spare space:	30%
1 x 30A TP IMCB 6kA	Main Switch
2 x 15A DP MCB 6kA	Feed to Mechanical AC1 to AC2
3 x 10A SP MCB 6kA	Light Circuits L1 to L3
2 x 63A SP MCB 6kA	Feed to Earth Leakage Units

2 x 63A DP Earth Leakage Unit 30mA 6kA supplying.

7 x 20A SP MCB 6kA	Normal Plug Circuits P1 to P7
1 x 20A SP MCB 6kA	Spare
2 x 10A SP MCB 6kA	Spare

The above section is fed from MEDB with a 16mm² 3 Core PVC/SWA ECC/PVC Copper Cable

16.14 Distribution Board –EDB10

The Distribution Board is to be partially type tested assembly.

Name:	EDB10
Mounting:	Semi recess mounted
Dimensions	900mm x 1000mm x 200m (WxHxD)
Doors:	Yes with concealed hinges
Meters:	No
Colour:	Signal Red, colour A11 of SABS 1091.
Supply:	Top/Bottom entry
Busbars rating:	60A
Fault Level:	6kA
Voltage:	415/230V
Surge Arrestors:	Yes
Spare space:	30%
1 x 40A TP IMCB 6kA	Main Switch
4 x 10A SP MCB 6kA	Light Circuits L1 to L4
3 x 63A SP MCB 6kA	Feed to Earth Leakage Units

3 x 63A DP Earth Leakage Unit 30mA 6kA supplying.

10 x 20A SP MCB 6kA	Normal Plug Circuits P1 to P9
2 x 20A SP MCB 6kA	Spare
2 x 10A SP MCB 6kA	Spare

The above section is fed from MEDB with a 25mm² 3 Core PVC/SWA ECC/PVC Copper Cable

16.15 Distribution Board –EDB11

The Distribution Board is to be partially type tested assembly.

Name:	EDB11
Mounting:	Semi recess mounted
Dimensions	800mm x 1000mm x 200m (WxHxD)
Doors:	Yes with concealed hinges

Meters:	No
Colour:	Signal Red, colour A11 of SABS 1091.
Supply:	Top/Bottom entry
Busbars rating:	60A
Fault Level:	6kA
Voltage:	415/230V
Surge Arrestors:	Yes
Spare space:	30%
1 x 40A TP IMCB 6kA	Main Switch
1 x 30A TP MCB 6kA	Feed to mechanical AC6
1 x 15A TP MCB 6kA	Feed to mechanical AC4
1 x 15A DP MCB 6kA	Feed to mechanical AC1 to AC3 & AC5
5 x 10A SP MCB 6kA	Light Circuits L1 to L5
1 x 63A SP MCB 6kA	Feed to Earth Leakage Units

1 x 63A DP Earth Leakage Unit 30mA 6kA supplying.

4 x 20A SP MCB 6kA	Normal Plug Circuits P1 to P4
2 x 10A SP MCB 6kA	Spare

The above section is fed from MEDB with a 25mm² 3 Core PVC/SWA ECC/PVC Copper Cable

16.16 Distribution Board – EDB12

The Distribution Board is to be partially type tested assembly.

Name:	EDB12
Mounting:	Semi recess mounted
Dimensions	800mm x 1000mm x 200m (WxHxD)
Doors:	Yes with concealed hinges
Meters:	No
Colour:	Signal Red, colour A11 of SABS 1091.
Supply:	Top/Bottom entry
Busbars rating:	60A
Fault Level:	6kA

Voltage:	415/230V
Surge Arrestors:	Yes
Spare space:	30%
1 x 40A TP IMCB 6kA	Main Switch
1 x 30A TP MCB 6kA	Feed to mechanical AC5
1 x 15A TP MCB 6kA	Feed to mechanical AC4
1 x 15A DP MCB 6kA	Feed to mechanical AC1 to AC3 & AC6
4 x 10A SP MCB 6kA	Light Circuits L1 to L4
1 x 10A SP MCB 6kA	External Light Circuits L5
1 x 63A SP MCB 6kA	Feed to Earth Leakage Units

1 x 63A DP Earth Leakage Unit 30mA 6kA supplying.

3 x 20A SP MCB 6kA	Normal Plug Circuits P1 to P3
1 x 20A SP MCB 6kA	Spare
2 x 10A SP MCB 6kA	Spare

The above section is fed from MEDB with a 25mm² 3 Core PVC/SWA ECC/PVC Copper Cable

16.17 Distribution Board – EDB13

The Distribution Board is to be partially type tested assembly.

Name:	EDB13
Mounting:	Semi recess mounted
Dimensions	1000mm x 1000mm x 200m (WxHxD)
Doors:	Yes with concealed hinges
Meters:	No
Colour:	Signal Red, colour A11 of SABS 1091.
Supply:	Top/Bottom entry
Busbars rating:	60A
Fault Level:	6kA
Voltage:	415/230V
Surge Arrestors:	Yes
Spare space:	30%

1 x 40A TP IMCB 6kA	Main Switch
1 x 15A DP MCB 6kA	Feed to mechanical AC1
6 x 10A SP MCB 6kA	Light Circuits L1 to L3, L5 to L7
1 x 10A SP MCB 6kA	External Light Circuits L4
1 x 63A SP MCB 6kA	Feed to Earth Leakage Units

4 x 63A DP Earth Leakage Unit 30mA 6kA supplying.

13 x 20A SP MCB 6kA	Normal Plug Circuits P1 to P13
3 x 20A SP MCB 6kA	Spare
2 x 10A SP MCB 6kA	Spare

The above section is fed from MEDB with a 25mm² 3 Core PVC/SWA ECC/PVC Copper Cable

17. LOW VOLTAGE DISTRIBUTION CUBICLES (KIOSKS)

17.1 General

This Specification covers the manufacture of distribution kiosks for general reticulation and distribution systems in normal environmental conditions for three-phase, four wire, 400/230V, 50Hz systems.

17.2 Size

Kiosks shall be of ample size to accommodate the specified equipment and provide space for future requirements, as specified.

17.3 Moisture and Vermin

Kiosks shall be weatherproof. To prevent the ingress of water onto live equipment, the door entry surrounds shall have a channel shape, at least 12mm deep, to accommodate the door edge.

The roof shall be constructed with an overhang above non-continuous panelling and shall be provided with a drip-edge.

17.4 Ventilation

Two ventilation grilles or slots, approximately 150 x 125mm, vermin-proofed and insect-proofed by means of 1,5mm brass mesh or perforated steel plate spot welded on the inside, shall be provided on the top and bottom of both side panels.

The construction of the grilles shall prevent the ingress of rain or water.

17.5 Sheet Steel Canopies

Where specified, the canopy and doors shall be manufactured of 3CR12 steel to the following requirements:

A metal framework shall be manufactured from solid angle iron, channel iron or 2,5mm minimum folded sheet steel.

Joints shall be non-continuously butt-welded. Welds shall be ground smooth and the joints wiped with plumber's metal in order to provide a smooth finish.

Side panels, doors and the roof shall be manufactured from 2mm minimum sheet steel. The panels shall have upturned edges which are recessed in the frame or which fit over lips on the frame. The side panels may be either bolted or welded on the frame or form part of the folded metal frame.

The roof of the cubicle shall be removable and shall be fitted by means of bolts which shall be accessible from inside the cubicle only.

All panels and doors shall be suitably braced and stiffened to ensure rigidity and to prevent warping.

The steel canopy and framework shall be fixed to the base frame by four M16 high tensile steel bolts.

17.5.1 Finish and Colour of Sheet Steel Kiosks

Metal components of the framework, panels and doors shall be painted in accordance with the Engineer "STANDARD PAINTING SPECIFICATION".

The colour shall be "BISCUIT" Colour B64 or "LIGHT STONE" Colour C37 of SANS 1091. A tin of matching touch-up paint (not smaller than 500ml) shall be provided with each consignment.

17.5.2 Doors

Doors shall be fitted to the front and to the rear of each cubicle. The doors shall provide free access to equipment which has to be operated and shall provide a full view of all meters. Cubicles wider than 700mm shall be provided with double doors.

Doors shall have well-returning edges to fit into the channel of the door entry surrounds.

Doors shall swivel through 135°.

Brass hinges shall be used to hang the doors. The hinges shall be bolted to the canopy with brass bolts and nuts. Bolt heads or nuts shall not protrude beyond the outer surface of the kiosk. Nylon, aluminium or piano hinges are not acceptable.

Doors shall be fitted with lever locks equal or similar to the "BARKER & NELSON" type with a 135° movement. The locking mechanism shall have a catch on the rear which catches behind the frame or door entry surround. The locking mechanism, as well as the catch support area, shall be backed with brass or galvanised steel plates. The locking mechanism shall be padlockable. Padlocks will be approved by the Engineer, unless otherwise specified in the Specification.

The locking mechanism shall be made of brass or stainless steel.

Door restraints shall be provided. Cloth or canvas straps are not acceptable. The fixing points of the restraint at both the door and canopy shall be reinforced.

At least three hinges shall be supplied on steel doors higher than 1,2m.

Doors shall be fitted with neoprene or equivalent seals.

Metal doors shall be earth bonded to the frame by means of a copper braided strap, tooth washers, bolts and nuts.

17.5.3 Equipment Support Frame

A free-standing, angle iron or similar type rigid support framework shall be provided.

The frame shall be bolted down on the base by four M16 high tensile steel bolts. The holding-down bolts shall be accessible from the inside of the cubicle only. The frame of sheet steel canopies shall be bolted to the canopy framework.

A galvanised steel cable gland plate shall be bolted to the bottom of the frame across the full width of the cubicle to cover the cable entry opening in the base.

The gland plate shall be suitably punched to accept the number and size of cables specified.

A panel of "DELARON" or "THIOLITE" resin bound synthetic wood or other suitable dielectric material shall be provided for the mounting of all equipment and busbars. Impregnated hardboard, other treated or untreated wood products are not acceptable.

Alternatively, all equipment and busbars shall be flush-mounted within a purpose-made sheet metal frame enclosed by a machine-punched removable front panel through which the operating handles of the equipment protrude. Care shall be exercised that the rear studs of circuit breakers are properly insulated from the steel chassis.

17.5.4 Concrete Bases and Base Frames

To ensure stability of the kiosk after installation, it shall be mounted on a base frame which, in turn, shall be bolted to a concrete base cast onto the bottom of the cable trench.

The base frame shall be constructed of angle iron, at least 50x50x4mm thick and shall be of welded construction hot-dip galvanised and coated with epoxy resin tar.

The vertical height of the box frame shall be at least 900mm and the construction shall be such as to provide a rigid support for the kiosk.

The base frame shall protrude to a maximum height of 200mm above ground level. Provision shall be made for the protection and concealing of the cables entering the kiosk and to prevent access of animals and vermin.

The base frame shall be secured by at least four M16 bolts to the support frame of the kiosk and four M16 bolts and nuts to the concrete base. The bolts, nuts and washers shall be galvanised and supplied with the kiosk.

All galvanising shall be to SANS 763.

The kiosk manufacturer shall supply a detailed drawing of the base frame and the concrete base required.

Alternative designs and materials for the base (or root) of the kiosk will be considered, but full details must be submitted for approval by the Engineer.

18. CONDUIT AND ACCESSORIES

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

The conduit and conduit accessories shall comply fully with the applicable SANS Specifications 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 1065 Part 1 & 2.

(b) Plain-end metallic conduit and accessories: SANS 1065 Part 1 & 2.

(c) Non-metallic conduit: SANS 950.

The installation shall be in PVC plascti conduit. All conduit shall be concealed in the building work where possible.

The conduit shall be supported and fixed with saddles with a maximum spacing of 1m, even in roof spaces (refer to SANS 10142). The Contractor shall supply and install **ALL ADDITIONAL SUPPORTING TIMBERS REQUIRED**.

The conduit is to be clear of moisture and debris before wiring is commenced.

Chasing must be limited to the absolute minimum. No chasing by hammer and chisel will be accepted. Slots for conduits must be cut where necessary.

18.1 Conduit in Roof Spaces

In roof spaces, the conduit shall be installed in such a manner as to allow for all wiring to be executed from below the ceilings.

Conduit in roof spaces shall be installed parallel or at right angles to the roof members and shall be secured at intervals not exceeding 1,0m by means of saddles screwed to the roof timbers. Nails or cramps will not be allowed.

18.2 Conduit in Concrete Slabs

In order not to delay building operations, the Contractor must ensure that all conduits and other electrical equipment, which are to be cast in the concrete columns and slabs, are installed in good time.

The Contractor shall have a representative in attendance at all times when the casting of concrete takes place.

Draw boxes, expansion joint boxes and round conduit boxes are to be provided where necessary.

Before any concrete slab is cast, all conduit droppers to switchboards shall be neatly spaced and rigidly fixed.

18.3 Switch Boxes

All switch boxes are to be manufactured from PVC hard plastic. The boxes are to be fitted with the necessary number of lugs to suit the number of switch units for which the box is intended.

Lugs are to be drilled and tapped at 82mm centres suitable for fixing either flush switch or standard flush plug units. Fixing screws must be provided.

The dimensions of the single gang boxes are to be approximately 50mm wide by 50mm deep by 100mm long, with one knock-out at each end and at the back and at least two knock-outs in each side.

The boxes must comply with SANS 1085.

All knock-outs are to be 20mm in diameter, suitable for 20mm electrical conduit.

19. **WIRING**

Wiring shall be carried out in galvansde steel trunking in roof void or in PVC conduit throughout. Only one circuit per conduit will be permitted.

No wiring shall be drawn into conduit until the conduit installation has been completed. All conduit to be clear of moisture and debris before wiring is commenced.

Switch socket circuits shall be wired by means of 4mm² phase conductors and a 2,5mm² earth conductor in 20mm diameter conduit, unless otherwise indicated.

Wiring for lighting circuits is to be carried out with 2,5mm² conductors with 2,5mm² earth conductors. In all other instances the number and size of cables drawn into any conduit, shall be as specified or shown on the drawings. Sizes and numbers of cables not specified, must be determined in accordance with Standard Regulations.

THE LOOP-IN SYSTEM SHALL BE FOLLOWED THROUGH OUT AND NO JOINTS OF ANY DESCRIPTION WILL BE PERMITTED.

The wiring shall be done in PVC insulated 600/1000V grade cables to SANS 1574.

Where cable ends connect onto switches, fittings, etc. the end strands must be neatly and tightly twisted together and firmly secured. Cutting away of wire strands of any cable will not be allowed.

Where earth conductors end onto switches, fittings, etc. the two end strands must be neatly and tightly twisted together and then firmly secured by a ferule. A single conductor must be secure at the other end of the ferule. The single conductor must be connected to the switches, fittings, etc.

20. **SWITCHES AND SOCKET OUTLETS**

20.1 **Light Outlets and Switches**

Light switches must be Crabtree Range or other SABS approved. Light switches shall be flush mounted and installed 1400mm above finished floor level.

Provide lighting outlets throughout the building as schedules and shown on the drawing.

Additional wood brandering shall be provided for the fixing of surface light fittings. No butterfly

clips are acceptable.

20.2 **Switched Socket Outlets**

Socket outlets shall be installed in the positions indicated on the drawings. Socket outlets must be the Crabtree Range or other SABS approved.

Socket outlets in plaster or face brick walls shall be flush mounted in 100 x 100 x 50mm deep PVC boxes, with cover plates similar to those for switches. Only socket outlets from the same manufacturer will be accepted.

Switched socket circuits shall be protected by means of earth leakage units as detailed.

Socket outlets shall be mounted at a height of 450mm above finished floor level unless otherwise indicated on the drawings.

21. **POWER SKIRTING**

The Contractor shall be responsible for the supply and installation of all power skirting complete with corner pieces, end pieces, junction pieces, supply conduits, cover plates, power outlets and outlets for other services as specified and indicated on the drawings. All outlets installed on power skirting shall be labelled.

The top compartment shall be used for switch socket outlets, whilst the lower compartment would be fitted with a divider for future telephone and data services.

If more than one circuit is installed in the same wireway, the conductors of each separate circuit, including earth conductor, shall be taped at intervals of 1m with PVC insulation tape.

Standard 16 Amp 3-pin flush switch socket outlets 100 x 50mm normal size shall be supplied and installed in the position indicated on the drawing and as specified.

The power skirting must comply with SANS IEC 61084-1 and 61084-2-1. The Contractor must ensure that the power skirting is installed to the satisfaction of the Engineer before commencing with the wiring thereof.

The power skirting shall be of the "O-line 2 compartment 2 cover power skirting including internal divider – PVC type or other SABS approved.

22. **COVERPLATES**

All Coverplates shall be manufactured of the plastic type and shall be of the colour grey or to be determined by the Architect on site.

23. **ENGRAVING OF CIRCUITS ON COVERS**

All switches, switch socket outlets, isolators, telephone, etc. outlets, shall have the covers engraved with the distribution and circuit number from which it is fed. Where covers cannot be of the plastic type, engraved plastic labels are to be fixed on the cover.

24. **LUMINAIRES**

The Contractor will be responsible for the supply and delivery of luminaires, including lamps. The Contractor shall be required to allow for the administration, attending to timeous delivery,

for storage on site, for handling all items and replacements, etc. and tenderers shall include their cost for this attendance and the cost for profit and handling on the supply of luminaires.

All fluorescent lamps shall comply with the SANS 1041 as revised and shall be 4 300°K cool white.

24.1 **Schedule of Luminaires**

TYPE	DESCRIPTION
A	The Luminaire shall be recessed in concrete ceiling 1200mm x 220mm LED Vandal Proof Light Fitting with High Strength Acrylic lens, Temper Proof Screws and complete with 2x24W Tubular LED lamps and electronic control gear.
B	The Luminaire shall be recessed in concrete ceiling 600mm x 220mm LED Vandal Proof Light Fitting with High Strength Acrylic lens, Temper Proof Screws and complete with 2x24W Tubular LED lamps and electronic control gear.
C	The Luminaire shall be recessed in concrete ceiling 280mm x 280mm LED Vandal Proof Light Fitting with High Strength Acrylic lens, Temper Proof Screws and complete with 2x24W Tubular LED lamps and electronic control gear.
D	The Luminaire shall be recessed in concrete ceiling Vandal Proof LED Downlighetr Fitting with High Strength Acrylic lens, Temper Proof Screws and complete with 18W LED lamps and electronic control gear.
E	The Luminaire shall be recessed in concrete ceiling 1200mm x 220mm LED Vandal Proof Light Fitting with High Strength Acrylic lens, Temper Proof Screws and complete with 2x24W Tubular LED lamps and electronic control gear.
F	The Luminaire shall be recessed in concrete ceiling 280mm x 280mm LED Vandal Proof Light Fitting with High Strength Acrylic lens, Temper Proof Screws and complete with 2x24W Tubular LED lamps and electronic control gear.
EM	The Luminaire shall be recessed in concrete ceiling 1200mm x 220mm LED Vandal Proof Light Fitting with High Strength Acrylic lens, Temper Proof Screws and complete with 2x24W Tubular LED lamps, battery emergency backup power kit and electronic control gear.

If specified light fittings are not available, the Engineer accepts other SABS approved.

The Contractor is to ensure that all luminaires are to be equipped with all fittings and accessories necessary for their complete installation.

In the case of the commodity complying with a compulsory specification, the manufacturer or agent shall furnish an Authorisation Mark. The new SANS Safety Specification will supersede all compulsory specifications.

25. **TELEPHONE INSTALLATION**

Lockable 450 x 450 x 150mm deep, flush-mounted distribution board with an architrave frame and door must be used for the telephone installation. A soft wood backing must be provided in this box. The Electrical Contractor must confirm the external dimensions with the Local Authority before any order is placed.

The outlet boxes must be 100 x 100 x 50mm with blank covers and mounted 450mm above finished floor level.

25mm diameter PVC conduit must be used for the telephone installation.

Draw wires must be installed.

The termination box must be labelled "Telephone" and must be mounted 500mm above finished floor level.

26. BUZZER

The buzzer must be suitable to operate on a 230V, 50Hz supply and the entire siren system must be controlled by a Timer Switch installed in the Administration building. The buzzer must be of the 203mm Gents type.

A 20A, two pole isolator must be mounted next to the bell. A label with the wording "Danger Supply is from Admin MAIN - DB" must be mounted on the isolator or on the wall next to the isolator at the bell, i.e. a suitable York box or similar approved box.

27. EARTHING ELECTRODES

27.1 General

This section covers uncoated, coated and metal clad circular rod electrodes intended to provide an earth in soil for electrical and lightning arrestor systems.

27.2 Category and Type

27.2.1 Only the following type of earthing rods shall be used:

1 (a)	Solid copper.
1 (b)	Solid stainless steel.
2 (a)	Solid steel with bonded copper protection.
2 (b)	Solid steel with plated copper protection.
2 (c)	Solid steel with a shrunk-on copper jacket.
3	Solid steel with a shrunk-on stainless steel jacket.
4	Galvanised steel.

27.2.2 Bare aluminium is not acceptable as an electrode material.

27.2.3 All rods shall be solid and of circular cross section with lengths as specified.

27.2.4 The nominal diameter of the earthing rods shall not be less than 16mm unless the rods are specified for placing in pre-drilled holes, in which event the minimum nominal diameter shall not be less than 12mm.

27.3 Couplings and Conductor Clamps

Earthing electrodes shall be provided with (n-1) couplings, where n = number of rods supplied.

Rods designed for coupling by means of external sleeves shall be provided with an adequate quantity of hydrocarbon or silicon grease to be applied to the coupling before the joint is made.

Rods designed for coupling by means of internal pins or splines shall be provided with tin-walled tubes and hydrocarbon or silicon grease to seal the joint.

The material of the clamps shall be electrolytically compatible with the rod and conductor materials.

Where brazed or welded connections are specified, the supplier of the rods shall stipulate at least two types of metals which are compatible with the rod and conductor materials.

27.4 **Earth Clamps**

Earth clamps shall consist of copper strips at least 1,2mm thick and not less than 12mm wide secured with a brass bolt, nut and washer and shall be so constructed that the clamp will fit firmly to the conduit without any additional packing.

28. EARTHING OF INSTALLATIONS

The type of main earthing must be as required by the supply authority, of other than the Engineer, who may require additional earthing to meet the test standards.

Installations shall be effectively earthed in accordance with the "Standard Regulations" and to the requirements of the supply authority, as well as the Engineer, who may require additional earthing to meet the test standards. Earthing must comply to SANS 10142.

All hot and cold water as well as waste pipes must be effectively bonded by 12,5 x 1,6mm solid or perforated copper tape (not wire) clamped by means of brass bolts and nuts. The tape to is to be fixed to walls by means of roundhead brass screws at intervals not exceeding 150mm.

The earth connection from the main earth bar in the main board must be made to the cold water main and the incoming service earth conductor by means of 16mm² stranded (not solid) bare copper earth wire or such conductor as the Engineer may direct. Where applicable, all steel roof sheeting as well as steel walkways and stairs shall be suitably earthed.

Furthermore an earth electrode (earth spike) of at least 1,5m long must be provided and driven into the ground at the centre of each gable-end wall of each individual block. These earth electrodes shall be installed at least 1m from the building's perimeter and shall clear all aprons and water channels. These earth spikes must be driven into the ground to at least 300mm below ground level and only after final bonding and tests have been carried out must proper backfilling and compacting of same be executed.

In each instance these earth spikes must be interconnected by means of a 70mm² stranded bare copper earth conductor which must be installed in the inside of the ridging of the roof structure encased in 20mm conduits installed in the gable walls. This earth conductor must be bonded to the roof sheeting at intervals not exceeding 5m, ensuring that roof sheeting on both sides of the ridging are properly bonded.

The overall earth resistance at the main distribution board shall not exceed 1 ohm. The Contractor shall assess the soil and site conditions at the time of tendering and allow for this to enable him to perform the proper earthing and bonding of all installations.

29. **MAINTENANCE REQUIREMENTS**

The maintenance period of 12 months from handover, is detailed in the contract conditions and contract preliminaries. It is, however, a further requirement of this contract that three months after handover of the installation, all faulty lamps and tubes shall be replaced by the Contractor at no additional cost to the Employer. The replacement parts such as tubes, lamps, starters, ballast, etc. will be supplied and delivered by the Contractor and he shall include in his tender price for all other costs associated with this requirement.

It is a further requirement of this contract that the Contractor with local contractors to perform the maintenance function on his behalf during the maintenance period. Details of this arrangement shall be provided within 14 days of acceptance of the contract. It should furthermore be noted that the maintenance requirements entail a 24-hour call-out 7 days a week during the maintenance period and in all cases, a response time of less than one hour is required.

30. **LOAD BALANCING**

The Contractor is required to balance the load as equally as possible over multi-phase supplies.

31. **ITEMS FOR COMMENT**

The right is reserved to reject any equipment which does not, in the opinion of the Engineer, conform to specification or which is of an inferior grade. Should such equipment be rejected, the Contractor shall at his own expense provide for alternative equipment and tenderers are thus warned to ensure that all equipment offered is in strict accordance with the requirements of this specification.

In certain cases the Contractor may be required to submit samples and where necessary, tests will be performed to establish the quality of the material offered.

32. **CONTRACT ADMINISTRATION, COMPLETION, TESTING AND COMMISSIONING**

32.1 **Quality Control Curing the Execution of the Contract**

The Contractor or his authorised representative, to ensure that all work is executed in accordance with the drawings, specifications and regulations, shall carry out day by day inspections of the Works. The Engineer will monitor these inspections.

32.2 **Standard of Workmanship**

All installation work in this contract is to be executed by qualified electricians and cable jointers in accordance with modern techniques. The Engineer shall have the right to reject any work which does not meet the specification, or which is not in accordance with standard practice.

32.3 **Maintenance of As-Built Drawings**

During execution of the contract, the Contractor shall update the drawings daily with all the relevant information.

At the end of the contract and prior to handover being accepted, the Contractor shall prepare as-built drawings of the installation. These drawings shall be a set of the latest drawings issued by the Engineer on which the Contractor shall highlight all changes. The Contractor shall take great care to ensure that all underground services are shown in the correct places.

The Contractor shall also issue three sets of drawings, wiring diagrams, service and instruction

manuals for equipment supplied by him and these will have to be acceptable to the Engineer prior to handover being approved.

32.4 **Preliminary Testing of Major Equipment**

All terms of major equipment are, where feasible, to be factory tested prior to delivery to site, and results of such tests, in a format to be agreed in advance, are to be produced before the equipment is delivered.

All such tests are to be in accordance with the relevant codes of practice, and with any other requirements as set out in this document.

32.5 **Completion of Installation**

Before the commencement of any test or commissioning procedures, the Contractor is to ensure that all nuts and bolts are securely fastened, and that paintwork on all items supplied has been touched up where damage has occurred.

32.6 **Inspection and Testing**

On completion of the entire installation or any particular section thereof, as may be decided by the Engineer, tests shall be carried out in full accordance with the current edition of the "Code of Practice for the Wiring of Premises", in the presence of the Engineer.

The Contractor should note that, where applicable, at least the following tests must be carried out:

- Insulation test.
- Continuity test.
- Loop Line Earth Line Impedance test.
- Polarity test.
- Earth Leakage Circuit Breaker test.
- Earth termination test.

Any further tests as deemed necessary by the Engineer.

The results of the above tests must be clearly recorded, signed and handed to the Engineer together with a Certificate of Compliance and any other form or forms as required by the Employer.

32.7 **Documentation**

The following documentation is required and shall be provided by the Contractor:

- Set of schematic wiring and function diagrams.
- Operating and maintenance instructions on equipment.
- Guarantees ceded to Employer.

Once the Engineer has inspected the complete installation and satisfied himself that all testing has been completed and the contract is complete in all respects, will he issue a letter to the Employer stating installation is complete.

32.8 **Labelling**

All switchgear and equipment installed in the switchboards, plus isolator boxes, cables, etc.

shall be clearly labelled as indicated elsewhere in this specification and schedules.

32.9 **Training of Institutional Staff**

Where applicable, allowance is to be made by the Contractor for the training of Institutional Staff in the setting up and operation of the various items of equipment supplied under the contract.

32.10 **Testing and Commissioning Documentation**

On completion of the testing and commissioning, the following documents shall be compiled and presented to the Engineer.

(a) A Certificate of Compliance and other form/s as required by the Engineer and Employer.
(b) Drawings of the installation marked up "As-Built" as described elsewhere.
(c) Completed set of test and commissioning sheets.

First delivery will not be taken unless above mentioned items are complied with.

33. **TESTING AND INSPECTION**

The Contractor shall test the entire installation in conjunction with and to the satisfaction of the Supply Authority and in the presence of the Engineer. The Contractor shall make all arrangements for testing and inspection, the costs thereof being included in the tender price.

All 220V socket outlets shall be tested for polarity and sensitivity of the earth leakage protection equipment shall be tested by means of an approved instrument.

Each length of cable shall be tested for insulation and polarity by means of a 1000V megger designed for that purpose. In the case of underground cables, this shall be done before backfilling. In addition, the earth-loop impedance of each main and sub-main feed shall be measured. The earth resistances shall be tested by means of an approved instrument.

If there is no power on the day of the test, the Contractor shall supply a 3kW, 230V generating plant for testing purposes.

"DANGER" notices shall be displayed at the remote ends of cables under test.

The Engineer reserves the right to witness all tests. The Contractor shall advise the Engineer in writing of all results and furnish copies of all certificates.

Load balancing shall be undertaken by the Contractor in conjunction with the Engineer. Where conductors are altered to achieve satisfactory results, they shall be re-laced by the Contractor.

The Contractor shall provide all the necessary instruments for the proper testing of the complete installation. If there is reason to doubt the accuracy of such instruments, the Contractor shall take the necessary action to prove their accuracy.

If the results of the first delivery tests are favourable and the installation is found to be in order, there will be no charge for the test. If the test is found to be unfavourable, a levy of R200-00 will be charged to the Contractor for each subsequent test in the form of a Variation Order omitting such costs from his contract price.

The Contractor shall ensure that the installation is complete in every respect and that there are no major defects prior to notifying the Engineer (in writing) of a first delivery inspection.

Should there be any minor defects upon final inspection, the Engineer will terminate that inspection and request that an additional final inspection be arranged by the Contractor.

public works

Department:
Public Works
PROVINCE OF KWAZULU-NATAL

GENERAL JUSTICE GIZINGA MPANZA REGIONAL HOSPITAL NEW 28 BEDDED MALE AND FEMALE INPATIENT AND OUTPATIENT MENTAL HEALTH UNIT

ELECTRICAL INSTALLATION

PART 3: SPECIAL FACILITIES AND EQUIPMENT SPECIFICATIONS

SECTION THREE

SPECIAL FACILITIES AND EQUIPMENT SPECIFICATIONS FOR ELECTRICAL INSTALLATIONS

1. Fire Detection and Public Address System
2. Data, Telephone and PABX Installation
3. CCTV and Alarm System
4. Access Control and Intercom System

1. FIRE DETECTION SYSTEM

1.1 GENERAL

This Sub-Contract covers the supply, delivery, installation, commissioning and handing over in approved working condition of an early warning Addressable Fire Detection is specified herein and as indicated on the drawings.

The extent of the Fire Detection Installation will basically cover the entire new psychiatric ward area excluding the ceiling void area and undercover basement parking area.

1.2 SCOPE OF WORK

The Scope of the Contract is generally for a Specialist Sub-contract to supply, deliver, install, test, commission and hand over in full working order:

- Four addressable Fire Panels interlinked and all linked to the existing main Hospital Fire Detection Network.
- Fire Retardant cable installed in the conduits and wire-ways installed by the Electrical contractor.
- All the fire optical Detectors, Manual Call Points and sirens for the Fire Detection system.
- A guarantee period of 12 months with free service and maintenance shall be provided for the systems.
- Testing and commissioning of the fire detection installation.
- Demonstrate the System operation to the Client and the Handing over of 3 sets of Comprehensive O & M Manuals.

1.3 TECHNICAL SPECIFICATION

1.3.1 Pre-amble

1.3.1.1 The installation shall be suitable for operation at the altitude and under the atmospheric conditions outlined in the Schedule of Details.

1.3.1.2 The onus is on the Tenderer to ascertain any other local conditions or peculiarities which might affect the working of the system, and no allowance in price or standard of materials and workmanship will be made for any ignorance on the part of the tenderer in this respect. This also applies to the nature and construction of the building, details of which can be obtained from the Principal Agent.

1.3.1.3 Tenderers shall include for everything required for the completion and successful operation of the installation, whether such items are expressly mentioned or not.

1.3.2 **Quality of Material**

1.3.2.1 Only material of first quality shall be used. All material is subject to the approval of the Engineer.

1.3.2.2 Where applicable, all materials must comply with the relevant standard specifications of the South African Bureau of Standards or the British Standard Specifications.

1.3.3. **Standard of Workmanship**

1.3.3.1 The whole of the above installation shall be executed in accordance with the best modern practice, and the Engineer shall have the right to reject, and demand satisfactory replacement at the Contractor's cost, of any part of it which, in his opinion does not conform to the highest standards of material and workmanship. This includes parts that are not easily available for maintenance or repair. In case of ready-made circuits, the connections shall be done neatly and according to approved standards.

1.3.3.2 If required by the Engineer, the Contractor shall perform at his own cost such a test in the presence of the Engineer.

1.3.3.3 **Responsibility of Contractor**

The Contractor, by tendering, will have to satisfy himself as to all the conditions and circumstances affecting his tender and as to the general circumstances of the Site of Works, the Conditions of Contract and the Nature of the Work to be carried out under this contract. No claim by the Contractor for additional payment will be entertained which is consequent upon failure on his part to obtain correct information as to any matter affecting his tender or the execution of the work.

IT IS A SPECIFIC REQUIREMENT OF THIS CONTRACT THAT SPECIALISTS WHO ARE CONVERSANT WITH THIS TYPE OF WORK SHALL DO THIS PART OF THE WORK.

1.4. **SUPPLY AND INSTALLATION**

1.4.1 The contract shall include for the complete supply, delivery, installation, testing, commissioning and handing over in working order (to the satisfaction of the Engineer) of the fire detection installation as specified and shown on the drawings.

1.4.2 The contract shall include for all work, labour, material, plant, equipment and everything necessary for the completion of the whole installation in accordance with the requirements of the SANS standards, and no extras will be allowed on the contract price for non-compliance with these requirements.

1.5. MATERIAL AND WORKMANSHIP

1.5.1 The Contract works shall be executed in accordance with the specified standards and level of workmanship, to the satisfaction of the Head: Works.

1.5.2 All materials shall be of the quality specified and the Contractor shall, upon request of the Head: Works, furnish her with proof to her satisfaction that the materials are of the specified quality.

1.5.3 All materials and equipment used for the installations shall be new and undamaged.

1.5.4 The Contractor shall, if requested by the Head: Works, provide samples of material and equipment for approval. If judged necessary by the Head: Works, such samples may only be returned after the completion of the installation, in order to ensure that the quality of the installed product is the same as that of the approved sample.

1.6. REFERENCE SPECIFICATIONS AND STANDARDS

1.6.1 The latest revision of any Specification referred to in this specification, will be applicable.

1.6.2 All materials, components and equipment shall be new and of good quality and shall comply with the relevant SANS, SAPO, DIN or IEC specifications.

The latest amendments to the following standards form part of this specification:

SANS 10139-2000	User code for the prevention, automatic detection and extinguishing of fires in buildings.
BS 5839 : Part 1-1980	Fire detection and alarm systems for buildings.
BS 6266 - 1982	User code for the fire protection of electronic data processing installations.
SANS 10142-2003	The wiring of premises.

Any uncertainty which may arise regarding of the above shall be submitted to the Engineer in writing for clarification during the tender period.

The equipment shall be from standard stock. Component shall fit easily into each other and shall be designed for ease of maintenance and replacement.

All the materials and equipment used on site shall be suitable for use under local conditions, these include weather conditions, as well as conditions at the time of installation and operation. If the equipment and material are not suitable for the specific conditions, the contractor shall protect or replace defective equipment at his own cost.

All of the equipment offered shall be suitably protected against lightning and the contractor shall indicate which precautions he has taken to prevent lightning damage to his equipment.

1.6.3 The SI ("Le Systeme International d' Unites") – Metric System of Units will apply. Refer to SANS – M33A: The International Metric System: Guide to the use of the SI in South Africa.

1.7. DRAWINGS

1.7.1 Engineers Drawings

1.7.1.1 Unless otherwise specified, the Engineer's Tender drawings are not manufacturing drawings and the dimensions given are only sufficient for tendering purposes or to enable the Contractor to complete manufacturing drawings. It is the responsibility of the Contractor to verify all dimensions.

1.7.1.2 The Engineer shall make available to and at the request of the Contractor any available record drawings of the present installation.

1.7.2 Contractors Drawings

1.7.2.1 The Contractor will be furnished, on request, with the Engineer's drawings.

1.7.2.2 The Contractor shall supply two (2) copies of all shop drawings to the Engineer. The Engineer will scrutinize the shop drawings and grant the Contractor permission to proceed with the installation. All work done by the Contractor without permission from the Engineer to proceed, will be at the risk of the Contractor. Shop drawings shall include details and dimensions of all equipment to be installed under this contract. The drawings must show full details of the installation.

1.7.2.3 Two (2) copies of the certified drawing shall be issued to the Engineer for distribution.

1.7.2.4 The Contractor will be required to produce the shop drawings on the proposed system.

1.7.2.5 Unless otherwise specified, cable routes shall be superimposed on the Mechanical Layout Drawings, showing the runs and fixing details.

1.7.2.6 The Contractor shall update all shop drawings once the installation has been completed. One (1) set of paper prints and one (1) electronic copy of these as-built drawings shall be supplied to the Head: Works as part of the O & M Manual.

1.7.3 Equipment Drawings

The Contractor shall provide the Engineer with working drawings of all items of equipment, with a detail technical specification of the equipment before placing an order for the equipment.

1.8. MAINTENANCE AND GUARANTEE

The tenderer of this contract shall allow in his price for the maintenance of the complete installation for a period of twelve months starting from the date of first take-over of the contract by the Department.

It is a specific requirement of this contract that the contractor shall allow for 4 inspection visits during the 12 month maintenance period, and that he shall submit full reports for each visit. The reports shall contain the status of the system as well as the faults which occurred on the system during the previous 3 months.

A log book shall be supplied by the contractor. The log book shall be kept on site in charge of the responsible person appointed by the User Department for this purpose. The contractor shall complete the log book, showing all maintenance done by him, as well as repairs of faults which may have occurred.

The log book shall also contain the following information:

- Date
- Type of fault reported and by whom
- Date of fault report
- Work done
- Name and signature of person carrying out the work.
- Name and signature of the person in charge of the site.

The log book shall be filled in TRIPLICATE. One copy shall accompany the monthly report to the Regional Representative of the Department; one copy shall be for the contractor's own use, whilst the third copy shall remain in the log book as a record.

The contractor shall also allow for a complete maintenance service of the system after the twelve (12) month guarantee period. The log book shall also be filled in and reports submitted for this service to the Regional Representative of the Department.

The report shall be submitted to the Department within seven (7) days of the service. Serious faults shall immediately be reported to the Regional Representative and the Consulting Engineer by telephone.

No maintenance or repair work shall be done on site without the knowledge, and approval, of the responsible person in charge on the site.

The normal maintenance, which is, for example, necessary for the maintenance of batteries in the system, shall be clearly indicated in the documentation in a separate section.

1.9. MAINTENANCE CONTRACT

The Department can insist on a full maintenance contract with the installer (after completion of the maintenance period).

The duration shall be for one year. The Department shall make a decision in this regard after the completion of the maintenance period.

1.10. OPERATING MANUALS

The contractor shall supply three complete sets of operating manuals.

A shortened operating manual in English shall be supplied with all emergency procedures covered.

Operating manuals shall be provided in English and shall be easily readable.

Two sets of concept documents shall be handed to the Engineer and Department for approval and commentary. The manuals shall be handed over before first take-over.

The operating shall consist of the following with clear descriptions, as well as purpose of installation:

(a) Paper copies of all approved drawings and diagrams.
(b) Complete description of different components of installation.
(c) On/off switch procedures.
(d) Instruction for routine test carried out by user.
(e) Detailed instructions for emergency procedures.
(f) Emergency aid procedures.
(g) Use of breathing apparatus.

1.11. MAINTENANCE MANUALS

Three complete sets of the Maintenance Manuals, in English only, shall be provided.

The manuals shall contain the following:

(a) A complete set of 'as built" drawings of the contract, in a form acceptable to the Department. No drawings shall be smaller than A4 size. Large drawings shall be reduced to A3 or A4 size for inclusion in the manuals, provided they remain legible.

(b) A complete set of "machine shop" drawings of the contract, showing dimensions, finishes, general arrangements of panels, consoles, computer assemblies, etc.

(c) A complete set of wiring diagram drawings of all equipment, showing component identification, types and values.

(d) A block diagram drawing for each piece of equipment containing more than one PC board, showing the interconnections of boards complete with connector and plug numbers, and PC board identification markings.

(e) A complete list of all equipment containing the following information :

(i) Name of the equipment (or description thereof).
(ii) Serial number of equipment.
(iii) Type number of equipment.
(iv) Manufacturer of equipment.
(v) Equivalent replacement model of equipment (where applicable).
(vi) Names, addresses, telephones and facsimile numbers of firms supplying equipment.
(vii) Supplier's catalogues.

(f) A complete and comprehensive description of the operation of the system and of each individual piece of equipment.

(g) A complete and comprehensive description of the maintenance of the system and of each individual piece of equipment in respect of daily, weekly, monthly or annual maintenance.

(h) Advanced technical information of the system may also be bound into the Maintenance Manuals as additional information. Any literature not in the English language, shall have the English translation attached.

A procedure to trace faults.

A concept copy of the Maintenance Manual(s) shall be submitted to the Department's consultant, at least two (2) weeks prior to the anticipated first hand-over of the installation for scrutinizing and possible amending.

(i) CD with all the as-built drawings in AutoCAD format.

First delivery of the installation will not be taken, unless acceptable manuals are submitted prior to the first hand-over inspections.

1.12. **BLOCK PLANS**

The various zones with the corresponding reference numbers of the zone indications shall be shown on the block plans.

It shall be installed at the main panel and at the entrance doors to each zone.

The block plans shall be submitted to the Engineer for approval before installation.

The block plans shall be installed in proper wooden frames and shall be laminated in plastic. The plans shall be produced in such a manner that light fading will not occur.

1.13. FRAMED INSTRUCTIONS

Complete framed instructions in English shall be placed at the reception and fire panel positions.

1.14. PREFERENCE LIST

Preference shall be given to South African made equipment if they comply with all the technical specifications.

Imported equipment shall only be considered if there is no local product at a competitive price available.

It is one of the conditions of tender to complete the Preference List. If it is not done, the tender can be disqualified

1.15. FIRE DETECTION SYSTEM

1.15.1 Approval of Equipment

The tenderer shall indicate whether the equipment offered complies with the requirements of one or more of the following:

(a) NFPA of the USA.

(b) BS 5839.

(c) BS 5446.

(d) EN 54.

Notwithstanding anything mentioned above, all the equipment shall be acceptable to the Department.

1.15.2 General Description

The fire detection system shall comprise of four interlinked fire panels located as per the drawings to be supplied by the engineer. The entire fore syestem shall be connected to a link to the Fire Brigade office, a mimic in the Reception as indicated on the drawings and a complete set of information to the maintenance package in the Reception. All of these connections shall be done with a fire proof cable (PH20 minimum requirement).

The fire detection devices, alarms, control devices, etc., throughout the building shall be connected (A-class) to the fire panel. These connections shall be done with a fire proof cable (PH20 minimum requirement) 4 - core copper cable and the Contractor shall ensure that the integrity of the shield is in place throughout the installation. There shall be a mimic panel installed in the Security room at the entrance which will indicate the layout of the devices on the floor plan of the zone.

The panels shall continuously monitor the analogue status of all sensing devices and initiate action when a fire or smoke condition is present. The main control panel shall make the decisions regarding the state of the system from the information received from the field devices.

The alarm management shall be field configurable from the control panels via a keypad to enable the system to be tailored to suit the protected building and to permit future additions and changes. This configuration shall be maintained intact in memory. The control unit shall have a front panel comprising of indicating LED's, control keyboard and backlit LCD display, as described in detail later. The LED display will give details of any event, which occurs in the system.

Data ports are to be provided for communicating with remote LCD repeaters, intelligent numeric panels and graphics computers.

Control units shall be modular in design and shall have facilities for operating as stand-alone unit, or as part of a network.

All fire detectors and other relevant equipment shall be installed in the positions indicated on the drawings.

Whenever a fire situation arises:
1. The air-conditioning shall be switched off via the wiring to each air-conditioning unit installed as part of this contract to a normally open relay in the air-conditioning unit.
2. The air extractor fans will be automatically switched on to extract the fire smoke out of the building
3. All automatic magnetic locks at all access points will be disengaged and all the doors will be able to be operated manually.

1.15.3 **Equipment**

1.15.3.1 Analogue addressable detectors

All automatic detectors must be formally approved by at least two (2) of the internationally recognised testing laboratories listed below:

* Underwriters Laboratories, USA (U.L.)
* Verband der Schass Versekerer, Germany (VDS)
* British Standards, Great Britain (BS)
* Loss Prevention Certificate Board, Great Britain (LPC)
* Underwriters Laboratories. Canada (ULC)

The detectors shall be suitable for connecting to a two-wire 24V central system and operate satisfactorily within the supply voltage range of 17V - 28V DC, and shall be polarity insensitive. A red indicator LED shall be provided on the detector, which illuminates when the detector has reached a pre-set alarm level. The indicator shall be operated independently of the detector from the central control panel. The indicator shall illuminate when there is a fire in the building.

Provision shall be made for an output from the detector suitable for operating a remote indicator or other device with a current limitation of 4 milli amps. The output shall be operated independently of the smoke detector from the central control panel.

Data transmission to and from the control panel from the detector shall be via communications circuitry which is factory fitted to the detector by the original detector manufacturer and forms a complete and integral part of the detector.

The detector shall be supplied complete and fully tested and calibrated. All detectors shall come standard with a locking mechanism.

Separate mounting bases shall be required which enable ready removal of the detectors for maintenance. The bases shall be fitted with dual finger steel receptacles.

The unique address of the detector shall be set by the installer by means of a coded plastic card fitted to the detector base. The base shall be electronics free.

The detector shall be capable of being remotely tested from the control panel by the transmission of a 3-bit code. The control panel will raise a maintenance alarm should this test fail.

1.15.3.2 Optical Smoke Detector

The photoelectric (optical) smoke detectors shall be suitable for detecting visible smoke such as is produced by slow smouldering fires including burning PVC.

They shall be of the light scattering type using a pulsed internal LED light source and a photo-diode sensor.

The detector shall be capable of operating within the following environmental limits:

Temperature operating range:	-20°C to + 60°C
Humidity operating range:	0% to 95% RH (no condensation)
Wind:	Not affected

The construction of the detector and bases shall be in white self-extinguishing polycarbonate plastic. Full circuitry must be protected against moisture and fungus. Smoke entry points must be protected against dust and insect ingress by corrosion resistant gauze. The optical chamber must be of conductive plastic and have a snap-lock fit for ease of removal when cleaning. The detectors must be unobtrusive when installed, having a dimension not exceeding 50mm x 100mm^2 diameter maximum including the mounting base.

The detector shall be capable of protecting an area up to 100 square metres at a height of up to 12m. The installation and siting of the detectors must conform to BS 5839 1988 or similar standards.

1.15.3.3 Heat Detectors

The device shall monitor ambient temperature by means of an NTC thermistor. The detector shall be capable of operating within the following environmental limits:

Temperature operating range: -20°C to + 60°C
Humidity operating range: 0% to 95% RH (no condensation)
Wind resistance: Unaffected

The construction of the detector and bases shall be in white self-extinguishing polycarbonate plastic. Full circuitry must be protected against moisture and fungus. The detectors must be unobtrusive when installed, having a dimension not exceeding 50mm x 100mm diameter maximum including the mounting base.

Each detector shall be suitable for protecting an area up to $50m^2$ at a height of up to 7.5m. The installation and siting of the detectors must conform to BS 5839 1988.

1.15.3.4 Multi-Sensor Detectors

This detector shall combine inputs from optical and heat sensors, and process them using sophisticated algorithm. This detector is for use in place of ionisation detectors where the latter is too sensitive for the environment. It shall be sensitive to a wide range of fires using five different modes to identify.

Mode 1

High smoke and temperature sensitivity (smouldering and flaming fires)

Mode 2

Sensitivity similar to that of an optical detector with no response to temperature.

Mode 3

Moderate smoke sensitivity combined with moderate heat sensitivity

Mode 4

Reduced smoke sensitivity combined with high heat sensitivity.

Mode 5

No smoke sensitivity combined with normal heat detector response (threshold at 58°C).

Temperature operating range: -20°C to + 600°C
Humidity operating range: 0% to 95% RH (no condensation)
Wind resistance: Unaffected

The construction of the detector and bases shall be white self-extinguishing polycarbonate plastic. All circuitry must be protected against moisture and fungus. Smoke entry points must be protected against dust and insect ingress by corrosion resistant gauze. The optical chamber must be of conductive plastic and have a

snap-lock fit for ease of removal when cleaning. The detectors must be unobtrusive when installed, having a dimension not exceeding 50mm x 100mm diameter maximum including the mounting base. Each detector shall be suitable for protecting an area up to $50m^2$ at a height of up to 7.5m. The installation and siting of the detectors must conform to prEN54-5 and prEN54-7.

1.15.3.5 Detector Mounting Bases

The mounting base shall be suitable for being mounted on a flat surface or in a round electrical box having 50 mm hole centres.

The fitting of a detector into a base shall be a simple one-hand operation without risk of damage to the base or detector. The detector shall click home clearly which shall also be an indication that the detector is fitted correctly.

Each base shall be uniquely addressable and it shall be possible to change its address by altering or replacing the address card.

The address of a base shall remain undisturbed and unchanged by the removal or replacement of a detector. The base shall be electronics free.

Each base shall be provided with a durable tag on which a number or mark is displayed which shall identify the address of the monitor.

1.15.3.6 Manual Call Points

The call point shall be manufactured from self extinguishing red polycarbonate plastic.

The overall size of the call point shall not exceed 87mm x 87mm x 52mm.

The call point shall be based upon a standard product manufactured by a reputable call point manufacturer. The manual call point shall then be modified by the manufacturer of the heat and smoke detectors to incorporate a communications module within the call point. No external alterations to the call point shall be made other than the fixing of a flush mounted LED to be located to the right of the word "Fire" which shall appear in black letters across the top of the call point on the vertical face. The LED shall be red in colour.

The LED shall illuminate when the call point is activated. However, the illumination of the LED will be by command from the control panel.

Manual call point units shall be protected against ingress of dust and water to IP65, if so required. A unit mounted outside buildings shall be provided with a hood mounted over the unit.

A call point shall be addressable and compatible with the central control panel. The unit shall be provided with a means of testing. It shall be capable of responding when polled by the fire panel by transmitting its address and status code. It shall be capable of handling the central control panel poll rate.

The call point shall be polarity insensitive and shall be capable of operating by means of a 2-wire looped system.

The communication module will incorporate a special interrupt facility which shall override any other data transmissions taking place in order to inform the central panel that the manual call point has been activated.

1.15.3.7 Door Magnet Controls

The door magnet control unit shall be able to control the hydraulic action of the door closers installed on the fire doors. The door closers will be supplied and installed by the main contractor and shall be equal or similar to the DORMA EMF range of door closers. A controller or controllers shall be supplied and installed in order to control the fire door magnet outlets of each zone separately. The supply voltage to these points shall be 24 Volt and each door magnetic consumes 3 Watts continuous duty.

The supply to the door magnet units shall be continuous to allow the door closers with normally open solenoids to operate if any disruption of the power supply occurs.

The smoke detector contractor shall connect to the door closer at a control box which will be situated in close proximity to the door.

1.15.3.8 Sounders and Strobes

The sounders and sounder strobe combinations shall comply with BS 5839, Parts 1 and 4. These units will be aesthetically designed with a high sound output and a low current consumption.

The frequency or major frequency in a two-tone alarm shall be between 500 and 1 000HZ.

The sound level for sounders and audible alarms shall be as follows:

Audible indications:	65dB (A) at 1m.
Evacuation sounders:	103 dB (A) at 1m.
Outdoor sirens:	112dB (A) at 1m.

The visual element on the sounder strobe combination unit will have a flash frequency of one second.

The units shall have at least an IP54 rating.

1.15.3.9 Alarm Bells

The bell shall be a 150mm diameter, red, stove enamelled gong. Operation is based on motorized striker movement, capable of a sound output of 95dBm. The

current consumption shall be equal to or less than 30mA with a supply voltage of 24VDC.

The sound output frequency shall comply with BS 5839 Part 1: 1988.

The bell shall also have an IP41 rating.

1.15.3.10 Loop Isolators

The loop isolator shall be designed to connect into the loop circuit and monitor the loop for short circuit. In the event of a short circuit occurring the loop isolators on each side of the short circuit are to disconnect and isolate that portion of loop from the system enabling the remainder of the system to function normally.

A light emitting diode (LED) must illuminate when an isolator is in an open condition.

1.15.3.11 Zone Monitor Unit

The zone monitor unit will interface a zone of conventional, non-addressable detectors and call points to the analogue addressable system. This unit will connect to the 2-wire loop. The device shall power the conventional zone from the analogue addressable loop and supervise the zone for short circuit and open circuit by means of an end-of-line resistor.

The device shall report fire alarms and faults to the panel under a single address common for all the conventional detectors. The alarm LED on the detectors will light up in alarm condition. The unit shall have an output to drive a remote LED.

The zone monitor unit shall be available in a flush mount and surface mount version with maximum dimensions 150x90x48 mm.

1.15.3.12 Fire Control Panel

The main control panel shall be supplied and installed by the Contractor in the security room by the Reception area.

The control panel shall house all control units and shall be manufactured of extruded aluminium, giving 20 % spare space for expansion.

The Contractor must liaise with the supplier of the equipment console to ensure a matching, neat and proper control panel and console.

The system shall be functional for 24 hours of the day and operated (controlled) by hand by trained staff.

All controls and lamps shall be accessible on the unit front panel/s. All loose interface equipment, power supplier, etc. shall be neatly installed in the control panel or equipment rack.

Matching blank panels shall be fitted into the spare section of the console to accomplish the requirements stated in this specification.

Plugs and sockets shall be fitted to the rear of the equipment to allow the equipment to be unplugged for maintenance purposes.

Sufficient cable and connecting wire slack shall be allowed for to enable the withdrawal of equipment on site for adjustments without the need to unplug.
This unit shall conform with BS 5839 Part 4 or EN 54-2 and shall be approved by Telkom in the RSA. It shall make provision for at least the following functions:

The control panel shall continuously monitor a number of parameters of the field devices, make decisions and take actions based on the information received.

Sensing devices shall not switch into an alarm state. All decisions shall be taken by the control panels only.

To enable the system to be tailored to suit the protected building and to permit future changes, the alarm management shall be configurable from the control panel via a keypad. This configuration shall be maintained under power failure conditions in non-volatile memory.

The front panel of the control panel shall comprise a keyboard, alpha numeric display, text and indicator LED, etc. The occurrence and location of an event shall be displayed on the screen.

Outputs for communication with devices such as remote text display units, graphic display units, computers, printers and intelligent mimic panels shall be provided where necessary.

The control panel shall be supplied complete with printout facilities. Connections (a printer port and 24 Vdc power connector) for a portable printer shall be required.

The control panel shall further have the facilities to execute the following functions, via potential free 2A rated contacts:

- Transmission of a general fire alarm to the Fire Brigade.
- Monitored switching off of air conditioning equipment in case of a general fire alarm.

The control unit shall be of a high degree of engineering design and of high level of workmanship. The design shall be modular so as to ensure rapid fault finding and replacement of faulty circuit boards or components.

Monitoring of detector circuits shall be such that the following conditions shall be detected and displayed as a "FAULT" condition on the control panel:

(a) Open circuit line

(b) Short circuit line

The system shall operate in the "Fail Safe" mode, that is, the presence and functional condition of each and every detector head and signal line shall be proven by a small current flowing continuously through a monitoring circuit.

A bleeper shall be provided on the control panel with the facility to be switched off. A "Fault Alarm" shall operate this local buzzer only and shall not be extended to the alarm bells.

Consecutive alarms shall be stored by the control panel in chronological order and shall have the ability to determine the priority order of alarms by means of repetitive receipt of data from detectors.

A "Fire Alarm" shall operate a local buzzer only and shall not extend to the main alarms in the passages. These alarms shall be activated by a special fool proof switch only after confirmation of a fire condition by the appropriate personnel.

The control panel shall be able to function as a stand-alone unit, together with its own power supplies and shall not be dependent on external control equipment, such as computers, for functioning.

Provision in the form of suitable terminals, connectors, or ports, shall be made on the control panel for the connection of peripheral equipment, such as computers, printers and interface equipment, to ensure that the accumulation of data generated by detectors and the control panel, to be used for future reference, or for the relaying thereof to remote monitor or control equipment.

The transmission of all data shall be via a two-wire system, which shall carry both the supply voltage and the data.

The type of wire or cable used shall be suitable for the speed of data transmission so that signals can be carried over without loss of information or corrupted data. Wiring shall meet the requirements of the detection system manufacturer, which requirements shall be published in a formal wiring specification.

The control panel shall be fully programmable through the keypad on the front of the panel, and through an RS 232 port by using a separate computer or global repeater panel.

It shall be possible to make back-ups of the programmed data onto separate magnetic media by means of an external computer linked to an RS 232 port on the control panel.

Communications with other equipment, such as computers, shall be achieved through RS 232 ports using a fully documented public domain protocol. The protocol documentation shall also be included in the Maintenance Manual so that it will be possible for another party to communicate with the control panel without the approval of the control panel manufacturer.

All communications with other equipment shall be bi-directional, and at least the functions and displays available on the front of the control panel shall be possible

through the communications port. Programming of the control panel by means of other equipment is not required (except as described earlier).

The control panel shall be equipped with an alpha numeric display capable of displaying at least 80 characters.

A message of at least 40 characters long per device shall be programmable and displayable on the display.

The display of the following reports/information shall be possible:

- Device information
- List of the devices isolated
- List of devices that need maintenance
- List of the most recent events
- I/O mapping
- Device messages

Each sensing device shall be numbered individually and uniquely to correspond with its address on the control panel.

If a detector head is moved from its base to another base, the address of such a detector shall remain at its original location indicated on the control panel, i.e. the base shall be addressed and not the head.

The address of each device shall be manually set to the desired value.

Addressable devices shall be polled by the control panel and the equipment condition and analogue status shall be read and stored in the control panel.

The varying status of each device shall be assessed by software algorithms and the control panel shall indicate the following conditions:

(i) Analogue Detectors

Detector removed
Incorrect type of Detector
Detector failed
Detector contaminated
Pre-alarm
Fire Alarm
Detector healthy

(ii) Interface to Contacts

Fire Alarm
Interface removed
Interface faulty
Contact wiring open circuit

Contact wiring short circuit
Contacts normal

A printer shall be provided.

The printer shall provide a hard copy of the following:

- Alarms
- Faults
- Maintenance date
- Control panel operations
- Outputs Operated
- Configuration report
- Status report

The printer shall print out the following information for each alarm or signal:

- Type of alarm or fault
- Device type
- Device number
- Zone number
- User message
- Day
- Date
- Time

It shall be possible to set the printer to print out alarms, faults, control panel operations, and outputs operated, either individually or in any combination.

Control panels shall utilize electronic devices specially designed for minimum power usage in both battery and main power supply modes.

Battery charging equipment mounted in the control panel, or elsewhere shall be mounted in such a way that 220 V terminals and wiring and other mains voltages are shielded against accidental contact. All shields shall be marked 220 V.

No 220 V terminals shall be placed directly next to other terminals containing wiring at other voltages.

The power pack of the control panel shall be able to accept an incoming 230 ± 10% Volt single phase supply and shall be equipped with transformers, rectifiers, inverters, condensers and integrated circuits for the supply of stabilised power to the control panel equipment and detector circuits.

The power supply unit shall be equipped with over voltage protection and spike arrestors to prevent damage to the equipment by lightning or other spikes, or damage due to over voltages.

The battery charger shall be able to deliver the full charging current to discharged batteries, and thereafter the charger shall automatically vary the charging current to the batteries as may be required by battery voltage conditions. Batteries shall not be subjected to overcharging. The battery charger shall be protected against reverse polarity and short circuits on the DC supply side.

The power pack of the control panel shall regulate the supply voltage to detectors so that detectors or bases are operated in their nominal supply voltage range.

Upon loss of mains power, the power supply unit shall automatically revert to battery power, where after the system shall remain fully operational for a period of 24 hours and shall be able to operate the total alarm load for a further period of 1 hour. The unit shall automatically revert back to mains power upon mains power restoration and manual resetting of the unit shall not be necessary.

The power supply shall be equipped with the following indications on the front of the unit:

(a)	"Mains On"	:	green LED
(b)	"Charger Fault"	:	amber LED

Batteries shall be mounted in a separate ventilated padlockable cubicle in such a way that contamination of other equipment cannot take place by utilizing a special plastic container to contain any possible spillage. Any supply fault, charging fault or low battery voltage shall be transmitted to the control panel so that an alarm can be generated. No fuses or switches shall be accessible on the front of the power supply unit without opening the door. Batteries shall be of the sealed lead acid type and the sizes of the batteries to be used shall be indicated on a label in the battery cubicle. Batteries shall be charged to 85% of their capacity within 24 hours.

Wiring terminals shall be clearly marked with a label strip for identification so as to simplify installation and connection of wires on site, during installation. All outgoing and incoming terminals and all other equipment in the control panel, shall be suitable labelled to simplify maintenance and installation and all panel mounted equipment shall likewise be labelled. Outgoing and incoming power and field wiring shall be individually and correspondingly, numbered at each point of termination.

The control panel shall have knock-outs in the bottom plate thereof to terminate conduit for all power cabling and knock-outs in the top plate thereof, to terminate conduit for signal and other electronic cabling or wiring. Holes drilled on site for this purpose will not be acceptable.

All identification labels, as well as wire terminal numbers shall be clearly shown on all wiring diagrams in the maintenance manual.

It shall be possible to silence the audible alarms without influencing the visual alarms or alarm transmissions to the Fire Brigade.

Two (2) spare fuses shall be provided.

1.15.3.12 Fire Panel Operation

The system shall be designed to operate at 4 (four) security levels, as follows:

Level 1: Control Key

The control key shall be used to enable or disable the key board and control keys of the panel.

Level 2: Access Codes

Access codes shall be used to prevent unauthorised entry into the programming menus of the panel. Each menu shall be able to have 2 different levels of access.

Level 3: Door Lock

The panel door lock shall be used to prevent unauthorised entry into the cabinet.

Level 4: Non-Volatile Memory Switch

The non-volatile memory switch shall prevent any unauthorised or accidental changes being made to the system configuration data.

The system shall be designed to operate with the minimum of operator training. Basic alarm functions shall be completely self explanatory, and shall be understood by a person with no training.

The occurrence of a fire, a fault signal, or a keyboard operation carried out by an operator shall not inhibit or delay in any way the receipt of additional alarms.

Should any part of the system be isolated or placed in a maintenance mode then a LED on the front of the panel must illuminate to indicate the systems abnormal status. This condition must also be indicated on the LCD display. The normal operation of all other devices shall not be affected in this state.

1.15.3.13 Self-Monitoring

The control panel shall be designed and programmed to perform extensive automatic self monitoring. If the control panel detects a fault, it shall result in a fault indication being given by means of a common fault amber LED.

The following shall be continuously monitored by each fire panel:

* 24 V power supply fault (external supply)
* Fire brigade / evacuation short circuit

* Alarm bell open circuit
* Fire Brigade short circuit
* Alarm Bell short circuit
* Power failure
* Watchdog time-out
* Low battery
* No battery connected
* Tamper switch
* No printer
* Memory lock unlock
* Event buffer full
* No communication
* Earth fault
* Battery over-voltage
* R.A.M memory check
* EPROM memory check

1.15.3.14 Fire Operation

Any fire alarm will cause the following actions to occur immediately:

* The LCD to light up and display the following information:
  - type of alarm
  - loop number
  - zone number
  - sensor address
  - type of sensor
  - event number
  - status
  - number of alarms
  - time and date
  - 2 lines x 40 characters of user programmable text
* The common fire indicator and appropriate zone fire indicator will illuminate
* The LED on the affected detector(s) will operate
* The event will be logged in memory
* Programmed relays will be triggered
* The fire alarm will override any fault condition that might be present on the display
* Bell & fire brigade/evacuation outputs will become active according to the immediate or delay parameters set
* Sounders and bells will continue to operate (continuous tone) until silenced by inserting the control key and pushing the silence alarm button
* If the bells and fire brigade have been silenced they will become active again for any new fire alarm
* Sounder circuit controllers will be sounded as programmed
* Messages will be sent to the configured data ports and/or printer

* Coincidence, area and adjacent area devices will be operated as programmed
* A red LED will be lit on the different mimic panels indicating the floor or detector which are in the active fire state.

1.15.3.15 Fault Operation

A fault warning will cause the following actions to occur immediately:

* The LCD to light up and display the following information:
  - type of alarm
  - loop number
  - zone number
  - sensor address
  - type of sensor
  - event number
  - status
  - number of alarms
  - time and date
  - 2 lines x 40 characters of user programmable text

* The system fault and appropriate zone fault indicator (LED) will illuminate
* The "general fault" relay will activate
* The panel buzzer will sound intermittently
* Inputs/outputs configured for fault will be operated, messages will be sent to the configurable repeater panels mimic drivers and graphics.
* The system fault and appropriate zone fault indicator (LED) will illuminate
* The "general fault" relay will activate
* The panel buzzer will sound intermittently
* An amber LED shall light up on the different mimic panels to indicate the position of the faulty detector.

Note: The removal of any unit will provide a communication fault signal, which cannot be reset until the appropriate unit has been replaced. The removal shall not restrict the normal operation of the rest of the loop.

1.15.3.16 Maintenance Alarm

Should a detector become contaminated, a maintenance alarm will be indicated and logged as follows:

* "Maintenance Alarm" LED will illuminate
* The LCD to light up and display the following information:

- type of alarm
- loop number

- zone number
- sensor address
- type of sensor
- event number
- status
- number of alarms
- time and date
- 40 characters of user programmable text

* The panel buzzer will sound intermittently
* An amber LED shall light up on the different mimic panels to indicate the position of the faulty detector.

1.15.3.17 Electronic Dialling Device

The unit shall be surface mounted next to the fire detection control panel.

This two-in-one alarm control unit shall be as supplied by "SESCO" cat. no. 4195 or similar and must consist of the following features and benefits:

(a) High quality keypad control unit.

(b) Lightning protected.

(c) Selectable entry/exit time delay or instant arming.

(d) Four (4) N/O or N/C zones and a N/O or N/C panic zone.

(e) Panic, burglary and power trouble facilities to report to one or more of eight pre-select telephone numbers.

(f) High quality, solid state devices to ensure voice clarity.

(g) Instant programming via units own keypad.

(h) 100% reliability.

(i) Adjustable siren output time from 30 seconds to ± five minutes.

(j) DTMF or pulse dialling with selectable "dial-tone detect".

(k) Test facility.

(l) Selectable siren or telephone activation.

(m) Selectable siren or buzzer annunciation.

(n) Play-back facility to listen to recorded messages.

(o) 4K7 end-of-line resistors on key switch, panic and burglary zones.

(p) 2K2 end-of-line resistors on the light trigger zone.

In the case of an alarm (fire, power failure or panic) this unit shall automatically, by using the telephone line dial up to eight pre-select telephone numbers, (e.g. Fire Brigade, Police, etc.) informing the dialled occupant of the relevant situation.

Inputs to this device shall be:

(a) Fire alarm from the fire alarm control panel.

1.15.4 WIRING AND ELECTRICAL REQUIREMENTS FOR DETECTORS

The Contractor must take note that it is a specific requirement that only fire proof multicore stranded wires and cables shall be used where wiring is done outside of steel conduit.

All wires and circuits shall be clearly identified by either using colour coded cable or plastic label tags.

Wiring shall be arranged in a return loop (ring), in such a manner that, in the event of an open circuit or a short occurring on the line, the control panel communicates with the detectors from both sides of the loop.

The arrangement shall be such that during an open or short circuit no more than 50% of any zone shall be deactivated. To enable this, line isolators shall be provided on the line on each side of each zone.

Cable ends shall be terminated in approved terminal blocks as supplied by MS^2, Klippon, Waco or other approved type. **"Chease blocks" are not acceptable**. In the distribution board the Contractor shall use terminal blocks that are specially designed for this function and in which the terminals are easily accessible, clearly labelled, well supported and easy to wire, using a spring mechanism to grip the wire.

The wires of each circuit shall be strapped together and clearly labelled in all wire ways.

Where coloured wires are used, the wiring shall be done in such a way that the same colour is used throughout for a specific circuit.

Identification shall be such that any circuit can be clearly identified and traced from the line diagrams.

The Contractor shall determine the various wire sizes to ensure that the voltage drop in any circuit shall not exceed 2 V under alarm conditions. These requirements also include the alarm circuits.

Cables shall be terminated on each detector base or break glass unit. The wiring shall be arranged in the "loop" method and no "T-offs" or joints shall be permitted.

All draw boxes shall be clearly indicated on the "As Built" drawings.

The insulation resistance of all circuits must be tested individually with a suitable insulation tester at 50 V and shall not be less than 1 Megohm with detector heads plugged in.

1.15.4.1 **The Communication Circuit**

Communication to the field devices of the entire detection system will be by means of a 2-wire circuit, which will simultaneously be used for power. The communication system shall be able to handle class A and class B loop arrangements. Spurs and branches shall be allowed in both cases.

All communication shall be under the control of the fire panel, which shall poll each device sequentially in order to obtain the latest status of a device. Even when a detector is in an alarm state, the panel shall still be able to determine the latest status of the detector. There shall be no limit to the number of devices, which may be in alarm simultaneously.

The control panel shall poll all devices attached to the system within 5 (five) seconds. However, should a fire or fault condition occur, the appropriate devices shall inform the control panel of their status within 1 (one) second. The panel shall then make decisions based upon the information received.

The addresses of all devices shall be uniquely identifiable by the control panel. All detector addresses shall reside in the mounting bases, which shall be electronics free. The removal of an addressable device from the loop shall not affect the operation of the remaining devices in the loop. The control panel shall be able to identify the type of alarm device located at each address in the loop.

1.15.4.2 **Conduit and Conduit Accessories**

The Contractor will be responsible for the supply and installation of all conduits and conduit accessories.

Conduit and conduit accessories shall be of the Bossil type and shall be cast in, or built into the building structure. Where conduit and conduit accessories are surface mounted on building structures, all work shall be done neatly, parallel to the building structure and in straight lines. Conduit shall be saddled at 1m centres with spacer saddles. M4 machine screws shall be used for fixing of spacer saddles onto steelwork. Suitable holes shall be drilled and tapped in the steel work.

All quality of materials and methods of installation of steel conduit and conduit accessories shall comply with SANS 10142.

Conduit installations shall be done in such a way that detector circuit wiring can be done without any interruption and without T-joints.

Round draw boxes for detectors shall be mounted against the ceiling in the case of false ceilings or ceilings of pitched roof buildings and detector bases shall be mounted against boxes so that no open wiring is visible anywhere in a conduit and wiring system.

No sprague tubing or PVC conduits shall be used in detector wiring system. Only flexible conduit that is not of the spiral type may be used in special applications.

1.15.5 **INSTALLATION**

1.15.5.1 **Control panel**

Mechanical design

The control panels shall be housed in a cabinet designed for mounting directly to a vertical surface. The back box and door shall be constructed with provisions for electrical conduit connections. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.

The control units shall be modular in structure for ease of installation, maintenance and future expansion.

System Capacity

The control panel shall provide and be capable of expansion to the following capacities:

Addressable loops - 12
Devices per loop - 127
Addressable devices per loop - 127
Total addressable devices or control modules - 508

The control panel shall be wall-mounted as indicated on the drawings. Cabling between the control panel and auxiliary equipment shall be neat and tidy in conduit channels supplied under this contract.

A 40 column impact printer shall be provided at the main fire panel.

1.15.5.2 **Sensors and Monitor**

The panel shall support at least the following types of sensors end monitors:

Fire Sensors

* Optical smoke
* Heat
* Manual call point (indoor and waterproof)

Monitoring Controllers

* Zone monitoring unit; used to interface a conventional zone of detectors or an aspiration system to the analogue addressable system
* Manual call point monitor; used to interface conventional break glass units to the analogue addressable system
* Control unit monitor; monitors voltage free fire and fault contacts, reporting their status to the analogue addressable system
* Isolator; for short circuit protection
* Sounder circuit controller; used to operate sounders in a zone

Input/Output Devices

* Single channel I/O unit; one input and one output
* Triple channel I/O unit; three inputs and three outputs
Switch monitor unit; for monitoring normally open or normally closed contacts

1.15.5.3 **Detectors**

Detectors shall be ceiling mounted where possible and break glass units at 1400mm above finished floor level. The onus is on the Contractor to contact the Engineer for a ruling whenever there is any uncertainty regarding the position of installation of any piece of equipment. Failure to comply with this specification might require later movement of such equipment at the Contractor's expense.

1.15.5.4 **Cables and Wiring**

Installation shall be in strict compliance with the manufacturer's recommendations. The manufacturer must be consulted for all wiring diagrams, schematics, sizes, outlets, etc before installing the equipment and wiring.

All equipment shall be held firmly in place. Fastening and supports shall be adequate to support the loads with a safety factor of five.

The fire alarm control panel shall be connected to a separate dedicated un-interrupted power supply branch circuit of maximum 20 amperes.

This circuit shall be labelled as "Fire Alarm" and supplied under this contract as a dedicated plug or isolator for each fire panel, global repeater panel or mimic panel.

All wiring shall be completely supervised. In the event of a primary failure, disconnected standby battery, disarrangement of any components, or any open circuits in the system, an audible and visual trouble signal will be activated until the system is restored to normal.
Zones shall be clearly indicated on the fire alarm control and mimic panel. The names and the position of the zones shall be co-ordinated with the engineer and client and shall meet with their approval.

Air conditioning system(s) shall be indicated on a separate zone.

Open cable shall not be allowed above ceilings, in attic's and in other areas allowing surface wiring. All wiring shall be done in conduit.

Cable shall be the type " listed for the use" as specified under National Electrical Codes, NEC article 760-30 (bell wire, intercom or telephone wire are not approved).

Enclosed cable installed in 20 mm diameter conduit shall be of 0,5 to 0,8 mm^2 screened (shield) "Belden" or equivalent type.

Open cable installed on the surface in open roof (void) spaces shall be of 0,5 to 0,8 mm^2 "Perilli" or "Alpha Pyron" special fire cable.

All cable shall be installed as per NEC article 760.

Leave 150 mm wire tails at each device box and 1 m wire tails at the fire alarm control panel.

Cable for the initiating devices (manual stations, heat detectors, smoke detectors, etc) shall be looped. Cable shall be installed from the monitor module to the first device, then to each succeeding device within each address line and back to the monitor module.

Cable shield continuity must be maintained and connected to earth ground only at the control panel. Intelligent detector wiring must not be routed power wiring, 240 V AC power wiring or other high current circuits.

Cable for the control of the air conditioning units must be installed in the cable duct air-conditioning plant room between the control room and the –2 basement level.

The air conditioning units of the entire complex must be shut down should a fire alarm occur. The fire alarm Contractor shall allow in his tender for one control cable and the control panels as indicated on the drawings. The control wiring from the air conditioning control panel to the air conditioning unit shall be done under this contract.

The system shall be wired such that the air conditioning system shall shut-down after detection of a fire by a detector.

Steel conduit or channels shall be installed under this contract for wiring to the break glass unit as indicated on the electrical drawings.

The surface fire cable shall be held in place at the device by means of two special cable glands fixed to a 65mm diameter draw box. The wiring/cable shall be installed as shown on detail sketches.

The surface wiring/cable shall be held in place at the device box, by means of gripper glands. The cable must be stapled or strapped per NEC or at 1 m maximum spacing.

Cables must be separated, minimum 50 mm from any open conductors of light, power and shall not be placed in any outlet or draw box or containing these conductors, as per NEC article 760-29.

All splices or connections shall be made within approved junction boxes and with approved fittings. Boxes shall be red and/or labelled "Fire Alarm System" or other approved markings.

1.15.5.5 **Detection Lines**

Detection lines may have a capacity of detectors or devices as decided upon by the manufacturer, but this capacity shall not exceed 127 devices per line.

These detectors/elements shall be freely distributable over any one of the individual alarm zones.

Zones must be clearly defined and quick and precise identification of a fire must be possible.

Each line shall be capable of all the self monitoring functions.

The control Unit with its mimic panel shall be utilised to indicate the exact position of triggered detectors/elements in any line.

A triggered detector/element shall not cause any other detectors on the line to seize monitoring.

The Central Control Unit (Global repeater panel) shall be capable of switching off air conditioning units in the case of a fire alarm.

It shall be possible to control the equipment, in the specific zone where a fire has been detected.

Any detector when triggered, shall be capable of causing specific control functions.

Any individual zone or detector in an alarm line shall be capable of being isolated without affecting the operation of the remaining zones or detectors in the line and without raising the fire alarm. However during this condition an isolation indication per zone, shall be displayed on the Control Unit.

1.15.5.6 **RS 485 Cable for Networking between Control Panels**

The maximum cable length is determined by three factors:

1. The data rate of the network
2. The capacitance/Km of the cable (both core to core and core to shield)
3. The loop resistance (core size) of the cable.

* Programming of sensors:

  - The type of sensor (Optical, ionisation. heat) will be set automatically in power-up stage or the panel
  - The monitoring units will be selectable by toggling through a monitor (I/O) menu
  - For each sensor it will be possible to programme:

* Status enabled/disabled
* The zone it belongs to
* The sector where it is located (ceiling. room or void)
* The detection level (level 1 (default) level 2, 3 or 4); each level will have a fixed pre-alarm and alarm calibration
* Selecting rate of rise operation for the heat sensors

1.15.6.3 **Programming I/O**

It will be possible to programme a minimum of 400 input or output blocks. Each input/output block will be associated with an input/output device. Different input/output blocks can refer to the same output device.

It shall be possible to freely programme I/O units without zone or loop restriction.

1.15.6.4 **Output Programming**

* It will be possible to switch (ON/OFF or Impulse) an output by:
  - Any input or any loop
  - Any zone on any loop in fire or fault or coincidence mode
  - Any sensor on any loop
* It will be possible to delay the activation of any output up to a maximum of 255 seconds on an individual basis.
* The outputs can be programmed to follow silence alarm or reset on an individual basis.

1.15.6.5 **Input programming**

* It will be possible for any input to trip:
  - Any output on any loop
  - Any lone on any loop in fire or fault mode
  - Any lone LED in standard or inverse way
  - Any of the 16 programmable relays
* It will be possible to programme an individual input delay up to a maximum of 60 seconds.

1.15.6.6 **Upload/Download**

It will be possible to programme all the above also from a PC by downloading the information to the panel. This way, it will allow the installer/user to have a copy of the complete system's programme on a compact disk.

One way of programming will not exclude the other.

It will be possible at all times to upload the stored programme to a PC in order to maintain updates.

1.15.7 PREVENTING FALSE ALARMS

It will be possible to put any zone(s) in coincidence mode. Coincidence mode will allow bells, fire brigade/evacuation, relays and I/Os to only activate whenever at lease 2 (two) detectors have alarmed within the selected zone(s).

Each call point shall be programmable as either a warning or an alarm (evacuation) call point. A warning call point will respect the fire brigade/ evacuation delay; an alarm call point will ignore this delay.

1.15.8 ZONE EXTENSIONS

1.15.8.1 Fireman's Panel

The open collector driver will come as a PC board to accommodate mimic panels. The outputs will drive at least 10mA.

The repeater will have the following outputs:

* Either 8, 16, 32 or 64 freely programmable open collector outputs
* Alarm
* General fault
* In service / processor running
* Communication failure

This board will have inputs for local silence buzzer and LED test.

1.15.8.2 Mimic Panels

The mimic is to be situated in the Reception area. It is to be an A1 sized steel cabinet with a tiled mimic depicting a section through the building. It shall indicate fire conditions present on each floor or part there-of. The indication shall be by means of two dual filament LEDs per area indicated. They shall be green under normal condition and change to red, indicating fire condition. Each fire control panel shall be indicated on this mimic, and have an amber LED associated with it. Should there be any fault condition on a panel, the amber LED shall be lit. Any

change of state with any LED on the mimic must raise an audible alarm.

In addition, the mimic is to house and display zone select controls for the PA evacuation system and a hand held microphone. Controls to over-ride the lift returns pressurisation fans and air-conditioning shut down shall also be present and functional on this mimic. To allow visual control of the three networked fore control panels there shall be an LCD node, connected to the nearest fire panel using 1 pair copper cable (Balden 9851). It shall be possible to view each panel from this LCD node. The mimic is to communicate to the LCD node using a 4-wire current loop. All relevant signals are to be acquired from the LCD node. These functions shall not appear on the copy of the mimic in the security room.

Drawings accompanying will depict the fascia of the mimic, as well as the internal electronics and necessary cable connections.

1.15.9 CONTROLLERS, MONITORS AND I/O UNITS

1.15.9.1 Manual Call Point Monitor

The manual call point monitor shall be able to monitor a zone comprising up to 20 conventional manual call points and shall have a priority interrupt facility. In other respects the manual call point monitor shall comply with the requirements for zone monitoring units.

1.15.9.2 Switch Monitoring Device

A switch monitoring device shall be addressable and be designed to monitor a normally open or normally closed switch contact. The switch shall be fully floating and low resistance when closed.

Eight wiring terminals shall be provided, 4 for connection of the incoming and outgoing ring circuit, two for a remote LED drive and two for an external switch connection.

1.15.9.3 Input/Output Devices

Input/output devices shall be designed to collect and transmit status information from external devices via the input bits, and operate relays as instructed by the output bits from the control information.

For relay operation the operation instruction shall be continually renewed each time the control unit addresses the device.

Output relay rating shall be 5A, 250VA.

LEDs shall be fitted to the units, which are turned on for input high or relay energised.

1.15.9.4 **Single Channel Input/Output Unit**

A single Channel input/output unit shall have a single logic input for reporting the status of an external device. One fully floating relay changeover contact switchable by the control unit shall also be provided. The relay shall be operated when the control equipment sets output bit 0 to logic high in two or more consecutive addressing of the unit.

Twelve wiring terminals shall be provided:

- 4 for the connection of the incoming and outgoing ring circuit
- 2 each for supply positive and negative, the relay pole normally open and normally closed contacts, and one for signal level.

1.15.9.5 **Gas Discharge Control Units**

The gas control unit shall be designed to interface a gas protected area to the analogue addressable control panel. The unit shall provide evacuate facilities and shall control the safe discharge of gas.

The self-contained unit shall have key switches for automatic or manual selection, as well as an isolate switch for maintenance and resetting the system after activation. Indicating dual LED's are to be provided for Auto, Manual, Isolate, Gas Discharge and Fault. A buzzer shall be sounded for fault warning. A lamp test push button shall also be provided. A dual-action (lift flap break glass) manual gas release device is to be provided on the gas control unit.

Supervised relay contacts are to be provided for the Bell, Siren, Evacuate Sign and Gas Discharge. These contacts shall be monitored for short circuit, open circuit and fuse failure. The door interlock mode shall provide a warning buzzer when the door is locked and the gas control unit is in manual mode, or when the door is unlocked and the gas control unit is in the automatic mode.

Internal LEDs shall be provided for the various fault conditions to allow for quick maintenance.

Should the protected area have a second entrance, a remote gas unit shall be provided.

The remote gas unit shall provide an indication of the status of the main gas control unit by means of dual LEDs as well as a manual call point discharge facility.

A gas status unit shall be provided to indicate the status of the gas control unit. Dual LED's provide indication for Auto, Manual, Isolate, Gas Discharge and Fault.

1.15.10 **SOFTWARE CONTROL**

In order to ensure the reliability of the system, the following requirements for software design shall apply:

- The software shall have a modular structure
- Measures shall be included in the program to prevent the occurrence of a

deadlock in the system

- The execution of the program shall be monitored
- The memory contents containing program and configuration data shall be checked automatically at intervals not exceeding 1 hour.

1.15.10.1 **Operating Programmes**

All executable code and data shall be held in memory, which is capable of continuous, reliable, maintenance free operation, for a period of at least 10 years. The program shall be held in non-volatile memory, which can only be written to at access level 4.

1.15.10.2 **Configuration Data**

The site-specific data shall be protected against power loss by a back-up energy source, which can only be separated from the memory at access level 4. The back-up battery shall be capable of maintaining the memory contents for at least 5 years.

1.15.10.3 **Maintenance Software**

Maintenance of the system shall be able to be performed via a computer/modem connection to the network. All control panels on the network shall be able to be accessed remotely via the computer. Entry into the system shall be password protected and it shall be impossible to change any site configurable data without operator intervention at the respective control panel.

It shall be possible, once connected to the system, to:

1. Emulate any panel as if the operator were standing at the panel;
2. Upload/Download the site configuration;
3. Selectively retrieve all or parts of the event buffer.

The system shall also operate in 'central station' mode whereby the panels may dial to the local fire brigade for fires and to a different station for faults and conditions. The telephone numbers for the central stations must be configured in the panel. It shall be possible to dial different stations for fires and faults.

1.15.11 **CONTROL SWITCH OPERATION**

1.15.11.1 **Acknowledge Switch**

Activation of the control panel acknowledge switch in response to a single new trouble or alarm condition the system alarm or trouble LEDs from flashing to steady-on. If additional new alarm or trouble conditions exist in the system, activation of this switch shall advance the display to the next alarm or trouble condition that exists, and shall not silence the local audible device or change the LED's to steady until all new conditions have been so acknowledged. New alarm conditions shall always be displayed before new trouble conditions. Occurrence

of a new alarm or trouble condition shall cause the panel to "resound" and the sequences described above shall repeat.

1.15.11.2 **Signal Silence Switch**

Activation of the signal silence switch shall cause all appropriate indicating appliances and relays to return to the normal condition after an alarm condition. The selection of indicating circuits and relays silenced by this switch shall be fully programmable and changeable in the field.

1.15.11.3 **System Reset Switch**

Activation of the system reset switch shall cause all electronically-latched initiating devices or zones, as well as all associated output devices and circuits, to return to the normal state. If alarm conditions exist in the system after the system reset switch activation, the system shall then resound the alarm.

1.15.11.4 **System Test Switch**

Activation of the system test switch shall initiate an automatic test of all intelligent detectors in the system. Such test shall activate the electronics in each intelligent device, simulating an alarm condition. A report summarising the results of this test shall be displayed automatically on the front panel.

1.15.11.5 **Lamp Test**

Activation of the lamp test switch shall turn on all LED indicators, LCD display and local sounder and then return to the previous condition.

1.15.11.6 **Automatic Door Test**

The system shall include a special automatic detector test, which permits a serviceman to test all intelligent detectors from the main control panel.

1.15.11.7 **Watch-dog Timers Test**

The system shall include independent "Watch-Dog" timers to detect and report failure of any microprocessor circuit, memory, or software.

1.15.11.8 **Programming**

The system shall be programmable, configurable and expandable in the field without the need for special tools or PROM programmers and shall not require replacement of memory IC's. All programming may be accomplished through the standard control panel keyboard. All programs shall be stored in non-volatile memory.

The programming function shall be entered with a special password that may be selected when the system is installed. The password may be changed in the field to a new value at any time by entering the old password and requesting a password change.

1.16. TESTING AND COMMISSIONING

Although this specification does not necessarily cover every detail of small specialized items, it is a requirement that the complete installation complies with the highest standards of engineering and design practice.

The testing shall be done to the satisfaction of the Engineer in the presence of the Engineer and the Department.

The test shall include the checking of the operation of all the detectors and the tripping of all electronic devices. The complete alarm function with the time delay shall be demonstrated.

The contractor shall supply all equipment needed for the testing of the installation, including a suitable smoke generator.

It shall be possible to put a zone in test mode. The zone in test mode will flash its fault LED and the general "test" LED. All outputs, relays, bells and fire brigade/evacuation will be switched off for this zone. Alarms or faults from other devices or zones will be handled in the normal way. While testing the detector, the panel will light up the detector's alarm LED when reaching the alarm level and reset it automatically afterwards. The printer will confirm this alarm by providing a "test alarm" printout as proof. In this way, maintenance can be performed by a single engineer. The panel will prevent leaving the test mode as long as any sensor is still in alarm.

It will be possible to perform an "electronic test" of all sensors. The "electronic test" will have to force sensors into alarm level. Sensors not able to reach the currently selected alarm level in test condition will report a maintenance alarm.

1.17. FIRE BRIGADE SIGNALLING FACILITIES

The transmitting equipment, for the transmission of a general fire alarm to the local Fire Brigade, shall form an integral part of the fire control panel. The transmitting equipment shall be fully compatible with the receiving equipment already installed at the Fire Brigade. Any facilities necessary to accomplish this compatibility shall be included in the transmitting equipment.

The output to the Fire Brigade shall be a monitored output.

The equipment shall include the following:

- Talk facility
- Fire signalling push button
- Ambulance signalling push button
- Automatic fire signal
- Test facility

1.18. **PROTECTION OF EQUIPMENT**

The electronic equipment under this contract shall be completely protected against electrical surges, voltage peaks and other electrical Newark differences.

It shall also be protected against lightning. Lightning protection shall be done on supplies to the different components of the electronic board associated with that component where applicable.

Special attention shall be given to the proper connecting and earthing of the system.

1.19. **SAMPLES**

Any samples required by the Department shall be supplied on request after 7 days. Not doing so may disqualify the tender.

1.20. **KEYS**

All keys to the system, such as doors, panel keys, switch keys and keys for locks shall be marked permanently with a key ring and be handed over with a certificate of the key schedule to a responsible person. This shall be done in writing with a stamp and the approval of the Engineer/Department.

1.21. **STATUTORY AND REGULATORY REQUIREMENTS**

The installations shall be erected, commissioned and maintained in compliance with the regulations as specified in SANS 10139.

In addition, the Contractor shall exempt the Employer from all losses, costs or expenditures that may arise as a result of the Contractor's negligence to comply with the requirements of the regulations enumerated in this Clause.

It shall be assumed that the Contractor is conversant with the abovementioned requirements. Should any requirement, by-law or regulation, which contradicts the requirements of this Document, apply or become applicable during erection of the installation, such requirement, by-law or regulation shall overrule this document and the Contractor shall immediately inform the Engineer of such a contradiction.

Under no circumstances shall the Contractor carry out any variations to the installations in terms of such contradictions without obtaining the written permission to do so from the Engineer.

2 VOICE EVACUATION AND PA SYSTEM

The system specified is the TOA or Equivalent approved rack mount system with line monitoring and which meets with the EN54 code for fire detection and evacuation.

The system is designed for "Automated Voice Emergency Evacuation", paging included, BGM possible.

Fully integrated system, according to key element schedule, as listed earlier on. The "Automated Emergency Voice Evacuation System"

- To be a fully integrated voice alarm system has to contain all components and features within one manufacturer's system may not rely onto other vendors' or manufacturers' devices in order to analyse and report on all safety features build-in as listed above has to be interconnected to a fire panel for receiving alarm signals relating to fire and evacuation signalling.
- A build-in protocol to be available to access the internally stored data (log-book) from an external personal computer, such as status and system information.
- The system shall fully comply with the standards as per above, SANS 7240 parts: 4 and 16 (ISO 7240-4, -16, -24); EN 54 parts: 4, 16 and 24; and/or BS 5839 part 8.

The system shall in all respects comply with KZN Province Project Specification for PUBLIC ADDRESS SYSTEMS.

2.1 SANS 7240 – 16:2008 EXTRACT

Sound system control and indicating equipment (s.s.c.i.e.) forms part of a sound system for emergency purposes (s.s.e.p.). An s.s.e.p. operates automatically or manually in a building or structure to alert occupants to a hazard which may require their evacuation in a safe and orderly manner. Equipment to warn occupants is therefore required to function after the hazard has been detected.

Fire in a building is a common hazard which is often detected by an automatic fire detection and alarm system. An s.s.e.p. may operate as part of a fire detection and alarm system or may function in conjunction with other emergency detection systems, such as those for storms, earthquakes and bomb threats. The s.s.c.i.e. may be a separate unit or may be physically combined with the fire detection control and indicating equipment (see ISO 7240-2).

The s.s.c.i.e. is primarily intended to broadcast information for the protection of lives within one or more specified areas in an emergency, to effect a rapid and orderly mobilization of occupants in an indoor or outdoor area. This includes systems using loudspeakers to broadcast voice announcements for emergency

purposes, alert signals complying with ISO 7731, and evacuate signals complying with ISO 8201.

2.2 SPEAKERS AND CABLING

Above speakers to be compliant, tested and certified in accordance to the relevant Standard, i.e. EN 54-24 and/or BS 5839-8, as per schedule on pages 1 and 2. Certification has to be presented in the tender document.

If the speakers are assembled in accordance to above standards but not certified, the tenderer has to make the consultant aware of this fact, so it can be considered during adjudication.

Speaker wiring has to be chosen such that not more than 10% power loss occurs over the cable in total, in order to conduct as much amplifier power to the speakers for full sound volume and minimal loss of sound pressure level. The speaker cable has to adhere to the Standard BS EN 50200, classification PH30. I.e. having a fire duration of survival of 30 minutes at 830°C surrounding temperature.

2.3 SOUND PRESSURE LEVELS

The Sound Pressure Level (SPL) of the alarm message(s) in each zone shall be of good coverage. The emergency message signal shall broadcast at 10dB SPL above ambient noise, as per ISO/SANS 7240 19 or BS 5839 8 Standard.

The following sound pressure levels shall be obtainable from the proposed loudspeakers at the following parameters.

SPL at 1m distance, 1W power input.
- Ceiling speakers: SPL [1W, 1m]: 94dB

2.4 AMPLIFIER WATTAGE PER INDIVIDUAL ZONE

The Voice Alarm System VAS (Emergency Voice Evacuation System) is designed for 2 zones, of which its power requirements are satisfied by the respective amplifiers in the technical specification list at the end of this document, and leaving enough headroom for more speakers to come in the future, without exhausting the existing amplifier capacity.

Zone #1 : 15W , 45W power to be provided
Zone #2 : 13W , 45W power to be provided

In total the required loudspeaker wattage is 28W over all amplifiers.
The total amplifier wattage to be supplied, including reserve, should be around 90W.
Each zone's respective amplifier shall hold the above electrical spare power for possible later growth.

2.5 MICROPHONES

Besides the one Fireman's Microphone integrated into the front panel of the master amplifier, the additional external Fireman's Microphone, without 20/10 button extension keypad, shall be wall mounted as per instruction by the consulting engineer.

The Remote Paging Microphone (incorporating 10 extension buttons), without 10 button extension keypad, shall be desk mounted as per instruction by the consulting engineer.

2.6 EMERGENCY BROADCASTING

Broadcasting automatically (pre-recorded messages) or manually. Individually per zone, group of zones or all-call.

Broadcasting of pre-recorded emergency messages to occur not simultaneously but sequentially, first the evacuation message in the emergency zone(s), then following the alert message in the neighbouring zone(s).

Additionally, each broadcast may contain two or more messages, or an attention drawing signal first and then followed by an announcement, etc.

2.7 STANDBY AMPLIFIER

A total of one (1) standby amplifier to be provided.
The standby amplifiers to take over the respective failing amplifier/s in the system.

Per each group of maximum ten operating amplifiers, one standby amplifier has to be provided, with the same or more signal power then the largest operational amplifier out of the ten.

2.8 BATTERY BACK UP

The following rating has to be sufficed:
- 24 hours system standby time, plus
- 30 minutes evacuation period under full speaker load.

The battery capacity provided has to be sufficient for the chosen system to stay operational for the above periods of time. Calculation of the battery capacity to be in compliance with Standards BS 5839 part 8 (or VDE 0833 part 4).

A total capacity of some 65Ah at 24Vdc is envisaged.

Above battery backup is required for the 'Automated Emergency Voice Evacuation System', including the fireman microphone(s) and remote paging microphone(s).

Further, the emergency power supply itself, including battery backup, is powered via the general power grid. Correct circuit breaker rating to be considered and supplied.

Those components of the system that are not directly part of the emergency evacuation system are to be supplied with electrical power via the general power grid, and backed up by UPS and/or emergency generator.

2.9 SPEAKER/AMPLIFIER WIRING

Each operational amplifier for PA/Evac to provide dual line output speaker connection for possible A/B-wiring.

The loudspeaker lines to utilize impedance matching between the amplifier's transformer output and the group of parallel switched loudspeaker transformer inputs.

2.10 COMPLIANCE

The quoted system shall comply with the following standards: SANS 7240 parts: 4 and 16 (ISO 7240-4, -16, -24); EN 54 parts: 4, 16 and 24; and/or BS 5839 part 8, whichever one applies, as specified below. Certification to be provided, where indicated.
Further, the standards SANS 10139 and SANS 10400-T: 2011 Edition 3 shall be adhered to.

Relevant Safety Elements and Features of the System:

- All-call emergency evacuation. Includes all zones.
- Automated emergency evacuation per individual zone.
- Built-in voice/tone alarms from pre-recorded messages.
- 2-phased voice alarm message broadcasting (VM-3000) (signal and voice) , and two message channels sequentially (alert and evacuation).
- Fireman's microphone, built into the master amplifier.
- Remote fireman's microphone.
- Remote fireman's microphone capsule fault detection.
- The remote microphone's capsule is included in the signal path's fault detection.
- Critical signal path fault detection.
- From microphone capsule to the last speaker on any speaker line.
- Continuous speaker line monitoring.
- Without interruption of BGM distribution or paging announcements.
- A/B-speaker line wiring.
- Amplifier system provides dual output for A/B-speaker lines.
- Automatic log-book keeping, internal, review via LAN connection on external PC.

Power Supply and Battery backup.

- With automatic and seamless switch over between AC and DC, according to EN 54 part 4.
- VRLA (vent regulated lead acid) batteries.

- Flame retardant according to UL94V-0 or UL94HB, and compliant to EN 50272-2, EN 60896-2.
- Speaker cable supplied having been tested in accordance with EN 50200, class PH30. I.e. having a fire duration of survival of 30 minutes at 830°C surrounding temperature.
- Standby amplifier(s). Maximum 10 amplifiers per 1 stand-by amplifier.
- Speakers equipped with thermal fuse (72°C or higher, according to BS 5839 part 8).
- Speakers equipped with fire resistant terminal block (according to BS 5839 part 8).

The various components are fully integrated into one system, from where the main processor head end device surveys and controls the entire setup, reporting to the internal data logbook all occurrences within the system as well as indicating on the front panel via LEDs.

The system shall be connected to an external fire panel for receiving alarm signals and respond accordingly.

The voice alarm system (VAS) to understand simultaneous triggers from the fire panel and relate them to the respective zones, regarding evacuation and/or alert.

2.11 TESTING AND COMMISSIONING

After completing the installation or any particular section thereof, the Contractor shall provide all the necessary test equipment and assistance, so that the installation could be tested to the complete satisfaction of the Engineer and Client.

On completion, the Contractor shall give notice, in writing, to the Engineer, who shall inspect the installation within one month from date of such written notice. The expiration of the one-month shall be deemed to be the completion date unless the installation is not approved.

The Contractor shall, at his own expense, supply the Client with a 3 complete sets of all the drawings on completion of the contract. These final drawings shall include:

- A proper and accurate as-made wiring diagram of the complete installation, showing circuit numbers, terminal strip numbers and conductor colours and numbers and the bus line layout.
- A schematic diagram clearly showing functions of all equipment items. A material list showing make, model, and characteristics of all components is to be included.

2.12 HANDING OVER AND INSTRUCTION OF OPERATIONS

After completion of the installation and when the systems are in working order, the Contractor will be required to instruct a representative of the Client in the complete

operation and control of the systems, including the basic adjustments and alignments to be made, until the Client is fully conversant with the equipment and its use.

The Electronics contractor shall during the whole of the contract period, mark up and prepare wiring diagrams which shall indicate each wire installed in the installation, the position where each wire is terminated and the way of identification of each wire.

In addition, the Contractor shall provide three copies of maintenance, fault-finding, and operating manuals, for all the equipment installed under the contract, and no payment of retention will be made until the above manuals have been received.

The contract shall be deemed incomplete until all manuals have been received and approved by the Client.

On satisfactory completion of the installation and testing thereof a guarantee period of 12 calendar months will apply.

2.13 GUARANTEES

All plant and equipment will be guaranteed for a period of 12 (twelve) months from the date of take-over, during which the Contractor will, at no extra charge, service and maintain the installation on a basis as decided with the Engineer.

RETURNABLES

Item	Description	Manufacturer	Code/Model No
1.	Voice Alarm System Manager with Amplifier built-in. • 240W / 100V line amplifier and digital mixer. • 6 channels output, sharing 240W. • Digital audio processed and controlled. • Line monitoring and fault indication. • Built-in electronic alert and evacuation messages. • 2-phase voice alarm. • Built in Fireman's Microphone. • General controls: 8x in, 8x out. • Emergency controls: 6x in, 3x out. • System event logging. • EN 54 part 16 certified.		
2.	Standby Amplifier • 240W Back-up amplifier. • Used for redundancy, to replace and takeover failing amplifier(s). • Amplifier input module included. • The programmable power amplifier standby function • maximises battery-powered operation time. • EN 54 part 16 certified.		
3.	Remote system microphone on a gooseneck and 15 freely programmable rugged press-buttons, one key with a hinged safety cover, expandable to a max. 105 keys. Easy to use with pre-programmable functions: • Start an emergency sequence with the covered alarm key. • Manual announcements in selectable zones or as an all-call. • Selectable background music. • Activate control outputs. • Amplifier monitoring.		

	• Change volume. • Distribute specific error messages. • Start announcements from message memory. • Chime trigger. Additional indicators for power on, general fault and emergency. Adjustable microphone and loudspeaker volume. Max. Cable length (Cat5): 450m, 900m with repeater, CAT RJ-45 cable. • Power supply: 24 VDC (14 - 28 Vdc) • Output level: 0 dBV at 600Ω balanced • Signal to Noise Ratio: > 60 dB • Distortion: < 1% • Frequency response: 100 – 20,000 Hz • Microphone: Unidirectional electret condenser on gooseneck • Finish: ABS resin • Weight: 790 g		
4.	A Fireman's Microphone: • incorporating the emergency activation key • permitting pre-recorded evacuation and alert announcements • activated on the processor equipment • Enabling manual microphone announcements in emergency situations • Press buttons assigned to zoning, or any other • possible function, individually per function key • Microphone unidirectional with Talk-key, 200-15000 Hz <u>Extension unit:</u>		

	• connecting to the fireman's microphone • expanding the system by up to 60 buttons <u>Buttons:</u> • Emergency key • Evacuation key • Alert key • Emergency reset key • CPU switch • Reset switch • Microphone volume control • Buzzer volume control Dimensions: 1.1 kg, 200(W) x 215(H) x 82.5(D) mm, with wall mounting bracket.		
5	<u>Voice Alarm Emergency Power Supply</u> Supply of 24Vdc to each component in the voice alarm system. Continuous surveillance and charging of batteries. Temperature-based compensation of charging voltage. Automatic switch over to batteries in case of AC mains failure. EN 54 part 4 certified.		
6	<u>12Vdc battery.</u> • sealed lead-acid • 65Ah capacity Maintenance free. VRLA (vent regulated lead acid) batteries, flame retardant according to UL94V-0 or UL94HB, and compliant to EN50272-2, EN60896-2.		

3 CCTV SYSTEM

3.1 INTRODUCTION:

Surveillance CCTV system is required to ensure effective surveillance of an area as well as create a tamperproof record for post event analysis. The System shall provide an online display of video images on TFT monitors/Video Wall/Large plasma monitors located in Central as well as Local control rooms.

System should facilitate viewing of live and recorded images and controlling of all cameras by the authorized users present in the LAN.

System should provide inter-operability of hardware, OS, software, networking, printing, database connectivity, reporting, and communication protocols. System expansion should be possible through off-the-shelf available hardware.

Equipment with better specifications shall be accepted.

The system shall in all respects comply with KZN Province Standard Quality Specification for General Electrical Installations

NOTE:

- **NVR & Camera Server are synonymous in these specifications.**
- **OEM of Cameras, Encoders, Decoders, NVR, Servers, NAS box/Raid backup device, Workstations, Monitors, and Switches shall be ISO firms & the offered products must be CE certified.**

3.2 GENERAL SPECIFICATIONS:

3.2.1. Proposed CCTV system shall be an open standard based integrated system with IP network centric functional and management architecture aimed at providing high-speed manual/automatic operation for best performance.

3.2.2. System shall use video signals from various types of indoor/outdoor CCD colour cameras installed at different locations, process them for viewing on workstations/monitors at Central Control Room/local control rooms and simultaneously record the cameras after compression using MPEG 4 or better standard. Joystick or Mouse-Keyboard controllers shall be used for Pan, Tilt, Zoom, and other functions of desired cameras.

3.2.3. System shall have combination of Digital CCD Colour video Cameras with Individual IP address, analogue CCD Colour Video Cameras with Fixed or P/T/Z Lens, encoders / decoders, Network Video recorders (NVR/CAMERA SERVER), Network attached storage (NAS) / Raid backup device for recording, Application software, Colour Video Monitors, Keyboards with Joystick controllers / Mouse-Keyboard, software based Video Matrix Switcher, workstation for System Administration / Management /Maintenance etc.

3.2.4. The NVR / CAMERA SERVER can be embedded type or server based. However the NVR / CAMERA SERVER software shall run on common off the shelf available servers (Camera server & Database server). Each NVR / Camera Server shall be able to handle 36 or more cameras.

3,2.5. Network Video Recorder shall offer both video stream management and video stream storage management. Recording frame rate & resolution in respect of individual channel shall be programmable.

3.2.6. System should ensure that once recorded, the video cannot be altered, ensuring the audit trail is intact for evidential purposes.

3.2.7. System shall provide sufficient storage of all the camera recordings for a period of 30 days or more @ 25 FPS, at 4 CIF or better quality using necessary compression techniques for all cameras (extended capacity of cameras i.e. present capacity + 25 %).

3.2.8. System shall use a combination of IP enabled cameras & analogue CCD cameras with external encoder. The video shall be compressed using MPEG-4 or better standard and streamed over the IP network.

3.2.9. Encoders shall digitize analogue video, compress the digital video using various compression algorithms (MPEG - 4 or better standard), and transmit the compressed digital video over packet-based IP network. Encoders shall have less than 200 milliseconds of latency and shall support dual stream – MPEG 4.

3.2.10. The recording resolution and frame rate for each camera shall be user programmable.

3.2.11. The Area under surveillance shall be monitored and controlled from Central/Local Control Room(s) through workstations and Joystick controllers.

3.2.12. Surveillance CCTV System shall operate on 230 V, 50 Hz single-phase power supply. Power for all the equipment will be conditioned using on-line UPS with minimum 30 minutes or more back up. If any equipment operates on any voltage other than the supply voltage and supply frequency, necessary conversion/correction device for supply shall be supplied along with the equipment.

3.2.13. All the control equipment e.g. servers, NVR/CAMERA SERVER, NAS/Raid backup device, decoders etc. shall be provided in standard Racks.

3.2.14. All the indoor cameras & control equipment shall be suitable for operation from 100 C to 400 C and relative humidity up to 80 % non-condensing. Cameras & other equipment, meant for outdoor installations, shall be suitable to work from (-) 10o C to (+) 50o C with RH up to 90% noncondensing. This temperature range may be achieved with or without heater.

3.3 SYSTEM REQUIREMENTS:

3.3.1. Camera with external encoder or IP Camera shall be used for image capture.

3.3.2. Indoor cameras shall be either with fixed focal length lens or with Pan/Tilt & Zoom lens as per site requirement. All outdoor Cameras shall be Day/Night cameras.

3.3.3. Housing of cameras meant for indoor use shall be of IP 42 rating whereas outdoor camera housing shall be of IP 66 or better rating. These must be integrated by the camera manufacturer.

3.3.4. System must provide built-in facility of watermarking or Digital certificate to ensure tamperproof recording so that these can be used as evidence at a later date, if so desired. The recording shall support audit trail feature.

3.3.5. All camera recordings shall have Camera ID & location/area of recording as well as date/time stamp. Camera ID, Location/Area of recording & date/time shall be programmable by the system administrator with User ID & Password.

3.3.6. Facility of camera recording in real-time mode (25 FPS)/15/12.5/10 or lower FPS as well as in any desired combination must be available in the system.

3.3.7. Facility of Camera recording in CIF, 2CIF, 4 CIF as well as in any combination i.e. any camera can be recorded in any quality – Selective or Group of cameras must be available in the system.

3.3.8. System to have facility of additional camera installation beyond the originally planned capacity.

8.3.9. In order to optimize the memory, while recording, video shall be compressed using MPEG-4 or better standard and streamed over the IP network. Once on the network, video can be viewed on a Control room workstation or on analogue monitor using a hardware decoder (MPEG- 4/compatible standard Receiver) and shall be recorded on NVR/CAMERA SERVER and shall be backed up on NAS/RAID Backup device.

3.3.10. System shall be triplex i.e. it should provide facility of Viewing, Recording & Replay simultaneously.

3.3.11. The offered system shall have facility to export the desired portion of clipping (from a desired date/time to another desired date/time) on CD or DVD. Viewing of this recording shall be possible on standard PC using standard software like windows media player etc.

3.3.12. PTZ Cameras shall have 64 or more pre-defined positions, to be selected through suitable input alarm.

3.3.13. Redundancy/Fail-over feature is required i.e. in case of failure of an NVR/CAMERA SERVER the relevant cameras shall automatically switch

over to the redundant NVR/CAMERA SERVER.

3.3.14. System shall have provision of WAN connectivity for remote monitoring.

3.4 SYSTEM DESIGN:

3.4.1. Each camera should be connected to a Hardware Encoder, through cable, which shall support minimum dual streams. Alternatively, the camera shall be IP based, UTP ready. The encoders should be capable of producing streams @ 25 fps for each camera for viewing on LAN and on monitors and also recording into the NVR/CAMERA SERVER/Camera servers and NAS box/Raid backup device @ 25 fps or lower frame rate, user selectable as per requirement, for each individual camera.

3.4.2. Encoders shall be Power over Ethernet (POE) compliant and connected to Layer 2 or Layer 3 switch as per system design using UTP CAT 6 Cable or fibre optic cable and the required connectors as per standards.

3.4.3. Central/Local Control Room will have workstations along with controllers for Camera operation. For monitoring purposes, Video monitors/Plasma monitors/Video wall shall be setup with suitable mounting arrangements, as per user requirements. Facility for viewing and controlling all the cameras at various other locations, as required, shall be provided.

3.4.4. Monitoring at Local control rooms may be restricted to operation of certain cameras only & system administrator should be able to configure the system, accordingly. More than one Local Control rooms may be required in the proposed system with individual configuration.

3.4.5. Each control room may have one or more Operators simultaneously using the installed Video monitors/Video wall. Operator control on cameras shall be on a static basis or rotary basis depending on the policies to be decided at site.

3.4.6. There shall be a Control System with Video Control Software to manage all the video surveillance devices.

3.4.7. Database Server shall keep track of all configurations & events. This will help in proper System administration & management of redundancies etc.

3.4.8. Video stream from individual cameras shall be recorded on respective NVR/Camera Server &, subsequently, archived to NAS box/RAID backup device. System shall have provision to automatically over-write the new information after the period of 30/31 days & necessary script/algorithm must be available in the Application.

3.4.9. All the workstations in LAN should be provided with software to view and control the cameras, encoders and retrieve the recorded video images from the NVR/CAMERA SERVER/NAS/Raid backup device seamlessly.

3.5 VIDEO SURVEILLANCE APPLICATION SOFTWARE

3.5.1. The software shall operate on open architecture for integration with perimeter safety, access control, PA and fire / safety systems based on open standards

3.5.2. Digital video surveillance control software should be capable to display and manage the entire surveillance system. It should be capable of supporting variety of devices such as cameras, video encoders, video decoders, PTZ controller, NVR, NAS boxes/Raid backup device etc.

3.5.3. The software should have inbuilt facility to store configuration of encoders / decoders and cameras.

3.5.4. The software should Support flexible 1/2/4 Windows Split screen display mode or scroll mode on the PC monitor or on preview monitor as per site requirement.

3.5.5. The software should be able to control all cameras i.e. PTZ control, Iris control, auto / manual focus, and colour balance of camera, Selection of pre-sets, Video tour selection etc.

3.5.6. There must be a single encoder for each camera

3.5.7. The software is required to generate reports of stored device configuration. The control software is required to provide alarm and alarm log. The log shall be able to be achieved, printed and displayed using a device filter, a device group filter and/or a time window.

3.5.8. The software should have user access authority configurable on per device or per device group basis. The user shall have the facility to request the access of any camera and can control the camera for a reservation period. Control of camera is released after the reservation period.

3.5.9. The system shall provide User activity log (audit trail) with user di, time stamp, and action performed, etc.

3.5.10. The administrator should be able to add, edit & delete users with rights. It shall be possible to view ability / rights of each user or the cameras which can be viewed & controlled as per the permission assigned by the administrator.

3.5.11. The users should be on a hierarchical basis as assigned by the administrator. The higher priority person can take control of cameras, which are already being controlled by a lower priority user. There should be minimum 3 hierarchical levels of security for providing user level log in.

3.5.12. It should have recording modes viz. continuous, manual, or programmed modes on date, time and camera-wise. All modes should be disabled and

enabled using scheduled configuration. It should also be possible to search and replay the recorded images on date, time and camera-wise. It should provide onscreen controls for remote operation of PTZ cameras. It should have the facility for scheduled recording. Different recording speeds (fps) and resolution for each recording mode for each camera should be possible.

3.5.13. It should provide programmable motion detection and recording, to be defined area wise. System must be able to support video motion detection algorithms to detect and track objects, learn the scene, Adapt to a changing outdoor environment, ignore environmental changes including rain, hail, wind, swaying trees and gradual light changes.

3.5.14. The settings shall be individually configurable for each alarm and each camera prerecord duration. This shall allow the Camera Server to capture video prior to the alarm/event, as well as after the alarm/event. Shall be selectable from a list of values ranging between 0 seconds and 5 minutes.

3.5.15. The software for clients should also be working on a browser based system for remote users. This will allow any authorized user to display the video of any desired camera on the monitor with full PTZ and associated controls.

3.5.16. Retrieval: The CCTV application should allow retrieval of data instantaneously or any date / time interval chosen through search functionality of the application software. In case data is older than 30 days and available, the retrieval should be possible. The system should also allow for backup of specific data on any drives like CD/DVD/Blu ray Recorders or any other device in a format which can be replayed through a standard PC based software. Log of any such activity should be maintained by the system which can be audited at a later date.

3.5.17. Backup: Online backup should be maintained to protect against storage failure.

3.5.18. Storage: Data storage should be at a central location in the airport. The capacity of the storage should be equal to 30 days of recoding of all cameras at 25 fps/4 CIF. The system should follow FIFO on recording.

3.5.19. Artificial Intelligence: It shall have image tracking facility. If any object is found to be stationary for a pre-defined period the system shall track the event and alert the operator. This facility shall be provided on select cameras at entry point, check-in counters, X-Ray BIS points, SHA and as defined by the tenderer. The system must have the features for identifying tail-gating, vehicle detection features, unattended baggage identification, queuing analysis, and external text insertion feature and intruder detection.

3.6 DETAILED TECHNICAL SPECIFICATIONS

COLOUR VIDEO DOME CAMERA WITH PTZ

Image Device	Interline transfer 1/4" or better format CCD sensor
Focal length	4 mm to 72 mm or better (for Artificial Intelligence Cameras with better focal length i.e.; 3.5 mm to 91 mm to be used)
Optical zoom (For Indoor Camera)	18 X or better
Optical zoom (For Outdoor Camera)	26 X or better
Number of Pixels	720 X 576
Scanning System	PAL
Resolution	480 TVL or better
Illumination (For Indoor camera)	1.0 Lux (Colour), 0.1 Lux (B/W) or better
Illumination (For Outdoor camera)	1.0 Lux (Colour), 0.05 Lux (B/W) or better
Pan Travel	360° Continuous
Tilt Travel	0 - 90°
Manual Tilt Speed	0.5°/SEC to 90°/SEC
Manual pan speed	0.5°/SEC to 90°/SEC
Preset Tilt speed	0.5°/SEC to 90°/SEC
Preset Pan Speed	0.5°/SEC to 300°/SEC
Preset positions	Min. 64
Iris Control	Auto
Focus	Auto
Back Light compensation	Required with black masking or other suitable technology
White balance	Auto
Electronic shutter	Auto
S/N ratio	>= 48 dB
Power supply	As per OEM's design, however generally AC 230 V @ 50Hz/12V or 24 V AC Rectifier and SMPS if DC supply

FIXED COLOUR DOME CAMERA VARIFOCAL

Image Device	1/3" or ¼" CCD Sensor
Number of Pixels	720 x 576
Scanning System	PAL

Resolution	480 TV Lines or better
Min Illumination	1 Lux at F 1.2
S/N Ratio	>=48 dB
Electronic Shutter	AUTO
Lens	Built-in Varifocal lens. Auto Iris, lens f = 4 – 9 mm. (approx.)
Backlight compensation	Required
Power supply	As per OEM's design

3.6.3 MPEG4 ENCODER (HARDWARE BASED)

3.6.3.1 The encoder shall be built on embedded processor and real time operating system. The Encoder should convert Analog Composite/S-Video input into good quality digital stream on real time basis and shall be able to transmit as Unicast /Multicast IP packet with low latency (less than 200 milliseconds.) for live viewing as well as for recording.

3.6.3.2 The video resolution should be configurable at either of 4 CIF, 2 CIF, and CIF @ 25 fps or at lower frame rate per camera, user selectable.

3.6.3.3 The encoder should generate MPEG4 video stream Compliant with ISO/IEC 14496 standard. The encoder should be interchangeable with any standard encoder of any other make, which generates MPEG4 video stream Compliant with ISO/IEC 14496 standard.

3.6.3.4 The Encoder should have the following specifications or should match with the requirement.

Format	PAL colour, B/W, composite, 25 fps, 2:1 interlaced
Resolution (H x V pixels)	4 CIF 704 x 576, 2 CIF , CIF, QCIF
Frame Rate	25 fps (PAL) and lower
Encoding	MPEG-4 Compliant with ISO/ IEC 14496 Standard
Video Parameters	Brightness, contrast, hue, sharpness, and sizing selectable
Video Latency	Less than 200 milliseconds.
Connectors	BNC for Composite Video for input, suitable connectors for Power, Alarm in, and Alarm out, RJ-45 for Ethernet 10/100 Base-T output.
IP Address	Static IP Address or as per System requirement.
MPEG4 standard	Compliant with ISO / IEC14496
IP Packets	Unicast and Multicast
POE	Compliant
Power supply	As per OEM's design

3.6.4 NETWORK ATTACHED STORAGE (NAS)/RAID BACKUP DEVICE

3.6.4.1 NAS box/RAID backup device shall be used to record video streams based on the configuration assigned by administrator. Workstations & Servers within the LAN should be able to access the recorded video streams. The NAS/RAID backup device should support simultaneous play back and recording at full duplex operation.

3.6.4.2 It shall provide a high quality recording storage and play back of images. It should support integration with LAN to provide Centralized Management and shall operate on Windows / Linux OS. Support of user management for security level control and authentication required. These NAS boxes/RAID backup device should have the following features and specifications:

On-board CPU	Dual Intel Xeon R Support up to 2.8 GHz
On-board Memory	2 GB DDR RAM
HD Drive	As per system requirement
Host Interface	Dual Gigabit Ethernet
RAID Support	RAID levels 0, 1, and 5
Network Transport Protocols	TCP/IP
Network File Protocols	CIFS, NFS, HTTP/HTTPS, FTP, NTP, SNMP, SMTP, DHCP and DNS
Drive Status /Space Monitoring	Supported
Operating System (OS)	MS Windows OS (Latest version) or Linux
Power supply	Hot pluggable Redundant Power Supply

3.6.5 WORKSTATION

CPU	Pentium ® 4 Processor 3.4 GHz, 800FSB, 2 MB Cache or better
Mother Board	Intel Original Mother Board
Memory	2 GB DDR RAM
Hard Drives	180 GB or more
Floppy Drive	1.44 MB
Keyboards	PS /2 Keyboard
Mouse	Optical Mouse with scroll
Video Card	In Built 2 Nos for connecting 2 monitors
RAID	Supported
Network Adapter (NIC)	Integrated 10/100/1000 Base -T
Sound Card	In- Built
DVD writer	DVD+16x –16x, RW +8x -6x, CDW 48x, Blu Ray
Monitor	19" TFT monitor
USB 2.0 or fire wire card	2 nos. at front panel
Operating system	MS Windows OS or Linux (Latest versions) at the time of tender.
Anti Virus Software	Latest software at the time of tender.

3.6.6 NVR/CAMERA/DATABASE SERVER

CPU	Pentium IV or Xeon, 3.2GHz or higher
Memory	2 GB DDR RAM
Hard Drives	2 TB with RAID 5 Support
DVD writer	External DVD+16x –16x, RW +8x -6x, CDW 48x, Blu Ray
Network Adapter (NIC)	Dual TCP/IP Integrated 10/100/1000 Base –T
Sound Card	In- Built
Graphic Card	Super VGA non-interlaced graphics card capable of 1024 x 768 pixel resolution and 65K colours (or true colour) with 4MB video memory or better
Recording Speed	25 fps / channel (minimum 32 channel)
USB 2.0 or fire wall	2 nos. at front panel
Keyboards	PS/2 Keyboard
Mouse	Optical Mouse with scroll
Monitors	19" TFT
Operating system	MS Windows OS or Linux (Latest versions) at the time of tender.
Anti-Virus Software	Latest software at the time of tender.

3.6.7 CAMERA HOUSING & MOUNT:

The camera mount should be:
i. Of the same make as that of camera and suitable for the model number offered as specified by the manufacturer and should be an integrated unit.
ii. Should be compact and indoor / outdoor type as required. iii. Should support the weight of camera and accessories such as housing, pan & tilt head in any vertical or horizontal position etc.

3.6.8 SPEED DOME CONTROLLER/PTZ CONTROLLER

Speed Dome Controller should have variable speed joystick, LCD display for programming and it should be able to control the speed dome for PAN / TILT / Zoom.

CABLES

Sr. No.	Connectivity	Cable Type
1	Camera to Video Encoder	CAT 6 / Fibre Optic
2	Video Encoder to Switch in control room	UTP CAT 6 / Fibre Optic

3	Switch to Video Wall Switches	UTP CAT 6 / Fibre Optic
4	From switches to NAS Box	Fibre Optic
5	Hardware Decoder to monitor	Composite signal cable

3.7 TESTING AND COMMISSIONING

After completing the installation or any particular section thereof, the Contractor shall provide all the necessary test equipment and assistance, so that the installation could be tested to the complete satisfaction of the Engineer and Client.

On completion, the Contractor shall give notice, in writing, to the Engineer, who shall inspect the installation within one month from date of such written notice. The expiration of the one-month shall be deemed to be the completion date unless the installation is not approved.

The Contractor shall, at his own expense, supply the Client with a 3 complete sets of all the drawings on completion of the contract. These final drawings shall include:

- A proper and accurate as-made wiring diagram of the complete installation, showing circuit numbers, terminal strip numbers and conductor colours and numbers and the bus line layout.
- A schematic diagram clearly showing functions of all equipment items. A material list showing make, model, and characteristics of all components is to be included.

The structured cabling system should be tested by the tenderer to conform to the requirements specified in the ISO 11801 Class D+ specifications and to be complaint to manufacturer ACR pr-pr warranty value.

100% of the UTP cables and fibre optic cables must be individually tested by the tenderer after installation of the cables.

A certain percentage of the outlets will be chosen at random for the final acceptance test by the end user.

Results of all acceptance tests performed are to be fully documented and submitted to end-user.

A 100% of total installation must be documented with a printout indicating Certifiers name, position, date, length, resistivity, impedance, attenuation, NEXT, ACR, PSNEXT, propagation delay, delay skew, ELFEXT, PSELFEXT, FEXT, PSACR, return loss, twisting lay and crosstalk at frequencies listed in the makers specifications.

3.8 HANDING OVER AND INSTRUCTION OF OPERATIONS

After completion of the installation and when the systems are in working order, The Contractor will be required to instruct a representative of the Client in the

complete operation and control of the systems, including the basic adjustments and alignments to be made, until the Client is fully conversant with the equipment and its use.

The ICT contractor shall during the whole of the contract period, mark up and prepare wiring diagrams which shall indicate each wire installed in the installation, the position where each wire is terminated and the way of identification of each wire.

In addition, the Contractor shall provide three copies of maintenance, faultfinding, and operating manuals, for all the equipment installed under the contract, and no payment of retention will be made until the above manuals have been received.

The contract shall be deemed incomplete until all manuals have been received and approved by the Client.
On satisfactory completion of the installation and testing thereof a guarantee period of 12 calendar months will apply.

3.9 GUARANTEES

Tenderer shall provide a 20 year passive product warranty, backed by the manufacturer, and a 20 year application assurance on the application described in this document from the date of successful implementation, testing and commissioning of the cabling system.

The tenderer shall provide on-site warranty for one year for the Structured Cabling System from the certified practical completion date of the whole contract.

The 20 year product warranty shall cover product manufacturing defects for all passive Structured Cabling System components.

The 20 year application assurance shall cover the failure of the offered cabling system to operate the applications which the system was designed to support and additional future applications.

The application assurance program should also cover:-

(a) Those identified in the current (at the time of installation) and future versions of the Cabling Performance Specifications; and
(b) Any applications introduced in the future by recognized standards or user forums that is the EIA/TIA 568-A or ISO/IEC 11801 component and link / channel specifications for cabling.

In the events of system failure, the tenderer / manufacturer shall repair or replace the defective products at its own cost for the cost of labour to repair or replace any such defective product until the cabling system is set up to support the required applications.

Progressive audit check of the workmanship quantity of the cabling system by the manufacturer is required. The site should be certified by a certified engineer from the manufacturer.

For the Class D+ Channel performance, the warranty ACR value provided by the manufacturer should be at least 10dB @ 100MHz (Silver). For the Proposed 14
Class E Channel performance, the warranty ACR value provided by the manufacturer should be at least 19dB @ 100MHz; 6.4dB@ 200MHz. (Gold).

3.10 RETURNABLES

Item	Description	Manufacturer	Code/Model No
1	Fixed box camera 1/3 inch, 600 TV Lines 0,05 lux colour, Supper Dynamics Range, Motion detection, Coaxial control, digital image stabilisation, electronic D/N, Dual power 12 VDC and 24 Volt AC. Including Tamron 2.8 – 12 mm DC iris Lens and aluminium housing and mounting bracket.		
2	1/3 inch varifocal 2.8-10 mm static Dome Camera, 600 TV lines colour,0.15 lux, super dynamic range, with motion detection, coaxial control and dual power 12 VDC and 24 Volt AC.		
3	Network Attached Storage (NAS) use 2 Tera Byte Hard Drive 5900RPM.		
4	Workstation		
5	NVR/Camera/Database Server		
6	Speed Dome Controller/PTZ Controller		
7	Control Room Screens 29 Inch		
8	32 inch Samsung wide video monitor, Contrast ratio 3000:1, with 600 TV Lines, with build in loudspeakers. Inputs include HDMI, CVBS, VGA and DVI.		

	Or similar approved		

4 ACCESS CONTROL SYSTEM

4.1 GENERAL

The facility shall require an Access Control system to increase both security and providing Staff with ease of movement throughout the various buildings.

STAND ALONE ACCESS CONTROL

The Access Control system shall consist of separate Stand-Alone systems installed at the various doors as shown on the Ancillary layout drawings.

ACCESS CONTROL FIELD EQUIPMENT

The Contractor shall supply and install the following field equipment as specified below:.

- 20 x BioStar XPass – Mifare, RF 13.56MHz, IP65, PoE Card Reader controller
- 20 x Z & L maglock mounting bracket
- 20 x YLI 280kg monitored maglock with LED indicator light.
- 20x Sherlotronic 12VDC 3,2Amp Power Supply / Battery charger including 12VDC 7AH sealed lead acid battery.
- 20 x Top door jamb mounted 40-60kG Door closer unit
- 20 x No Touch Exit switch
- 20 x Green resettable Manual Call Point for emergency exit

4.2 TESTING AND COMMISSIONING

After completing the installation or any particular section thereof, the Contractor shall provide all the necessary test equipment and assistance, so that the installation could be tested to the complete satisfaction of the Engineer and Client.

On completion, the Contractor shall give notice, in writing, to the Engineer, who shall inspect the installation within one month from date of such written notice. The expiration of the one-month shall be deemed to be the completion date unless the installation is not approved.

The Contractor shall, at his own expense, supply the Client with a 3 complete sets of all the drawings on completion of the contract. These final drawings shall include:

- A proper and accurate as-made wiring diagram of the complete installation, showing circuit numbers, terminal strip numbers and

conductor colours and numbers and the bus line layout.

- A schematic diagram clearly showing functions of all equipment items. A material list showing make, model, and characteristics of all components is to be included.

The structured cabling system should be tested by the tenderer to conform to the requirements specified in the ISO 11801 Class D+ specifications and to be complaint to manufacturer ACR pr-pr warranty value.

100% of the UTP cables and fibre optic cables must be individually tested by the tenderer after installation of the cables.

A certain percentage of the outlets will be chosen at random for the final acceptance test by the end user.

Results of all acceptance tests performed are to be fully documented and submitted to end-user.

A 100% of total installation must be documented with a printout indicating Certifiers name, position, date, length, resistivity, impedance, attenuation, NEXT, ACR, PSNEXT, propagation delay, delay skew, ELFEXT, PSELFEXT, FEXT, PSACR, return loss, twisting lay and crosstalk at frequencies listed in the makers specifications.

4.3 HANDING OVER AND INSTRUCTION OF OPERATIONS

After completion of the installation and when the systems are in working order, The Contractor will be required to instruct a representative of the Client in the complete operation and control of the systems, including the basic adjustments and alignments to be made, until the Client is fully conversant with the equipment and its use.

The ICT contractor shall during the whole of the contract period, mark up and prepare wiring diagrams which shall indicate each wire installed in the installation, the position where each wire is terminated and the way of identification of each wire.

In addition, the Contractor shall provide three copies of maintenance, faultfinding, and operating manuals, for all the equipment installed under the contract, and no payment of retention will be made until the above manuals have been received.

The contract shall be deemed incomplete until all manuals have been received and approved by the Client.
On satisfactory completion of the installation and testing thereof a guarantee period of 12 calendar months will apply.

4.4 GUARANTEES

Tenderer shall provide a 5-year passive product warranty, backed by the

manufacturer, and a 5 year application assurance on the application described in this document from the date of successful implementation, testing and commissioning of the cabling system.

The tenderer shall provide on-site warranty for one year for the Structured Cabling System from the certified practical completion date of the whole contract.

The 5 year product warranty shall cover product manufacturing defects for all passive Structured Cabling System components.

The 5 year application assurance shall cover the failure of the offered cabling system to operate the applications which the system was designed to support and additional future applications.

The application assurance program should also cover:-

(a) Those identified in the current (at the time of installation) and future versions of the Cabling Performance Specifications; and
(b) Any applications introduced in the future by recognized standards or user forums that is the EIA/TIA 568-A or ISO/IEC 11801 component and link / channel specifications for cabling.

In the events of system failure, the tenderer / manufacturer shall repair or replace the defective products at its own cost for the cost of labour to repair or replace any such defective product until the cabling system is set up to support the required applications.

Progressive audit check of the workmanship quantity of the cabling system by the manufacturer is required. The site should be certified by a certified engineer from the manufacturer.

5 PABX AND DATA CABLING INSTALLATION

5.1 PABX INSTALLATION

The Contractor shall allow for the complete installation of all conduits, outlet boxes, Telkom Distribution boards, sleeve pipes, etc., required for the telephone system as shown on the drawings.

The sizes of all telephone conduits are indicated on the drawings and must be installed in the floor slab. Galvanized steel draw-wires shall be installed in all conduits.
End boxes must consist of a 50 mm x 100mm outlet box fitted with suitable blank cover plates, flush mounted at a height as specified above floor level.

Where Power Skirting is installed, the Contractor shall ensure that adequate conduit link provisions are installed, for the number of Telephone Outlets on Power

Skirting, between the Local Telephone Distribution Board and the Power Skirting as indicated on the drawings.

The Main Telkom Distribution Board shall consist of a 150mm deep x 600mm x 600mm metal box and hinged door with a 20mm thick wooden backboard. The TELKOM Sub-Distribution Boards shall consist of 150mm deep x 300mm x 300mm metal box and hinged door with 20mm thick wooden backboard. The boards shall be flush mounted with architrave, installed at 600mm above the floor.

5.2 DATA INSTALLATION

The Contractor shall allow for the complete installation of all conduits, outlet boxes, sleeve pipes, etc., required for the Data cabling as shown on the drawings.

The sizes of all data conduits are indicated on the drawings and must be installed in the floor slab. Galvanized steel draw-wires shall be installed in all conduits.

End boxes must consist of a 50 mm x 100mm outlet box fitted with suitable blank cover plates, flush mounted at a height as specified above floor level.

Where Power Skirting is installed, the Contractor shall ensure that adequate conduit link provisions are installed, for the number of Data Outlets on Power Skirting, between the Local Data Router Equipment and the Power Skirting as indicated on the drawings.

5.3 TELEPHONE INSTALLATION

The Contractor shall allow for the complete installation of all conduits, outlet boxes, Telkom Distribution boards, sleeve pipes, etc., required for the telephone system as shown on the drawings.
The sizes of all telephone conduits are indicated on the drawings and must be installed in the floor slab. Galvanized steel draw-wires shall be installed in all conduits.
End boxes must consist of a 50 mm x 100mm outlet box fitted with suitable blank cover plates, flush mounted at a height as specified above floor level.

Where Power Skirting is installed, the Contractor shall ensure that adequate conduit link provisions are installed, for the number of Telephone Outlets on Power Skirting, between the Local Telephone Distribution Board and the Power Skirting as indicated on the drawings.

The Main Telkom Distribution Board shall consist of a 150mm deep x 600mm x 600mm metal box and hinged door with a 20mm thick wooden backboard. The TELKOM Sub-Distribution Boards shall consist of 150mm deep x 300mm x 300mm metal box and hinged door with 20mm thick wooden backboard. The boards shall be flush mounted with architrave, installed at 600mm above the floor.

6. SPECIALIZED HOSPITAL FACILITIES

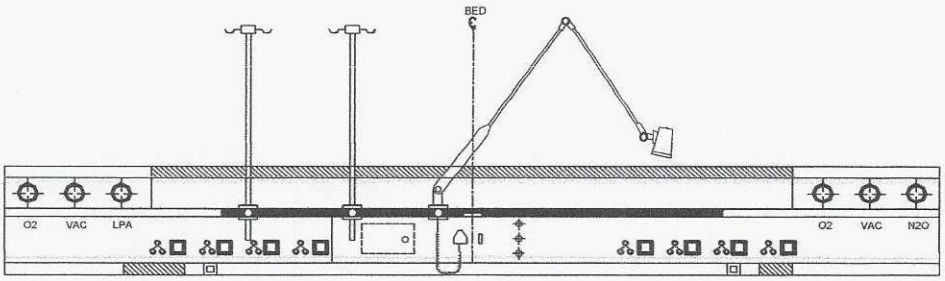
All electrical wiring to the pendants and the bed head units must be done in accordance to the Standard Specification.

All bedhead units shall be made from Anodised Aluminium.

6.1 Summarised bed head unit schedule and specifications

6.1.1 Intensive care, recovery, pre-op, and high care areas

Below is a typical horizontal type installation. The unit must comply with the following minimum requirements:



- Material: Horizontal extruded Aluminium profile
- Covers: Hinged covers
- Finish and colour: Anodised Aluminium
- Mounting: Wall mounted on the surface and suspended from ceiling
- Height from final floor level to underside of bed unit: 1,6m
- Medical Gas outlets: 2 x O_2, 1 x LPG and 1 x N_2O
- Vacuum connectors: 2
- Electrical outlets: 8 isolated double pole MCB
- Electrical supply: Isolated
- Nurse call with hand held unit as described in the specification
- Monitor take-off point
- Patient earth
- Medical rail: 2 x 500mm
- Examination light with medical rail bracket and Bulgin plug connected to switched socket outlet
- Drip hangers: 2 x double drip hangers with medical rail bracket

In the ICU the bed head units are suspended from a double volume rafter system through a standard 500 x 1500 suspended ceiling. Provision must

be made for support of the units to prevent excessive movement when equipment is connected or removed from the units.

KWAZULU-NATAL PROVINCE
PUBLIC WORKS & INFRASTRUCTURE
REPUBLIC OF SOUTH AFRICA

NEW 28 BEDDED MALE & FEMALE INPATIENT & OUTPATIENT MENTAL HEALTH UNIT

ANNEXURE 5 - MECHANICAL WORKS SPECIFICATIONS

KWAZULU-NATAL PROVINCE
PUBLIC WORKS
REPUBLIC OF SOUTH AFRICA

WIMS 048152

GENERAL JUSTICE GIZENGA MPANZA REGIONAL HOSPITAL

NEW 28 BEDDED MALE AND FEMALE INPATIENT AND OUTPATIENT MENTAL HEALTH UNIT

SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF HVAC INSTALLATION

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HVAC INSTALLATION

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PART 2

GENERAL JUSTICE GIZENGA MPANZA REGIONAL HOSPITAL
NEW 28 BEDDED MALE AND FEMALE INPATIENT AND OUTPATIENT MENTAL HEALTH UNIT

STANDARD SPECIFICATION

1. PART OF THE SPECIFICATION

The Standard Mechanical Specification covers the general technical requirements of the mechanical installation. These specifications shall be read in conjunction with the document in its entirety. If the conditions and/or specifications contained herein are at variance with anything contained in the detail specification, the latter shall take preference, otherwise these Standard Mechanical Specifications shall apply as if duly included.

2. MINIMUM REQUIREMENT

The conditions and/or specifications in this section shall be regarded as the absolute minimum requirement. More stringent similar conditions and/or specifications stated in the detail specification shall take preference to those in these Standard Mechanical Specifications.

3. PROPRIETARY MATERIALS

The Tenderer's attention is drawn to the Detail Specification and Bills of Quantities generally which forms an integral part of the specification, specifically to the following clauses:

Where the term "or other approved" is used in connection with proprietary materials or articles, it is to be understood that approval shall be at the discretion of the Principal Agent.

Where brand or trade names are referred to in the Detailed Specification and Bills of Quantities, these shall indicate the quality and type of material or fitting required and no substitution of materials so specified will be permitted unless the authority of the Principal Agent has been obtained in writing before tenders close.

4. STANDARD TYPE AND MAKE OF EQUIPMENT

Once installation has commenced with the appropriate approvals for using any type and make of article or equipment, the same type and make of article or equipment shall be used throughout the project for that specific application unless otherwise specified.

5. STANDARD OF WORKMANSHIP

The workmanship under this contract shall be of a high standard and to the satisfaction of the Principal Agent.

6. STANDARD OF MATERIALS

All materials and equipment supplied and/or installed under this contract shall be new and the best of their respective kinds and shall comply with the requirements laid down in the latest editions of the relevant SANS or BS and their amendments and with the requirements of this specification.

7. VARIATIONS

The Principal Agent reserves the right to instruct the Contractor to carry out variations to the contract in accordance with the conditions of contract.

8. CONSTRUCTION, PLANT, ETC.

Tenderers shall include in their prices for the supply of all scaffolding, hoisting, ladders, trestles, dust sheets and everything necessary for the proper performance of the contract, for clearing and removal of all rubbish due to the work, for the protection of the work from damage due to the building operations, other contracts and the weather. In existing buildings Contractors shall in particular take adequate precautions to the satisfaction of the Principal Agent to prevent damage to existing apparatus during erection operation.

9. MATERIAL, OFF-LOADING AND STORAGE

Tenderers must make due allowance in their tenders for the off-loading of materials and the storage and safe custody thereof according to manufacturer's specifications on or off site until such can be accommodated or is required on site.

10. ACCESS TO BUILDING

Workmen are to be identified to security and issued with access/identity cards. Identifiable uniforms must be worn by workmen and supervisors on site.

11. INSPECTION OF LOCALLY MANUFACTURED SUPPLIES

Where locally manufactured plant or materials are offered, the Principal Agent reserves the right to inspect such plant or goods during manufacture and to reject items that do not conform to the Employer's requirements. Where a number of units are ordered, the Contractor shall notify the Principal Agent when one unit has been completed so that the Principal Agent may inspect and approve it.

12. ORDERING MATERIALS

The Contractor is warned to place all orders for materials or special articles as early as possible as he will be held solely responsible for any delay in the delivery of such goods.

13. PACKING

The Contractor will be held responsible for packing all plant and other goods in such a manner as to ensure freedom from any loss or damage in transit. Unless otherwise specifically agreed upon, receptacles will not be returned or paid for and no additional charges will be allowed for packing or packing materials.

14. SAMPLES FOR TEST

The Contractor shall furnish, without delay, such samples for testing, or other purposes, as called for, or may be called for, by the Engineer, who may reject all materials or workmanship not corresponding with the approved sample.

Notwithstanding that samples and approved brands of materials, etc. are exhibited or included in classified lists at the offices of the Principal Agent, the Engineer may retest any samples, brands of materials, etc. included in the contract and reject articles and materials, etc. that do not strictly comply with the specification.

15. DAMAGE TO BUILDINGS AND THE MISUSE OF FACILITIES

Any damage done to the buildings, roads and landscaped areas by the Contractor, or his men, shall be made good by the Contractor. Should the Contractor, or his personnel, be granted leave by the Principal Agent to utilise on-site facilities and such facilities be misused or damaged, the facilities shall be cleaned and/or repaired to the satisfaction of the Principal Agent (It should be understood however, that the provision of facilities (toilets, etc.) in terms of the Preliminaries costs called for in the tender document, are the responsibility of the Contractor).

16. PROTECTION OF EMPLOYER'S EQUIPMENT

The Contractor shall ensure that any computers or other valuable equipment of the Employer is sufficiently protected against work or dust by means of temporary coverings or sealed-off partitions.

17. INSPECTIONS, TESTING, COMMISSIONING AND HANDING OVER

The Contractor shall provide all tools and instruments required for inspections, testing and commissioning of the works as detailed in the detail Technical Specification.

First Offer for Acceptance (First Inspection)

Once the Contractor has completed the total installation, written notice shall be given to the Principal Agent in order that a mutually acceptable date may be arranged for a joint inspection. During the course of the inspection the Engineer, in collaboration with the Principal Agent, will compile a list of items (if any) requiring further attention. These items shall be identified by checking each and every clause in the contract (all specifications and drawings) in relation to the offered installation.

A copy of this list of outstanding items will be provided to the following:

(a) Principal Contractor – for action.

(b) Contractor – for action.

(c) Principal Agent – for information.

Subsequent and/or final offer for Acceptance (Subsequent and/or final Inspection)

The Contractor shall similarly provide written notice that he is ready for an inspection of the remedial work done on the offending items. If the installation is accepted as complete at this stage, by both the Engineer and Principal Agent, the Principal Agent may certify the works as completed. If at this stage there are still outstanding items requiring attention, irrespective of whether those items were identified during prior inspections or not, the procedure will continue until the entire installation has been correctly completed to the satisfaction of the Principal Agent.

Tests

In addition to the above, the Contractor shall have the complete installation tested and the correct operation of all plant demonstrated to:

(a) Engineer, and/or

(b) The Principal Agent.

Subsequent to the above testing and approval, the Contractor, in the presence of the Engineer, shall test the works as per the Detail Technical Specification.

First Delivery

First delivery (See conditions of contract) may only be proceeded with after final acceptance and testing have been completed successfully.

18. CONTRACTOR'S LIABILITY IN RESPECT OF DEFECTS (Maintenance Period)

The Contractor shall make all adjustments necessary for the correct operation of the plant for a period of 12 (twelve) months after the date of first delivery of the Principal Building Contract. The Contractor shall make good any defects due to inferior materials or workmanship that may arise during this period. If, during this period, the plant is not in working order for any reason for which the Contractor can be held responsible or if the plant develops defects, the Contractor will be notified and immediate steps shall be taken by him to remedy the defects or to make any adjustments required.

Should such defects occur so frequently as to become objectionable or should the equipment otherwise prove unsatisfactory during the abovementioned period, the Contractor, if called upon by the Engineer, shall replace at his own expense the whole, or such parts thereof, as the Engineer may deem necessary, with apparatus to be specified by the Engineer.

The contractor shall within 8 hours of callout report to site, investigate and carry out the necessary minor repairs. Major repairs shall be done within 24 hours.

19. ARRANGEMENTS WITH SUPPLY AUTHORITIES

The Contractor shall apply for and complete all the formalities necessary for compliance with any statutory requirements as necessary. He shall also make himself available for all statutory authority inspections in order to complete all the formalities and tests. Inspection fees shall be allowed for in the tender.

20. COMPLIANCE WITH REGULATIONS

The entire installation shall be carried out in accordance with the latest revision and amendments of the following:

(a) The Code of Practice for the Wiring of Premises issued by the South African Bureau of Standards, SANS 10142-2003.

(b) The Occupational Health and Safety Act.

(c) The municipal by-laws and any special requirements of the supply authorities of the area and district concerned.

(d) The local fire-brigade regulations.

(e) The applicable SABS specifications, or the BS specifications where no SABS specifications exist.

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

Where conflict exists between any of the above regulations and the specification, the said conflict must be referred to the Principal Agent in writing for his ruling.

The Contractor shall be responsible for serving all notices and paying all fees due in terms of the laws and regulations mentioned.

21. TAKING RESPONSIBILITY FOR THE INSTALLATION (For normal electrical or electrical within mechanical installations)

Before any inspection or hand over of the electrical installation or part thereof takes place, the Electrical Contractor (employed by the Mechanical Sub-contractor) will present a Certificate of Compliance of the electrical installation or part of the installation to be handed over as defined in the regulations of the OSH Act of 1993, as amended.

With first delivery, the Contractor shall accept in writing the responsibility for the total installation as installed by him by certifying the correctness of the installation in accordance with and on the certificates of compliance of the work as per the Specification.

22. ELECTRICAL INSTALLATION

SUPPLY

A single and three phase, 50 Hertz electrical supply will be provided by others at the points shown on the drawings. This tender shall include for the supply points and all other cabling, conduits, cable racks, trays, switchgear, panels, distribution boards, etc., necessary for the satisfactory operation of every part of the installation as well as for the connection of the supply cable into control panels, etc.

CONTROL PANEL

A motor control and switchgear board shall be supplied and installed in each plantroom at the position indicated.

Each board shall be fitted with the following:

a. A main isolator.

b. A set of copper busbars of adequate size, if the peak current on the board exceeds 50 amperes per phase.

c. Individual motors shall be supplied through a circuit breaker and suitable D.O.L., automatic Star-Delta, or slip ring starter.

d. All other equipment shall be supplied through a circuit breaker.

e. In the case where the rupturing capacity of a circuit breaker is lower than the rupturing capacity of the electric feed system at the specific point, the circuit breaker shall be protected by H.R.C. fuses of adequate size.

f. Phase rotation protection.

g Over/under current protection.

All starters shall be equipped with auxiliary contacts, which shall be brought to an easily accessible terminal block for the purpose of remote control (if specified). An ammeter with suitable scale shall be fitted to each motor above 7, 5 kW output on at least one phase, and shall be installed in the panel next to the relevant switchgear.

Switchgear panels and boards shall be factory pre-wired so that the only "on site" connections to be made will be the main connection, the supply to each motor, and the control system connections to the terminal block.

Each item on the board, switches, instrument control, etc., shall be clearly labelled in white print on black, hard plastic labels, which shall be neatly glued onto the back panel of the Board.

All switchgear and distribution boards shall be of the metal clad surface type, with a framework, which is electrically continuous and properly bonded to earth.

The boards shall be equipped with hinged steel doors adequately braced each with a flush lock and two keys.

All boards shall be treated with two layers of rust inhibiting paint.
Switches, push-buttons, and indication lamps and gauges shall be so installed that they remain fastened to the doors when doors are opened.

The layout of each board as well as the wiring diagrams and details of the switchgear provided shall be approved by the Consulting Engineer before any manufacture is commenced.

All wiring in distribution boards shall be labelled to ease the later tracing of circuits, these shall correspond to drawing labelling.

WIRING

All boards which are to be mounted outdoors shall be weather proof and guaranteed by the manufacturers for such outdoor operation.

The wiring of the plant shall be carried out by the contractor in surface work in the plantrooms and concealed work in all finished spaces. Wiring shall be done by means of solid drawn or lap-welded screwed tubing and PVC insulated copper conductors, or in multicore PVC/SWA/PVC cable. The main runs of conduit or cable shall preferably be carried out at high level (if possible in false ceiling spaces). Distribution shall be vertically down to the required points. All electric conduit and conduit fittings must be thoroughly inspected for defects before installation, and all sharp edges and burrs removed. Bushes and locknuts are to be used where conduit enters switch boxes.

The proposed location of tubing and cables shall be approved by the Consulting Engineer before commencement of work.

Conduit to be installed under plaster finish shall be installed in good time so as not to delay the Building Contractor or cause finished plaster to be chased.

All electrical cables shall be fastened to cable racks or shall be laid in cable ducts. Cables carried in racks shall as far as possible be laid parallel and shall be neatly installed. Descents shall be firmly secured with provision for the swinging of flexible tubing or cables where attached to moving machines and electrical motors.

Sizes of conduit, conductors and cables shall be at least equal to those laid down in the relevant tables of the Code of Practice.

Flexible conduit and cables shall be provided wherever it is necessary to avoid transmission of vibration. No joints in cables or wires will be permitted in a conduit. The ends of cables shall be properly made off. Terminal lugs shall be used wherever special clamp-washers or sleeve terminals are not provided on equipment. Conductor strands may not be cut away or reduced in size, and care must be taken to select switchgear, etc., with terminals of adequate size for looping, etc., where necessary.

No open wiring will be permitted at any point in the system, with the exception of the copper bus-bars in the switchgear boards. These shall be taped up with PVC tape with the relevant phase colours.

BOXES

Where boxes are used in concrete or masonry, approved removable cover plates shall be supplied. For 100 mm x 100 mm boxes, standard blank metal switch-type cover plates may be used, but for larger boxes, removable cover plates of metal or other approved material must be supplied with bevelled edges and must be neatly painted.

Cover plates shall be large enough to overlap and cover any gaps between the draw box and the masonry or concrete, and must be finished off to match the surroundings so as not to mar the architectural appearance of the building.

WIRING IN CONDUIT

No joints shall be allowed and all looping must be done through approved connectors at fitting points.

The live phase shall be connected at the switching point. All wiring in conduit shall conform to the requirements of SANS 10142 (Table 4 of SABS 0142-1981 as amended). Not more than one circuit shall be accommodated in one circuit unless special permission is obtained from the Engineer. Before any wires are drawn into the conduit, a swab is to be drawn through to clear any water, dirt etc.

PVC INSULATED CABLES

LT cables with PVC insulation must conform to the requirements of SANS 1574 (SABS 150 of 1970 as amended), and must be laid according to the requirements as set out in the Electrical Specification of this document.

SOLID CONDUIT

All conduit shall be of heavy gauge steel, screwed and conform to SANS 61386 (SABS 162 of 1987 as amended). No conduit shall be less than 20 mm in diameter.

All joints shall be screwed and all outlets fitted with rustproof iron boxes. Conduit must be both screwed and lock-nutted on both sides, bushed on the inside of the box or board to which it is attached.

The whole conduit system shall be electrically and mechanically continuous over all joints by means of screwed couplings, well bonded and efficiently earthed by means of earthing terminals and earth continuity conductors. The contractor must keep in touch with the builder and install all conduit so as not to delay his work and to ensure the closest co-operation. Every effort must be made to avoid running conduit in "U"-form, but where this is unavoidable, provision should be made, if possible, to drain the conduit.

All chasing of brickwork, etc., for conduit shall be carried out under this contract.

MINIATURE CIRCUIT BREAKERS

All miniature circuit breakers of the single and double pole type shall be 250 volt grade, and triple pole breakers shall be 600 volt grade. Circuit breakers shall be of the Heinemann, F.W. or other approved make. MCBs may be secured directly to the front panel in which case this panel shall be hinged and wiring taped together to allow for easy movement of the panel. Preferably the MCBs shall be mounted on a metal frame attached to the board casing, access being given to the MCBs and connections by a removable or hinged panel, suitably slotted for toggles, etc.

FUSES

Where circuits are scheduled to be fed through fuses, these shall be mounted directly on the panel. All rewireable fuses shall be of the porcelain bridge type, of approved manufacture, connected through bushed insulated holes in the panel. An I.C. fuseboard unit may be used instead of separate fuses. Connections shall be made through the back of the panel so that no surface wiring results. Tinned copper fuse wire shall be fitted to suit the loading indicated in the schedules, where rewireable fuses are used, and cartridge fuses shall be fitted with the appropriate cartridges.

CHASING OF CONCRETE COLUMNS, BEAMS AND SLABS

The Contractor must take particular care that all pipes, boxes etc., in columns, beams or slabs are fitted before the concrete is cast. Where, however, through unforeseen circumstances it becomes necessary to chase columns, beams, or slabs, the permission of the Engineer must first be obtained. Where this is not done, the Contractor will be held responsible for any damage to the structure which may result.

EARTHING

The whole installation shall be efficiently earthed to the satisfaction of the Engineer, the Inspector of Factories, the Supply Authority, and strictly in accordance with the Code of Practice for the Wiring of premises. Any points proposed as earthing points by the Contractor shall first be approved by the Engineer before connection.

FLEXIBLE CONNECTIONS

Flexible connections shall be of "Kopex" manufacture or approved type. All flexible connections shall be properly earthed to ensure earth continuity.

CABLE TRAYS AND LADDERS

The contractor shall supply and install all cable trays or ladders as specified or as required by the cable routes including the necessary supports, clamps, hangers, fixing materials, bends, angles, junctions, reducers, T-pieces, etc.

Metal cable trays shall be manufactured from perforated rolled steel. Only the following metal cable tray types may be used:

(a) Less than 250mm wide 1,6mm minimum thickness with 12mm minimum return.

(b) 250mm and wider equivalent to trays supplied by "PERFORATION AND CONDIDURE", or other approved, manufactured from 2mm thick steel with folded over returns and a minimum up stand of 50mm.

(c) 250mm and Wider 2,4mm minimum thickness with 76mm minimum return as alternative to (b) above.

The return of trays shall not be perforated and the top of the return shall be smooth. The same cable tray type shall be used in long parallel tray runs.

Metal cable ladders shall be of the "CABSTRUT CL76 series" and shall consist of a 76mm high side rail of 2mm minimum thickness. Cross pieces shall consist of P3300 "CABSTRUT", or other approved. Cross pieces shall be spaced at maximum intervals of 250mm. Where 10mm^2 cables are to be installed the cross pieces shall be spaced at 125mm centres. Cables shall be clamped in position by means of purpose made cable clamps that fit into the cross pieces. Alternatively with prior approval of the Principal Agent on vertical runs against walls cross pieces consisting of slotted metal rails which accommodate plastic or metal cable binding bands, may be used. These cross pieces are not acceptable in horizontal cable runs and CABSTRUT CL76 cable ladder is to be used.

Rigid unplasticised PVC trays are acceptable. Only the following tray types may be used:

(a) Less than 50mm 3,0mm minimum wide and 40mm minimum return.

(b) 250mm and wider 4,0mm minimum thickness and 60mm minimum return.

Metal cable trays and ladders shall be finished as follows:

(a) In coastal areas (for all applications): Hot-dipped galvanised to SANS 121 and SANS 32 or epoxy powder coating.

(b) False ceiling voids: Electro-galvanised or epoxy powder coating.

(c) Vertical building ducts: Hot-dipped galvanised to SANS 121 and SANS 32.

(d) Plant Rooms, Substations, service tunnels or basements: Electro-galvanised or epoxy powder coating.

(e) Damp areas, exposed to weather: Hot-dipped galvanised to SANS 121 and SANS 32 or epoxy powder coating.

(f) Undercover industrial applications: Hot-dipped galvanised to SANS 121 and SANS 32 or epoxy powder coating.

The abovementioned finishes shall apply unless specified to the contrary. Hot-dipped galvanised or electro-galvanised trays and ladders shall be cold galvanised at all joints, sections that have been cut and at places where the galvanizing has been damaged. Powder coated trays and ladders shall likewise be touched up at joints, cuts and damaged portions using spray canisters recommended by the manufacturer of the trays and ladders.

Trays shall be supported at the following maximum intervals:

(a)	1,6mm thick metal trays with 12mm return	1,22m maximum spacing
(b)	Metal trays with folded over return and 50mm up stand	1,22m spacing
(c)	2,4mm thick metal trays and 75mm return	1,5m spacing
(d)	Metal cable ladders	1,5m spacing
(e)	3,0mm thick PVC trays with 40mm return	1,0m max. spacing
(f)	4,0mm thick PVC trays with 60mm return	1,5m max. spacing

In addition, trays and ladders shall be supported at each bend, off-set and T-junction.

Joints shall be smooth without projections or rough edges that may damage the cables. The Specialist Controls Contractor will be required to cover joints with rubber cement or other hardening rubberised or plastic compounds if in the opinion of the Engineer, joints may damage cables. Joints shall as far as possible be arranged to fall on supports. Where joints do not coincide with supports, joints shall in the case of trays with single returns be made by means of wrap-around splices of the same thickness as the tray ends shall butt tightly at the centre of the splice and the splice shall be bolted to each cable tray by means of at least 8 round head bolts, nuts and washers. Splices shall have the same finish as the rest of the tray. Where joints which do not coincide with supports occur in trays with folded over returns, tight fitting metal guide pieces, at least 450mm long, shall be inserted in the folded returns to provide the necessary support to the two cable tray ends. Splices as described above shall be provided if trays sag.

Trays shall be bolted to supports by at least two round head bolts per support. Bolts shall be securely tightened to avoid cables being damaged during installation.

The supports for cable trays and ladders shall in all cases be securely fixed to the structure by means of heavy duty, expansion type anchor bolts. It is the responsibility of the Specialist Controls Contractor to ensure that adequate fixing is provided since cable trays and ladders that work loose shall be rectified at his expense.

Horizontal and vertical bends, T-junctions and cross connections, shall be supplied by the Specialist Controls Contractor. The dimensions of these connections shall correspond to the dimensions of the linear sections of which they are connected.

The radius of all bends shall be 1000mm minimum. The inside dimensions of all horizontal angles or connections shall be large enough to ensure that the allowable bending radius of the cables is not exceeded. Sharp angles shall have 45° comices.

Cables shall be installed adjacent and parallel to teach other on the trays with spacings as determined by the current ratings. Horizontal trays and ladders shall in general be installed 450mm below slabs, ceilings, etc. to facilitate access during installation.

22.13 12 All metal trays and ladders shall be bonded to the earth bar of the switchboard to which the cables are connected. Additional bare copper stranded conductors or copper tape shall be bolted to the tray or ladder where the electrical continuity cannot be guaranteed.

23. ELECTRIC MOTORS

STANDARD SPECIFICATION

All electric motors shall comply fully with the relevant standard specifications:

- SANS 1804: "Standard Specification for Three Phase Induction Motors".
- BS 2613: "The Electrical Performance of Rotating Electrical Machinery".
- BS 170: "The Electrical Performance of Fractional Horsepower Electric Motors and Generators".

MOTOR SPECIFICATIONS

(a) Standard Squirrel Cage Motors shall be three phase (or single phase up to THREE kW), continuously rated, screen-protected drip-proof, suitable for direct-on-line or star-delta starting.

(b) High-starting-torque squirrel-cage motors shall be three-phase, continuously rated, screen-protected drip-proof, with a special arrangement of rotor conductors giving high starting torque and moderate starting current and suitable for direct-on-line or star-delta starting.

(c) Slip-ring motors shall be three-phase, continuously rated, screen-protected drip-proof, with continuously rated slip rings and brushers and brushgear suitable for automatic starting.

(d) Fractions kW motors shall be continuously rated, totally enclosed single phase, capacitor-start induction run type, shaded pole of three-phase squirrel-cage where required.

(e) Motors suitable for part-wound starting shall be three phase, continuously rated, screen-protected drip-proof with wound rotor circuits suitably rated to provide continuous full load power when fully switched and to provide starting in graded steps sufficient to overcome the starting load torque without exceeding the specified starting current.

(f) Hermetically sealed motors shall be three phase squirrel cage motors, totally enclosed with suitable internal cooling medium and suitable insulation to provide continuous full load power under the specified ambient conditions.

(g) Pole-changing motors shall be three-phase, continuously rated, screen-protected drip-proof with cage rotor and separate stator windings providing several numbers of poles with various interconnections of the windings. The use of pole-changing motors to alleviate starting conditions shall be limited to 2:1 speed ratios. Additional speed ratios shall only be used where the driven load specifically so requires. Pole-changing rotor circuits are not recommended and shall only be used in exceptional circumstances with the proper approval of the Engineer. Dahlander connections providing a 2:1 speed ratio with variable torque and variable power characteristics of the motor may be used to drive centrifugal fans and centrifugal pumps. Dahlander connections providing constant torque characteristics may be used for high friction loads and connections providing constant power characteristics may be used for constant power loads viz. machine tools.

Motors with a speed in excess of 1500 r/min except in the case of centrifugal compressors, will not be accepted unless agreed to by the Engineer.

MOTOR RATINGS

When determining motor rating, the following shall be taken into account:

(a) All motors shall be rated for continuous full load duty.

(b) The Continuous Maximum Rating (C.M.R.) of the motor shall be 20% in excess of the full load running duty of the load in order to withstand the tolerance of 105% - 120% in the tripping characteristics of over-load protection devices allowed in BS 4941 Part 1.

(c) All starting times, irrespective of the load characteristics or the method of starting **shall be limited to 20 seconds** unless prior approval to the contrary is obtained from the Engineer. The safe locked rotor time shall be well in excess of the run-up time to allow protection discrimination.

(d) All motors shall be capable of a **minimum** of three **consecutive** starts per hour with the load connected and employing the method of starting to be installed without exceeding the allowed temperature limits of the insulation. In addition, the motor shall be capable of the numbers of starts per hour for the particular load as may be specified or as may be experienced under normal operating condition.

(e) Unduly over-rated motors resulting in a low power factor and efficiency are not acceptable.

(f) The motor starting torque and speed/torque characteristics shall be carefully matched to that of the load to ensure that the motor does not stall at a low speed. A safety margin shall be allowed to overcome voltage drops and load fluctuations. The maximum torque developed by the motor in its final running condition (i.e. when the motor is switched to its final running configuration in the case of pole-changing motors and all starting devices have been switched out of circuit in the case of assisted starting) shall be 1.6 times the rated full load torque to overcome temporary overloads and voltage fluctuations.

(g) The actual ambient temperature in which the motor will be operating (and not the prevailing outside ambient temperature only) shall be taken into account.

It is a requirement that the above information and any other requirements that will affect the type of motor to be used be submitted to the motor manufacturer when ordering the motor. The Contractor may at the discretion of the Engineer be required to submit written proof that the **motor manufacturing** will guarantee the performance of the motor for the expected duty and load.

Special attention shall be paid to the starting requirements of motors. It is essential that the starting torque produced by motors under the starting conditions specified, will be sufficient to accelerate the load within the time period allowed by the manufacturer of the motor with a maximum starting time of 20 seconds (refer above). The contractor may be required to submit calculations showing accelerating torque available, load torque characteristics and run-up time. The following formula may be used to calculate the run-up time:

Te	=	equivalent accelerating torque in N-m
T1	=	Maximum accelerating torque in N-m
T2	=	Minimum accelerating torque in N-m
GD^2	=	Moment of inertia of the rotating parts of the load and motor in kg-m^2
N	=	Final speed in r/min.
t	=	Run-up time in seconds

Accelerating torque is the difference between motor torque and load torque at any given speed on the torque/speed characteristic curve.

Where inching operations occur or where motors are controlled by pressure or level switches where frequent cycling duty may occur, motors shall be capable of 40 starts per hour.

MOTOR WINDINGS

All motor windings shall have Class E or better insulation. The following maximum temperatures as determined by the resistance method may not be exceeded:

Class of Insulation	Altitude					
	0 – 1000m	1200m	1400m	1600m	1800m	2000m
E.....	150°C	112.6	111.2	109.8	108.4	107
B.....	120°C	118.4	116.8	115.2	113.6	112
F.....	140°C	138	136	134	132	130
H.....	165°C	163.7	162.5	161	160	158.7

The above figures comply with BS 2613 and SANS 1804 (SABS 948 as amended) for a maximum cooling air temperature of 40°C. Where higher ambient temperatures occur (particularly in cases where heaters are installed), the above temperatures shall be reduced in accordance with BS or SANS specifications.

All windings shall be varnished and baked. The insulation shall provide protection against dust, oil and high humidity as well as aggressive vapours and gases where these are specified.

End-windings shall be carefully wrapped and supported to prevent movement and prevent mechanical damage due to vibrational stresses.

MOTOR PROTECTION

Motor protection shall be provided as follows:

Type of Protection	Application
Thermal overload	All motors.
Magnetic overload	Only for short circuit protection when acting on circuit breakers with sufficient rupturing capacity.
Thermistor over-temperature	All motors of 25 kW and more.
Single phasing	All 3-phase motors without thermistor over-temperature protection.
Earth fault	Only when condensation in motors can take place, e.g. standby close coupled pumps on chilled water system.
Phase reversal	All centrifugal compressor circuits

	and large reciprocal compressors or other circuits where phase reversal can cause damage.
Under voltage	As specified.
Over-temperature	Auto-transformer starters, liquid starters and resistor starters.

All the protection specified in the detailed Technical Specification shall be supplied.

Motor overload (O/L) protection shall be provided in accordance with BS 587. O/L protection shall be provided by means of thermal trips or relays actuating contactors, manual motor starters or circuit breakers. **HRC fuses are not acceptable for this purpose.**

On motor starters on which the overload protection forms an integral part of the starter the protection shall be by means of temperature compensated bimetal thermal O/L trips indirectly heated by separate heating elements in each phase and connected in series with the load. The O/L trips shall be adjustable within the range of approximately 75% to 120% of the rated current of the motor.

Where motors are used frequent repetitive cycles or for inching operations, magnetic overload protection with time delays may be used provided the motor is suitably rated for the duty.

Single phasing protection where provided shall be inherent in the overload protection unit in the case of integral motor starters. Protection schemes depending solely on the excess current drawn by the motor during the single phasing are not acceptable.

Magnetic over current trips or relays for short circuit protection may never be allowed to actuate contactor starters and may only operate on suitably circuit breakers.

Short circuit protection shall be provided by means of HRC fuses or suitably rated circuit breakers.

Thermistor over-temperature protection shall be installed. The thermistor control units shall where possible be integrated with the motor starter. Care shall be taken to select units with sufficient current rating to operate the contactor coil.

Thermistor protection may not be provided in lieu of over current protection.

Motor protection shall be "ENGLISH ELECTRIC" type "CMM" OR "P & B GOLDS" type "M", or other approved, for all motors where preferred. Thermal (or magnetic if required) overload, single phasing (or phase unbalance) and earth fault protection relays as well as auxiliary relays where required, shall be included. The relays shall be housed in a panel mounted unit in a withdrawable case.

Motor protection relays shall not be allowed to operate on metering current transformers, but shall be connected to separate protection class current transformers matched to the motor full load current and the relay power consumption.

In all cases where protection relays are used, "CHAMBERLAIN AND HOOKHAM", or other approved, test blocks type shall be provided to facilitate remote testing or relay operation, current transformers, etc.

Proven electronic protection relays are acceptable.

Where motors which are not described in BS specifications, e.g. semi-hermetic compressor motors, etc. are used, protection shall comply with the manufacturer's requirements.

Special attention shall be paid to motors driving high inertia loads to ensure that motors are adequately protected against sustained over currents but do not trip unnecessarily during starting.

(a) Shorting of the over current protection during starting is not acceptable.

(b) Increased overload settings on protection units are not acceptable.

(c) Connecting the overload relay in the delta loop in star-delta starting applications thus providing no protection during starting, is not acceptable.

Saturable core current transformers providing a normal over current characteristic up to 120% of full load current may be used provided they are properly matched. Alternatively, separate starting and running over current protection units shall be used. For star-delta starting methods, the latter can be achieved by connecting the starting over current unit in the main supply line to the motor and the running over current unit in the delta loop. For other starting methods, a change-over arrangement is required to switch from the starting to the running after the starting time has lapsed. For motors larger than 50 kW electronic integrating type relays with individually adjustable time/current characteristics shall preferably be used. Whichever protection method is used, a safe discrimination between "safe locked rotor time" and "starting time" shall be maintained.

MOTOR PROTECTION - THERMISTORS

All motors with ratings of 25 kW and higher and all motors with a rating of 15 kW and more that are subjected to run-up times in excess of 15 seconds shall have thermistors for over-temperature protection installed in the stator windings. Three thermistors, one per phase, shall be installed in single wound motors and 6 thermistors shall be installed in double wound motors.

Where thermistors are installed in the end-winding, the "Curie Point" shall be 5°C above the temperature. Where thermistors are installed in the winding "hot spot", the Curie Point shall be 15°C above the temperature values stated.

The thermistors shall comply with the following:

(a) Only Positive Temperature Co-efficient (PTC) thermistors shall be used.

(b) Thermistors installed in motors connected to supply voltages up to 600 V shall be flash tested at 2 kV r.m.s. Additional insulation shall be provided on higher voltage machines.

(c) A varnished Terylene or glass fibre sleeve shall be fitted around those parts of the thermistor leads, which are embedded in the winding for mechanical protection of the leads. Care shall be taken that the sleeve does not cover the thermistor bead.

(d) The thermistor shall be inserted in the winding in such a way to ensure best thermal contact with the adjacent conductors of the winding.

(e) All leads from thermistors to the protection control units shall be twisted pairs to minimise stray voltage pick-up. Screened cables shall be used where the control units are far from the motor.

(f) All the thermistors acting on one control unit shall be connected in series.

Where thermistors are installed it is essential that relay panels be safeguarded against high voltages in case of a short circuit between sensor and motor windings. Isolation transformers are recommended for this purpose.

MOTOR CONSTRUCTION

The housing, end-shields and feet of totally enclosed surface-cooled motors shall be of cast iron to BS 1452. Standard protected, internally cooled motors may be of welded steel construction. A condensation hole shall be provided at the lowest point in the motor frame.

It is essential that the correct mounting type is selected for each application.

Motor terminals shall be clearly marked, U, V, W or U1, V1, W1 and U2, V2, W2. An earth terminal shall be provided at a convenient position on the motor frame. Vulcanised rubber insulation shall not be used for the connection from windings to the terminals.

When viewed from the drive shaft end, the motor rotor shall rotate in a clockwise direction when the R-W-B supply leads are connected to the U-V-W motor terminals.

All terminals shall be totally enclosed in a waterproof box sealed with gaskets and shall be complete with nuts, locknuts, lugs, etc. Cable boxes for PILCA cables shall be complete with tinned brass wiping gland and armour clamps. PVC cables shall be terminated using compression glands with shroud. Cables shall be provided with a means of support to remove the weight of the cable from the gland. All terminal boxes shall be large enough to ensure proper termination of the cables and connection of cores without exceeding the allowable bending radius. All terminal boxes shall be capable of being rotated through 360°. Where condensation may form on motor terminals, e.g. certain centrifugal refrigeration compressors, terminal boxes shall be hermetically sealed and filled with silica gel.

Motors shall as far as possible have pre-lubricated and sealed ball or roller bearings. Unsealed bearings shall be loaded conservatively in order that the grease need not be renewed at intervals of less than one year. Bearings shall be suitable for flat or V-belts drives where these are indicated without the use of outrider support bearings. Belt pulleys and couplings shall be balanced.

Bearings shall be protected against possible shaft eddy current and shall be suitable to withstand vibrations caused by reciprocating or unbalanced loads.

Anti-condensation heating elements shall be provided in the motor windings for the following motor applications:

(a) Close-couples motors and pumps in chilled water systems.

(b) Standby motors in refrigeration installations where the ambient air surrounding the motor may drop below the dew point.

(c) Pumps installed in damp areas where the pumps will not run continuously.

The heating elements shall be arranged to prevent terminals and exposed connections becoming damp. As an alternative to heating elements, a low voltage transformer (approx. 50V) can be switched into the circuit when the motor is stationary to provide a continuous circulating current in the motor windings.

Where requested copies of type test certificates for routine and performance tests in accordance with SANS 1804, BS 2613 or BS 170 shall be submitted before delivery of the motors. In additions the Manufacturer's guarantee that the motor will comply with the duty as described in this specification, shall be submitted. Curves of Torque/Speed and Current/Speed shall be provided on request.

The client reserves the right to witness all routine or performance tests and shall be notified in writing 14 days before the commencement of such tests.

Motors that have become damp shall be dried out before connection to the supply. Damaged motors resulting from non-compliance with this requirement, shall be rectified by the Contractor at his cost.

STAR-DELTA STARTERS

(a) All star-delta starters including resistors where applicable shall be rated for 15 starts per hour unless automatic time delays are incorporated which will prevent more frequent starts than the starter rating allows. In no case however, shall ratings be less than 3 consecutive starts per hour. Starters for plugging duty shall be rated at 40 starts per hour.

(b) The timers for open transition star-delta starters, shall be a break-before-make, snap acting type with a distinct time delay before make, of sufficient length to quench the arc on the star contactor but short enough to prevent magnetic flux decay in the motor with consequent high transients.

(c) All star-delta starters shall be electrically interlocked via N/C contacts on the contactors.

(d) The timing and control circuit for closed transition star-delta starters, shall be designed to employ only one timer to initiate the star-to-delta changeover. The closed transition switching shall be inherent in the arrangement of the auxiliary contact operation. A "policeman" timer to protect the transition resistance may be added.

(e) An overall "policeman" timer shall be provided on all closed transition star-delta starters in addition to the star-delta changeover timer to disconnect the load if the total allowable starting time is exceeded. The make and principle of operation, e.g. electronic vs. electro-mechanical, shall be different from the star-delta timer. On 2-wire control systems the "policeman" timer must lock out and shall be manually reset in order to prevent recycling.

24. CONTROL EQUIPMENT

GENERAL

The equipment offered must meet the following minimum specified standards. The Trade names only mention the name of a product, which will be acceptable if it is installed. Tenderers can offer another product to the product mentioned in the specification, if it is of similar or improved type and quality and if it has been accepted by the Engineer in writing.

All equipment shall operate from a 24 V supply.

CONTROLLERS

The controllers shall be of the microprocessor based programmable controllers with a fixed operating system.

Each controller shall be composed of the following:

a) Analog input ports

b) Digital input ports

c) Control modules for P, PI, PID and digital control

d) Numerical calculation modules

e) Logic calculation modules

f) Analog output ports

g) Digital (on/off) output ports

h) Dedicated service module socket

i) Updating of readings twice per second

Configuration of the controller shall be carried out in the following ways:

(a) Using a hand held service module.

(b) Using a personal computer with graphic configuration software.

(c) Down loading of a previous up-loaded configuration from a PC or service module.

Each controller shall display the following on an alpha numeric panel with keypads:-

(a) Temperature in °C.

(b) Relative humidity in % RH.

(c) Pressure in Pa.

The controllers shall be used to read temperature, pressure and relative humidity and to adjust valve and damper actuators proportionally. It shall also be used to reset supply air temperature set points in relation to outside air temperature.

The controller shall be designed to be DIN rail mounted into a standard electrical panel with the face of the controller protruding through the panel front cover. The controller housing shall be manufactured from polycarbonate, blended with ABS.

The controller offered shall be engineered to be used as a stand-alone controller, but must incorporate technology to be connected and to communicate to a supervisory control system through a high speed (RS 485) serial communication bus.

PRESSURE DIFFERENTIAL SWITCHES

Pressure differential switches shall be used as digital inputs to the control system to give dirty filter alarms and fan run stop indication. The switches shall be used to interlock the control system with fan operation, thus ensuring that humidifiers and steam heaters are not activated if the fan is not in operation. The switch point shall be adjustable to suit the specific requirement. In general the following shall apply:

(a)	Pressure differential over roll filter	:	150 Pa
(b)	Pressure differential over bag filter	:	250 Pa
(c)	Pressure differential over hepa filter	:	300 Pa
(d)	Pressure differential in supply air and return air ducts	:	100 Pa

The pressure differential switches must be designed to operate in an environment where the duct pressure can increase to 1500 Pa. The pressure differential switches shall be connected with appropriated PVC tubes, which will be connected on a static pressure probe, which will be mounted on the duct. The pressure probe shall consist of a 50 x 50mm galvanised plate, with a copper tube protruding through it. The plate shall be pop riveted to the duct with the probe protruding into the duct. All piping shall be neatly attached to the duct.

PRESSURE TRANSMITTERS

Pressure transmitters shall accurately measure low differential pressures and shall convert the measurement into a standard proportional 0-10 Volt signal.

The transmitters shall have the following features:

(a) Low zero drift time.
(b) Low sensitivity to ambient temperature change.

(c) Low hystresis.

(d) Good over rangeability.

(e) High accuracy.

(f) Splash proof dust type case.

The pressure transmitters shall be required to measure duct static pressure in low pressure duct systems and shall have a measuring range from 0-600 Pa. It shall be designed to operate in an environment where the duct pressure can increase to 500 Pa.

TEMPERATURE TRANSMITTERS

General

Accuracy

(a)	Duct, emersion, strap-on and outdoor sensors	:	1% accuracy
(b)	Return air sensors	:	1,2% from +10 to + 30°C and 3,5% from to +10°C and from 30°C to +40°C

Protection

Minimum protection to be IP 54.

Ambient Operating Limits

Temperature	:	0 to +50°C
Humidity	:	10 to 90% rh

Emersion or Duct Mounted Type

The temperature transmitters shall provide active sensing of air or water temperature and shall produce a 0-10 Volt DC signal, directly proportional to the sensed temperature. The transmitters shall be used to provide an analogue input to the plant controllers. The temperature transmitters shall use a positive temperature compensation, silicon sensor and shall be available in the following modules:

(a) Emersion/duct mounting.

(b) Return air mounting.

(c) Outdoor mounting.

(d) Strap-on mounting.

The temperature ranges of the various transmitters shall be as follows:

(a)	Chilled water	:	0° to + 40°C
(b)	Cold duct supply	:	0° to 40°C
(c)	Hot duct supply	:	20° to +120°C
(d)	Outdoor air	:	-20° to +40°C
(e)	All other applications	:	0° to +40°C

Room Type

The room type temperature transmitter shall be to the type described for the duct mounted type, with the exception that the control components shall be accommodated in a neatly designed and attractive housing with sufficient openings for room air circulation over the temperature sensing element. The room sensors shall not be equipped with an adjustment facility, or with temperature indication. Room sensors shall be designed for installation on a 50 x 100mm existing electrical box. The temperature range shall be 0°C to +40°C.

25. WELDING

Welding shall be carried out in accordance with the current edition of SANS 10044 Parts I to VII where applicable.

All welded filler of butt joints shall be free from porosity, cavities and entrapped slag. Joints shall be ground smooth, if required for aesthetic reasons only, without effecting weld strength.

The joints in the weld run, where welding has been recommended, shall be as smooth as possible and shall show no pronounced hump or crater in the weld surface.

The profile of the weld shall be uniform, of approximately equal leg length and free from overlap at the toe of the weld. Unless otherwise specified the surface shall be either flat or slightly convex in the case of filler welds and with reinforcement of not more than 3mm in the case of butt welds.

The weld face shall be uniform in appearance throughout its length.

Filler metal electrodes shall be of an approved type for the material being used and shall be kept in a dry condition. All electrodes shall conform to SANS 455.

Only welders in possession of a valid approved competence certificate shall be employed.

All welds must show proper fusion. Unless otherwise specified in the technical specification, the contractor shall allow for the removal and testing by an approved body of 5% of the welded joints in the system. These will be removed at random as indicated by the Engineer and tested. Should faulty welding be discovered, all other joints shall be X-ray tested by the SANS or an approved body, all at the expense of the Contractor. The expenses involved in the testing of joints shall be included in the tender form.

KING DINUZULU HOSPITAL: TB COMPLEX COMPLETION CONTRACT

AIR-CONDITIONING & VENTILATION INSTALLATION

BILLS OF QUANTITIES

GENERAL NOTES

1. The bills of quantities form part of and must be read in conjunction with the specifications and drawings which contain the full description of the work to be done and material and equipment to be used.

2. No alteration, erasure or addition is to be made in the text of the bills of quantities. Should any alteration, erasure of addition be made, it will not be recognised but the original wording of the bills of quantities will be adhered to.

3. The priced bills of quantities of the successful tenderer will be checked and the Engineer reserves the right to call for reasonable adjustments to any individual price and to rectify any discrepancy whilst the total tender price, as submitted, remains unaltered.

4. The responsibility for the accuracy of the quantities written into the bills remains with the party who prepared the bills. The tenderer shall be relieved of responsibility of measuring quantities at the tender stage, and the tender sum submitted shall be in respect of the quantities set out in the bills, although he will be required to make his assessment of items such as fixings, etc. from details stated in the bills and shall include in the item prices for such small installation materials as are required for the complete installation in accordance with the specification.

5. The rates contained in this document shall apply irrespective of the final quantities of the different classes and kinds of work actually executed.

6. The quantities in these bills of quantities are not to be used for ordering purposes. Quantities set out in this document are to be regarded as provisional only.

   The work, when completed, shall be remeasured and the final contract sum calculated, using the tendered tariffs and the finally measured quantities.

7. Variations in the scope and extent of the work included in the bills shall be allowed to meet the Employer's requirements.

   The rules governing the extent and valuation of variations shall be those provided for in the conditions of contract.

8. Unless separate rates for the supply and for the installation of any item is specifically called for, the supply and installation costs of any item shall be fully included in the unit price.

   The description of each item shall, unless otherwise stated herein, be held to include making, conveying and delivering, unloading, storing, unpacking, hoisting, setting, fitting and fixing in position, cutting and waste, patterns, models and templets, plant, temporary works, return of packings, establishment charges, profit and all other obligations arising out of the conditions of contract.

9. The quantities and rates included for dayworks shall form part of the tender price, but tenderers shall note that this item must be regarded as indicative and will only be payable to the Sub-Contractor if and when covered by a Variation Order.

10. Tenderers shall price the Preliminaries under one group only: i.e.

    (a) a fixed amount

11. All provisional sums shall be expended as directed by the Principal Agent and any balance remaining shall be deducted from the amount of the contract sum.

12. Provision is made on the final summary for the applicable Value Added Tax to be added.

13. In these bills, the word "supply" shall be deemed to include the acquiring of equipment and materials from suppliers and workshops and the delivery, off-loading and safe storage of the equipment on site.

14. In the bills the word "install" shall be deemed to include the unpacking, hoisting, placing and fixing, suspending or building in an approved position, cutting, connection, commissioning, testing and handing over of plant, equipment and materials.

15. Piping shall be measured in metres, stating the internal or external diameter in accordance with accepted trade usage. The rate for piping shall include cutting, jointing and running joints. The lengths of pipes shall be measured over/through all fittings, but not over valves, pumps and inline instruments such as strainers, site glasses, etc.

    All pipe fittings to pipes exceeding 50mm diameter shall be given separately for each diameter of pipe and each type of fitting. Unions, valves, flanges, etc. shall be given separately for all diameters of pipe. Purpose-made fittings are to include for lining up of fittings. Welded joints, including joints to fittings, shall be measured separately and shall allow for all cutting, preparation of ends and welding.

    Pipe supports and brackets shall be measured separately in number on main piping systems with diameter above 80mm only.

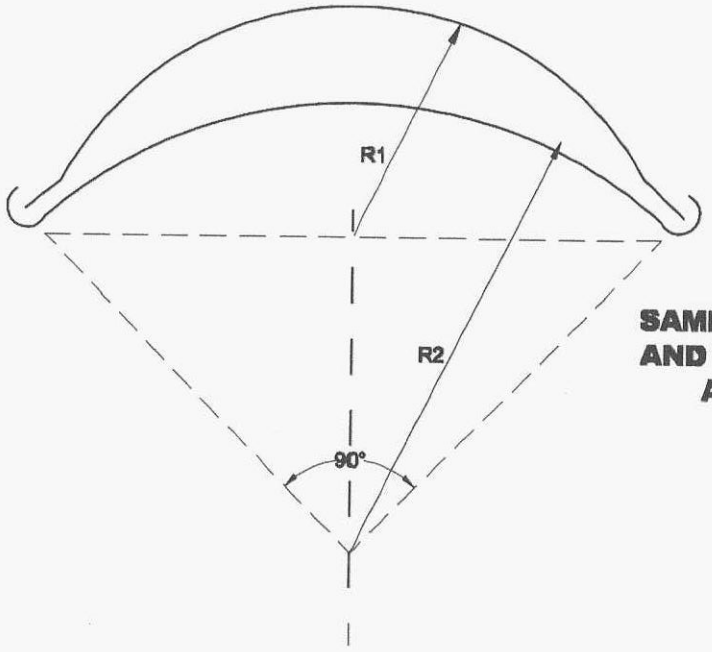
KING DINUZULU HOSPITAL: TB COMPLEX COMPLETION CONTRACT

AIR-CONDITIONING & VENTILATION INSTALLATION

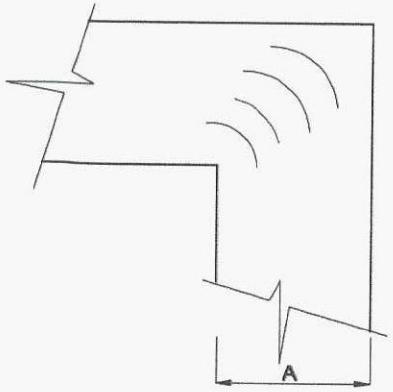
STANDARD AND LAYOUT DRAWINGS

1. The following standard drawings are attached and are to be read in conjunction with the Specification:

STD11	Brackets for ducts.
STD12	Hangers for ducts.
STD13	Brackets for ducts
STD15	Aerofoil type guide vanes for square bends.
STD16	Radiused bends and vanes.
STD17	Flexible Duct Connection.
STD18	Pipe U-bolt and Insulation Pipe Fixing Details.
STD19	Standard Machine Base Tray
STD24	Tee Connections.
STD25	Insulating Fixing Details.



SAME MATERIAL AND THICKNESS AS BEND



A	R1	R2	S
UP TO 600	25	50	55
OVER 600	55	115	80

REFERENCE DRAWINGS

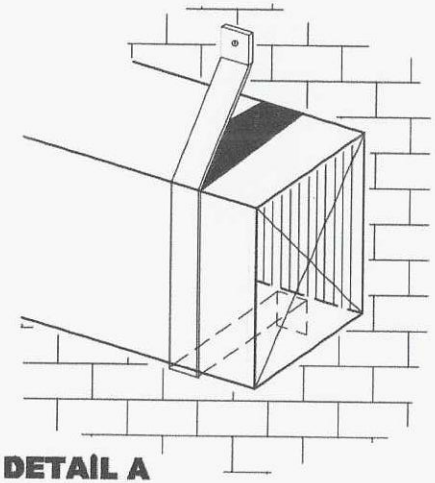
REV:	DATE:	DESCRIPTION	SIGN:
.	.	.	.
0		FIRST ISSUE	

Dihlose CONSULTING ENGINEERS (Pty) Ltd
Practical Innovation

PROJECT:

DRAWING DESCRIPTION:
AEROFOIL TYPE VANES
FOR
SQUARE BENDS

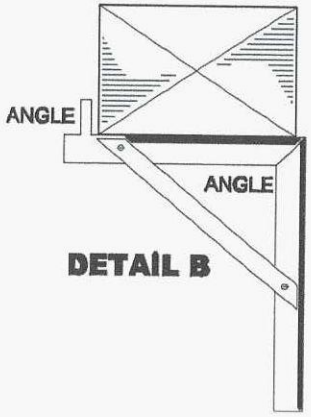
DATE: AUGUST 2005	DRV REF. NO.: STD
FILE NO.:	DESIGNED BY: W. VENTER
SCALE: N.T.S.	DRAWN BY: L.A.LE ROUX
REV. NO.: 0	CHECKED BY: P. MORNET
DRAWING NO.: STD 15	



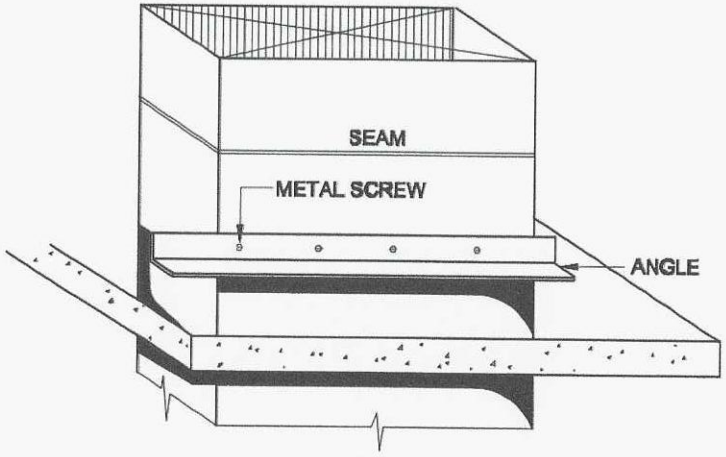
DETAIL A

DUCT SIZE	ANGLE	SPACING
300x450	38x1,6	2400
380x600	38x1,6	2400
450x900	38x1,6	2400

DUCT SIZE (WIDTH)	ANGLE	SPACING
UP TO 450	38x38x3,2	2400
460x760	38x38x3,2	2400
761	38x38x3,2	2400



DETAIL B



DETAIL C

DUCT SIZE	ANGLE
900x450	38x38x3,2
1200x600	38x38x3,2
1520x750	38x38x3,2
1520	51x51x4,8

NOTE:
OVER 1520mm INCREASE
ANGLE SIZE AS REQUIRED
FOR SPACING AND DUCT SIZE

REFERENCE DRAWINGS

REV:	DATE:	DESCRIPTION	DRN:
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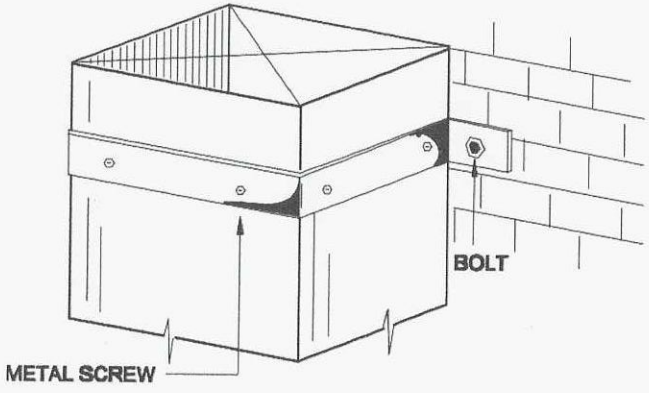
PROJECT:

DRAWING DESCRIPTION:
BRACKETS
FOR
DUCTS

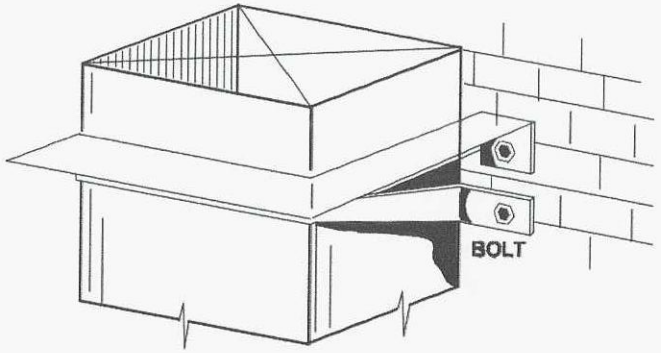
DATE: AUGUST 2005	CAD REF. NO. STD
FILE NO:	DESIGNED BY: W. VENTER
SCALE: N.T.S.	DRAWN BY: L.A.LE ROUX
REV. NO. 0	CHECKED BY: P. MORNET
DRAWING NO: STD 11	



DETAIL A

DUCT SIZE	ANGLE	SPACING
460x300	13x1,6	3660
600x380	13x1,6	3660
600x500	13x1,6	3660

DUCT SIZE	ANGLE	SPACING
760x300	25x25x3,2	3660
900x460	25x25x3,2	3660
1060x600	32x32x3,2	3660
1200x760	32x32x3,2	3660



DETAIL B

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PROJECT:

DRAWING DESCRIPTION:
BRACKETS
FOR
DUCTS

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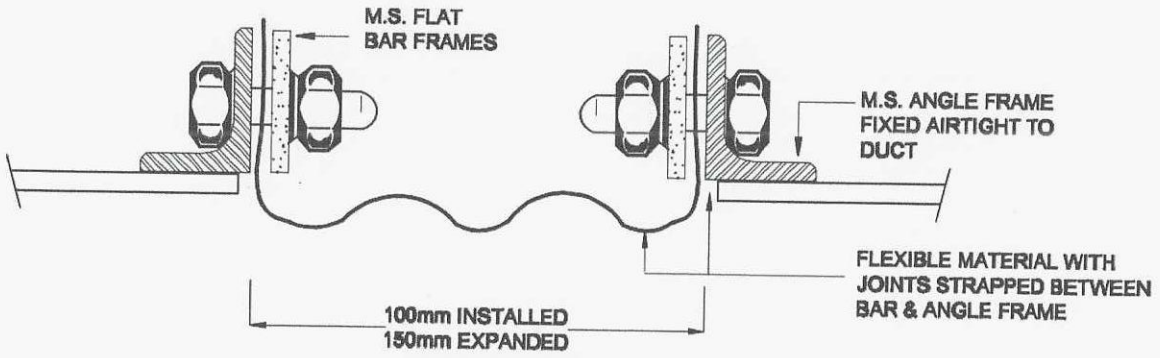
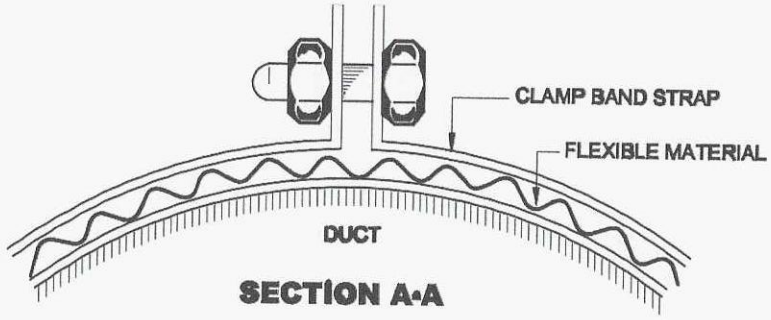
REV. NO. 0	CHECKED BY: P. MORNET
DRAWING NO: STD 13	

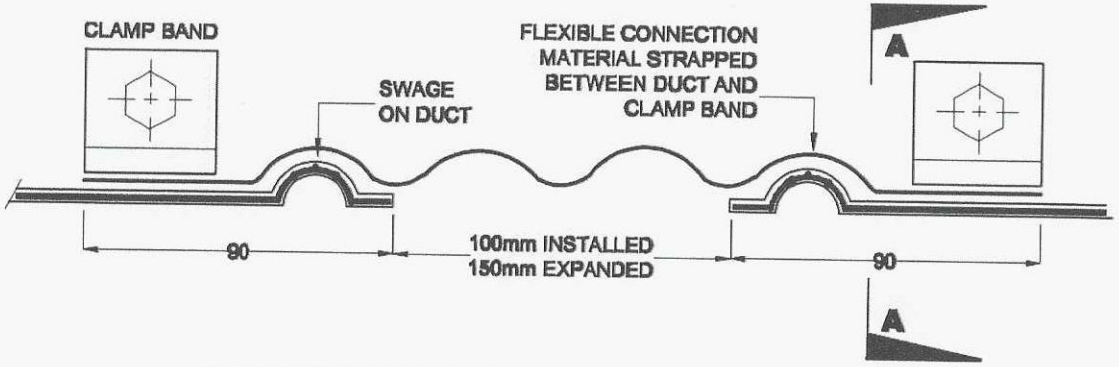


SECTION THROUGH FLEXIBLE CONNECTION FOR RECTANGLULAR DUCTS

FLEXIBLE CONNECTION IS NOT TO BE DRAWN TIGHT



SECTION A-A



SECTION THROUGH FLEXIBLE CONNECTION FOR ROUND DUCTS

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FLEXIBLE DUCT CONNECTIONS

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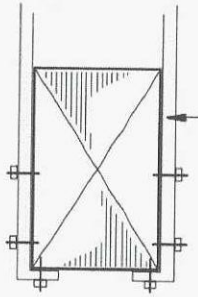
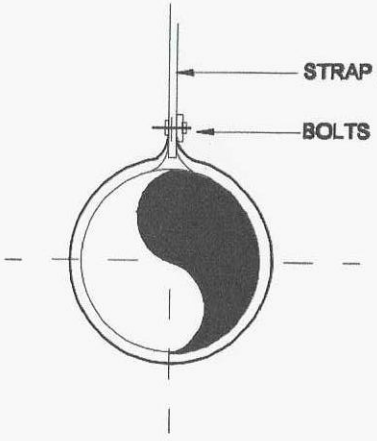
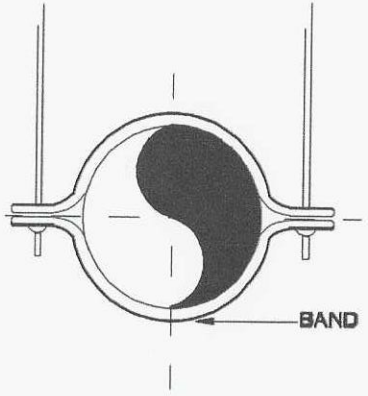
DRAWING NO: STD 17	

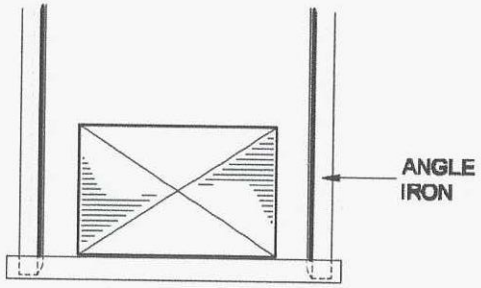
STRAP HANGERS

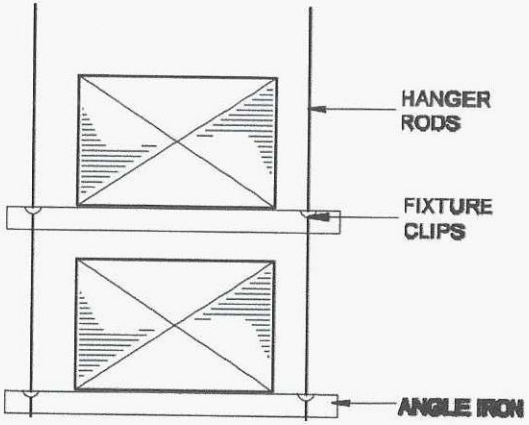






TRAPEZE HANGERS





NOTE:
HANGERS FOR HOT
OR COLD DUCTS

REFERENCE DRAWINGS			
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DRAWING DESCRIPTION:
HANGERS
FOR
DUCTS

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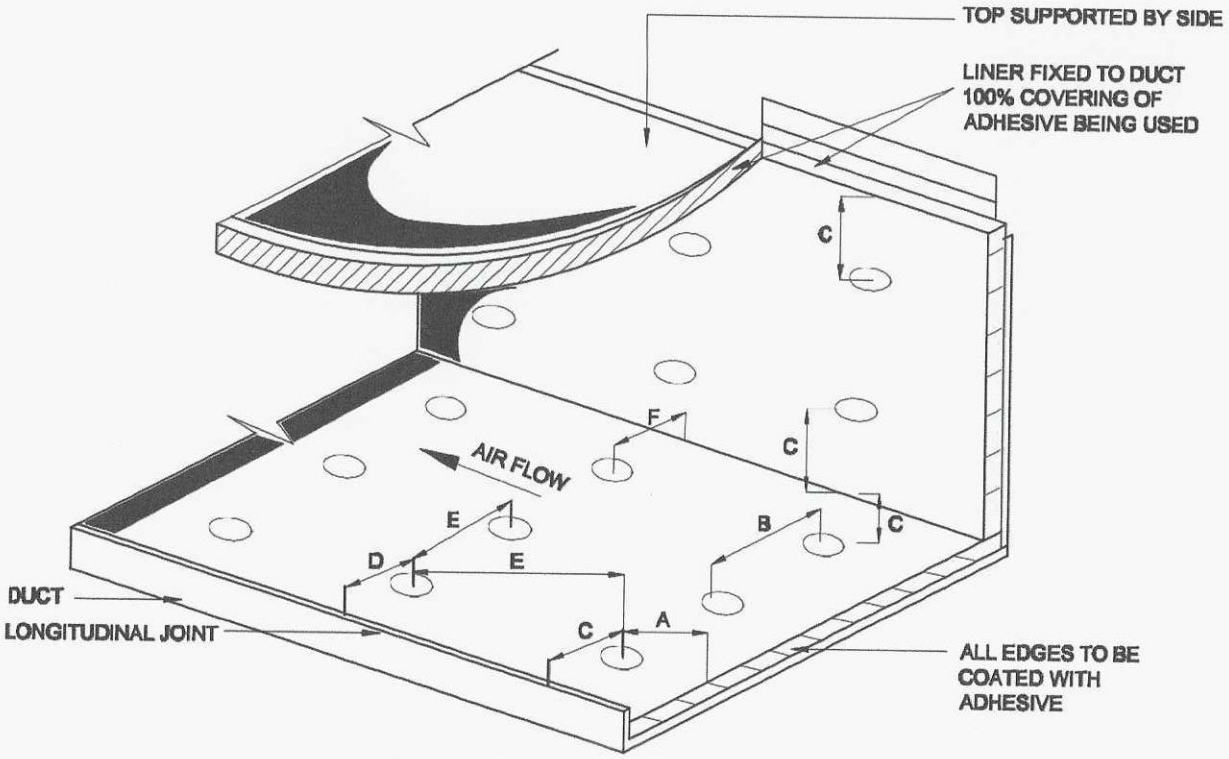
SCALE: N.T.S.	DRAWN BY: L.A.LE ROUX
REV. NO. 0	CHECKED BY: P. MORNET
DRAWING NO: STD 12	



FASTENING OF RIGID INTERNAL INSULATING MATERIAL

	SPACING OF MECHANICAL FASTNERS (mm)					
DUCT SYSTEM	A	B	C	D	E	F
LOW PRESSURE	75	400	400	400	400	400
MEDIUM PRESSURE	75	400	400	400	400	400

REFERENCE DRAWINGS

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PROJECT:

DRAWING DESCRIPTION:
INSULATION
FIXING DETAILS

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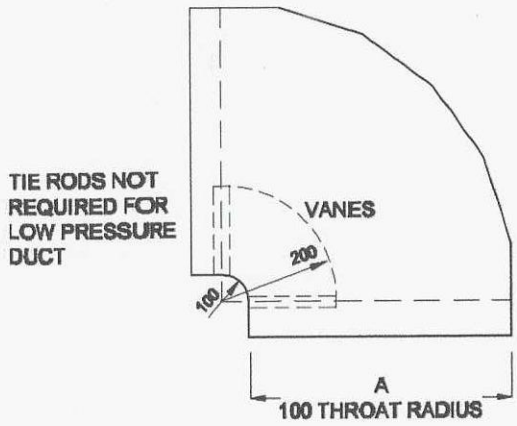
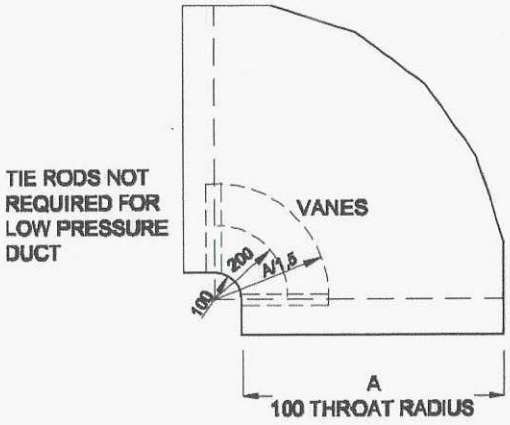
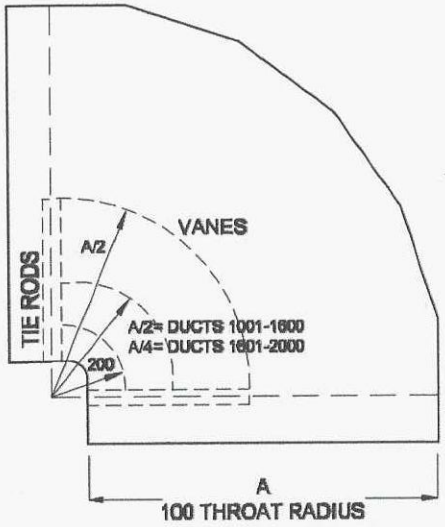
SCALE: N.T.S.	DRAWN BY: L.A.LE ROUX
REV. NO. 0	CHECKED BY: P. MORNET
DRAWING NO: STD 25	



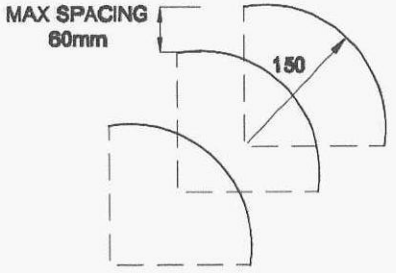
A 301 to 500 WIDE



A 501 to 1000 WIDE



A 1001 to 2000 WIDE



GUIDE VANES IN SQUARE BENDS FOR LOW PRESSURE DUCTING

NO. OF RODS (NOT FOR L.P. DUCTS)
301 - 500 = 1
501 - 1000 = 2
1001 - 1600 = 3
1601 - 2000 = 4

REFERENCE DRAWINGS

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PROJECT:

DRAWING DESCRIPTION:

RADIUSED BENDS & VANES

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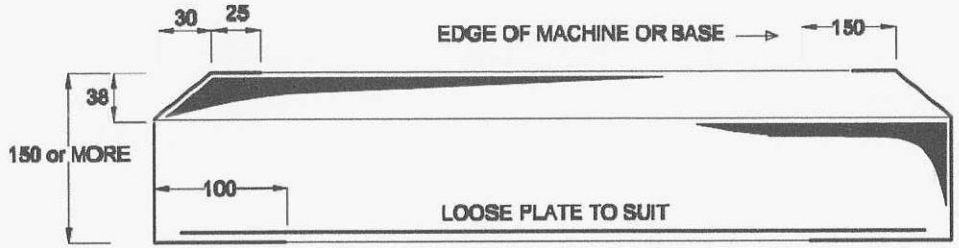
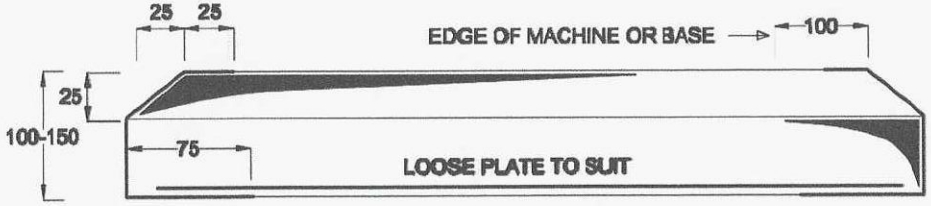
REV. NO. 0	CHECKED BY: P. MORNET
DRAWING NO: STD 16	



SECTION OF BASE TRAY - 150mm OR DEEPER



SECTION OF BASE TRAY - 100mm TO 150mm DEEP

MAX. LENGTH OF SIDE	S/M THICK
UP TO 1220	1.6mm
1220 AND OVER	2.0mm

WEIGHT OF CONCRETE IN BASE TRAY TO EQUAL 1,5 WEIGHT OF EQUIPMENT RESTING ON IT.
WEIGHT OF CONCRETE=2403kg/m³ (150lbs/cu ft)

MATERIAL: GALVANISED SHEETMETAL (SEE TABLE)

CONSTRUCTION: WELDED CORNER JOINTS

FINISH: WELDS WERE BRUSHED & GIVEN 1 COAT ZINC OXIDE PAINT & ONE FINAL COAT GLOSS ENAMEL TO BE APPLIED ON SITE WITH COLOUR TO SUIT

POLYSTERENE BLOCKS IN APPROX.MTG POSITION TO BE PROVIDED FOR FIXING BOLTS TO BE GROUTED IN.

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	DRN.
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PROJECT:

DRAWING DESCRIPTION:
STANDARD MACHINE BASE TRAY (PLINTH)

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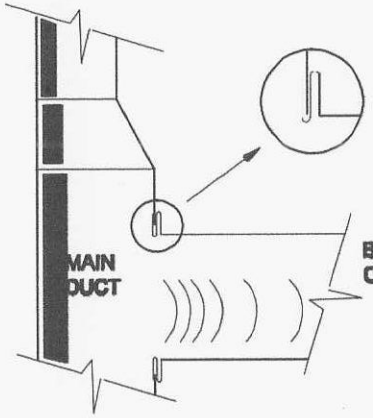
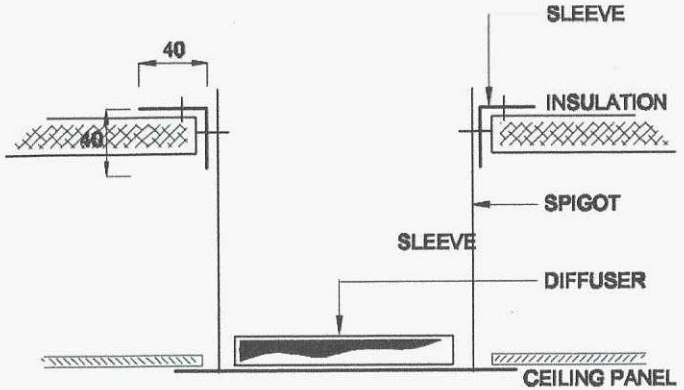
DRAWING NO: STD 19	

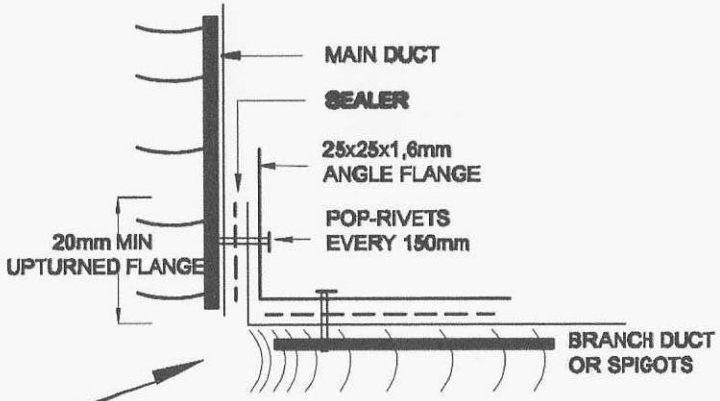


CLINCH LOCK DETAIL

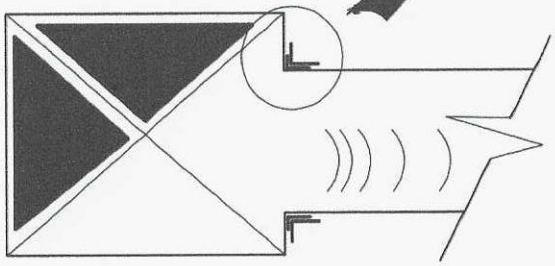
CLINCH LOCK CONNECTION



DETAIL OF SPIGOT FIXING FOR DIFFUSERS



DETAIL OF BRANCH DUCT & SIDE WALL OUTLET SPIGOT CONNECTIONS



FLANGE CONNECTION

THIS DRAWING REFERS TO
LOW PRESSURE DUCTS ONLY.
FOR MEDIUM & HIGH PRESSURE
DUCTS REFER TO SABS 1238–1979

'MEZ' FLANGES ARE TO BE USED
FOR ALL THESE CONNECTIONS
WHEN 'MEZ' HAVE BEEN QUALIFIED
FOR USE ON THE DUCTING SYSTEM.

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	INITIALS
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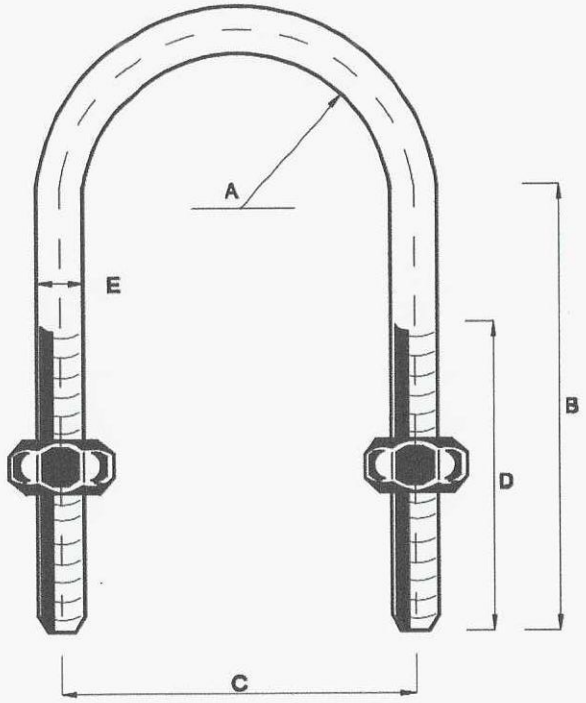
PROJECT:

DRAWING DESCRIPTION:

TEE CONNECTIONS

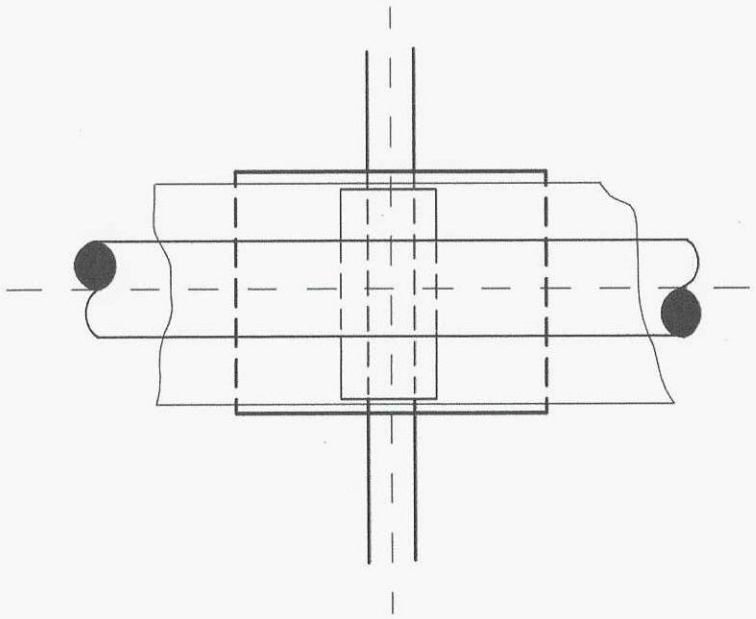
DATE: AUGUST 2005	DRV REF. NO. STD
FILE NO:	DESIGNED BY: W. VENTER
SCALE: N.T.S.	DRAWN BY: L.ALE ROUX
REV. NO. 0	CHECKED BY: P. MORNET

DRAWING NO: STD 24



U-BOLT DETAIL

MATERIAL: MILD STEEL ROUND BAR



THESE SIZES ARE FOR PIPES WITHOUT INSULATON. ALLOWANCE MUST BE MADE TO THE LENGHTS AND RADIUS OF THE U-BOLTS WHERE INSULATION ON PIPING IS TO BE USED.

PIPE BORE	A	B	C	D	E
25	19	84	45	50	6
32	22	84	50	50	6
38	25	87	59	50	8
50	32	75	73	50	8
64	41	75	90	50	8
75	48	86	103	50	8
100	60	100	129	50	8
127	73	110	154	50	8
150	86	127	179	50	8

REFERENCE DRAWINGS

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PROJECT:

DRAWING DESCRIPTION:
PIPE U-BOLT & INSULATION PIPE FIXING DETAILS

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FILE NO:	DESIGNED BY: W. VENTER
SCALE: N.T.S.	DRAWN BY: L.A.LE ROUX
REV. NO. 0	CHECKED BY: P. MORNET
DRAWING NO: STD 18	

PART 2

GENERAL JUSTICE GIZENGA MPANZA REGIONAL HOSPITAL NEW 28 BEDDED MALE AND FEMALE INPATIENT AND OUTPATIENT MENTAL HEALTH UNIT

AIR-CONDITIONING AND VENTILATION INSTALLATION

TECHNICAL SPECIFICATION

INDEX

b) Multiple independent extract air ventilation systems via ducted and wall/ window systems.
c) Heat pump type air cooled chilled water system for large parts of the facility within this scope of works via chillers and air handling units
d) Multiple inverter split type systems
e) Separate DX cooling for the server room and electrical room

4. PROGRAMMING AND GUARANTEE

Programming

4.1 Before commencing the work, the Contractor shall submit a written construction programme in collaboration with the main contract programme to the Engineer for information purposes.

4.2 The Engineer shall have the right to alter the programme mutually agreed upon if, in his opinion, circumstances so dictate, and any such alteration or deviation shall in no case be deemed a basis for claims for extra work or cost by the Contractor.

Guarantee

The 12 months guarantee period will only commence after the entire plant is completed and first delivery/ practical completion has been taken.

5. REFERENCE SPECIFICATIONS AND STANDARDS

5.1 The latest revision of any Specification referred to in this specification, will be applicable.

5.2 Where a specification or standard is not specifically referred to, it will be assumed that the relevant SABS, ISO, BSS, DIN or equivalent American standard, listed in order of preference will apply.

5.3 The SI ("Le Systeme International d' Unites") – Metric System of Units will apply. Refer to SANS – M33A: The International Metric System: Guide to the use of the SI in South Africa.

5.4 The entire new installation shall be carried out in accordance with:

5.4.1 The Application of the National Building Regulations SANS 10400 (including all SANS addenda).

5.4.2 The South African Bureau of Standards Code of Practice fo wiring of Premises SANS 10142.

5.4.3 The Occupational Health and Safety Act No 85 of 1993.

5.4.4 The Standard Specification for the Air-conditioning and Ventilation Services for the Provincial Administration of the Republic of South Africa, as amended, issued by the Chief Director: Work of Kwa-Zulu Natal Provincial Administration.

5.4.5 Refrigeration Systems including Plants associated with Air-conditioning Systems SANS 10147.

5.4.6 The installation testing and balancing of Air-Conditioning Ductwork SANS 10173.

5.4.7 Air-conditioning Ductwork SANS 1238.

5.4.8 Filters for use in Air-conditioning and General Ventilation SANS 1424.

5.4.9 The General Electrical Specification for the Provincial Administration of the Republic of South Africa Part 2E.

5.4.10 Municipal by-laws and any special requirements of the Supply Activities of the area or district concerned.

5.4.11 Municipal Fire Regulations.

5.4.12 Room air-conditioners and heat pump SANS 1125.

5.4.13 Non-ducted air conditioners heat pumps testing and rating performance SANS 5151.

6. DRAWINGS

6.1 ENGINEER'S DRAWINGS

6.1.1 Unless otherwise specified, the Engineer's Tender drawings are not manufacturing drawings and the dimensions given are only sufficient for tendering purposes or to enable the contractor to complete manufacturing drawings. It is the responsibility of the contractor to verify all dimensions.

6.1.2 The Engineer shall make available to and at the request of the contractor any available record drawings of the present installation.

6.2 CONTRACTOR'S DRAWINGS

6.2.1 The contractor will be furnished, on request, with the Engineer's drawings and a complete set of "as built" drawings identified as available in this document.

6.2.2 The contractor shall supply two (2) copies of each detail design drawing for approval. The contractor shall allow the Engineer one (1) week for drawing approval. After a marked-up copy with all the Engineer's comments has been returned, the contractor shall update the original, which shall then be submitted to the Engineer for signature. This will ensure that all prints used for construction will be certified as approved.

6.2.3 Two (2) copies of the certified drawing shall be issued to the Engineer for distribution.

6.2.4 The contractor will be required to produce the following detail design drawings:

(a) Builder's Work Drawings.

(b) Mechanical Drawings

These are all Workshop and Equipment Layout Drawings required for the manufacture and erection of the installations.

(c) Instrumentation Drawings, such as:

Schematic Control Diagrams.
General Arrangement Drawing of Control Board.

(d) Electrical Power Drawings, such as:

General Arrangement Drawing of Switchboard.

Circuit Diagrams and interconnecting diagram giving cable schedules with numbers and sizes corresponding with the circuit diagrams and interconnection diagram.

Busbar details such as; current rating, fault current rating, positions and spacings of busbars and access to busbars, dimensions of busbars, details, positions and spacing of supports, type of material of busbars and supports and busbar identification.

Switchgear details such as; minimum fault capacity of switchgear, type and manufacture of switchgear used, current and voltage transformer ratio and V A ratings.

Meter details such as; maximum capacity of meter in A, V. kWh etc., type and manufacturer of meter, full scale of meter and multiplication factor, if applicable.

6.2.5 Unless otherwise specified, cable routes shall be superimposed on the Mechanical Layout Drawings, showing the runs and fixing details.

6.2.6 Any work done by the contractor without an approved signed drawing, will be at the risk of the contractor.

6.2.7 The Contractor shall update all drawings ("record drawings") once the installation has been completed. One (1) set of paper prints and one (1) set of sepia copies shall be supplied to the Engineer as part of the O & M Manual.

6.3 EQUIPMENT DRAWINGS

The contractor shall provide the Engineer with working drawings of all items of equipment, with a detail technical specification of the equipment, for approval, before placing an order for the equipment.

7. OPERATING AND MAINTENANCE MANUAL

7.1 The contractor shall, at his cost, prepare and supply manuals for the successful operation and maintenance of the installation.

7.2 Six weeks prior to the commencement of commissioning, the contractor shall supply a draft of the manual to the Engineer for approval. Two weeks after commissioning, the Contractor shall supply three (3) additional manuals, which have been updated and included all commissioning data and "record" drawings.

7.3 These manuals shall contain the following information:

INDEX OF CONTENTS

SECTION 1: SYSTEM DESCRIPTION

A comprehensive description of the installation.

SECTION 2: OPERATING INSTRUCTIONS

2.1 Starting and stopping instructions.

2.2 Pre-start checks.

2.3 Equipment running checks.

SECTION 3: MECHANICAL EQUIPMENT

The following information shall be provided in full for each item of equipment:

3.1 General information

Description, Make, Model Number, Name and Address of Supplier, Manufacturer, etc.

3.2 Design information

Design Data Sheet containing all design and selection parameters, calculations, selection curves, etc.

3.3 Settings and values recorded during commissioning.

3.4 Manufacturer's Brochures and Pamphlets.

3.5 Maintenance Data and Schedules

The lapse of time between services and the description of the service required of each part, lubrication requirements, etc.

3.6 Schedule of Spares.

8. INSPECTIONS AND TESTING

8.1 INSPECTIONS (PART III, SAACE – 1978)

The Engineer shall have general supervision and direction of the Contract Works. Supervision shall comprise such periodic visits as the Engineer may consider necessary to inspect the Contract Works for conformity with the Contract documentation and to provide clarification and further information as necessary.

The Engineer shall have the power at any time to inspect and examine any part of the Contract Works or any materials intended for use in or on the Contract Works, either on the site or at any factory, workshop or other place where such parts or materials are being constructed or manufactured or at any place where same are lying or from where they are being obtained and the Contractor shall give all such facilities as the Engineer may reasonable require to be given for such inspection and examination.

The Contractor shall not be liable for the cost of inspecting materials at the place of manufacture, construction or storage nor be responsible for any travelling or accommodation costs arising out of the execution of such inspection, etc.

8.2 TESTING

8.2.1 The Contractor shall supply all test equipment, test facilities and everything necessary, at his cost, to perform these tests. The minimum testing and commissioning equipment that is required, is as follows:

1. Pitot tube and manometer.

2. Hot wire anemometer.

3. Crane type manometer for balancing valves.

4. Thermometer for insertion into pipe and duct pockets alongside temperature detectors.

5. Sling psychrometer.

6. Revolution counter suitable for measuring fan and motor shaft rotation.

7. Megger equipment.

8. Clamp on ammeter.

9. Voltmeter.

10. Power factor meter.

11. Ohmmeter suitable for continuity testing.

12. Neon type ON/OFF test lamp.

13. Maximum indicating ammeter suitable for measuring peak motor starting currents.

14. Vacuum pump.

15. Thermo couple – electronic or calibrated micrometer gauge.

8.2.2 The contractor shall record all measurements taken during testing and shall do the necessary adjustments until the Engineer is satisfied with the results.

8.2.3 The Engineer shall be notified one (1) week in advance of any tests so that he may witness such tests.

8.2.4 Unless otherwise specified, the contractor will be required to perform the following tests:

Electrical Switchboards

(a) A simulated functional test in the factory to ensure the correct operation of equipment, controls, interlocks and measuring circuits.

(a) A 2,5 kV pressure test in the factory

Ducting

Pressure test medium and high pressure ducting in terms of SANS 10173: Code of Practice for the Installation, Testing and Balancing of the Air Conditioning Ductwork.

Water Piping

Pressure test of all piping at a test pressure of 1,5 times the maximum working pressure at the lowest point in the system, but not less than 700 kPa. All instrumentation or other equipment, which could be damaged during the pressure test,

shall be removed from the pipe system. The relevant system shall be filled with water and all high points shall be vented at least 24 hours before the test. The duration of the pressure test shall be 24 hours, after which no water leaks shall be visible and no pressure drop shall occur after corrections have been made for changes in ambient temperature during the test period.
Pressure tests shall be completed in sections, which adhere to the schedule as specified in this specification, prior to insulating or covering piping.

If leaks are found, welded connections shall be cut out and rewelded and screwed joints shall be dismantled, cleaned and reconnected. Rectified piping shall be retested.

Pressure Vessels

Refer to the requirements set out in the Occupational Health and Safety Act of 1993.

Refrigerant Piping

Refrigerant pipes and equipment shall be tested in terms of SANS 10147: Code of Practice for Refrigeration and Air Conditioning Installations.

Prior to the pressure test, equipment which has been factory tested and refrigerant charged, as well as any other equipment which could be damaged or cause personal injury by imposed pressure test, shall either be isolated or removed from the system. Safety relief valves and rupture discs where not part of factory sealed systems shall also be removed and openings plugged.

Pressure control and excess pressure protection shall also be provided. The pressure test shall be applied in two stages, before any joints are insulated or piping covered. The test gas shall be dry nitrogen.

The first stage shall be at 69 kPa with every joint checked with a thick soap or colour indication solution. The test pressure and ambient temperature is to be recorded to which the system is exposed.

The second stage shall be tested at pressure not less than the lower of the system design operating pressure or the protecting pressure relief device with 10% increments above 690 kPa. The final pressure shall be maintained for 24 hours with the system pressure and ambient temperature recorded. Should any leaks be found, then the joints shall be removed, thoroughly cleaned and re-installed as a new joint. Joints repaired by calking, remelting or back weldingshall not be acceptable. After the necessary repairs, the system shall be re-tested.

Following a successful pressure test, each system shall be relieved and evacuated to an absolute pressure 300 micrometers. The ambient temperature is to be higher than 2°C during a vacuum test. Once the desired vacuum is reached, the vacuum shall be closed and stand for 1 hour. Should the pressure rise over 500 micrometers after 1 hour, the system shall be evacuated down to 300 micrometers and left for 1 hour. The system shall not be charged until a vacuum of at least 500 micrometers is maintained for 1 hour without a vacuum line. Should any leaks occur, they are to be repaired with vacuum procedure redone.

9. COMMISSIONING AND HANDING OVER

9.1 PROCEDURE

9.1.1 Physical Completion

After physical completion of the erection phase of the installations, the Engineer will issue a Defects List certifying that commissioning can proceed. Items which would not influence the commissioning process could, at the discretion of the Engineer, be attended to during commissioning stage.

9.1.2 Commissioning Stage

After commissioning the Engineer will issue a second Defects List (the Commissioning Defects List). Any outstanding work will be recorded on this list.

9.1.3 Engineer's Certificate

After completion of all outstanding items and receipt of all manuals and drawings as recorded on the Commissioning Defects List the Engineer will issue a First Delivery Certificate. This certificate will accompany a certificate of acceptance by the Client's representative.

The one year maintenance and guarantee period will commence on the date of the First Delivery Certificate.

9.2 COMMISSIONING

The Commissioning of the entire installation shall be carried out timeously. The workshop drawings, to be produced by the Contractor, are to be perused and approved, in principal, by the Contractor's Commissioning Engineer who is to confirm that the installation as indicated can be commissioned.

The commissioning of the installation shall be in terms of the following codes, or any other code approved by the Engineer:

(a) Air Distribution Systems:

SANS 10173: Code of Practice for the Installation, Testing and Balancing of Air Conditioning Ductwork.

(b) Refrigeration Systems:

CIBS: Commissioning Code: Series R: Refrigeration Systems.

(c) Control System:

CIBS: Commissioning Code: Series C: Automatic Controls.

(d) Water Distribution Systems:

CIBS: Commissioning Code: Series W: Water Distribution Systems.

The Contractor shall submit the Commissioning program to the Engineer, at least four (4) weeks prior to the commencement of commissioning.

The power connections to the various installed equipment must be energized to facilitate commissioning of the installation.

To enable this switch-on to take place the installation must be substantially complete.

The Contractor shall inform the Engineer within (4) weeks of his appointment, what time allocation has been allowed for commissioning purposes. This must be reflected on the Critical Path Schedule to be submitted by the Contractor.

9.3 TRAINING AND MAINTENANCE

The Contractor shall provide a suitably qualified and trained person to train the Employer's staff in the correct operation and maintenance of the installation. The Contractor shall allow for this person to be full time on site as called for in the maintenance contract conditions.

10. MAINTENANCE DURING THE GUARANTEE PERIOD

During the contract and guarantee period, the Contractor shall be fully responsible for complete maintenance of the installation as specified in the included maintenance contract. Whilst the guarantee period on material, equipment and labour performed commences on the date when the Engineers Certificate and the Clients Certificate of Acceptance is issued and expires one calendar year later.

Maintenance of the installation shall mean the regular servicing, lubrication, repairing, cleaning and adjustment of the installation as per the included specification, as well as the free of charge replacement of any defective components of the new installed equipment during the guarantee period.

As part of the final hand over the contractor is to submit all maintenance log-sheets for the maintenance carried out during the 12 Maintenance Period.

11. STATUTORY AND REGULATORY REQUIREMENTS

The installations shall be designed, erected, commissioned and maintained in compliance with the following appropriate regulations as specified in the Standard and Technical Specification.

In addition, the contractor shall exempt the Employer from all losses, costs or expenditures which may arise as a result of the Contractor's negligence to comply with the requirements of the regulations enumerated in this Clause.

It shall be assumed that the Contractor is conversant with the abovementioned requirements. Should any requirement, by-law or regulation, which contradicts the requirements of this Document, apply or become applicable during erection of the installation, such requirements, bye-law or regulation shall overrule this document and the contractor shall immediately inform the Engineer of such a contradiction.

Under the circumstances shall the Contractor carry out any variations to the installations in terms of such contradictions without obtaining the written permission to do so from the Engineer.

12. ARRANGEMENTS WITH THE SUPPLY AUTHORITY

It shall be the responsibility of the Contractor to make the necessary arrangements at his own cost with any Statutory Authority and to supply the labour, equipment and means to inspect, test, commission and to hand over the installation.

The Contractor shall supply and install all notices and warning signs that are required by the appropriate laws or regulations and/or by these documents.

13. DESIGN PARAMETERS

The following design parameters shall apply:

Ambient Conditions

Altitude		:	0 m
Barometric Pressure		:	101.25 kPa
Summer	DB	:	32°C
	WB	:	23°C
Winter	DB	:	10°C
Ambient Condensing Temperature		:	35°C

Indoor Conditions

Summer Inside	DB	:	24°C to 26°C +-1°C
Winter Inside	DB	:	24°C to 26°C +-1°C

14. AVAILABLE SERVICES

Details of available services on site:

Electrical Supply

415 V/230 V	:	TBC
Steam Supply	:	N/A

Municipal Water Supply

Available pressure	:	TBC

15. NOISE AND VIBRATION CONTROL

The Contractor shall be responsible for maintaining noise and vibration transmission from his equipment to the building structure and adjacent rooms within the limits suggested in the SANS "Code of Practice for the Rating of Noise for Speech Communication and with the respect to Annoyance, Code Number 10103 - 1994.

In order to attain the noise levels specified below,the Contractor shall provide the necessary spring type vibration mountings under all rotating equipment, flexible pump piping connections, etc.

All noise and vibration control equipment must be clearly shown on the Contractor's drawings which are to be submitted for approval.

Noise levels specified below may be amended in the supplementary specification if a specific part of the contract works so requires. This shall not however relieve the Contractor of the responsibility of meeting the requirements of the above clauses as far as the remainder of the contract work is concerned.

The following table is an excerpt from the abovementioned SANS code.

Type of indoor space	**Intruding noise level dB(A), maximum**
Hospital ward, theatre, church, cinema, concert hall, small office, reading room, conference room, lecture room	25 – 35
Large office, business store, department store, meeting room, small quiet restaurant	35
Large restaurant, secretarial office(with typewriter), gymnasium	45
Large typing halls	55
Workshop (according to intended use)	45 - 75

Noise generating equipment such as fans, compressors, pumps, motors etc. shall be selected to operate as close to the point of maximum efficiency as possible. It is the responsibility of the Tenderer to check operating noise levels of the equipment before tendering. Tenderers offering equipment with low noise ratings may receive preference.

Tenderers are advised to calculate sound levels on the system offered before tendering. Where it is not possible to meet the specified sound levels due to the noise generated by the equipment, or due to inadequacies in the building structure, or the design of the plant, such deficiencies shall be stated in the tender together with the Tenderer's recommendations and cost implications.

The Contractor shall submit noise estimating sheets for all systems as well the insertion loss ratings of sound attenuators for approval before ordering. Failure to do so may result in additional costs to the Contractor if noise levels in any area should exceed the specified limits.

If the noise levels exceed the values specified above, the Contractor shall be responsible to carry out all the necessary rectifications at his own expense.

16. CODING, LABELLING AND NOTICES

16.1 GENERAL

The Contractor shall supply and install all coding, labelling and notices as required under this Clause.

The wording shall be in English.

To reduce the possibility of incorrect labels and/or notices, the Contractor shall submit a schedule of labels and notices to the principal agent for approval. Costs to rectify inscriptions, resulting from the failure by the Contractor to obtain approval, will be for his account.

16.2 CODING

16.2.1 General

Codes and numbers for wiring shall be CRITCHLEY IZ-type, or other approved, Cable Marker interlocking endless expanding markers, as supplied by CABLE ACCESSORIES (PTY) LTD. CRITCHLEY C-type, or other approved, Cable Markers shall only be used with the approval of the Engineer where wires and piping have already been terminated.

Lettering shall be marked in black on a white background.

16.2.2 **Electrical**

Provide and install the following coding:

(a) Numbering of both ends of power and control conductors in switchboards.

(b) Numbering of both ends of field cables.

(c) Numbering of both ends of individual field conductors within cables of control circuits only, where such conductors are not uniquely identified by means of insulation colour codes.

16.3 LABELLING

16.3.1 **General**

Labelling shall be CRITCHLEY UNILABEL, or other approved, Cable Marker, as supplied by CABLE ACCESSORIES, or engraved "IVORENE" or "TRAFOLITE" labels.

Black letters on a white background shall be used.

Labels shall be fixed with screws or acceptably glued to all equipment.

16.3.2 **Equipment**

All mechanical, electrical and instrumentation equipment shall be identified by means of an equipment code.

Minimum height of letters: 10mm.

16.4 NOTICES

16.4.1 Supply and install all notices required in terms of Statutory Regulations.

16.4.2 In terms of the Occupational Health and Safety Act, Act 85 of 1993, the following notices are required:

(C.52)
At the entrance to each plantroom, the following notice shall be provided:

(a) Prohibiting unauthorized persons from entering.

(b) Prohibiting unauthorized persons from handling or interfering with electrical apparatus.

(c) Directions as to procedure in case of fire.

(d) Directions as to restoration of persons suffering from the effects of electrical shock.

(C.73)
Manufacturer's Plate on Pressure Vessels:

(a) Manufacturer's name.

(b) Country of Origin.

(c) Maker's Number.

(d) Year of Construction.

(e) Maximum permissible working pressure in Pascal.

(f) Capacity in cubic metres

(g) Name and Number of Code of Manufacture.

17. PAINTING AND MARKING

17.1 GENERAL

All steelwork, piping, lagging, etc. supplied under this contract shall be painted as required under this clause:

Exposed portions of boilers, calorifiers, cylinders, etc. in the plant room shall be properly cleaned, primed and painted two coats of heat resistant paint.

All other exposed metal parts such as pumps, belt guards, all piping, pipe lagging, fittings, dampers, fans, coils, motors, pumps, packaged units, control panels, steelwork, exposed ducts and lagging, expansion tanks, make-up tanks, cooling tower, unit shelters, etc. shall be cleaned, primed, undercoated and finished in a high quality gloss paint of approved colour.

All external equipment exposed to the weather must be cleaned, primed and painted with two coats of epoxy paint.

The lagged surface of calorifier, headers and pipes shall be primed, undercoated and finished in a high quality gross of approved colour. Unlagged steam piping shall be painted with heat resistant paint.

All plants shall be generally painted in accordance with SANS 10140 as indicated below.

Machinery, Structural steelwork etc.

1.	All exposed metal parts Checker plates, Pipe supports Handrails, Base plates	:	Black
2.	Body portions of machines	:	Olive Green
3.	All machinery external to the building (except piping		

	and valves and fittings)	:	Dove Grey
4.	All moving parts which are visible when operating. Inside surfaces of all machine guards, belt guards etc.	:	Orange
5.	All handles, levers, handwheel centres adjustment knobs, etc.	:	Yellow
6.	All lagging on boilers, calorifiers, tanks, cylinders etc. except on piping and pump sets and ducting)	:	Aluminium
7.	Electrical distribution boards (except where transparent covers are used)	:	Orange
	Control panels Indicator panels		
8.	Water treatment plant (except on piping.	:	Light Grey
	Air Conditioning plant (except on piping.	:	Light Blue
9.	All points which constitute a physical hazard, e.g. (stay-wires, low pipes, access doorways, etc.)	:	Yellow and Black Cross Hatch
10.	Drainage piping	:	Black

17.2. PIPING, PUMPS,VALVES, FITTINGS ETC.

17.2.1 The colour code for pipelines and machines is based on the following:

(1) SANS, 10140-3 : Identification colour marking; Contents of Pipelines

(2) BS 1710-1975 : Identification of pipelines

17.2.2 All unlagged black piping, holderbolts, supports anchors fittings, etc. shall be painted in accordance with British Standard Specification No. BS 1710.

17.2.3 In enclosed horizontal or vertical ducts, surfaces, mezzanine spaces and basements where pipelines are already painted or galvanised or are lagged, painting may be restricted to 150 mm long lengths at a maximum spacing of 4 m, and at all branches, tees, valves, and at the entry from such ducts, spaces, etc.

17.2.4 Except where otherwise specified all piping on surfaces shall be painted with a primer, an undercoat and a finishing coat in approved high quality gloss paint. to the colour indicated in the schedule. This also applies to all holderbolts, supports, anchors,

fittings and valves. Where only 150 mm lengths of the pipe are painted the colour and specification of the painting shall be in terms of this clause.

17.2.5 Pump sets, valves, fittings, etc. shall be painted the same basic colour as the pipelines, except those of firefighting services, which shall be painted red.

17.2.6 **Bands**

The length of the band shall be same as the final pipe diameter, but not less than 100 mm. Where three strips are required per band, each strip shall be one third of the final pipe diameter but not less than 35 mm. Where 150 mm lengths alone are colour painted, the 50 mm band shall be centrally placed on the 150 mm length.

17.3 ARROWS

The direction of flow shall be indicated with a 25 x 100 mm long black arrow at intervals of approximately 4 m and at valves and junctions. Flow lines shall be marked with an F and return lines with an R at each arrow.

17.4 SERVICE OUTLETS

Where outlets require identification the colour identification shall take the form of coloured centre pieces on handwheels or cocks, and/or other suitable approved marking on the neck of the outlet fittings as specified. The colour shall primarily be that of the pipe colour and where banding is used, the colour shall be that of the band and stroke.

17.5 RADIATORS AND PIPES IN FINISHED AREAS

All radiators, pipes, fittings etc. in finished areas such as wards, offices, passages, etc. shall be cleaned, primed, undercoated and finished in a high gloss paint to match the existing finish.

17.6 IDENTIFICATION COLOURS

	Basic Pipe Colour	**Banding Colour**
Cold water supply (drinking water)	Brilliant green	Cornflower
Condenser water	Brilliant green	White
Boiler feed water	Brilliant green	Crimson/white/Crimson
Boiler condensate lines	Brilliant green	Crimson/Emerald Green/ Crimson
Chilled water lines	Brilliant green	White/Emerald Green/ White
Domestic hot water	Brilliant green	Crimson/Cornflower
Fire-fighting mains	Signal red	
Central heating hot water	Brilliant green	White/Yellow/White
Steam	Pastel grey	
Gas (except air and medical gas)	Light stone	
Compressed air	Artic blue	
Ducts and conduits for electric services	Light orange	
Diesel	Golden brown	White
Acids and alkalis	Jacaranda	

17.7 IDENTIFICATION COLOUR CODES

Colour name	Colour classification no.
Artic blue	F28
Brilliant green	D10
Cornflower	F29
Crimson	A03
Emerald green	A14
Golden Brown	B13
Jacaranda	F18
Light stone	C37
Light orange	B26
Pastel grey	G54
Signal red	A11

17.8 COLOUR CODING FOR DUCTWORK

All ducting in plantrooms is to be colour coded according to the schedule below. If the duct is internally lined, then the whole duct surface shall be painted in accordance with the schedule blow. If the duct is externally lined with insulation, then the ducting must be painted with a symbol to the relevant colours. The form of these symbols are to be as follows:

(a) In order to make the colour clearly visible it may be necessary to paint the symbol colour onto a neutral colour background. This background colour is to be agreed upon by the Consulting Engineer.

(b) The colour symbols are to be 150 mm wide band, running around the duct. The background colour is to extend 300 mm on either side of the colour symbol strip.

(c) In the case of conditioned air where the colour symbol is both red and blue, one colour strip is to be used (150 mm wide) but the two colours shall alternate each being 200 mm long.

Duct/Air type	Colour	Colour No.
Ventilation Air Supply	Blue with Yellow Band	F11 and C61
Exhaust Air	Brown	B07
Reticulated air	Grey	G25
Outside air	Green	P14
Hot deck (on dual duct)	Blue with Red Band	F11 and A14
Cold deck (on dual duct)	Blue with Dark Blue Band	F11 and F02

The colours as defined as above are according to SANS 10173-1980.

18. DIRECT EXPANSION AIR-CONDITIONING UNITS

18.1 MIDWALL TYPE ROOM AIR-CONDITIONING SPLIT UNITS

18.1.1 GENERAL

The units shall be of the Daikin series or other approved.

The units shall be supplied and installed in the positions shown on the drawings and each shall be of the heat pump type.

The Sub-Contractor is to note that the indoor unit shall be mounted against the wall or in the ceiling or the ceiling, suspended from the roof structure or slab, in terms of the suppliers' recommendations.

Each system shall consist of an indoor unit connected to an outdoor unit.

a) Each unit shall be equipped with a condensate drain pan and the condensate must be drained to each drain point indicated on the drawing through a 22mm uPVC pipe. Drain piping built into walls shall be copper class O diameter 22mm. No drain shall be surface mounted and the onus is therefore on the air conditioning Sub-Contractor to ensure that his drain pipes are in position when the walls are being built. The cassette units will be equipped with a condensate pump capable of at least pumping 150mm head.

b) The temperature controls shall be accommodated in the remote fan switch housing and shall consist of a temperature adjustment facility and temperature scale. Each unit shall be equipped with a time delay safety circuit which shall delay the restart of the compressor for approximately 3 minutes even if the air conditioner is manually restarted too quickly. **The wiring between the remote controller and the unit shall not be surface mounted and is therefore to be done in conduit chased into the wall.**

c) The thermostat control shall be installed in a position indicated by the Engineer.

Each outdoor unit shall conform to the following specification:

a) The unit shall be mounted on purpose made galvanised unistrut wall brackets where indicated. The wall brackets forms part of this contract.

b) The unit shall accommodate the refrigerant compressor, the condenser fan and air-cooled condenser coil. The compressor shall be installed on anti-vibration mountings as provided by the manufacturer.

c) The condenser coil shall be protected against damage by a removable wire mesh screen.

d) The units shall be able to operate on a run/ standby feature by utilizing a central controller as per the BOQ

18.1.2 PIPING

a) The system must be charged with R410A refrigerant.

b) The indoor and outdoor unit must be interconnected with copper refrigerant piping in terms of the suppliers' recommendation. The tenderer is to note that the

distances between the indoor and outdoor units and the relevant pipe sizes have been indicated on the drawings. The return of oil to the compressor is to be ensured by the installation of traps at regular intervals.

c) All piping through walls shall pass through sleeves which shall be properly sealed after installation. Installation through sleeves shall be continuous.

d) All surface mounted piping shall be installed in suitably sized rectangular PVC Cabstruct trunking, complete with removable coverplate and bends, securely fixed to the walls.

e) All piping and cabling above ceilings shall be installed on factory manufactured galvanised steel cable tray, hung from the structure above.

f) All refrigerant, liquid and suction, shall be separately insulated with thermoflex insulation. Insulation exposed to weather conditions shall be covered with suitable galvanised steel trunking (see Clause 19.7) and also be covered with cloth and painted with "Foster seal".

g) All refrigerant piping shall be seamless cold drawn copper piping.

h) The insulation shall be applied to form a continuous and homogenous vapour barrier over bends, supports, etc.

i) Inside the building (ceiling voids) piping shall be installed on "Cabstrut" or other approved heavy-duty galvanised cable basket wide enough to accommodate both pipes and the drain piping. Piping may not be suspended from these cable racks.

j) Horizontal piping may be strapped to cable trays with 10mm wide cable ties. Care shall be taken not to pinch or damage the pipe insulation when strapping to cable trays. Any damaged insulation shall be completely removed and replaced to the satisfaction of the Engineer.

k) All piping shall be run so to avoid passing through ductwork, recessed light fixtures or interference with electric light outlets.

l) Where piping protrudes through building structures, pipe sleeves are to be installed, as part of the contract, to ensure easy removal thereof. No pipes may be built or plastered directly into the structure.

m) The contractor shall be responsible for the drilling of the holes and making good on the outside of the building to the plaster and paint.

n) When completed, the installation shall ensure a complete vapour barrier and any signs of sweating or dripping shall cause the installation to be rejected

19 PIPING INSTALLATION

The pipe routes shown on the drawings are generally diagrammatic. The runs and arrangements of piping shall be as indicated, subject to modifications as required to suit conditions at the building, to avoid interference with work of other services and for proper convenient and accessible location of all parts of the piping system. All required offsets, fittings, valves, traps, drains, etc. may not be indicated but allowance must be made in tenders for all such necessary items to be furnished.

Piping shall be installed as straight and direct as possible, neatly spaced and in general forming right angles with, or parallel to walls or other piping.

The pipe sizes shall be installed by the contractor for the sizes of units offered in accordance with the manufacturer's specifications. Any discrepancy between this specification and the manufacturer's specification is to be brought under the attention of the Engineer.

The piping network shall be connected using "REFNET" or "Y Branch" joints complete with the necessary reducers with the matching insulation as supplied by "Daikin" or other approved.

Suction and liquid pipes are to be insulated separately and not grouped together as for a single line. "Thermaflex" or other approved pipe insulation as per Clause 19.7 shall be used.

All piping shall be run so to avoid passing through ductwork, recessed light fixtures or interference with electric light outlets.

Where piping protrudes through building structures, pipe sleeves are to be installed, as part of the contract, to ensure easy removal thereof. No pipes may be built or plastered directly into the structure.

The contractor shall be responsible for the drilling of the holes and making good on the outside of the building to the plaster and paint.

Pipe sleeves must be of similar material as the pipe and must be large enough to allow enough free space for movement.

Where specified and where the opening between the sleeve and pipe is large and unsightly, blank cover plates must be installed.

Sleeves through outside walls, slabs and piping through roofs and windows must be sealed off watertight.

All sleeves must be installed neatly and made watertight. The opening between the pipe and sleeve must be sealed off by means of silicon rubber or any other approved product.

Where piping is installed through ceilings approved blank cover plates must be used to ensure a neat finish.

Where pipes run in areas exposed to sunlight (between outdoor units and the building), they will be installed inside suitably sized galvanized mild steel trunking.

Inside the building (ceiling voids) piping shall be installed on galvanized cable baskets wide enough to accommodate both pipes and the drain piping. Piping may be strapped to cable trays with cable ties.

Piping shall be installed strictly in accordance with the manufacturer's requirements. Pipe sizes are indicated on the pipe schematic drawings.

Pipes marked with * in the diagrams must be connected to the device with a reducing joint.

19.5 REFRIGERANT PIPING

All piping and fittings shall be of the best quality seamless, dehydrated, de-oxidised refrigeration class copper tubing, suitably sized for the unit installed and in accordance with SANS 460 as amended.

All refrigerant piping shall be "Maksal" Type RL hard drawn refrigeration copper tubing in accordance with ASTM B280-88.

Only jointing by means of capillary fittings will be allowed except in cases where equipment needs to be removed from the piping system for regular maintenance or replacement. In such cases joints between the equipment and piping shall be with DZR brass compression fittings.

Capillary type fittings shall comply with SANS 1067 - Part 2 or any of the related ISO 2016, DIN 2856 and BSS 864 - Part 2 specifications.

Soldering flux shall be used to remove residual traces of oxides, to promote wetting and to protect the surface to be soldered from oxidation during heating.

The flux shall be applied to clean surfaces and only enough should be used to lightly coat the areas to be joined and should be applied as soon as possible after cleaning.

Only the following solders shall be allowed to be used on capillary joints:-

Composition	Specification
97/3 (97% tin and 3% copper)	SANS 24 – DIN 1707
96/4 (96% tin and 4% silver)	SANS 24 – DIN 1707
75/25 (75% tin and 25% zinc)	

Resin core and acid core solder **shall not be used at all.**

No welding of refrigeration systems will be allowed unless the pipe system is continuously filled and under pressure using nitrous gas.
All soldered joints, on factory supplied equipment, shall be carefully checked before commissioning and remade if found damaged in transit.

Refrigerant piping shall be arranged so that normal inspection and servicing of the compressor and other equipment is not hindered. Locations where copper tubing will be exposed to mechanical damage shall be avoided.

A refrigerant charging connection shall be provided in the liquid line. Before charging the system with refrigerant the circuit shall be leak tested and dehydrated.

All pipes, vessels, etc. operating below ambient dew point shall be insulated and a vapour barrier provided.

An isolating valve shall be installed in both the liquid and gas lines where connected to the evaporator unit. Valves shall be of the bronze body, ball type.

When completed, the installation shall maintain a complete vapour barrier and any signs of sweating or dripping shall cause the installation to be rejected.

All piping shall be rigidly supported, both vertically and horizontally.

Inside the building (ceiling voids) piping shall be installed **on** "Cabstrut" or other approved medium-duty galvanised welded wire mesh cable tray wide enough to accommodate both refrigerant pipes and the drain piping. The mesh pitch shall not exceed 100x50mm with longitudinal side-wall wires spaced at intervals of not more than 25mm.

Outside the building piping shall be installed **on** "Cabstrut PW100" or other approved heavy-duty welded galvanised cable ladder wide enough to accommodate both refrigerant pipes and the drain piping, including galvanised sheet metal covers painted to colour match the walls. Rung spacing shall be at 300mm intervals.

All wire mesh cable trays shall be supported on "Unistrut P2000" or other approved 41x41x1.5mm galvanised channels including galvanised hold down saddles, bolts, nuts, washers and screws. The channel shall be supported from 8mm diameter hanger rods including washers and nuts. Channels to be spaced at intervals not exceeding 1500mm.

All cable ladders shall be supported on "Unistrut P1000" or other approved 41x41x2.5mm galvanised channels including galvanised hold down cup, bolts, nuts, washers and screws. The channel shall be "Rawl" bolted directly to external walls or slabs. Channels to be spaced at intervals not exceeding 1500mm.

All piping shall be secured to cable trays and ladders with "Cabstrut Q-series" or other approved adjustable type galvanised cross rung clamps **only**. Care shall be taken not to pinch, compress or damage the pipe insulation when securing piping to cable trays and ladders. Any damaged insulation shall be completely removed and replaced to the satisfaction of the Engineer.

Strappings and cable ties will not be permitted.

Hangers and supports where piping penetrates through walls shall be designed to prevent transmission of vibration to the building.

Supports must be installed near to joints and fittings. Pipe clamps shall be installed at the following centre to centre distances.

Extra support must be supplied at T-offs, valves and other heavy fittings.

Nominal Pipe Size	**Centre to Centre Spacing**	
Copper	**Horizontal Pipe**	**Vertical Pipe**
12 mm	1.0 m	1.2 m
15 mm	1.2 m	1.5 m
22 mm	1.5 m	1.8 m
28 mm	1.9 m	2.1 m
35 mm	2.1 m	2.4 m
42 mm	2.4 m	2.7 m
54 mm	2.4 m	3.0 m
66 mm	2.4 m	3.0 m
76 mm	2.5 m	3.0 m

19.6 DRAIN PIPING

Provision shall be made for condensate drainage from the inside of the building to the outside of the building by means of uPVC piping of not less than 20mm inside

diameter.

Piping shall run above ceilings and vertical down in the positions indicated on the drawings. All piping shall terminate at ground level where it shall be routed to the nearest drain point.
Drain piping shall be installed without any loops in the piping where condensate can accumulate. The pipes shall have a uniform slope (1:100) from the unit to the outside and show be tested in the presence of the Engineer.

All drain piping in ceiling voids shall be insulated as per Clause 19.7. Drain piping on external walls shall be copper class O and shall be un-insulated and painted to match the colour of the walls.

19.7 PIPE INSULATION (SANS 1445 & SANS 1508 AS APPLICABLE)

The copper piping installed inside the building shall all be insulated with "Thermaflex" or other approved insulation. Vapour barrier integrity will be critical to prevent dripping. No zip type insulation will be allowed. Liquid and gas lines shall be insulated separately.

The insulation material shall meet the following minimum requirements:

Temperature range	:	-80°C + 120°C
Thermal conductivity	:	0,038 W/m K at 0°C
Thickness	:	15 mm
Density	:	35kg/m^3
Odour Properties	:	Neutral
Cellular Structure	:	Totally closed
Fire Properties	:	Self-extinguishing

The insulation shall be applied to form a continuous and homogenous vapour barrier over bends, supports, etc. All joints and seams shall be glued. **Non-drip tape shall not be used for assembling seams and joints**.

All fittings and valves shall be wrapped with black non-drip tape.

When completed, the installation shall ensure a complete vapour barrier and any signs of sweating or dripping shall cause the installation to be rejected.

19.8 CONTROLS

19.8.1 Individual control unit

The contractor shall supply and install hard-wired remote controllers in the positions indicated on the drawings. All control wiring shall be to the manufacturer's recommendation.

The controller shall perform the following functions:

a) Start/Stop.

b) Temperature setting.
c) Airflow setting.

The controller shall display the following:

a) Operation display.
b) Filter sign.
c) Temperature setting display.
d) Timer display.
e) Airflow display.
f) Abnormal operation display.

The controller shall control all indoor units of one room simultaneously.

19.8.2 **Schedule timer**

Supply and install a schedule timer only if specified and indicated on the drawings.

The unit shall control up to 128 indoor units. On/off times shall be set by units of day, hour and minutes.

20. AIR COOLED CHILLERS

CONTRACTORS ARE TO NOTE THE FOLLOWING WITH REGARD TO THE CHILLER SPECIFICATION:

(1) The total number of chillers required is two (2), which are of the heat pump type with partial heat recovery

(2) The specification details the minimum requirements that are to be complied with.

(3) Any chillers not meeting the minimum requirement must be offered as an alternative. In the event that a non-compliant unit is offered as the main bid then the contractor will be responsible for modifying the unit to the Engineers specification at their own cost.

(4) All chillers offered as an alternative must be accompanied by a detailed variation list in which all deviations are confirmed.

20.1 GENERAL

The Contractor shall provide two (2) scroll compressor, reverse cycle, air-cooled, liquid chillers of the scheduled capacities as shown and indicated on the drawings, including but not limited to:

1. Chiller package.
2. Charge of refrigerant and oil.
3. Electrical power and control connections.
4. Plate heat exchangers.
5. Chilled water connections.
6. Hot water connections.
7. Partial energy heat recovery.

The chillers shall be of the "Airco" air cooled high efficiency suitable for 2 pipe water systems, extremely low noise or other approved type.

20.2 QUALITY ASSURANCE

The chillers shall be designed, tested, rated and certified in accordance with, and installed in compliance with applicable sections of the following Standards and Codes:

1. ANSI/ASHRAE Standard 15 – Safety Code for Mechanical Refrigeration
2. ANSI/NFPA Standard 70 – National Electrical Code (N.E.C.)
3. ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
4. ARI Standard 550/590 – Positive displacement compressors and air-cooled rotary screw water-chilling packages
5. Conform to Intertek Testing Services, formerly ETL, for construction of chillers and provide ETL/cETL listing label
6. Manufactured in facility registered to ISO 9001
7. Participation in the **Eurovent Certification Programmes**
8. An **EC Declaration of Conformity** certification.

20.2.1 Factory Test:

The chillers shall be pressure-tested, evacuated and fully charged with refrigerant and oil, and shall be factory operational run tested with water flowing through the vessel.

20.2.2 Warranty:

Manufacturer shall warrant all equipment and material of its manufacture against defects in workmanship and material for a period of one year from date of initial start-up.

20.3 DELIVERY AND HANDLING

The chillers shall be delivered to site fully assembled and charged with refrigerant and oil by the manufacturer.

The chillers shall be stored and handled per the manufacturer's instructions.

20.4 CHILLER MATERIALS AND COMPONENTS

20.4.1 Cabinet

External structural members shall be constructed of heavy gauge, galvanized steel coated with baked on powder paint which, when subject to ASTM B117, 500 hour, 5% salt spray test, yields minimum ASTM 1654 rating of "6".

20.4.2 Compressors

Shall be hermetic, scroll-type, including:

1. Tip seals to provide efficient axial sealing while preventing scroll tip to base contact.
2. Controlled Orbit Design for radial sealing to incorporate minimum flank to flank contact for long service life.
3. Refrigerant flow through the compressor with 100% suction cooled motor.
4. Large suction side free volume and oil sump to provide liquid handling capability.
5. Compressor crankcase heaters to provide extra liquid migration protection.

6. Annular discharge check valve and reverse vent assembly to provide low-pressure drop, silent shutdown and reverse rotation protection.
7. Initial Oil charge.
8. Oil Level sight-glass.
9. Vibration isolator mounts for compressors.
10. Brazed-type connections for fully hermetic refrigerant circuits.

20.4.3 **Hydraulic circuit**

The hydraulic circuit shall consist of the following:

1. Evaporator.
2. Heat recovery condenser.
3. Temperature Senor
4. Antifreeze sensor
5. Drain valve.

20.5 **REFRIGERANT CIRCUIT COMPONENTS**

Each refrigerant circuit shall include:

- liquid line electro shutoff valve with charging port
- high and low side pressure relief devices
- sight glass with moisture indicator
- electronic and thermostatic expansion valves
- level and humidity indicator
- anti-acid solid cartridge dehydrator filter
- inversion valve of the 4-way cycle
- non-return and shut-off valves
- liquid receiver
- liquid separator on the suction line
- Intercepting valves on liquid line and intermediate exchanger in suction

20.6 **HEAT EXCHANGERS**

The evaporators will consist of:

1. Direct expansion type coils with refrigerant inside high efficiency copper tubes, chilled liquid forced over the tubes by galvanized steel baffles, and including integral sub cooling circuits.

2. It will be constructed, tested and stamped in accordance with applicable sections of ASME pressure vessel code for minimum 24-bar refrigerant side design working pressure and 10-bar waterside design working pressure.

3. The shell will be with 19mm flexible, closed-cell insulation. The water nozzles with grooves for mechanical couplings will be insulated by the Contractor after pipe installation.

4. Vent and drain fittings and thermostatically controlled heaters will be fitted to protect to (-8°C) ambient in off-cycle.

KWAZULU-NATAL PROVINCE
PUBLIC WORKS & INFRASTRUCTURE
REPUBLIC OF SOUTH AFRICA

NEW 28 BEDDED MALE & FEMALE INPATIENT & OUTPATIENT MENTAL HEALTH UNIT

ANNEXURE 6 - JOINT VENTURE AGREEMENT

Annexure 5

Joint Venture Agreement

(March 2004)

(First Edition of CIDB document 1017)

KWAZULU-NATAL PROVINCE
PUBLIC WORKS & INFRASTRUCTURE
REPUBLIC OF SOUTH AFRICA

1. **PREAMBLE**

This agreement is made and entered into by and between

_____

_____

_____

of the first part and

_____

_____

_____

of the second part and

_____

_____

_____

of the third part.

(allow for additional parties as necessary).

Whereas the foregoing parties have resolved to form a Joint Venture under the title of

_____

_____

_____

for the exclusive purposes of securing and/or executing the Contract to be awarded by

(name of Employer)

to the KZN Department of Public Works in respect of the following project:

for *(brief description of Contract)*

NEW 28 BEDDED MALE & FEMALE INPATIENT & OUTPATIENT MENTAL HEALTH UNIT

Now it is hereby agreed as follows :

2. **DEFINITIONS AND INTERPRETATION**

2.1 Definitions

The following words and expressions shall have the meanings indicated, except where the context otherwise requires. Defined terms and words are, in general, signified in the text of the Agreement by the use of capital initial letters, but the absence of such letters does not necessarily signify that a term, or word, is not defined.

'Agreement' means the agreement between the Members of the Joint Venture and includes this model form of agreement together with the Preamble, Specific Provisions, if any, Schedules 'A', 'B' and 'C' and any relevant Documents prepared prior to the signing of the Agreement and appended thereto.

'Contract' means the contract with the Employer for the supply of the Deliverables, for the purposes of securing and executing which, the Joint Venture has been formed.

'Deliverables' means the works and/or services, equipment, materials, goods, etc. to be furnished by the Joint Venture to the Employer in terms of the Contract.

'Document' means any written, drawn, typed, printed, or photographic material, which relates to the Agreement.

'Employer' means the person, or body, which is to award the Contract and will employ the Joint Venture if it is awarded the Contract.

'Joint Venture' means the joint venture formed by the Members in accordance with the Agreement.

'Management Committee' means the body established in terms of the Agreement to manage all aspects of the work of the Joint Venture in securing and executing the Contract and in meeting the provisions for the Agreement.

'Member' means a person, or body which, being a party to the Agreement, is a member of the Joint Venture.

'Member's Interest' means the proportion expressed as a percentage, which the total monetary value of all resources provided and contributions made by a Member towards the execution by the Joint Venture of the Contract bears to the total of such values by all Members and, unless otherwise indicated in the Agreement, represents the extent to which the Member participates in the fortunes of the Joint Venture.

'Representative' means the person representing a Member on the Management Committee.

'Schedules' means Schedules 'A', 'B' and 'C' which set out general, financial and other information relating to the Members and the obligations, duties, rights, risks and benefits arising from their participation in the Joint Venture.

'Specific Provisions' means the variations, if any, required to this standard form of agreement for the specific purposes of the Agreement.

2.2 Interpretation

Unless inconsistent with the context, an expression in the Agreement which denotes:

- any gender shall include the other genders
- a natural person shall include a juristic person and vice versa
- the singular shall include the plural and vice versa

2.3 Headings

The headings to clauses of the Agreement shall not be considered part thereof, nor shall the words they contain be taken into account in the interpretation of any clause.

2.4 Law

The Agreement shall be construed in accordance with and governed by the laws of the Republic of South Africa and the English language versions shall prevail.

2.5 Language

English shall be exclusively used by the Members in the preparation of Documents unless otherwise indicated.

2.6 Conflict between Agreement and Contract

Should any provision of the Agreement be in conflict with the terms of the Contract, the Agreement shall be amended to the approval of the Management Committee so as to eliminate the conflict.

3. JOINT VENTURE GENERAL

3.1 Establishment and Purpose

The Joint Venture established by the Members in terms of the Agreement is an unincorporated association with the exclusive purposes of securing and executing the Contract for the benefit of the Members.

3.2 Termination

The operation of the Joint Venture and the validity of the Agreement shall terminate if and when it becomes evident that the Joint Venture will not be awarded the Contract, or, if the Joint Venture secures the Contract, when all obligations and rights of the Joint Venture and the Members in connection with the Contract and the Agreement have ceased and/or been satisfactorily discharged.

Unless otherwise decided by the Management Committee, the Agreement shall not terminate if a Member changes its name, or is taken over by, or merged with, another body.

This agreement will terminate when any one of the Members resigns, are liquidated or opts out of this agreement and the Joint Venture will be in breach of contract with the Employer and their contract could be cancelled.

3.3 Exclusivity

Unless otherwise agreed by the Management Committee, or provided for in the Contract no Member shall engage in any activity related to the Contract other than as a Member of the Joint Venture and Members shall ensure that their subsidiaries and other bodies over which they have control comply with this requirement.

3.4 Participation of Members

Except as may otherwise be stipulated in the Agreement, each Member shall be responsible for all costs incurred by it prior to the date of inception of the Agreement.

Subsequent to the date of inception of the Agreement, each Member shall, participate in the operations, risks, responsibilities and fortunes of the Joint Venture including, inter alia, the provision of funding, sureties, guarantees, insurances, human and other resources and participation in profits and losses to the extents indicated in the Schedules. Participation in any aspect not covered in the Schedules shall, if an agreement cannot be reached between the Members, be to the same extents as indicated by the Members Interests.

3.5 Management

The affairs of the Joint Venture shall be directed and controlled by the Management Committee, as set out in Section 4 hereof.

3.6 Confidentiality

All matters relating to the Agreement and the Contract shall be treated by the Members as confidential and no such matter shall be disclosed to any third party without the prior written approval of the Management Committee.

No Member shall be party to the dissemination of publicity relating to the Contract, or the Agreement, without the prior written approval of the Management Committee and the Employer.

3.7 Assignment

No Member shall cede, assign, or in any other way make over any of its rights, or obligations, under the Agreement without the prior written consent of the Management Committee.

3.8 Subcontracting

No Member shall subcontract any obligation, work or duty for which it is, itself, responsible in terms of the Agreement without the prior written consent of the Management Committee.

3.9 Variations to Agreement

No variation, modification, or waiver of any part of the Agreement shall be of any force, or effect, unless unanimously agreed by the Members and reduced to writing.

3.10 Liability

Each Member warrants that it will indemnify the other Members against all legal liabilities arising out of, or in connection with the performance of its obligations under the Agreement.

It is acknowledged by the Members that they may be held jointly and severally liable in respect of claims against the Joint Venture by the Employer or third parties.

4. MANAGEMENT OF JOINT VENTURE

4.1 General

The affairs of the Joint Venture shall be directed, controlled and managed by the Management Committee, which, within the terms of the Agreement and the Contract, shall have full authority to bind the Members in all matters relating to the affairs of the Joint Venture.

Communication between the Joint Venture and the Employer, or third parties, relating to the Contract shall be conducted exclusively by the Management Committee, or by such person as it may delegate to perform this function.

The Management Committee shall have the power to appoint a project manager and/or such other persons as it may see fit to appoint for the purpose of executing the Contract and may delegate such of its powers, responsibilities and duties as it may consider necessary, or desirable, to persons or bodies appointed or seconded for this purpose.

Such administrative functions as are necessary to ensure the effective operation of the Management Committee shall be performed by its chairman.

4.2 Management Committee

4.2.1 *Composition*

The Management Committee shall, unless otherwise agreed by all the Members, consist of one Representative of each Member and each Member shall be obliged, at all times, to maintain a Representative on the Management Committee.

Each member shall, not later than three working days after the signing of the Agreement, appoint its Representative and notify the other Members of the name and contact details of the Representative. Such Representative shall have the power to bind the Member that he represents in all matters relating to the execution of the Contract and the performance of the Agreement.

A Member shall be entitled, after giving the other Members not less than three working days written notice of his intention to do so, appoint, remove and/or replace, an alternate who shall, at any meeting of the Management Committee from which the Representative whom he represents is absent, be vested with all rights and powers and subjected to all the obligations of the absent Representative.

The chairman of the Management Committee shall be the Representative of the Member which has the largest Member's Interest. If two, or more, Members have the same, largest Member's Interest, the chairmanship shall rotate between the Representatives of such Members at three monthly intervals, the order of rotation to be determined by ballot.

Notwithstanding the foregoing, the chairmanship of the Management Committee may be determined, or changed, at any time by unanimous decision of the Management Committee.

No remuneration shall be paid by the Joint Venture to Representatives or their alternates for serving on the Management Committee,

4.2.2 *Meetings*

Meetings of the Management Committee shall take place at such times and places as the Management Committee may determine, provided that the chairman shall convene a meeting of the Management Committee to be held not later than ten working days after he has been requested, in writing, by a Member to do so. Not less than five working days written notice of any meeting of the Management Committee shall be given to all Representatives and their alternates.

The Management Committee may permit, or invite, persons other than Representatives or alternates to attend any of its meetings, but such persons shall not have voting rights.

4.2.3 *Decisions*

Each Representative shall have one vote on the Management Committee and where, in terms of this clause, a casting vote is required, this shall be exercised by the chairman.

All decisions of the Management Committee shall, desirably, be unanimous. Accordingly, if unanimity cannot, initially, be achieved in regard to a decision, the meeting at which that decision is sought shall be adjourned for a period of 48 hours to enable Representatives to consult with their principals. If, on resumption of the adjourned meeting, unanimity can still not be achieved, the decision, provided it is not one requiring unanimity of the Members, shall be taken by majority vote and, in the event of a tie, the chairman shall exercise a casting vote.

A Member not satisfied with a majority decision of the Management Committee may declare a dispute, to be dealt with in terms of Clause 8 hereof, but the majority decision shall, nevertheless, be implemented with immediate effect.

Decisions of the Management Committee, whether taken at a meeting, or otherwise, shall be recorded in written minutes, which shall be distributed by the chairman to reach the Representatives not later than five working days after those decisions were taken. Such minutes shall be deemed to have been affirmed by the Representatives unless written notice of dissent is received by the chairman not later than three working days after receipt of the minutes by the Representative.

4.2.4 Powers and duties

The functions, responsibilities and powers of the Management Committee shall include, inter alia, those listed below:

4.2.4.1 Formulating overall policy in regard to the achievement of the objectives of the Joint Venture.

4.2.4.2 Managing the day to day affairs of the Joint Venture.

4.2.4.3 Monitoring, directing and co-ordinating the activities of the Members to ensure that the objectives of the Joint Venture are achieved and that the obligations and responsibilities of the individual Members are met.

4.2.4.4 Monitoring and controlling the financial affairs of the Joint Venture and ensuring that proper books of account and financial records relating to affairs of the Joint Venture are maintained in an approved form and submitted to the Management Committee for approval at regular intervals, which shall not be longer than one month.

4.2.4.5 Determining the necessity for and the details of any changes in the duties and responsibilities of Members provided that any resulting changes in Members' Interests shall be unanimously approved by the Members.

4.2.4.6 Determining the terms and conditions of employment of personnel and the emoluments applicable to staff seconded to the Joint Venture by the Members.

4.2.4.7 Controlling and approving the appointment of all subcontractors.

4.2.4.8 Procuring, after the completion of the Contract and the release of all bonds, guarantees and sureties given in respect of the performances of the Joint Venture and the Members, the preparation and auditing of a final set of accounts, on the basis of which the final profits, or losses, attributable to the individual Members shall be determined and any necessary adjustments effected.

5 RESOURCES OF JOINT VENTURE

The resources to be utilised by the Joint Venture in securing and executing the Contract shall, insofar as these are to be provided directly by the Members, be as set out in the Schedules and may, from time to time, be amended by decision of the Management Committee, provided that the Member's Interests are not, except with the unanimous approval of the Members, affected thereby.

Similarly, specific areas of responsibility of the Members for the performance of work and the provision of facilities shall be as set out in the Schedules and may, from time to time, be amended by decision of the Management Committee, provided that the Members' Interest are not, except with the unanimous approval of the Members, affected thereby.

5.1 Schedule 'A' (General)

Schedule 'A' shall contain general information relating to the Joint Venture including, inter alia, the following :

1. The Employer's name and address.
2. A brief description of the Contract and the Deliverables.
3. The name, physical address, communications addresses and domicilium citandi et executandi of each Member and of the Joint Venture.
4. The Members' Interests.
5. A statement indicating whether, or not, Specific Provisions apply to the Agreement.
6. A schedule of insurance policies which must be taken out by the Joint Venture and by the individual Members.
7. A Schedule of sureties, indemnities and guarantees that must be furnished by the Joint Venture and by the individual Members.
8. Details of the persons, who, in the event of failure by the Members to reach agreement on the appointments of mediator and arbitrator, will nominate appointees to these positions in terms of Clauses 8.2 and 8.3.

5.2 Schedule 'B' (Financial)

Schedule 'B' shall contain information regarding the financial affairs of the Joint Venture including, inter alia, the following :

1. The working capital required by the Joint Venture and the extent to which and manner whereby this will be provided and/or guaranteed by the individual Members from time to time.
2. The banking accounts that are to be opened in the name of the Joint Venture and the manner in which these are to be operated.
3. The rates of interest that will be applicable to amounts by which Members are in debit, or credit, to the Joint Venture.
4. The names of the auditors and others, if any, who will provide auditing and accounting services to the Joint Venture.
5. The intervals at which interim financial accounts and forecasts will be prepared for approval by the Management Committee.
6. Insofar as not covered in Schedule 'C', the basis on which contributions of various types by the Members towards the work of the Joint Venture in securing, executing, managing and satisfactorily completing the Contract, will be valued.
7. The basis on which profits and/or surplus cash will, if available from time to time, be distributed to Members.
8. The basis upon which losses, if any, are to be apportioned to Members.

5.3 Schedule 'C' (Contributions by Members)

Schedule 'C' shall set out the contributions of various types, other than cash, that will be made by the individual Members towards the work and obligations of the Joint Venture and shall, as far as possible, indicate the monetary values to be placed on such contributions, which may include, inter alia, the following :

1. Staff seconded to the Joint Venture.
2. Work carried out and services provided to, or on behalf of, the Joint Venture.
3. Plant, equipment, facilities etc. made available for use by the Joint Venture.
4. Materials and goods supplied to, or on behalf of, the Joint Venture.
5. Licences, sureties, guarantees and indemnities furnished to, or on behalf of, the Joint Venture.
6. Joint Venture Disclosure form required for the Contract.

6. BREACH OF AGREEMENT

If a Member breaches any material provision of the Agreement, or delays or fails to fulfil its obligations in whole, or in part, and does not remedy the situation within fourteen calendar days of receipt of notice from the Management Committee, or another Member, to do so, the other Members shall have the right, without prejudice to any other rights arising from the default, to summarily terminate the Agreement and re-assign the defaulting Member's rights and obligations in the Joint Venture as they see fit and withhold any moneys due to the defaulting member by the Joint Venture.

Each Member shall indemnify the other Members against all losses, costs and claims which may arise against them in the event of the Agreement being terminated as a result of breach of the Agreement by the said Member.

7. INSOLVENCY OF MEMBER

Should a Member be placed in liquidation, or under judicial management, whether provisionally or finally, or propose any compromise with its creditors, the other Members shall be entitled to proceed in terms of Clause 6, as if the Member had breached the Agreement.

8. DISPUTES

8.1 Settlement

The Members shall negotiate in good faith and make every effort to settle any dispute, or claim, that may arise out of, or relate to, the Agreement.

If agreement cannot be reached, an aggrieved Member shall, if he intends to proceed further in terms of Clause 8.2 hereof, advise all other Members in writing that negotiations have failed and that he intends to refer the matter to mediation in terms of Clause 8.2.

8.2 Mediation

Not earlier than ten working days after having advised the other Members, in terms of Clause 8.1, that negotiations in regard to a dispute have failed, an aggrieved Member may require that the dispute be referred, without legal representation, to mediation by a single mediator.

The mediator shall be selected by agreement between the Members, or, failing such agreement, by the person named for this purpose in Schedule 'A'. The costs of the mediation shall be borne equally by all Members.

The mediator shall convene a hearing of the Members and may hold separate discussions with any Member and shall assist the Members in reaching a mutually acceptable settlement of their differences through means of reconciliation, interpretation, clarification, suggestion and advice. The Members shall record such agreement in writing and thereafter they shall be bound by such agreement.

The mediator is authorised to end the mediation process whenever in his opinion further efforts at mediation would not contribute to a resolution of the dispute between the Members.

8.3 Arbitration

Where a dispute or claim is not resolved by mediation, it shall be referred to arbitration by a single arbitrator to be selected by agreement between the Members or, failing agreement, to be nominated by the person named for this purpose in Schedule 'A'.

The Member requiring referral to arbitration shall notify the other Members, in writing, thereof, not later than thirty calendar days after the mediator has expressed his opinion, failing which the mediator's opinion shall be deemed to have been accepted by all Members and shall be put into effect.

Arbitration shall be conducted in accordance with the provisions of the Arbitration Act No. 42 of 1965, as amended, and in accordance with such procedure as may be agreed by the Members or, failing such agreement, in accordance with the rules for the Conduct of Arbitrations published by the Association of Arbitrators and current at the date that the arbitrator is appointed.

The decisions of the arbitrator shall be final and binding on the Members, shall be carried into immediate effect and, if necessary, be made an order of any court of competent jurisdiction.

9. DOMICILIUM

The Members choose domicilium citandi et executandi for all purposes of and in connection with the Agreement as stated in Schedule 'A'. A Member shall be entitled to change his domicilium from time to time, but such change shall be effective only on receipt of written notice of the change by all other Members.

Member No. 1

Thus done and signed at _____ this _____ day of _____ 20___

For and on behalf of _____ *[Company]*

by *[name]* _____ who warrants his authority to do so.

_____

As witnesses 1. _____ As witnesses 2. _____

Member No. 2

Thus done and signed at _____ this _____ day of _____ 20___

For and on behalf of _____ *[Company]*

by *[name]* _____ who warrants his authority to do so.

_____

As witnesses 1. _____ As witnesses 2. _____

Member No. 3

Thus done and signed at _____ this _____ day of _____20___

For and on behalf of_____*[Company]*

by *[name]* _____ who warrants his authority to do so.

_____

As witnesses 1. _____ As witnesses 2. _____

[Allow for additional parties as necessary].

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ANNEXURE 7 - EPWP SPECIFICATIONS

ADDITIONAL SPECIFICATION - EPWP

SL **EMPLOYMENT AND TRAINING OF EPWP BENEFICIARY ON THE EXPANDED PUBLIC WORKS PROGRAMME (EPWP) Infrastructure Projects:**

CONTENTS

SL 01 SCOPE

This project is part of the Expanded Public Works Programme aims to train young people and provide them with practical work experience as part of this programme. Youth aged between 18 and 35 will be recruited and trained in skills relevant to the work to be done on this project. These youth will have to be employed by the contractor as part of this project so that they can gain their work experience on these projects. The training of the youth will be coordinated and implemented by a separate service provider. This service provider will provide the contractor with a list of all the youth and the training each of these youth have received. The Contractor will be required to employ all of these youth for a minimum period of 6 months. Furthermore the Contractor will be required to supervise these youth to ensure that the work they perform is of the required standard. If necessary the contractor's staff will be required to assist and mentor the youth to ensure that they are able to perform the type of work they need to do to the satisfactory standards required. The contractor will not be required to employ all youth in the programme at the same time, but may rotate the youth on the project, as long as all youth are employed for the minimum duration stated earlier.

This specification contains the standard terms and conditions for workers employed in elementary occupations and trained on a Expanded Public Works Programme (EPWP) for the Infrastructure Programme.

SL 02 TERMINOLOGY AND DEFINITIONS

SL 02.01 TERMINOLOGY

(a) EPWP The Code of Good Practice for Expanded Public Works Programmes, which has been gazetted by the Department of Labour, and which provides for special conditions of employment for these EPWP projects. In terms of the Code of Good Practice, the workers on these projects are entitled to formal training, which will be provided by training providers appointed (and funded) by the Department of Labour. For projects of up to six months in duration, this training will cover life-skills and information about other education, training and employment opportunities.

(b) EPWP Expanded Public Works Programme, a National Programme of the government of South Africa, approved by Cabinet.

(c) UYF Umsobumvu Youth Fund.

(d) DOL Department of Labour.

SL 02.02 DEFINITIONS

(a)	"employer"	means the contractor or any party employing the worker / beneficiary under the EPWP Programme.
(b)	"client"	means the Department of Public Works.
(c)	" worker / trainee"	means any person working or training in an elementary occupation on a EPWP.

SL 03 APPLICABLE LABOUR LAWS

In line with the Expanded Public Works Programme (EPWP) policies, the Ministerial Determination, Special Public Works Programmes, issued in terms of the Basic Conditions of Employment Act of 1997 by the Minister of labour in government Notice No. R63 of 25 January 2002, of which extracts have been reproduced below in clauses SL 04 shall apply to works described in the scope of work and which are undertaken by unskilled or semi-skilled workers. The Code of Good Practise for Employment and Conditions of Work for Expanded Public Works Programmes, issued in terms of the Basic Conditions of Employment Act of 1997 by the Minister of Labour in Government Notice No. R64 of 25 January 2002 shall apply to works described in the scope of work and which unskilled or semi-skilled workers undertake.

SI 04 EXTRACTS FROM MINISTERIAL DETERMINATION REGARDING EPWP

SL 04.01 DEFINITIONS

(a) "department" means any department of the State, implementing agent or contractor;

(b) "employer" means any department that hires workers to work in elementary occupations on a EPWP;

(c) "worker" means any person working in an elementary occupation on a EPWP;

(d) "elementary occupation" means any occupation involving unskilled or semi-skilled work;

(e) "management" means any person employed by a department or implementing agency to administer or execute a EPWP;

(f) "task" means a fixed quantity of work;

(g) "task-based work" means work in which a worker is paid a fixed rate for performing a task;

(h) "task-rated worker" means a worker paid on the basis of the number of tasks completed;

(i) "time-rated worker" means a worker paid on the basis of the length of time worked

(j) "Service Provider" means the consultant appointed by Department to coordinate and arrange the employment and training of labour on EPWP infrastructure projects.

SL 04.02 TERMS OF WORK

(a) Workers on a EPWP are employed on a temporary basis.

(b) A worker may NOT be employed for longer than 24 months in any five-year cycle on a EPWP.

(c) Employment on a EPWP does not qualify as employment and a worker so employed does not have to register as a contributor for the purposes of the Unemployment Insurance Act 30

SL 04.03 NORMAL HOURS OF WORK

(a) An employer may not set tasks or hours of work that require a worker to work–

(i) more than forty hours in any week
(ii) on more than five days in any week; and
(iii) for more than eight hours on any day.

(b) An employer and a worker may agree that the worker will work four days per week. The worker may then work up to ten hours per day.

(c) A task-rated worker may not work more than a total of 55 hours in any week to complete the tasks (based on a 40-hour week) allocated to him.

Every work is entitled to a daily rest period of at least eight consecutive hours. The daily rest period is measured from the time the worker ends work on one day until the time the worker starts work on the next day.

SL 04.04 MEAL BREAKS

(a) A worker may not work for more than five hours without taking a meal break of at least thirty minutes duration.

(b) An employer and worker may agree on longer meal breaks.

(c) A worker may not work during a meal break. However, an employer may require a worker to perform duties during a meal break if those duties cannot be left unattended and cannot be performed by another worker. An employer must take reasonable steps to ensure that a worker is relieved of his or her duties during the meal break.

SL 04.05 SPECIAL CONDITIONS FOR SECURITY GUARDS

(a) A security guard may work up to 55 hours per week and up to eleven hours per day.

(b) A security guard who works more than ten hours per day must have a meal break of at least one hour duration or two breaks of at least 30 minutes duration each.

SL 04.06 DAILY REST PERIOD

Every worker is entitled to a daily rest period of at least eight consecutive hours. The daily rest period is measured from the time the worker ends work on one day until the time the worker starts work on the next day.

SL 04.07 WEEKLY REST PERIOD

Every worker must have two days off every week. A worker may only work on their day off to perform work which must be done without delay and cannot be performed by workers during their ordinary hours of work ("emergency work").

SL 04.08 WORK ON SUNDAYS AND PUBLIC HOLIDAYS

(a) A worker may only work on a Sunday or public holiday to perform emergency or security work.

(b) Work on Sundays is paid at the ordinary rate of pay.

(c) A task-rated worker who works on a public holiday must be paid –

(i) the worker's daily task rate, if the worker works for less than four hours;

(ii) double the worker's daily task rate, if the worker works for more than four hours.

(d) A time-rated worker who works on a public holiday must be paid –

(i) the worker's daily rate of pay, if the worker works for less than four hours on the public holiday;

(ii) double the worker's daily rate of pay, if the worker works for more than four hours on the public holiday.

SL 04.09 SICK LEAVE

(a) Only workers who work four or more days per week have the right to claim sick-pay in terms of this clause.

(b) A worker who is unable to work on account of illness or injury is entitled to claim one day's paid sick leave for every full month that the worker has worked in terms of a contract.

(c) A worker may accumulate a maximum of twelve days' sick leave in a year.

(d) Accumulated sick-leave may not be transferred from one contract to another contract.

(e) An employer must pay a task-rated worker the worker's daily task rate for a day's sick leave.

(f) An employer must pay a time-rated worker the worker's daily rate of pay for a day's sick leave.

(g) An employer must pay a worker sick pay on the worker's usual payday.

(h) Before paying sick-pay, an employer may require a worker to produce a certificate stating that the worker was unable to work on account of sickness or injury if the worker is –

(i) absent from work for more than two consecutive days; or

(ii) absent from work on more than two occasions in any eight-week period.

(i) A medical certificate must be issued and signed by a medical practitioner, a qualified nurse or a clinic staff member authorised to issue medical certificates indicating the duration and reason for incapacity.

(j) A worker is not entitled to paid sick-leave for a work-related injury or occupational disease for which the worker can claim compensation under the Compensation for Occupational Injuries and Diseases Act.

SL 04.10 MATERNITY LEAVE

(a) A worker may take up to four consecutive months' unpaid maternity leave.

(b) A worker is not entitled to any payment or employment-related benefits during maternity leave.

(c) A worker must give her employer reasonable notice of when she will start maternity leave and when she will return to work.

(d) A worker is not required to take the full period of maternity leave. However, a worker may not work for four weeks before the expected date of birth of her child or for six weeks after the birth of her child, unless a medical practitioner, midwife or qualified nurse certifies that she is fit to do so.

(e) A worker may begin maternity leave –

(i) four weeks before the expected date of birth; or

(ii) on an earlier date –

(1) if a medical practitioner, midwife or certified nurse certifies that it is necessary for the health of the worker or that of her unborn child; or

(2) if agreed to between employer and worker; or

(iii) on a later date, if a medical practitioner, midwife or certified nurse has certified that the worker is able to continue to work without endangering her health.

(f) A worker who has a miscarriage during the third trimester of pregnancy or bears a stillborn child may take maternity leave for up to six weeks after the miscarriage or stillbirth.

(g) A worker who returns to work after maternity leave, has the right to start a new cycle of twenty-four months employment, unless the EPWP on which she was employed has ended.

SL 04.11 FAMILY RESPONSIBILITY LEAVE

(a) Workers, who work for at least four days per week, are entitled to three days paid family responsibility leave each year in the following circumstances -

(i) when the employee's child is born;

(ii) when the employee's child is sick;

(iii) in the event of the death of –

(1) the employee's spouse or life partner

(2) the employee's parent, adoptive parent, grandparent, child, adopted child, grandchild or sibling

SL 04.12 STATEMENT OF CONDITIONS

(a) An employer must give a worker a statement containing the following details at the start of employment –

(i) the employer's name and address and the name of the EPWP;

(ii) the tasks or job that the worker is to perform;

(iii) the period for which the worker is hired or, if this is not certain, the expected duration of the contract;

(iv) the worker's rate of pay and how this is to be calculated;

(v) the training that the worker may be entitled to receive during the EPWP.

(b) An employer must ensure that these terms are explained in a suitable language to any employee who is unable to read the statement.

(c) An employer must supply each worker with a copy of the relevant conditions of employment contained in this specification.

(d) An employer must enter into a formal contract of employment with each employee. A copy of a pro-forma is attached at the end of this specification.

SL 04.13 KEEPING RECORDS

(a) Every employer must keep a written record of at least the following –

(i) the worker's name and position;

(ii) in the case of a task-rated worker, the number of tasks completed by the worker;

(iii) in the case of a time-rated worker, the time worked by the worker;

(iv) payments made to each worker.

(b) The employer must keep this record for a period of at least three years after the completion of the EPWP.

SL 04.14 PAYMENT

(a) A task-rated worker will only be paid for tasks that have been completed.

(b) An employer must pay a task-rated worker within five weeks of the work being completed and the work having been approved by the manager or the contractor having submitted an invoice to the employer. Payment must be made in cash, by cheque or by direct deposit into a bank account designated by the worker.

(c) A time-rated worker will be paid at the end of each month and payment must be made in cash, by cheque or by direct deposit into a bank account designated by the worker.

(d) Payment in cash or by cheque must take place –

(i) at the workplace or at a place agreed to by at least 75% of the workers; and

(ii) during the worker's working hours or within fifteen minutes of the start or finish of work;

(e) All payments must be enclosed in a sealed envelope which becomes the property of the worker.

(f) An employer must give a worker the following information in writing –

(i) the period for which payment is made;

(ii) the number of tasks completed or hours worked;

(iii) the worker's earnings;

(iv) any money deducted from the payment;

(v) the actual amount paid to the worker.

(g) If the worker is paid in cash or by cheque, this information must be recorded on the envelope and the worker must acknowledge receipt of payment by signing for it.

(h) If a worker's employment is terminated, the employer must pay all monies owing to that worker within one month of the termination of employment.

SL 04.15 DEDUCTIONS

(a) An employer may not deduct money from a worker's payment unless the deduction is required in terms of a law.

(b) An employer must deduct and pay to the SA Revenue Services any income tax that the worker is required to pay.

(c) An employer who deducts money from a worker's pay for payment to another person must pay the money to that person within the time period and other requirements specified in the agreement law, court order or arbitration award concerned.

(d) An employer may not require or allow a worker to –

(i) repay any payment except an overpayment previously made by the employer by mistake;

(ii) state that the worker received a greater amount of money than the employer actually paid to the worker; or

(iii) pay the employer or any other person for having been employed.

SL 04.16 HEALTH AND SAFETY

(a) Employers must take all reasonable steps to ensure that the working environment is healthy and safe and that all legal requirements regarding health and safety are strictly adhered to.

(b) A worker must:

(i) work in a way that does not endanger his/her health and safety or that of any other person;

(ii) obey any health and safety instruction;

(iii) obey all health and safety rules;

(iv) use any personal protective equipment or clothing issued by the employer;

(v) report any accident, near-miss incident or dangerous behaviour by another person to their employer or manager.

SL 04.17 COMPENSATION FOR INJURIES AND DISEASES

(a) It is the responsibility of employers to arrange for all persons employed on a EPWP to be covered in terms of the Compensation for Occupational Injuries and Diseases Act, 130 of 1993.

(b) A worker must report any work-related injury or occupational disease to their employer or manager.

(c) The employer must report the accident or disease to the Compensation Commissioner.

(d) An employer must pay a worker who is unable to work because of an injury caused by an accident at work 75% of their earnings for up to three months. The employer will be refunded this amount by the Compensation Commissioner. This does NOT apply to injuries caused by accidents outside the workplace such as road accidents or accidents at home.

SL 04.18 TERMINATION

(a) The employer may terminate the employment of a worker provided he has a valid reason and after following existing termination procedures.

(b) A worker will not receive severance pay on termination.

(c) A worker is not required to give notice to terminate employment. However, a worker who wishes to resign should advise the employer in advance to allow the employer to find a replacement.

(d) A worker who is absent for more than three consecutive days without informing the employer of an intention to return to work will have terminated the contract. However, the worker may be re-engaged if a position becomes available for the balance of the 24-month period.

(e) A worker who does not attend required training events, without good reason, will have terminated the contract. However, the worker may be re-engaged if a position becomes available for the balance of the 24-month period.

SL 04.19 CERTIFICATE OF SERVICE

(a) On termination of employment, a worker is entitled to a certificate stating –

(i) the worker's full name;
(ii) the name and address of the employer;
(iii) the SPWP on which the worker worked;
(iv) the work performed by the worker;
(v) any training received by the worker as part of the EPWP;
(vi) the period for which the worker worked on the EPWP;
(vii) any other information agreed on by the employer and worker.

SL 05 EMPLOYER'S RESPONSIBILITIES

The employer shall adhere to the conditions of employment as stipulated in the *Code of Good Practice for Employment and Conditions of Work for Expanded Public Works Programmes*. Over and above the conditions stipulated above, he shall be responsible to:

(a) formulate and design a contract between himself/ herself and each of the recruited EPWP beneficiary, ensuring that the contract does not contravene any of the Acts stipulated in South African Law, e.g. Basic Conditions of Employment Act, etc. (A copy of a pro-forma contract is attached at the end of this specification);

(b) screen and select suitable candidates for employment from the priority list of EPWP beneficiary provided by the Umsobumvu Youth Fund (UYF);

(c) ensure that the recruited EPWP beneficiary are made available to receive basic life skills training which will be conducted and paid for by the Umsobumvu Youth Fund;

(d) ensure that all EPWP beneficiary receive instruction on safety on site prior to them commencing with work on site;

(e) ensure that all EPWP beneficiary are covered under workmen's compensation for as long as they are contracted to the contractor. Payment to the Compensation Commissioner shall be the responsibility of the contractor;

(f) assist in the identification and assessment of potential EPWP beneficiary to undergo advanced technical training in respective trades;

(g) test and implement strict quality control and to ensure that the health and safety regulations are adhered to;

(h) provide all EPWP beneficiary with the necessary protective clothing as required by law for the specific trades that they are involved in.

(i) provide overall supervision and day-to-day management of EPWP beneficiary and/or sub-contractors; and

(j) ensure that all EPWP beneficiary are paid their wages on time through a pre-agreed payment method as stipulated in the contract with the EPWP beneficiary.

SL 06 PLACEMENT OF RECRUITED EPWP BENEFICIARY

Employers will be contractually obliged to:

(a) employ EPWP beneficiary from targeted social groups from the priority list provided by the Service Provider/ Umsobumvu Youth Fund.

(b) facilitate on-the-job training and skills development programmes for the EPWP beneficiary;

(c) achieve the following minimum employment targets:

(i) 55% people between the ages of 18 and 35

(ii) 55% women;

(iii) 2% people with disabilities.

(d) brief EPWP beneficiary on the conditions of employment as specified in sub clause SL 04.09 above;

(e) enter into a contract with each EPWP beneficiary, which contract will form part of the Employment Agreement;

(f) allow EPWP beneficiary the opportunity to attend life skills training through DOL. This shall be arranged at the beginning of the contract;

(g) ensure that payments to EPWP beneficiary are made as set out in sub clauses SL 04.14 and SL 04.15 above.

(h) set up of personal profile files as prescribed by EPWP beneficiary and as set out in sub clause SL 04.13 above.

(i) in addition to (h)
- a copy of the I.D;
- qualifications;
- career progress;
- EPWP Employment Agreement, and
- list of small trade tools;

must be included in the EPWP beneficiary's personal profile file.

SL 07 TRAINING OF EPWP BENEFICIARY

Three types of training are applicable, namely

- Life skills;
- On the job training and
- Technical Skills training.

Training will be implemented by training instructors accredited by DOL and/or CETA :

- EPWP beneficiary shall be employed on the projects for an average of 6 months.
- EPWP beneficiary shall be deployed on projects in the vicinity of their homes. The same arrangements as for other workers regarding accommodation, subsistence and travel shall be applicable to EPWP beneficiary.

(a) Life skills training

All EPWP beneficiary are entitled to undergo life skills training. Training of this module will be flexible enough to meet the needs of the employer. Training should take place immediately after site hand-over and during the period of site establishment and pre-planning before actual construction starts, alternatively this will be spread over the duration of the contract period. The contractor will be required to work closely with the person to schedule the training sessions so that the timing of the training is aligned with the contractors work schedule and his demand for workers.

(b) On-the job training

The Employer shall provide EPWP beneficiary with on-the-job training to enable them to fulfil their employment requirements. The employer shall also be expected to closely monitor the job performance of EPWP beneficiary and shall identify potential EPWP beneficiary for skills development programmes.

(c) Technical skills training
The Employer shall assist in identifying EPWP beneficiary for further training. These EPWP beneficiary will undergo further technical training to prepare them for opportunities as semi-skilled labourers.

Such training will comprise of an off-site theoretical component and practical training on-site. The contractor will be responsible for on-site practical work under his supervision. EPWP beneficiary who graduate from the first phase of the training programme will be identified and given opportunities to register for skills development programmes. These can ultimately result in a accredited qualification. The programme will consist of theoretical instruction away from the construction site as well as on-site practical work under the supervision of the employer. Candidates will be entitled to employment to complete all training modules.

SL 08 BENEFICIARY (EPWP BENEFICIARY) SELECTION CRITERIA

SL 08.01 PREAMBLE

The *Code of Good Practise for Employment and Conditions of Work for Expanded Public Works Programmes* encourages:

- optimal use of locally-based labour in a Expanded Public Works Programme (EPWP);
- a focus on targeted groups which consist of namely youth, consisting of women, female-headed households, disabled and households coping with HIV/AIDS; and
- the empowerment of individuals and communities engaged in a SPWP through the provision of training.

SL 08.02 BENEFICIARY (EPWP BENEFICIARY) SELECTION CRITERIA

(a) The EPWP beneficiary of the programmes should preferably be non-working individuals from the most vulnerable sections of disadvantaged communities who do not receive any social security pension income. The local community must, through all structures available, be informed of and consulted about the establishment of any EPWP

(b) In order to spread the benefit as broadly as possible in the community, a maximum of one person per household should be employed, taking local circumstances into account.

(c) Skilled artisans from other areas may be employed if they have skills that are required for a project and there are not enough persons in the local communities who have those skills or who could undergo appropriate skills training. However, this should not result in more than 20% of persons working on a programme not being from local communities.

(d) Programmes should set participation targets for employment with respect to youth, single male- and female-headed households, women, people with disabilities, households coping with HIV/AIDS, people who have never worked, and those in long-term unemployment.

(e) The proposed targets as set out in sub clause SL 06 (c)

- 55% youth from 18 to 35 years of age;
- 55% women;
- 2% disabled.

SL 09 CONTRACTUAL OBLIGATIONS IN RELATION TO YOUTH LABOUR

The EPWP beneficiary to be employed in the programme (EPWP) shall be directly contracted to the employer. Over and above the construction and project management responsibilities, the employer will be expected to perform the tasks and responsibilities as set out in clause SL 05 above.

SL 10 PROVINCIAL RATES OF PAY

It is stipulated that youth workers on the EPWP receive a minimum of R 1 000 per month whilst working and R 600 per month whilst on training in ALL provinces. Should EPWP beneficiary be attending training whilst employed by the contractor, the contractor will still be responsible for payment to the EPWP beneficiary whilst at training.

SL 11 MEASUREMENTS AND PAYMENT

The number of EPWP beneficiary specified for this contract that will receive life skills training is 50 and technical training is 50

SL 11.01 PAYMENT FOR TRAINING OF EPWP BENEFICIARY (TARGET:- 50 EPWP BENEFICIARY)

SL 11.01.01 Skills development and Technical training for EPWP beneficiary for an average of 10 days .....(Prov.Sum).....Unit: R/EPWP beneficiary

The above item is only applicable if DoL does not fund the Technical Training PRIOR to site handover.

SL 11.01.02 Penalty due to not meeting the target as in SL 11.01.01.....Unit: EPWP beneficiary

LESS R 2000 per EPWP beneficiary

SL 11.02 PAYMENT FOR TRAVELLING AND ACCOMMODATION DURING OFF-SITE TRAINING

SL 11.02.01 Life skills training for 26 days:

01 Travelling (based on 50 km/EPWP beneficiary) .....Unit: km

02 Accommodation.....(Prov.Sum).....Unit: R/EPWP beneficiary

03 Profit and attendance..... Unit: %

SL 11.02.02 Skilled development and Technical training:

01 Travelling (based on 50 km/EPWP beneficiary).....Unit: km

02 Accommodation.....(Prov.Sum)....Unit: R/EPWP beneficiary

03 Profit and attendance ..... Unit: %

The units of measurement for sub items SL 11.02.01 (01) and SL 11.02.02 (01) above shall be the distance travelled in km by the EPWP beneficiary trained off site. The tendered rate shall include full compensation to safely transport the youth workers to and from the training venue/s.

The unit of measurement for sub items SL 11.02.01 (02) and SL 11.02.02 (02) above shall be the amounts in Rand expended for accommodation and daily meal allowances for the EPWP beneficiary trained off site that must be arranged by the contractor. Amounts quoted shall be corrected according to re-measurement based on actual invoices.

The tendered percentages under sub items SL 11.02.01 (03) and SL 11.02.02 (03) will be paid to the contractor on the value of each payment pertaining to the accommodation and advance meal allowances to cover his expenses in this regard.

SL 11.03 ALTERNATIVE WORKERS FOR THE PERIOD OF OFF-SITE TRAINING

SL 11.03.01 Life skills training for 26 days ..... Unit: worker-days

SL 11.03.02 Skilled development and Technical training for EPWP beneficiary for (.....) days..... Unit: worker-days

The unit of measurement shall be the number of EPWP beneficiary replaced while in training multiplied by the number of days absent from the site.

The rates tendered shall include full compensation for additional replacement labour during periods of off-site training.

SL 11.04 EMPLOYMENT OF EPWP BENEFICIARY

SL 11.04.01 Employment of EPWP beneficiary.....(Prov.Sum)¼.Unit: R/ worker-month

SL 11.04.02 Employment of EPWP beneficiary.....(Prov.Sum)¼.Unit: R/ worker-month

The unit of measurement shall be the number of EPWP beneficiary at the statutory labour rates of R ..... multiplied by the period employed in months and the rate tendered shall include full compensation for all costs associated with the employment of EPWP beneficiary and for complying with the conditions of contract. The cost for the training shall be excluded from this item. This item is based on 6 months appointment for EPWP beneficiary.

SL 11.05 PROVISION OF EPWP DESIGNED OVERALLS TO EPWP BENEFICIARY

SL 11.05.01 Supply EPWP designed overalls to EPWP beneficiary ..... (Prov.Sum).....Unit: R

EPWP beneficiary overalls should be orange (top and bottom) as per EPWP specification with the exception of Correctional Services contracts where the EPWP beneficiary top would be blue and the bottom orange.

SL 11.05.02 Profit and attendance..... Unit: %

An amount has been provided in the Schedule of Quantities under sub item SL 10.05.01 for the supply of EPWP designed overalls, as per the specification provided by the EPWP unit, arranged by the Service Provider. The Engineer will have sole authority to spend the amounts or part thereof. The tendered percentage under sub items SL 10.05.02 will be paid to the contractor on the value of each payment pertaining to the supply of overalls to cover his expenses in this regard.

SL 11.06 PROVISION OF SMALL TOOLS FOR EPWP BENEFICIARY

SL 11.06.01 Provide all EPWP beneficiary with prescribed tools for their respective trades. Specification for the mentioned tools to be provided by the EPWP Service Provider. These tools will become the property of the EPWP beneficiary after the completion of the programme.....(Prov.Sum)….Unit: **R 500-00** /youth worker

SL 11.06.02 Profit and attendance..... Unit: %

SL 11.07 APPOINTMENT OF EPWP BENEFICIARY TEAM LEADER/S

SL 11.07.01 Appointment of (_____) EPWP beneficiary team leader/s for the duration of the contract.....(Prov.Sum)..... Unit: R / EPWP beneficiary team leader

The EPWP beneficiary Team Leader will act as CLO/PLO to facilitate the project work between the EPWP beneficiary and the contractor. Umsobumvu Youth Fund can assist with the sourcing of EPWP beneficiary Team Leader for employment by the contractor.

SL 11.08 LIAISON WITH SERVICE PROVIDER .....Unit: hours

The tendered rate shall include full compensation for the cost of liaising with the Service Provider and Social Facilitators on all issues regarding the works.

KWAZULU-NATAL PROVINCE
PUBLIC WORKS & INFRASTRUCTURE
REPUBLIC OF SOUTH AFRICA

NEW 28 BEDDED MALE & FEMALE INPATIENT & OUTPATIENT MENTAL HEALTH UNIT

ANNEXURE 8 - WAIVER OF CONTRACTOR'S LIEN

WAIVER OF CONTRACTOR'S LIEN

DEFINITIONS

Contractor: _____

Employer: Head: Public Works (KZN Department of Public Works: Province of KwaZulu-Natal)

Agreement: GCC FOR CONSTRUCTION WORKS - SECOND EDITION 2010

Works (description): **NEW 28 BEDDED MALE & FEMALE INPATIENT & OUTPATIENT MENTAL HEALTH UNIT**

Site: District Municipality: iLembe; Local Municipality: KwaDukuza; Ward Nr.: 19

AGREEMENT

The Contractor waives, in favour of the Employer, any lien or right of retention that is or may be held in respect of the Works to be executed on the Site

Thus done and signed at _____ on _____
[Date]

_____
Name of signatory

_____
Capacity of signatory

_____
As witness

_____
For and on behalf of the contractor who by signature hereof warrants authorisation hereto

KWAZULU-NATAL PROVINCE
PUBLIC WORKS & INFRASTRUCTURE
REPUBLIC OF SOUTH AFRICA

NEW 28 BEDDED MALE & FEMALE INPATIENT & OUTPATIENT MENTAL HEALTH UNIT

ANNEXURE 9 - CIDB CONTRACTOR PARTICIPATION GOALS AND BUILD PROGRAMME IMPLEMENTATION GUIDE

CONTRACT PARTICIPATION GOALS AND CIDB BUILD PROGRAMME IMPLEMENTATION GUIDE

1 SEPTEMBER 2023

NDPWI CONTRACT PARTICIPATION GOALS AND CIDB BUILD PROGRAMME IMPLEMENTATION GUIDE

1. PURPOSE

The purpose of this Contract Participation Goal (CPG) guideline is to provide guidance on the implementation of the CPGs which forms part of the Economic Reconstruction and Recovery Plan which also includes the cidb BUILD Programme that entails Enterprise Development and Skills Development through infrastructure and construction projects.

2. INTRODUCTION

The applicable cidb Standards establishes uniformity and standardisation of implementing CPGs and the cidb BUILD programme on construction and engineering works.

A separate CPG section for the Bill of Quantities was created to include all CPGs and the cidb BUILD programme for the following reasons (Document available @ www.publicworks.goc.za/consultantsdocs.html under Forms and Documents / Consultant's Guidelines / **Item 3 Quantity Surveyors/**):

- The implementation of CPGs should not give any bidder a competitive advantage. Borderline value thresholds can be manipulated by tenderers electing to tender just below the CPG value threshold requirement thereby creating a competitive advantage in not pricing for CPG;
- Bidders can determine the project estimate cost of the project through reverse calculations;
- Provisional amounts to be provided for in the Bills of Quantities, which is adjusted once enterprises and individual beneficiaries have been identified and associated cost have been determined;
- Different methods of calculating CPG values in terms of the definition used for "Contract Amount" in the respective cidb Standards; and
- Ease of extracting CPG reports and associated costs as well as contributions in the form of one overall report and/or individual CPGs.

Targeted enterprises or beneficiaries of any CPG may not participate or form part of more than one CPG.

All CPGs are Conditions of Contract, i.e. the tender does not need to submit any proof of CPG participation at the time of tender.

Sanctions (penalties) are applicable to all CPGs where the contractor fails to achieve the minimum specified requirements, unless the contractor can prove to the Employer's satisfaction that the non-achievement was beyond his/her control. The minimum percentage sanctions currently indicated in the tender documents are recommended by the cidb and can be adjusted to be project specific. All sanctions to be fair and reasonable and exclude VAT. Note that minimum percentage sanctions applicable to the cidb BUILD Programme elements is 30%.

The minimum required specifications and pricing instructions have been included in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts) and the Pricing Assumption documents (PG02.1 for GCC Contracts or PG02.2 for JBCC Contracts) respectively.

Normative reference documents:

- SANS 10845-5:2015 ISO 10845-5:2011. Construction procurement – Part 5: Participation of targeted enterprises in contracts. South African Bureau of Standards.

- SANS 10845-8:2015 ISO 10845-8:2011. Construction procurement – Part 8: Participation of targeted labour in contracts. South African Bureau of Standards.se

Even though minimum project requirements are prescribed by the cidb, CPGs may be implemented on any project where feasible, irrespective of the cidb prescribed project value, categories and construction period.

In calculating the respective CPGs, allowances and VAT are excluded from the Tender Amount at the time of award.

Allowances include the following:

- Provisional amounts (Contractor and Consultants)
- CPG allowances (Contractor and Consultants)
- Nominated and/or selected subcontractors (Contractor)
- Other expenses included in consultant pricing activity schedule (Consultants)
- Contract price adjustment (Not provided for within the B of Q by NDPWI)
- Contingency amounts (Not provided for within the B of Q by NDPWI)

Note: CPG values in the CPG Bill of Quantities Section will be recalculated based on the awarded "Tender Amount" excluding provisional amounts, allowances and VAT, i.e. the Contract Amount as defined by the cidb Standards. No penalties will be applied should the CPG value based on the original "Contract Amount", has been achieved. The CPG values do not increase in the event of any expansion to the construction cost after award by way of variation orders, remeasurements or escalation applicable to the project.

The main contractor shall submit monthly reports in terms of CPGs achievement and accumulative targets achieved including audited supporting documentation to the Employer's Representative. The final CPG reconciliation will form part of the final account, clearly indicating the CPG targets, CPGs achieved and penalties applied if applicable.

3. FEASIBILITY STUDY

The project must be introduced to the local community well in advance before going out on tender (at least 12 months) if possible upon which a feasibility study must be conducted to determine both the viability and extent of implementing the respective CPGs. A Social Facilitator to be appointed to assist in this regard either as a disbursement to the Principal Agent or a direct appointment.

Liaise with:

Community leaders
Business forum/s
Any other Civic organisations / forums

Department of labour
Emerging contractor development forum/s

Refer to the cidb Standard for Targeting Enterprises and Labour through Construction Works Contracts as published in the Government Gazette Notice No. 41237 of 10 November 2017 for:

- Appendix A: Guidelines for Undertaking a Feasibility Study for Specifying CPGs.

3.1 Establish a Community Project Support Committee

The objectives of this Memorandum of Understanding (MOU) Agreement are to establish and enter into an agreement with the Community Project Support Committee, representing the affected communities on the following aspects:

- Targeting strategies and contract participation goals to be implemented on the project;
- Establish minimum requirements of beneficiaries for subcontracting, NYS and skills development.
- Establish respective roles and responsibilities of:
  - NDPWI
  - Community Project Support Committee
  - Community Liaison Officer (CLO)
  - Consultants
  - Contractor
- Deliverables and Timeframes
- Mediation for the resolution of community matters affecting the performance of the construction works contract;
- Enter into a written agreement

Refer to the cidb Standard for Targeting Enterprises and Labour through Construction Works Contracts as published in the Government Gazette Notice No. 41237 of 10 November 2017 for:

- Appendix B: Guidelines for Community Engagement.

4. CONTRACT PARTICIPATION GOALS

4.1. Targeted Local Material Manufacturers CPG

A targeted local manufacturer is a targeted enterprise that operates or maintains a factory or establishment that produces on its premises materials or goods required by the principal contractor for the performance of the contract.

This CPG is a **Condition of Contract** therefore it is not a requirement to submit substantiating documentation with the tender other than pricing the item in the CPG section of the Bills of Quantities.

The main contractor shall submit monthly reports in terms of CPG monthly achievement and accumulative targets achieved including audited supporting documentation to the Employer's Representative.

4.1.1. Applicable standards and implementation documents

- The cidb Standard for Targeting Enterprises and Labour through Construction Works Contracts as published in the Government Gazette Notice No. 41237 of 10 November 2017; and
- cidb Best Practice Project Assessment Scheme Notice No. 43726 of 18 September 2020

4.2.2 Minimum Requirements

- Grade 7GB / 7EC and higher (project value above R20 000 000);
- Minimum construction period 6 months;
- Selected materials subject to Local Content requirements as published by TDI&C from time to time;
- Material to meet SABS / SANS requirements;
- Material to meet minimum specified requirements; and
- Must be economically viable in terms of price and be aware of price fixing and / or cover quoting.

4.2.3 Penalties

The percentage penalty applicable to be **indicated** in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts) and is applied to the prorate targeted value of material not achieved with (Excluding VAT). **The percentage penalty is project specific to a maximum of 30% and should be fair and reasonable.**

4.2.4 CPG Calculation

- Feasibility study to indicate achievable CPG and specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts).
- CPG is Expressed as a percentage of the "Contract Amount" = Tender amount at the time of award excluding allowances and VAT.
- Feasibility study established compliant material manufacturers.

The PQS determines value of material obtainable from compliant local material manufacturers, expressed as a percentage of Contract Amount (Pre-tender estimate excluding allowances and VAT / Tender amount excluding allowances and VAT). The actual CPG to be achieved will be based on the Tender amount of the awarded bid, excluding allowances and VAT.

CPG calculation example:
"Tender Amount" = R150 Mil all inclusive of allowances and VAT
"Contract Amount" = R130 Mil (Tender Amount at the time of award excluding allowances and VAT)
CPG to be achieved = 5% as specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)
CPG target value = R130 Mil x 5% = R 6,5 Mil (Value of material to be purchased from local manufacturers, excluding VAT)

Calculation of penalty:
Percentage penalty applicable = 10% as specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)
CPG target value = R6,5 Mil excluding VAT
CPG Achieved = R5,5 Mil (R1 Mil shortfall) excluding VAT

Penalty = R1 Mil x 10% = R100 000 excluding VAT

4.2. Targeted Local Building Material Suppliers CPG

A targeted local supplier is a targeted enterprise which:

- owns, operates or maintains a store, warehouse or other establishment in which goods are bought, kept in stock and regularly sold to wholesalers, retailers or the public in the usual course of business; and
- engages as its principal business and in its own name, in the purchase and sale of goods.

This CPG is a **Condition of Contract** therefore it is not a requirement to submit substantiating documentation with the tender other than pricing the item in the CPG section of the Bills of Quantities.

The main contractor shall submit monthly reports in terms of CPG monthly achievement and accumulative targets achieved including audited supporting documentation to the Employer's Representative

4.2.1. Applicable standards and implementation documents

- The cidb Standard for Targeting Enterprises and Labour through Construction Works Contracts as published in the Government Gazette Notice No. 41237 of 10 November 2017; and
- cidb Best Practice Project Assessment Scheme Notice No. 43726 of 18 September 2020

4.2.2 Minimum Requirements

- Grade 7GB / 7EC and higher (above R20 000 000);
- Minimum construction period 6 months;
- Selected materials subject to Local Content requirements as published by TDI&C from time to time;
- Material to meet SABS / SANS requirements;
- Material to meet minimum specified requirements; and
- Must be economically viable in terms of price and be aware of price fixing and / or cover quoting.

4.2.3 Penalties

The percentage penalty applicable to be **indicated** in the Scope of Works (PG01.1 or PG01.2) and is applied to the prorate targeted value of material not achieved with (Excluding VAT). **The percentage penalty is project specific to a maximum of 30% and should be fair and reasonable.**

4.2.4. CPG Calculation

- Feasibility study to indicate achievable CPG and specified in Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)
- CPG is Expressed as a percentage of the "Contract Amount" = Tender amount at the time of award excluding allowances and VAT.
- Feasibility study established compliant material suppliers.

The PQS determines value of material obtainable from compliant local material suppliers, expressed as a percentage of Contract Amount (Pre-tender estimate excluding allowances and VAT or the Tender amount excluding allowances and VAT). The actual CPG to be achieved will be recalculated based on the Tender amount of the awarded bid, excluding allowances and VAT.

CPG calculation example:
"Tender Amount" = R150 Mil all inclusive of allowances and VAT
"Contract Amount" = R130 Mil (Tender Amount at the time of award excluding allowances and VAT)
CPG to be achieved = 5% as specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)
CPG target value = R130 Mil x 5% = R 6,5 Mil (Value of material to be purchased from local suppliers, excluding VAT).

Calculation of penalty:
Percentage penalty applicable = 20% as specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)

CPG target value = R6,5 Mil excluding VAT
CPG Achieved = R5,5 Mil (R1 Mil shortfall) excluding VAT
Penalty = R1 Mil x 20% = R200 000 excluding VAT.

4.3. Targeted Local Labour Skills Development CPG

Targeted labour are individuals who:

a) are employed by the principal contractor, sub-contractor or targeted enterprises in the performance of the contract;
b) are defined as the target group in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts); and
c) permanently reside in the target area or who are recognized as being residents of the target area on the basis of identification and association with and recognition by the residents of the target area.

Targeting of local labour by skills categories is only permissible within categories of semi-skilled and unskilled labour.

Contract participation goals for semi-skilled and unskilled labour shall be limited to on-the-job training to targeted labour to enable such labour to master the basic work techniques required to undertake the work in accordance with the requirements of the contract and in a manner that does not compromise worker health and safety. Training can either be provided by an appointed suitably qualified training service provider or a foreman or artisan employed by the main contractor.

This CPG is a **Condition of Contract** therefore it is not a requirement to submit substantiating documentation with the tender other than pricing the item in the CPG section of the Bills of Quantities.

The contractor to submit monthly reports on training provided to include beneficiary particulars, type of training provided and the number of man hours converted to working days.

4.3.1. Applicable standards and implementation documents

- The cidb Standard for Targeting Enterprises and Labour through Construction Works Contracts as published in the Government Gazette Notice No. 41237 of 10 November 2017; and
- cidb Best Practice Project Assessment Scheme Notice No. 43726 of 18 September 2020

4.3.2. Minimum Requirements

- Grade 7GB / 7EC and higher (above R20 000 000)
- Minimum construction period 12 months.
- Only semi-skilled and unskilled labour.
- Subject to the nature of the work.

4.3.3 Penalties

Failure to achieve the minimum Targeted Local Labour Skills Development CPG will result in a payment reduction of an amount specified in the Scope of Works (PG01.1 or PG01.2) per working day where training was not provided.

4.3.4 CPG Calculation

- Feasibility study to indicate achievable CPG and specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts).
- Expressed as a percentage of the "Contract amount" = Tender amount at the time of award excluding allowances and VAT.

The cidb standard provides 2 calculation methods:

Method 1:
Converting the total monetary value of wages and allowances paid to targeted labour, exclusive of any value added tax or sales tax required by law, to a percentage of the applicable contract amount and multiplying such values by the appropriate

weightings for the different target groups, if any, as identified in the feasibility study and targeting strategy; **or**

Method 2:
Converting the amount (number) equal to the person days worked for which the principal contractor, sub-contractors or targeted enterprises contract to engage targeted labour expressed as a percentage of the total person days worked associated with the targeting strategy that is identified in the feasibility study and defined in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts).

Method 2 should be used for ease of calculation and standardisation. The POPI Act also makes it very difficult to obtain all the personal information, especially from subcontractors and SMME subcontractors.

The number of working days allocated to local labour skills development will be derived from the feasibility study based on the nature of the work, the contract period and local labour available.

The PQS to determine the number of CPG % expressed as a percentage of the total number working days required to complete the Works.

The labour intensity outputs per person per day for the respective trades as per the EPWP LABOUR INTENSITY OUTPUTS PER PERSON PER DAY FOR BUILDING WORKS could be used as a guide in determining the number of working days applicable to the beneficiaries.

A suitably qualified and experienced training service provider to be appointed by the main contractor.

CPG calculation example:
"Tender Amount" = R150 Mil all inclusive of allowances and VAT
"Contract amount" = R130 Mil (Tender Amount at the time of award excluding allowances and VAT)
Number of working days required to complete the Works based on the construction period = 600 days
CPG percentage participation to be achieved = 30% as specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)
Required number of working days training to be provided = 180 days (600 x 30%)

Calculation of penalty:
Payment reduction = R 5 000 per day for not providing training as specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)
CPG = 600 x 30% = 180 working days training to be provided
CPG Achieved = 160 days (20 days shortfall where no training was provided)
Penalty = 20 days x R5 000 payment reduction per day= R100 000 excluding VAT

4.4 Cidb BUILD Programme: Enterprise Development (Principal contractor including subcontractors)

The aim is to promote enterprise development by providing for a **minimum** contract participation goal (CPG) of **five percent (5%)** of the **contract amount** as defined in the Standard (Tender amount, excluding allowances and VAT) on selected contracts to be undertaken by joint-venture partners or to be subcontracted to developing contractors that are also to be beneficiaries of enterprise development support from the main contractor. **A minimum 5% CPG is applicable to projects with a tender amount above R20 000 000**. The contract participation goal for projects above R30 Million (Tender Value) to be 30% depending on the nature of the works, the extent of specialised work and available suitably qualified and experienced compliant prospective sub-contractors. The participation goals may therefore vary between 5% and 30% on projects above R30 Million. Note that the 30% threshold is subject to a specific directive yet to be issued in this regard at the time of compilation of this implementation guide, although it is advisable to apply to avoid disruptions on site). **The training to be provided to the SMME business owners which is limited to one beneficiary per business.**

This CPG is a **Condition of Contract** therefore it is not a requirement to submit substantiating documentation with the tender other than pricing the item in the CPG section of the Bills of Quantities.

It is ***applicable to contracts in Grades 7 to 9 General Building and Civil Engineering contracts and can be adopted to other CIDB Classes of Works*** at the discretion of the end users/Construction Management Branch.

A targeted enterprise is an enterprise which:

a) Is a contractor registered with the cidb acting in the capacity of a subcontractor or JV partner; and
b) The contractor does not have an equity holding exceeding 20% in the enterprise, either directly or through a flow through calculation in accordance with the Construction Sector Code of Good Practice published in General Notice 862 of 2009 in Government Gazette No 32305 of 2009 in terms of BBBEE Act of 2003) (Act 53 of 2003); and
c) Employs at least three permanent employees other than the owner; and
d) Be registered in terms of the Company's Act of 2008 (Act No. 71 of 2008) or Close Corporation Act of 1984 (Act No. 69 of 1984); and
e) Is 50% or more black owned or 30% or more black women owned; and
f) Has entered into a written relationship agreement of co-operation and assistance with the developed enterprise (main contractor) for the duration of the contract.

Where 30% black woman owned is an enterprise in which black people who are women:

a) Hold more than 30% of the voting rights that are not subject to any limitation; and
b) Hold more than 30% of the economic interest.

The criteria for The Standard for Indirect Targeting and the Skills Standard is as follows:

There must be a needs analysis for indirect targeting and development or skill standard and should be development in at least any two developmental areas namely;

a) Management and labour skills transfer;
b) Establishment of Administrative systems
c) Establishment of Cost Control systems
d) Establishment of construction management systems and plans (health and safety, quality and environmental)
e) Planning, tendering and programming skills transfer
f) Business skills transfer with emphasis on entrepreneurial and negotiation skills
g) Technical skills transfer with emphasis on innovation
h) Legal compliance
i) Establishing financial loan capacity / Credit rating/history
j) Contractual knowledge

The above needs analysis shall be mutually agreed upon between the contractor and the targeted enterprise. However, it is advisable to provide the same training to all the SMMEs

The main contractor shall submit monthly reports in terms of CPG monthly achievement and accumulative targets achieved including audited supporting documentation to the Employer's Representative.

Training requirements

The main contractor must develop a training plan to address the developmental needs of the Targeted Enterprise. As a guide the development plan should refer to applicable unit standards that reside in NQF level 3 National Certificate: Supervision of Construction Process qualification or equivalent. Contractual knowledge development and planning, tendering and programming skills transfer must be pitched at NQF 3 level and aligned to the outcomes of the applicable unit standard.

The contractor shall appoint an enterprise development coordinator to:

a) develop a project specific enterprise development plan; and
b) submit to the employer's representative a monthly enterprise development report.

To assist the contractor to comply with contractor development, the contractor is guided by the **cidb Competence Standard for Contractors, Government Gazette No. 41237, 10 November 2017**, which outlines the minimum recognised qualifications to which development of Targeted Enterprises must be undertaken by the main contractor. Note that development will not necessarily translate into an accredited outcome.

4.4.1 Applicable standards and implementation documents

- Minimum Targeted Enterprise Development Contract Participation Goal in accordance with the cidb Standard for Indirect Targeting for Enterprise Development through Construction Works Contracts, No 36190 Government Gazette, 25 February 2013; and
- cidb Best Practice Project Assessment Scheme Notice No. 43726 of 18 September 2020

read in conjunction with:

- The cidb Standard for Targeting Enterprises and Labour through Construction Works Contracts as published in the Government Gazette Notice No. 41237 of 10 November 2017, and
- SANS 10845-5:2015 ISO 10845-5:2011. Construction procurement – Part 5: Participation of targeted enterprises in contracts. South African Bureau of Standards.

4.4.2 Minimum requirements

- Grade 7GB / 7 EC or higher
- In the case of a JV at least one of the JV partners must be 7GB / 7CE or higher.
- Minimum construction period 6 months
- **Minimum 5%** of contract amount to be subcontracted to beneficiaries to receive training and a maximum 30% on projects above R30 million.
- Minimum 25 % of project to be subcontracted to CE, EB, GB and/or ME.
- Only Qualifying Small Enterprises (QSE) and Exempt Micro Enterprises (EME)

4.4.3 Penalties

Minimum thirty percent (30%) penalty of the value not achieved in terms of % to be subcontracted and the training value, excluding VAT.

4.4.4 CPG Calculation

- Feasibility study to indicate achievable percentage CPG and specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)
- CPG is expressed as a percentage of the "Contract amount" = Tender amount at the time of award excluding allowances and VAT.

EXAMPLE 1: 5% CPG PARTICIPATION

Part 1: Calculation of minimum 5% CPG example:

"Tender Amount" = R150 Mil all inclusive of allowances and VAT
"Contract Amount" = R130 Mil (Tender Amount at the time of award excluding allowances and VAT)
CPG percentage participation to be achieved = 5% as specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)
CPG value = R6,5 Mil (Value of work to be subcontracted to emerging enterprises)

Calculation of penalty:
Percentage penalty applicable = 30% as specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)
CPG Minimum 5% = R6,5 Mil
Achieved = R5,5 Mil (Only subcontracted work to the value of R5,5 Mil, i.e. R1 Mil shortfall)
Penalty = R1 Mil x 30% = R300 000 Excl. VAT

Part 2: Calculations in terms of training to be provided:

The number of enterprises to be developed is subject to the contract amount and the apportionment of the work as per Example 1 below.
Number of enterprises to be trained = 6 x 1 GB subcontractors
Total cost for training = R 1 660 000

Calculation of penalty
Total number of enterprises to be trained = 6
Total number trained = 4 (2 Shortfall)
Training cost per beneficiary = R1 660 000 / 6 = R 276 666,67 per beneficiary
Penalty = R 276 666,67 x 2 x 30% = R166 000 Excl. VAT

TABLE 1: EXAMPLE 1 - MINIMUM 5% CPG PARTICIPATION (MINI BILL OF QUANTITIES)

B of Q Item	Description	Unit	Rate	Quantity	Amount (R)
5	**Enterprise Development**				
5.1	Enterprise Development of Targeted Enterprise or JV partners				
5.1.1	Appointment of training co-ordinator *	Per Quarter	45,000	8	360,000
5.1.2	Appointment of Mentor /Training Service provider *	Per Quarter	101,250	8	810,000
5.1.3	Needs Analysis and Enterprise Development Plan per Targeted Enterprise **	No.	5,000	6	30,000
5.1.4	Monitoring and Interim reporting per targeted enterprise *	Per Quarter	20,000	8	160,000
5.1.5	Project Completion report per Targeted Enterprise*	No.	5,000	6	30,000
	Provisional Sum to be carried over to CPG bill of quantities				1,390,000

"Contract amount" Tender amount excl. allowances and VAT,	130,000,000	150 Mil - allowances and VAT = R130 Mil
CPG Monetary value (30%) to be subcontracted to beneficiary SMMEs	39,000,000	130 000 000 x 30% = 39 000 000
No of enterprises based on the CPG value and agreed by project Support committee	6	Grade 1 / 2 GB/CE,ETC.
Contract period (months)	24	
Number of Quarters	8	24 / 3 = 8

*** Rates prescribed by the cidb. PQS to determine rate depending on the location of the project**

**** Rates to be determined by PQS and adjusted to accepted quotation amounts**

The number of periods is project specific.

The training coordinator & the mentor/training service provider can be the same service provider which could reduce costs.

- The mini bill will be used to reflect actual cost once the bid has been awarded, the actual cost of the respective items are known and the provisional amount adjusted accordingly. Rather overestimate than underestimate in order not to negatively impact on the 20% expansion limitation on the project value.

- The Community Project Support Committee needs to be sensitised with regards to the number of enterprise development beneficiaries and may insist that all SMMEs are to be trained which will have a major financial impact on the training allowance as reflected in Example 2 below.

- Training is a once off event for each SMME beneficiary. However, the example allowed for training throughout the contract period as and when SMMEs are appointed and additional mentoring. The training period should be project specific. The number of quarters training to be provided will depend on the nature of the work, the trades to be subcontracted, and the anticipated date of appointments in relation to the construction programme. One can if possible arrange one training session for all beneficiaries in some instances.

- The mini bill will be used to reflect actual cost once the bid has been awarded, the actual cost of the respective items are known and the provisional amount adjusted accordingly. Rather overestimate than underestimate in order not to negatively impact on the 20% expansion limitation on the project cost.

- The Community Project Support Committee needs to be sensitised with regards to the number of enterprise development beneficiaries and agree on the number of beneficiaries of the CPG preferably prior to going out on tender.

- Training to be provided as close as possible to the project site to minimize cost.

- The intention is not to provide training for the full duration of the project. The assessment of the SMMEs will determine the type of training to be provided and at what stage/s of the projects whilst noting that this is managerial/business training for the owners of the companies only. It is also dependent on the nature of the works, SMME trades to be appointed and when the SMMEs are appointed. The ideal would be to limit the training sessions to a maximum of three sessions.

- Beneficiaries will not be replaced should a beneficiary exit the programme prematurely for whatever reason and the main contractor will not be penalised for not achieving the CPG if it is due to a beneficiary exiting the programme prematurely.

EXAMPLE 2: 30% CPG PARTICIPATION (MINI BILL OF QUANTITIES)

Part 1: Calculation of minimum 30% CPG example:

"Tender Amount" = R150 Mil all inclusive of allowances and VAT
"Contract Amount" = R130 Mil (Tender Amount at the time of award excluding allowances and VAT)
CPG percentage participation to be achieved = 30% **as specified** in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)
CPG value = R39,000,000 (Value of work to be subcontracted to emerging enterprises to undergo training)

Calculation of penalty:
Percentage penalty applicable = 30% as specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)
CPG Minimum 30% = R39,000,000 Mil
Achieved = R30 Mil (Only subcontracted work to the value of R30 Mil, i.e. R9 Mil shortfall)
Penalty = R9 Mil x 30% = R 2 700 000 Excl. VAT

Part 2: Calculations in terms of training allowance for training to be done:

The number of enterprises to be developed is subject to the contract amount and the apportionment of the work as per Example 1 below.
Number of enterprises to be trained = 15 (1GB) + 3 (1CE) + 5 (2GB) + 3 (2CE) = 26 SMME subcontractors
Total cost for training = R 4 020 000

Calculation of penalty
Total number of enterprises to be trained = 26
Total number trained = 24 (2 Shortfall)
Training cost per beneficiary = R4 020 000 / 26 = R154 615 per beneficiary
Penalty = R154 615 x 2 x 30% = R 92 769.23 Excl. VAT

TABLE 2: EXAMPLE 2 - 30% CPG PARTICIPATION

Example of calculating cost of SMME training (Worst case scenario)

B of Q Item	Description	Unit	Rate	Quantity	Amount (R)
5	**Enterprise Development**				
5.1	Enterprise Development of Targeted Enterprise or JV partners				
5.1.1	Appointment of training co-ordinator *	Per Quarter	45,000	8	360,000
5.1.2	Appointment of Mentor /Training Service provider *	Per Quarter	390,000	8	3,120,000
5.1.3	Needs Analysis and Enterprise Development Plan per Targeted Enterprise **	No.	5,000	26	130,000
5.1.4	Monitoring and Interim reporting per targeted enterprise *	Per Quarter	20,000	8	160,000
5.1.5	Project Completion report per Targeted Enterprise*	No.	5,000	26	130,000
	Provisional Sum to be carried over to CPG bill of quantities				3,900,000

"Contract amount" Tender amount excl. allowances and VAT,	130,000,000	150 Mil - allowances and VAT = R130 Mil
CPG Monetary value (30%) to be subcontracted to beneficiary SMMEs	39,000,000	130 000 000 x 30% = 39 000 000
No of enterprises based on the CPG value and agreed by project Support committee	26	Grade 1 / 5 GB/CE,ETC.
Contract period (months)	24	
Number of Quarters	8	24 / 3 = 8

*** Rates prescribed by the cidb. PQS to determine rate depending on the location of the project**

**** Rates to be determined by PQS and adjusted to accepted quotation amounts**

All rates are provisional and will be adjusted upon receipt of quotations from service providers and acceptance.

4.5 Cidb BUILD Programme: Skills Development (Principal contractor including subcontractors and consultants)

The aim is to provide opportunities to learners requiring structured workplace learning facilitated by the principal contractor including subcontractors and consultant service providers.

This CPG is a **Condition of Contract** therefore it is not a requirement to submit substantiating documentation with the tender other than pricing the item in the CPG section of the Bills of Quantities.

The contract Skills Development Goal (CSDG) shall be expressed as follows:

- In the case of engineering and construction works contracts, design and build contracts and services contracts the contract skills development participation goals, expressed in Rand, shall be no less than the "contract amount" multiplied by a percentage (%) factor given in Table 5 for the applicable class of construction works used in the application of the Construction Industry Development Regulations issued in terms of the Construction Industry Development Board Act of 2000.

- In the case of professional services contracts the contract skills development goals, expressed in hours, shall be not less than the professional fees in millions of Rand multiplied by 150.

Upon registration of the project with the cidb, NDPWI will be invoiced to pay the cidb 0,2% to a maximum of R2 Mil under second contract (0002) on the WCS as a once off Payment. Project Managers must ensure that provision is for the payment of the BUILD programme costs when requesting funding prior to the invitation of tenders

and ideally register a Contract 0002 on the WCS for that purpose as soon as they become aware that the cidb BUILD Programme will be applicable to the project. The PQS is to include the cost in his estimate based on the pretender estimate including allowances and VAT. The actual amount payable to the cidb = the awarded tender amount x 0,2% to a maximum of R2 Million.

The main contractor shall submit monthly reports in terms of CPG monthly achievements and accumulative targets achieved including audited supporting documentation to the Employer's Representative

Contract skills development credits will not be awarded for learners enrolled as beneficiaries of other funded or subsidised programmes.

In the case of services contracts:

a) The contract skills development goals shall be granted by multiplying the number of people employed by the contractors and placed for continuous training opportunities in a three-month period by the notional values contained in Table 4, or as revised in a Gazette notice.
b) The contractor may source beneficiaries of the contract skills development goal from the cidb Skills Development Agency (SDA).
c) All beneficiaries of the Standard must be registered with the cidb Skills Development Agency (SDA). Where an unemployed learner is employed directly by the service provider / contractor, the service provider / contractor shall pay the stipend directly to the learner
d) Where an unemployed learner is sourced through an SDA, training provider or skills development facilitator the consultant / contractor must pay the stipend to the SDA, training provider or skills development facilitator who in tum will pay the learner
e) The notional cost of providing training opportunities will be increase by CPI on an annual basis. The new, revised costs will be published on the cidb website on the 1st of April in each year.

Credits towards the contract skills development goal for professional services contracts shall be granted by summating the hours of structured workplace learning opportunities provided to P1 and P2 learners as well as professional candidates in accordance with this standard.

No more than 45 hours may be claimed per week for any individual.

Contract skills development goal credits shall be reduced to the extent that they fail to comply with the requirements of this standard.

Role and function of skills development agency

The Skills Development Agency (SDA) will provide career management and compliance reporting functions for all learners for CSDG compliance in terms of this Standard. Where the service providers / contractors provide direct employment to unemployed learners, or enrols own employees for CSDG compliance, the service provider shall register them with the cidb SDA. The SDA can also act as an employment intermediary for unemployed learners. NOTE: The role and function of a cidb SDA is outlined in Annexure B of the standard for skills development.

Providing workplace learning opportunities through direct employment from colleges and indirect employment through Skills Development Agency (SDA). The aim of the SDA will be to facilitate structured, workplace training for beneficiaries of the CIDB Standard for Developing Skills through Infrastructure Contractors (Skills Standard) and their roles will be to ensure the smooth processing of training learners or beneficiaries in partnership with the contractor.

Appointing a coach/mentor for learners whose responsibilities are:

a) Submitting compliance baseline training plans 30 days after contract award(60 to 90 days is more realistic);
b) Submitting quarterly compliance reports; and
c) **Submitting final contract compliance report prior to achieving Practical Completion and not 30 days after practical completion as per the cidb Standard. Certificate of Practical Completion will not be issued unless the report has been issued to the project manager.**

Career management and compliance reporting

The contractor shall enter into a contract agreement with the cidb SDA training provider or skills development facilitator to manage their learners according to the provisions given below:

a) preparing training plans for registered learners, including details of the scope of experiential work to be covered and expected outcomes;
b) registering learners with the appropriate Sector Educational and Training Authority established in terms of the Skills Development Act of 2008 (Act 37 of 2008);
c) conducting entry and exit level medicals for learners at the conclusion of each placement opportunity;
d) providing personal protective equipment;
e) liaising with the supervisor to monitor onsite training progress of learners;
f) liaising with the supervisor to arrange for summative assessments at appropriate stages of the training; and
g) liaising with the supervisor to prepare reports for the employer's representative and cidb at practical completion of the contract.

The relevant training service provider or skills development facilitator shall invoice the main contractor for the provision of these services.

The cidb SDA shall open a trust fund to ring-fence monies essential for all learner requirements where necessary provided for in this standard such as personal protective equipment, medical assessments, insurance, course fees, monitoring as well as top up training and assessment.

Employment Intermediary
The cidb SDA can act as an employment intermediary for unemployed learners and provide contractors with learners qualifying for participation in the CSDG, as well as managing their employment functions such as payment of stipends, workman's compensation, provision of personal protective equipment, trade specific tools, etc.

In such cases, the consultant / contractor shall contract directly with an SDA, training provider or skills development facilitator of their choice for the recruitment, placement and management of learners. The contractor shall pay the SDA, training provider or skills development facilitator in accordance with the notional costs provided for in this standard, or as amended by a Gazette.

Provision of different types of workplace opportunities linked to work associated with a contract which culminate in or lead to registration in a professional category by one of the professional bodies listed in the standard **(Table 3 below).**

Table 3: Categories of registration
Source: cidb Standard for Developing Skills through Infrastructure Contracts as published in the Government Gazette Notice No. 48491 of 28 April 2023 (Table 1, Page 5)

Profession	Category of registration	Act
Architectural	Architect, Senior Architectural Technologist, Architectural Technologist or Architectural Draughts person	Architectural Profession Act of 2000 (Act No.44 of 2000
Construction Project Management or Construction Management	Construction Project Manager or Construction Manager	Project and Construction Management Professions Act of 2000 (Act No. 48 of 2000
Engineering	Engineer, Engineering Technologist, Engineering Technician or Certificated Engineer	Engineering Profession Act of 2000 (Act No. 46 of 2000)
Health and Safety Practitioners	Construction Health and Safety Agent, Construction Health and Safety Manager, Construction Health and Safety Officer	Occupational Health and Safety Act of 1993 (Act No. 85 of 1993) Construction Regulations, 2014
Landscape Architectural	Landscape Architect, Landscape Technologist, Landscape Technician or Landscape Assistant	Landscape Architectural Profession Act of 2000 (Act No. 45 of 2000)
Planning	Planner or Technical planner	Planning Profession Act, 2002. (Act No. 36 of 2002)
Quantity surveying	Quantity surveyor	Quantity Surveying Profession Act of 2000 (Act No. 49 of 2000)
Scientists	Natural scientists	Natural Scientific Professions Act (Act No. 27 of 2003)

Profession	Category of registration	Act
Surveying	Land surveyor, Engineering surveyor or Technician engineering surveyor	Professional and Technical Surveyors' Act (Act No. 40 of 1984)
Valuers	Valuer or Associate Valuer	Property Valuers Profession Act (Act No. 47 of 2000)

Training Methods:
The contractor / service provider shall achieve the measurable contract skills development goal by providing opportunities to learners requiring structured workplace learning using one or a combination of any of the following in relation to work directly related to the contract or order:
Method 1: structured workplace learning opportunities for learners towards the attainment of a part or a full occupational qualification;
Method 2: structured workplace learning opportunities for apprentices or other artisan learners towards the attainment of a trade qualification leading to a listed trade (GG No. 35625, 31 August 2012) subject to at least 60% of the artisan learners being holders of public TVET college qualifications (N/A for consultants);
Method 3: work integrated learning opportunities for University of Technology or Comprehensive University students completing their national diplomas; or
Method 4: structured workplace learning opportunities for candidates towards registration in a professional category by a statutory council listed in Table 3 above.

Employed learners may not account for more than 33 percent of the contract skills development goal. Not more than one method may be applied to any individual concurrently in the calculation of the contract skills development goal. The principle is that an individual can only be counted once towards the CSDG.

The contractor shall apportion the learners in the different construction activities based on the scope of work. The cost of accommodating learners will be determined by using **Table 3** and this cost will be used to determine the value in Rand for skills development and will be added to the provision for training as provided for in the CPG Bill of Quantity section.

Table 3: The notional cost pf providing training opportunities per quarter

Source: cidb Standard for Developing Skills through Infrastructure Contracts as published in the Government Gazette Notice No 48491 Government Gazette, 23 April 2023 (Table 3, Page 9)

Type of Training Opportunity	Provision for stipends (Unemployed learners only)	Provisions for mentorship	Provisions for additional costs*	Total costs	
				Unemployed learners	Employed learners
Method 1					
Occupational qualification	**R7 000**	**R0**	**R9 000**	**R16 000**	**R9 000**
Method 2					
TVET College graduates	**R14 000**	**R0**	**R9 000**	**R23 000**	**N/A**
Apprenticeship	**R14 000**	**R0**	**R12 000**	**R26 000**	**R12 000**
Method 3					
P1 and P2 learners	**R24 000**	**R20 000**	**R4 500**	**R48 500**	**N/A**
Method 4					
Candidates with a 3 year diploma	**R37 000**	**R20 000**	**R4 500**	**R61 500**	**R20 000**
Candidates with 4 year qualification	**R47 000**	**R20 000**	**R4 500**	**R71 500**	**R20 000**

Note: the required CPG will be recalculated based on the awarded tender amount and "Contract amount" once the beneficiaries have been appointed and actual costs are known. The notional cost of providing training opportunities will increase by CPI on an annual basis based on April CPI. Should the rates increase after bid award or during construction then the rates will be adjusted as a remeasuarble item.

4.5.1 Applicable standards and implementation documents

- Minimum Targeted Contract Skills Development Goal in accordance with the cidb Standard for Developing Skills through Infrastructure Contracts as published in the Government Gazette Notice No. 43495 of 3 July 2020
- cidb Best Practice Project Assessment Scheme Notice No. 43726 of 18 September 2020

4.5.2 Minimum requirements

Contractor:

- All classes of work from Grade 7 and above
- Minimum Construction Period 12 Months

Consultant:

- Minimum total tender value = R5 Mil
- Minimum service contract period = 12 Months

4.5.3 Penalties

Contractor:

- Minimum thirty percent (30%) penalty of the value of the CPG portion not achieved, excluding VAT; **AND**
- **The issuing of completion certificates only after the completion certificate of achieving the skills development goal, counter-signed by the relevant individuals has been submitted**

Consultants:

- Minimum thirty percent (30%) penalty of the value of the CPG portion not achieved in terms of hours training to be provided and the associated notional cost , excluding VAT

4.5.4 CPG Calculation

Table 4: Contracting skills development goals for different classes of engineering and construction works contracts

Source: cidb Standard for Developing Skills through Infrastructure Contracts as published in the Government Gazette Notice No. 48491 Government Gazette, 23 April 2023 (Table 2, Page 7)

Class of construction works as identified in terms of Regulation 25 (3) of the Construction Industry Regulations 2004		Construction skills development goal (CSDG) (%)
Designation	**Description**	
CE	Civil Engineering	0.25
CE and GB	Civil engineering and General Building	0.375
EE	Electrical Engineering works (buildings)	0.25
EP	Electrical Engineering works (infrastructure)	0.25
GB	General Building	0.5
ME	Mechanical Engineering works	0.25
SB	Specialist	0.25

Note: the required CPG will be recalculated based on the awarded tender amount and "Contract amount" once the beneficiaries have been appointed and actual costs are known. The notional cost of providing training opportunities is subjected to annual increases as per the CPI issued on the 1st of April annually by Stats SA. The rates will be adjusted as an adjustment to the provisional amounts should the rates increase after bid award or during the construction period. The ideal is to maximize the number of beneficiaries and not target beneficiary with the highest associated costs which will reduce the number of beneficiaries. The beneficiaries to be targeted can be established during the feasibility study which can be specifically specified.

Contractor CPG calculation:

"Contract amount" = Tender amount at the time of award excluding allowances and expenses, and VAT
"Contract amount" x factor from Table 5 above.
The PQS to make allowance for CPI increases for the full duration of the training within the provisional amount allowed for in the Bill of Quantities whilst noting that the cidb uses the April CPI for annual increases.

CPG calculation example:
"Tender Amount" = R150 Mil for GB, all inclusive of allowances and VAT
"Contract Amount" = R130 Mil (Tender Amount at the time of award excluding allowances and VAT)
Factor for "GB" = 0,5% (as per Table 5 above)
CPG in R value = R130 Mil x 0,5% = R650 000 i.e. total notional cost of training to amount to R650 000

Calculation of penalty (excluding escalation):
Percentage penalty applicable = 30% as specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)
CPG value = R650 000
Achieved = R550 000 = R100 000 Shortfall
Penalty = R100 000 x 30% = R30 000 Excl. VAT

CPG calculation **if escalation is applicable:**
CPG in R value = R130 Mil x 0,5% = R650 000
+ 6,5% annual increase (if applicable) = R42 250
Total CPG value to be achieved = R692 250

Calculation of penalty (including escalation):
Percentage penalty applicable = 30% as specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)
CPG value = R650 000
+ 6,5% escalation = R42 250
Total CPG value = R692 250
Achieved = R500 000 = R192 250 Shortfall
Penalty = R192 250 x 30% = R57 675 Excl. VAT

Calculations based on "Contract Amount" after bid award and appointment of beneficiaries

Actual CPG training requirement value after award upon selecting method/s of training and appointment of beneficiaries = R676 000 [or R719 940 if is escalation is applicable] **(Table 5 below)**. The provisional amount allowed for must therefore be adjusted accordingly. The new monetary value of training required will then form the basis for determining penalties applicable. No penalties will be applied should the CPG value, based on the original "Contract Amount" be achieved. Note that it could emanate from the feasibility study that there are local candidate beneficiaries to which certain methods apply which could be specified specifically in the Scope of Works (PG-01.1 / PG01.2) to avoid increase in cost.

Table 5: Notional cost recalculation upon bid award and appointment of beneficiaries.

Adapted from the cidb Standard for Developing Skills through Infrastructure Contracts as published in the Government Gazette Notice No. No 48491 Government Gazette, 23 April 2023 (Table, Page 9))

Skills Types	Number of learners	Notional Cost / Learner / Quarter	Notional cost / learner / year	Total Notional Cost over 12 months Contract
Method 2: Workplace learning opportunities, with unemployed TVET graduates	2	R23 000	R92 000	R184 000
Method 3: Candidacy for an unemployed learner with a 3-year qualification	2	R61 500	R246 000	R492 000
Total CPG value if escalation is not applicable / Sub-Total if escalation is applicable				**R676 000**
Add 6,5% escalation as per April CPI (if applicable)*				**R43 940**
Total CPG Value if escalation is applicable				**R719 940**

**Escalation percentage to be based on the latest CPI indices*

Consultant CPG calculation:

- CPG value based on the "Contract Amount" = Number of Hours training to be provided x the Notional Cost per hour of beneficiaries appointed.
- Number of hours training to be provided = "Contract Amount" x 150.
- "Contract amount" = Tender amount excluding allowances, expenses and VAT [Basic fee tendered item (1) from the activity schedule) excluding VAT]

Calculating consultant CPG example:

Step 1: Calculate number of Hours training to be provided:

"Tender Amount" = R5.1 Mil

"Contract amount" = R4.5 Mil (Basic fee tendered item (1) from the activity schedule) excluding VAT)

Number of hours skills development training required = R4.5 x 150 = 675 hours (hours to be rounded off)

Step 2: Calculate the Notional Cost per hour

(a) Notional Cost per quarter as per Table 4 of Clause C 3.16 (Scope of Services) and optional methods

(b) Number of Hours per quarter = 3 months x 20 days x 8 hours per day = 480 Hours

(c) Notional Cost per Hour = (a) / (b)

Step 3: Calculate Total Notional Cost

(a) Total hours training to be provided x notional cost per hour

Example: Calculating the Total Notional Cost

(a) Fees (1) from Activity Schedule = R4.5 Mil

(b) Number of hours skills development required = R4.5 Mil x 150 = 675 hours

(c) Total number of hours per quarter = 40 hours per week x 4 weeks x 3 months = 480 hours

(d) Notional cost per hour "Method 4" = R71 500 per quarter / 480 hours = R148.95 per hour

(e) Total Notional cost = R148.95 (Rate per hour) x 675 (total number of hours) = R100 541.25

(f) PM to insert the calculated amount into the activity schedule as a provisional amount which will be adjusted upon the selection and appointment of the beneficiaries.

Calculation of penalty:
Total notional cost = R 100 541.25
Achieved = R60 000 Shortfall of R40 541.25
Penalty = R40 541.25 x 30% = R12 162.38 Excl. VAT

Note: Annual escalation is applicable and allowance must be made in the provisional amount, as indicated in the above example for the contractor.

The project manager must indicate in the consultant tender document whether the CPG is applicable or not, and provide a provisional amount in the activity schedule. In the event of being indicated as applicable and the awarded consultant tender amount is less than R5 Million, the CPG will still be applicable.

If the estimate consultant fees is in the region of R5 Million make the CPG applicable and provide an allowance.

This CPG is strongly advocated by the cidb and one may apply same to projects where the cost / fees is expected to increase above the minimum thresholds.

4.6 National Youth Service Programme (NYS) CPG

- The programme shall be implemented in terms of the Implementation of the National Youth Service Programme under the Expanded Public Works Programme (EPWP) and shall be priced in the CPG section of the Bills of Quantities. The CPG determined in conjunction with NDPWI NYS component which would quantify the NYS bill of quantities
- This CPG is a **Condition of Contract** therefore it is not a requirement to submit substantiating documentation with the tender other than pricing the NYS component within the CPG section in the Bill of Quantities.
- Monthly proforma reports are to be submitted to the Employer's Representative.

4.6.1 Applicable standards and implementation documents

- National Youth Service Programme

4.6.2 Minimum Requirements

- Minimum contract value R2 Mil
- Minimum construction period 12 months

4.6.3 Penalties

Payment reduction as stipulated in the CPG bill of quantities per person not trained (Excluding VAT).

Calculation of penalty example:
Payment reduction per person not trained as stipulated in the NYS Bill of Quantities = R 2 500 per person.
Total number of NYS Beneficiaries as stipulated in the NYS Bill of Quantities = 25
Total Number of NYS beneficiaries trained = 20 (shortfall of 5 beneficiaries)
Penalty = 5 x R2 500 = R12 500 Excl. VAT

4.7 Labour Intensive Works CPG

The consultant team is expected to use their initiative to identify activities that can be done labour-intensively to comply with the set minimum labour intensity target based on the Generic labour intensive works specifications.

This CPG is a **Condition of Contract** therefore it is not a requirement to submit substantiating documentation with the tender other than making allowance in his pricing of items indicated "LI" in the Bills or Quantities.

The main contractor shall submit monthly reports in terms of CPG monthly achievement and accumulative targets achieved including audited supporting documentation to the Employer's Representative

4.7.1 Applicable standards and implementation documents

- Expanded Public Works Programme (EPWP) and generic labour intensive works specifications.

4.7.2 Minimum Requirements

- All civil works projects.
- As general construction projects are labour intensive by nature specific general building items need not to be indicated as "LI" in the Bills of Quantities. It is however a requirement to implement and indicate "LI" items as defined in the Scope of Works (PG01.1 and PG01.2) where feasible on projects below R30 Mil.
- Compulsory for projects above R30 Mil where feasible.
- Minimum construction period 6 months

4.7.3 Penalties

Minimum thirty percent (30%) penalty of the value of the works not done by means of labour-intensive methods, excluding VAT.

4.7.4 CPG Calculation

- Feasibility study to indicate achievable CPG and specified in the Scope of Works (PG01.1 for GCC

Contracts or PG01.2 for JBCC Contracts)

- CPG determined by PQS in conjunction with consultant team and NDPWI representative.
- Example:

CPG Calculation
"Tender Amount" = R150 Mil all inclusive of allowances and VAT
"Contract Amount" = R130 Mil (Tender Amount at the time of award excluding allowances and VAT)
CPG value = R10 Mil (Total value of labour-intensive works specified in the Bills of Quantities)

Calculation of penalty
CPG value = R10 Mil
Percentage penalty applicable = 30% as specified in the Scope of Works (PG01.1 for GCC Contracts or PG01.2 for JBCC Contracts)
CPG Achieved = 9 Mil (R1 Mil shortfall)
Penalty = R1 Mil x 30% = R300 000 Excl. VAT

5. INFORM THE CIDB

Failing to inform the cidb is a criminal offence.

Cidb to be informed of:

- Bid award to be registered with the cidb within 21 days from date of award - SCM responsibility;
- List of skills development beneficiaries within 30 days from bid award – PM Responsibility (cidb informed to change to 90 days. Lists to be submitted soonest);
- Practical Completion within one calendar month from issuing certificate – PM Responsibility; and
- The compliance of such project with the Standard for Developing Skills through Infrastructure Contracts and the contract skills development achieved– PM Responsibility.

6. CIDB CONTACT PERSON CIDB BUILD PROGRAMME

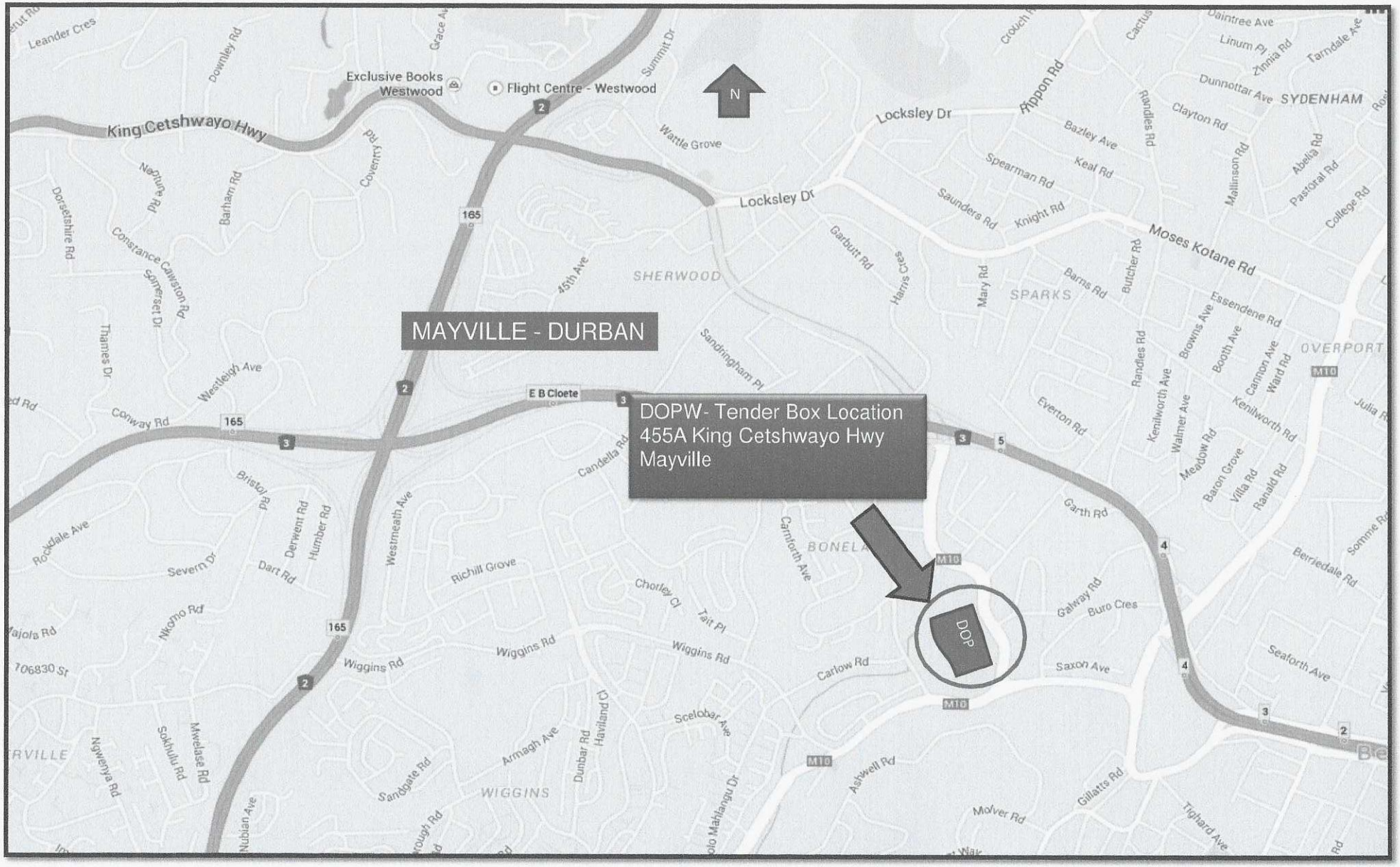
Cidb contact person cidb BUILD Programme for assistance with implementation:
Mr Ishmail Cassiem, Mobile Nr 078 801 8476, Email: IshmailC@cidb.org.za

Fully understanding the contract participation goals demands self-study of the relevant cidb Standards as well as the Standards and SANS documents referred to within the respective cidb Standards and Practice Notes

KWAZULU-NATAL PROVINCE
PUBLIC WORKS & INFRASTRUCTURE
REPUBLIC OF SOUTH AFRICA

NEW 28 BEDDED MALE & FEMALE INPATIENT & OUTPATIENT MENTAL HEALTH UNIT

ANNEXURE 10 - LOCATION OF TENDER BOX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Summit Dr
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Downley Rd
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Knight Rd
Clayton Rd
Mallinson Rd
Abella Rd
Pastoral Rd
College Rd
Daintree Ave
Linum Pl
Zinnia Rd
Tarndale Ave
Dunnottar Ave
Bristol Pl
Derwent Rd
Humber Rd
Severn Dr
Dart Rd
Rockdale Ave
Nkomo Rd
Majola Rd
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Nqwenya Rd
Sokhulu Rd
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