REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF PUBLIC WORKS

BILLS OF QUANTITIES

FOR

NTUZUMA SAPS:

COMPLETION OF CCTV CONTROL ROOM

WCS NO.: 046725

VOLUME 2: RETURNABLE DOCUMENTS

QUANTITY SURVEYOR:

EDGECOMBE & HAYES-HILL
P O Box 25178
Gateway
4320

TEL: 031 566 2977

EMAIL: ianhill@mitsol.co.za

ARCHITECT:

DEPARTMENT OF PUBLIC WORKS
DURBAN REGIONAL OFFICE
Private Bag X54315
Durban
4000
TEL : 031 207 3131

EMAIL: sumesh.govender@dpw.gov.za

STRUCTURAL ENGINEERS:

TGC ENGINEERS
P.O. Box 446
Pavilion
3611

TEL: 031 265 1777

EMAIL: tgc@tgcengineers.co.za

CIVIL CONSULTING ENGINEERS:

BVI CONSULTING ENGINEERS
P.O.BOX 889
Westville
3630

TEL: 031 266 8382

EMAIL: dbn@bvikn.co.za

ELECTRICAL ENGINEERS:

AA POWER
55 Road 718
Chatsworth
4092

TEL: 031 404 3810

EMAIL: aapower@gmail.com

MECHANICAL ENGINEERS:

PARSONS & LUMSDEN
P O Box 800
Kloof
3640

TEL: 031 764 7727

EMAIL: nigel@parsonsandlumsden.com

DEPARTMENT OF PUBLIC WORKS
DURBAN REGIONAL OFFICE
Private Bag X54315
Durban
4000
TEL: 031 314 7105

EMAIL: nkosinathi.mchunu@dpw.gov.za

NOVEMBER 2022

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF PUBLIC WORKS

BILLS OF QUANTITIES

FOR

NTUZUMA SAPS:

COMPLETION OF CCTV CONTROL ROOM

WCS NO.: 046725

T2.2: RETURNABLE DOCUMENTS REQUIRED FOR TENDER EVALUATION PURPOSES

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EMAIL: ianhill@mitsol.co.za

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TEL: 031 314 7105

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NOVEMBER 2022

SARS

TCC

001 TAX CLEARANCE

Application for a Tax Clearance Certificate

Purpose

Select the applicable option — Tenders ☐ Good standing ☐

If "Good standing", please state the purpose of this application

Particulars of applicant

Name/Legal name (Initials & Surname or registered name)

Trading name (if applicable)

ID/Passport no

Company/Close Corp. registered no

Income Tax ref no

PAYE ref no 7

VAT registration no 4

SDL ref no L

Customs code

UIF ref no U

Telephone no

Fax no

E-mail address

Physical address

Postal address

Particulars of representative (Public Officer/Trustee/Partner)

Surname

First names

ID/Passport no

Income Tax ref no

Telephone no

Fax no

E-mail address

Physical address

Particulars of tender (If applicable)

Tender number

Estimated Tender amount R ,

Expected duration of the tender year(s)

Particulars of the 3 largest contracts previously awarded

Date started	Date finalised	Principal	Contact person	Telephone number	Amount

Audit

Are you currently aware of any Audit investigation against you/the company? YES | NO

If "YES" provide details

Appointment of representative/agent (Power of Attorney)

I the undersigned confirm that I require a Tax Clearance Certificate in respect of Tenders or Goodstanding.

I hereby authorise and instruct to apply to and receive from SARS the applicable Tax Clearance Certificate on my/our behalf.

Signature of representative/agent Date

Name of representative/ agent

Declaration

I declare that the information furnished in this application as well as any supporting documents is true and correct in every respect.

Signature of applicant/Public Officer Date

Name of applicant/ Public Officer

Notes:

1. It is a serious offence to make a false declaration.
2. Section 75 of the Income Tax Act, 1962, states: Any person who
   (a) fails or neglects to furnish, file or submit any return or document as and when required by or under this Act;
   or (b) without just cause shown by him, refuses or neglects to-
   (i) furnish, produce or make available any information, documents or things; (ii) reply to or answer truly and fully, any questions put to him ...
   As and when required in terms of this Act ... shall be guilty of an offence ...
3. **SARS will, under no circumstances, issue a Tax Clearance Certificate unless this form is completed in full.**
4. Your Tax Clearance Certificate will only be issued on presentation of your South African Identity Document or Passport (Foreigners only) as applicable.

DPW-09 (EC): PARTICULARS OF TENDERER'S PROJECTS

Project title:	*Ntuzuma SAPS: Completion of CCTV Control Room (003)*		
Tender / quotation no:	DBN22/11/02	**Closing date:**	02/12/2022
Advertising date:	11/11/2022	**Validity period:**	84 days

1. PARTICULARS OF THE TENDERER'S CURRENT AND PREVIOUS COMMITMENTS

1.1. Current projects

	Projects currently engaged in	Name of Employer or Representative of Employer	Contact tel. no.	Contract sum	Contractual commence-ment date	Contractual completion date	Current percentage progress
1							
2							
3							
4							
5							
6							
7							
8							

Tender no: ***DBN2211/02***

1.2. **Completed projects**

Projects completed in the previous 5 (five) years		**Name of Employer or Representative of Employer**	**Contact tel. no.**	**Contract sum**	**Contractual commence-ment date**	**Contractual completion date**	**Date of Certificate of Practical Completion**
1							
2							
3							
4							
5							
6							
7							
8							
9							

Name of Tenderer	Signature	Date

PA-11: BIDDER'S DISCLOSURE

1. PURPOSE OF THE FORM

Any person (natural or juristic) may make an offer or offers in terms of this invitation to bid. In line with the principles of transparency, accountability, impartiality, and ethics as enshrined in the Constitution of the Republic of South Africa and further expressed in various pieces of legislation, it is required for the bidder to make this declaration in respect of the details required hereunder.

Where a person/s are listed in the Register for Tender Defaulters and / or the List of Restricted Suppliers, that person will automatically be disqualified from the bid process.

2. Bidder's declaration

2.1 Is the bidder, or any of its directors / trustees / shareholders / members / partners or any person having a controlling interest (1) in the enterprise, employed by the state?

YES / NO

2.1.1 If so, furnish particulars of the names, individual identity numbers, and, if applicable, state employee numbers of sole proprietor/ directors / trustees / shareholders / members/ partners or any person having a controlling interest in the enterprise, in table below.

Full Name	Identity Number	Name of State institution

(1) the power, by one person or a group of persons holding the majority of the equity of an enterprise, alternatively, the person/s having the deciding vote or power to influence or to direct the course and decisions of the enterprise.

2.2 Do you, or any person connected with the bidder, have a relationship with any person who is employed by the procuring institution?

YES / NO

2.2.1 If so, furnish particulars:

.....
.....

2.3 Does the bidder or any of its directors / trustees / shareholders / members / partners or any person having a controlling interest in the enterprise have any interest in any other related enterprise whether or not they are bidding for this contract?

YES / NO

2.3.1 If so, furnish particulars:

.....

.....

3 DECLARATION

I, the undersigned, (name).....
in submitting the accompanying bid, do hereby make the following statements that I certify to be true and complete in every respect:

3.1 I have read and I understand the contents of this disclosure;
3.2 I understand that the accompanying bid will be disqualified if this disclosure is found not to be true and complete in every respect;
3.3 The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However, communication between partners in a joint venture or consortium2 will not be construed as collusive bidding.
3.4 In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications, prices, including methods, factors or formulas used to calculate prices, market allocation, the intention or decision to submit or not to submit the bid, bidding with the intention not to win the bid and conditions or delivery particulars of the products or services to which this bid invitation relates.
3.5 The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.
3.6 There have been no consultations, communications, agreements or arrangements made by the bidder with any official of the procuring institution in relation to this procurement process prior to and during the bidding process except to provide clarification on the bid submitted where so required by the institution; and the bidder was not involved in the drafting of the specifications or terms of reference for this bid.

2 Joint venture or Consortium means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract.

3.7 I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

I CERTIFY THAT THE INFORMATION FURNISHED IN PARAGRAPHS 1, 2 and 3 ABOVE IS CORRECT.

I ACCEPT THAT THE STATE MAY REJECT THE BID OR ACT AGAINST ME IN TERMS OF PARAGRAPH 6 OF PFMA SCM INSTRUCTION 03 OF 2021/22 ON PREVENTING AND COMBATING ABUSE IN THE SUPPLY CHAIN MANAGEMENT SYSTEM SHOULD THIS DECLARATION PROVE TO BE FALSE.

.....	.....
Signature	Date
.....	.....
Position	Name of bidder

This form has been aligned with SBD4

public works
Department:
Public Works
REPUBLIC OF SOUTH AFRICA

PA-14: MEDICAL CERTIFICATE FOR THE CONFIRMATION OF PERMANENT DISABLED STATUS

Project title:	***Ntuzuma SAPS: Completion of CCTV Control Room (Contract 003)***		
Tender / Bid no:	**DBN22/11/02**	**Reference no:**	**6310/1220/26/1**

I, _____ (*surname and name*),

Identity number, _____ do hereby declare that I am a registered medical

practitioner, with my practice number being _____, practicing at

_____ _____(Physical and postal addresses)

declare that I have examined Mr/Mrs _____,

identity number of _____ and have found the said person to be

permanently disabled or having a recurring disability.

"Disability" means, in respect of a person, a permanent impairment of a physical, intellectual, or sensory function, which results in restricted, or lack of, ability to perform an activity in the manner, or within the range, considered normal for a human being." – As per Preferential Procurement Policy Framework Act: No 5 of 2000 (PPPFA)

The nature of the disability is as follows:

_____

_____

_____

Thus signed at _____ on this day of _____ of _____.

_____ _____

Signature Date

OFFICIAL STAMP OF MEDICAL PRACTITIONER

PA-15.1: RESOLUTION OF BOARD OF DIRECTORS

RESOLUTION of a meeting of the Board of *Directors / Members / Partners of:

_____

(Legally correct full name and registration number, if applicable, of the Enterprise)

Held at _____ *(place)*

on _____ *(date)*

RESOLVED that:

1. The Enterprise submits a Bid / Tender to the Department of Public Works in respect of the following project:

   _____

   (Project description as per Bid / Tender Document)

   Bid / Tender Number: _____ *(Bid / Tender Number as per Bid / Tender Document)*

2. *Mr/Mrs/Ms: _____

   in *his/her Capacity as: _____ *(Position in the Enterprise)*

   and who will sign as follows: _____

   be, and is hereby, authorised to sign the Bid / Tender, and any and all other documents and/or correspondence in connection with and relating to the Bid / Tender, as well as to sign any Contract, and any and all documentation, resulting from the award of the Bid / Tender to the Enterprise mentioned above.

	Name	Capacity	Signature
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13			
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15			
16			

17			
18			
19			
20			

The bidding enterprise hereby absolves the Department of Public Works from any liability whatsoever that may arise as a result of this document being signed.

Note:

1. ** Delete which is not applicable.*
2. ***NB:** This resolution must, where possible, be signed by all the Directors / Members / Partners of the Bidding Enterprise.*
3. *In the event that paragraph 2 cannot be complied with, the resolution must be signed by Directors / Members / Partners holding a majority of the shares / ownership of the Bidding Enterprise (attach proof of shareholding / ownership hereto).*
4. *Directors / Members / Partners of the Bidding Enterprise may alternatively appoint a person to sign this document on behalf of the Bidding Enterprise, which person must be so authorized by way of a duly completed power of attorney, signed by the Directors / Members / Partners holding a majority of the shares / ownership of the Bidding Enterprise (proof of shareholding / ownership and power of attorney are to be attached hereto).*
5. *Should the number of Directors / Members / Partners exceed the space available above, additional names and signatures must be supplied on a separate page.*

ENTERPRISE STAMP

PA-15.2: RESOLUTION OF BOARD OF DIRECTORS TO ENTER INTO CONSORTIA OR JOINT VENTURES

RESOLUTION of a meeting of the Board of *Directors / Members / Partners of:

_____

_____

(Legally correct full name and registration number, if applicable, of the Enterprise)

Held at _____ *(place)*

on _____ *(date)*

RESOLVED that:

1. The Enterprise submits a Bid /Tender, in consortium/Joint Venture with the following Enterprises:

   _____

   _____

   (List all the legally correct full names and registration numbers, if applicable, of the Enterprises forming the Consortium/Joint Venture)

   to the Department of Public Works in respect of the following project:

   _____

   _____

   (Project description as per Bid /Tender Document)

   Bid / Tender Number: _____ *(Bid / Tender Number as per Bid / Tender Document)*

2. *Mr/Mrs/Ms: _____

   in *his/her Capacity as: _____ *(Position in the Enterprise)*

   and who will sign as follows: _____

   be, and is hereby, authorised to sign a consortium/joint venture agreement with the parties listed under item 1 above, and any and all other documents and/or correspondence in connection with and relating to the consortium/joint venture, in respect of the project described under item 1 above.

3. The Enterprise accepts joint and several liability with the parties listed under item 1 above for the due fulfilment of the obligations of the joint venture deriving from, and in any way connected with, the Contract to be entered into with the Department in respect of the project described under item 1 above.

4. The Enterprise chooses as its *domicilium citandi et executandi* for all purposes arising from this joint venture agreement and the Contract with the Department in respect of the project under item 1 above:

   Physical address: _____

   _____

   _____

   _____ (code)

Postal Address: _____

_____

_____

_____ (code)

Telephone number: _____

Fax number: _____

	Name	Capacity	Signature
1			
2			
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The bidding enterprise hereby absolves the Department of Public Works from any liability whatsoever that may arise as a result of this document being signed

Note:

1. ** Delete which is not applicable.*
2. ***NB:** This resolution must, where possible, be signed by <u>all</u> the Directors / Members / Partners of the Bidding Enterprise.*
3. *In the event that paragraph 2 cannot be complied with, the resolution must be signed by Directors / Members / Partners holding a majority of the shares / ownership of the Bidding Enterprise (attach proof of shareholding / ownership hereto).*
4. *Directors / Members / Partners of the Bidding Enterprise may alternatively appoint a person to sign this document on behalf of the Bidding Enterprise, which person must be so authorized by way of a duly completed power of attorney, signed by the Directors / Members / Partners holding a majority of the shares / ownership of the Bidding Enterprise (proof of shareholding / ownership and power of attorney are to be attached hereto).*
5. *Should the number of Directors / Members / Partners exceed the space available above, additional names and signatures must be supplied on a separate page.*

ENTERPRISE STAMP

PA-15.3: SPECIAL RESOLUTION OF CONSORTIA OR JOINT VENTURES

RESOLUTION of a meeting of the duly authorised representatives of the following legal entities who have entered into a consortium/joint venture to jointly bid for the project mentioned below: *(legally correct full names and registration numbers, if applicable, of the Enterprises forming a Consortium/Joint Venture)*

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

6. _____

_____

7. _____

_____

8. _____

_____

Held at _____ *(place)*

on _____ *(date)*

RESOLVED that:

RESOLVED that:

A. The above-mentioned Enterprises submit a Bid in Consortium/Joint Venture to the Department of Public Works in respect of the following project:

_____

_____

(Project description as per Bid /Tender Document)

Bid / Tender Number: _____ *(Bid / Tender Number as per Bid /Tender Document)*

B. *Mr/Mrs/Ms: _____

in *his/her Capacity as: _____ *(Position in the Enterprise)*

and who will sign as follows: _____

be, and is hereby, authorised to sign the Bid, and any and all other documents and/or correspondence in connection with and relating to the Bid, as well as to sign any Contract, and any and all documentation, resulting from the award of the Bid to the Enterprises in Consortium/Joint Venture mentioned above.

C. The Enterprises constituting the Consortium/Joint Venture, notwithstanding its composition, shall conduct all business under the name and style of:

_____

D. The Enterprises to the Consortium/Joint Venture accept joint and several liability for the due fulfilment of the obligations of the Consortium/Joint Venture deriving from, and in any way connected with, the Contract entered into with the Department in respect of the project described under item A above.

E. Any of the Enterprises to the Consortium/Joint Venture intending to terminate the consortium/joint venture agreement, for whatever reason, shall give the Department 30 days written notice of such intention. Notwithstanding such decision to terminate, the Enterprises shall remain jointly and severally liable to the Department for the due fulfilment of the obligations of the Consortium/Joint Venture as mentioned under item D above.

F. No Enterprise to the Consortium/Joint Venture shall, without the prior written consent of the other Enterprises to the Consortium/Joint Venture and of the Department, cede any of its rights or assign any of its obligations under the consortium/joint venture agreement in relation to the Contract with the Department referred to herein.

G. The Enterprises choose as the *domicilium citandi et executandi* of the Consortium/Joint Venture for all purposes arising from the consortium/joint venture agreement and the Contract with the Department in respect of the project under item A above:

Physical address: _____

_____

_____

_____ (Postal code)_____

Postal Address: _____

_____

_____

_____(Postal code)_____

Telephone number: _____

Fax number: _____

PA-15.3: Special Resolution of Consortia or Joint Ventures

	Name	Capacity	Signature
1			
2			
3			
4			
5			
6			
7			
8			
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10			
11			
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13			
14			
15			

The bidding enterprise hereby absolves the Department of Public Works & Infrastructure from any liability whatsoever that may arise as a result of this document being signed.

Note:

1. ** Delete which is not applicable.*
2. ***NB:** This resolution must be signed by <u>all</u> the Duly Authorised Representatives of the Legal Entities to the consortium/joint venture submitting this tender, as named in item 2 of Resolution PA-15.2.*
3. *Should the number of the Duly Authorised Representatives of the Legal Entities joining forces in this tender exceed the space available above, additional names, capacity and signatures must be supplied on a separate page.*
4. *Resolution PA-15.2, duly completed and signed, from the separate Enterprises who participate in this consortium/joint venture, must be attached to this Special Resolution (PA-15.3).*

Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

DPW-16 (EC): SITE INSPECTION MEETING CERTIFICATE

Project title:	***Ntuzuma SAPS: Completion of CCTV Control Room***		
Tender / Quotation no:	*DBN22/11/02*	**Reference no:**	*6310/1220/26/1*
Closing date:	*02 December 2022*		

This is to certify that I, _____ representing

_____ in the capacity of

_____ visited the site on: ***insert date***

I have made myself familiar with all local conditions likely to influence the work and the cost thereof. I further certify that I am satisfied with the description of the work and explanations given at the site inspection meeting and that I understand perfectly the work to be done, as specified and implied, in the execution of this contract.

Name of Tenderer	Signature	Date

Name of DPW Representative	Signature	Date

PA16: PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2017

This preference form must form part of all bids invited. It contains general information and serves as a claim form for preference points for Broad-Based Black Economic Empowerment (B-BBEE) Status Level of Contribution

NB: BEFORE COMPLETING THIS FORM, BIDDERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF B-BBEE, AS PRESCRIBED IN THE PREFERENTIAL PROCUREMENT REGULATIONS, 2017 AND THE AMENDED B-BBEE CODES.

---

1. GENERAL CONDITIONS

1.1. The following preference point systems are applicable to all bids:

- the 80/20 system for requirements with a Rand value of up to R50 000 000 (all applicable taxes included); and
- the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).

1.2. The value of this bid is estimated to ***Not Exceed*** R50 000 000 (all applicable taxes included) and therefore the... ***80/20*** .....system shall be applicable.

1.3. Preference points for this bid shall be awarded for:

(a) Price; and
(b) B-BBEE Status Level of Contribution.

1.3.1 The maximum points for this bid are allocated as follows:

		POINTS
1.3.1.1	**PRICE**	***80***
1.3.1.2	**B-BBEE STATUS LEVEL OF CONTRIBUTION**	***20***
	Total points for Price and B-BBEE must not exceed	**100**

1.4. Failure on the part of a bidder to fill in and/or to sign this form and submit a B-BBEE Verification Certificate from a Verification Agency accredited by the South African Accreditation System (SANAS) or an Accounting Officer as contemplated in the Close Corporation Act (CCA) together with the bid, will be interpreted to mean that preference points for B-BBEE status level of contribution are not claimed.

1.5. An Exempted Micro Enterprise (EME) is only required to obtain a sworn affidavit or a certificate issued by Companies and intellectual property Commission (CIPC) confirming their annual turnover of R10 Million or less and level of black ownership to claim points.

1.6. Qualifying Small Enterprise (QSE) is only required to obtain a sworn affidavit or a certificate issued by Companies and intellectual property Commission (CIPC) confirming their annual turnover of R10 Million or less and level of black ownership to claim points.

1.7 The purchaser reserves the right to require of a bidder, either before a bid is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the purchaser.

1.8 CERTIFICATES ISSUED BY IRBA AND ACCOUNTING OFFICER HAVE BEEN DISCONTINUED; HOWEVER VALID CERTIFICATES ALREADY ISSUED BEFORE 01 JANUARY 2017 MAY BE USED UNTIL THEY PHASE OUT COMPLETELY BY DECEMBER 2017

2. DEFINITIONS

(a) **"all applicable taxes"** includes value-added tax, pay as you earn, income tax, unemployment insurance fund contributions and skills development levies;

(b) **"B-BBEE"** means broad-based black economic empowerment as defined in section 1 of the Broad-Based Black Economic Empowerment Act;

(c) "**B-BBEE status level of contributor"** means the B-BBEE status received by a measured entity based on its overall performance using the relevant scorecard contained in the Codes of Good Practice on Black Economic Empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act;

(d) **"bid"** means a written offer in a prescribed or stipulated form in response to an invitation by an organ of state for the provision of services, works or goods, through price quotations, advertised competitive bidding processes or proposals;

(e) **"Broad-Based Black Economic Empowerment Act"** means the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(f) **"comparative price"** means the price after the factors of a non-firm price and all unconditional discounts that can be utilized have been taken into consideration;

(g) "consortium or joint venture" means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract;

(h) **"contract"** means the agreement that results from the acceptance of a bid by an organ of state;

(i) "EME" means an Exempted Micro Enterprise as defines by Codes of Good Practice under section 9 (1) of the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(j) **"Firm price"** means the price that is only subject to adjustments in accordance with the actual increase or decrease resulting from the change, imposition, or abolition of customs or excise duty and any other duty, levy, or tax, which, in terms of the law or regulation, is binding on the contractor and demonstrably has an influence on the price of any supplies, or the rendering costs of any service, for the execution of the contract;

(k) **"functionality"** means the measurement according to predetermined norms, as set out in the bid documents, of a service or commodity that is designed to be practical and useful, working or operating, taking into account, among other factors, the quality, reliability, viability and durability of a service and the technical capacity and ability of a bidder;

(l) **"non-firm prices"** means all prices other than "firm" prices;

(m) **"person"** includes a juristic person;

(n) **"QSE"** means a Qualifying Small Enterprise as defines by Codes of Good Practice under

section 9 (1) of the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(o) **"rand value"** means the total estimated value of a contract in South African currency, calculated at the time of bid invitations, and includes all applicable taxes and excise duties;

(p) ***"sub-contract"*** *means the primary contractor's assigning, leasing, making out work to, or employing, another person to support such primary contractor in the execution of part of a project in terms of the contract;*

(q) **"total revenue"** bears the same meaning assigned to this expression in the Codes of Good Practice on Black Economic Empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act and promulgated in the *Government Gazette* on 9 February 2007;

(r) **"trust"** means the arrangement through which the property of one person is made over or bequeathed to a trustee to administer such property for the benefit of another person; and

(s) **"trustee"** means any person, including the founder of a trust, to whom property is bequeathed in order for such property to be administered for the benefit of another person.

3. ADJUDICATION USING A POINT SYSTEM

3.1 The bidder obtaining the highest number of total points will be awarded the contract.

3.2 Preference points shall be calculated after prices have been brought to a comparative basis taking into account all factors of non-firm prices and all unconditional discounts;.

3.3 Points scored must be rounded off to the nearest 2 decimal places.

3.4 In the event that two or more bids have scored equal total points, the successful bid must be the one scoring the highest number of preference points for B-BBEE.

3.5 However, when functionality is part of the evaluation process and two or more bids have scored equal points including equal preference points for B-BBEE, the successful bid must be the one scoring the highest score for functionality.

3.6 Should two or more bids be equal in all respects, the award shall be decided by the drawing of lots.

4. POINTS AWARDED FOR PRICE

4.1 THE 80/20 OR 90/10 PREFERENCE POINT SYSTEMS

A maximum of 80 or 90 points is allocated for price on the following basis:

80/20 **or** **90/10**

$$Ps = 80\left(1 - \frac{Pt - P\min}{P\min}\right) \quad \text{or} \quad Ps = 90\left(1 - \frac{Pt - P\min}{P\min}\right)$$

Where

Ps = Points scored for comparative price of bid under consideration

Pt = Comparative price of bid under consideration

Pmin = Comparative price of lowest acceptable bid

5. Points awarded for B-BBEE Status Level of Contribution

5.1 In terms of Regulation 6(2) and /or 7(2), of the Preferential Procurement Regulations, preference points must be awarded to a bidder for attaining the B-BBEE status level of contribution in accordance with the table below:

B-BBEE Status Level of Contributor	Number of points (90/10 system)	Number of points (80/20 system)
1	10	20
2	9	18
3	6	14
4	5	12
5	4	8
6	3	6
7	2	4
8	1	2
Non-compliant contributor	0	0

5.2 A trust, consortium or joint venture, will qualify for points for their B-BBEE status level as a legal entity, provided that the entity submits their B-BBEE status level certificate.

5.3 A trust, consortium or joint venture will qualify for points for their B-BBEE status level as an unincorporated entity, provided that the entity submits their consolidated B-BBEE scorecard as if they were a group structure and that such a consolidated B-BBEE scorecard is prepared for every separate bid.

5.4 Tertiary institutions and public entities will be required to submit their B-BBEE status level certificates in terms of the specialized scorecard contained in the B-BBEE Codes of Good Practice.

5.5 A person awarded a contract may not sub-contract more than 25% of the value of the contract to any other enterprise that does not have an equal or higher B-BBEE status level than the person concerned, unless the contract is sub-contracted to an EME that has the capability and ability to execute the sub-contract.

6. BID DECLARATION

6.1 Bidders who claim points in respect of B-BBEE Status Level of Contribution must complete the following:

7. B-BBEE STATUS LEVEL OF CONTRIBUTION CLAIMED IN TERMS OF PARAGRAPHS 1.3.1.2 AND 5.1

7.1 B-BBEE Status Level of Contribution: ..... = ...(maximum of 10 or 20 points)

(Points claimed in respect of paragraph 7.1 must be in accordance with the table reflected in paragraph 5.1 and must be substantiated by means of a B-BBEE certificate issued by a Verification Agency accredited by SANAS or Sworn Affidavit for EME's and QSE's.

8 SUB-CONTRACTING (relates to 5.5)

8.1 Will any portion of the contract be sub-contracted? YES / NO (delete which is not applicable)

8.1.1 If yes, indicate:

(i) what percentage of the contract will be subcontracted? .....%

(ii) the name of the sub-contractor? .....

(iii) the B-BBEE status level of the sub-contractor? .....

(iv) whether the sub-contractor is an EME/ a QSE YES / NO (delete which is not applicable)

Designated Group: An EME or QSE which is at last 51% owned by:	EME √	QSE √
Black people		
Black people who are youth		
Black people who are women		
Black people with disabilities		
Black people living in rural or underdeveloped areas or townships		
Cooperative owned by black people		
Black people who are military veterans		
OR		
Any EME		
Any QSE		

9 DECLARATION WITH REGARD TO COMPANY/FIRM

9.1 Name of company/firm .....

9.2 VAT registration number .....

9.3 Company registration number .....

9.4 TYPE OF COMPANY/ FIRM

- ☐ Partnership/Joint Venture / Consortium
- ☐ One person business/sole propriety
- ☐ Close corporation
- ☐ Company
- ☐ (Pty) Limited

[TICK APPLICABLE BOX]

9.5 DESCRIBE PRINCIPAL BUSINESS ACTIVITIES

.....

.....

.....

9.6 COMPANY CLASSIFICATION

☐ Manufacturer
☐ Supplier
☐ Professional service provider
☐ Other service providers, e.g. transporter, etc.
[TICK APPLICABLE BOX]

9.7 Total number of years the company/firm has been in business? .....

9.8 I/we, the undersigned, who is / are duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the B-BBE status level of contribution indicated in paragraph 7 of the foregoing certificate/ Sworn Affidavit, qualifies the company/ firm for the preference(s) shown and I / we acknowledge that:

(i) The information furnished is true and correct;
(ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form.
(iii) In the event of a contract being awarded as a result of points claimed as shown in paragraph 7, the contractor may be required to furnish documentary proof to the satisfaction of the purchaser that the claims are correct;
(iv) If the B-BBEE status level of contribution has been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the purchaser may, in addition to any other remedy it may have –

(a) Disqualify the person from the bidding process;
(b) Recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;
(c) Cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;
(d) restrict the bidder or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, from obtaining business from any organ of state for a period not exceeding 10 years, after the audi alteram partem (hear the other side) rule has been applied; and
(e) forward the matter for criminal prosecution

WITNESSES:

1. .....

2. .....

.....
SIGNATURE(S) OF BIDDER(S)

DATE:..... ADDRESS:.....

.....

Any reference to words "Bid" or Bidder" herein and/or in any other documentation shall be construed to have the same meaning as the words "Tender" or "Tenderer".

PA-36: DECLARATION CERTIFICATE FOR LOCAL PRODUCTION AND CONTENT FOR DESIGNATED SECTORS

This Standard Bidding Document (SBD) must form part of all bids invited. It contains general information and serves as a declaration form for local content (local production and local content are used interchangeably).

Before completing this declaration, bidders must study the General Conditions, Definitions, Directives applicable in respect of Local Content as prescribed in the Preferential Procurement Regulations, 2017, the South African Bureau of Standards (SABS) approved technical specification number SATS 1286:2011 (Edition 1) and the Guidance on the Calculation of Local Content together with the Local Content Declaration Templates [Annex C (Local Content Declaration: Summary Schedule), D (Imported Content Declaration: Supporting Schedule to Annex C) and E (Local Content Declaration: Supporting Schedule to Annex C)].

1. General Conditions

1.1. Preferential Procurement Regulations, 2017 (Regulation 8) make provision for the promotion of local production and content.

1.2. Regulation 8.(2) prescribes that in the case of designated sectors, organs of state must advertise such tenders with the specific bidding condition that only locally produced or manufactured goods, with a stipulated minimum threshold for local production and content will be considered.

1.3. Where necessary, for tenders referred to in paragraph 1.2 above, a two stage bidding process may be followed, where the first stage involves a minimum threshold for local production and content and the second stage price and B-BBEE.

1.4. A person awarded a contract in relation to a designated sector, may not sub-contract in such a manner that the local production and content of the overall value of the contract is reduced to below the stipulated minimum threshold.

1.5. The local content (LC) expressed as a percentage of the bid price must be calculated in accordance with the SABS approved technical specification number SATS 1286: 2011 as follows:

$$LC = [1 - x / y] * 100$$

Where
x is the imported content in Rand
y is the bid price in Rand excluding value added tax (VAT)

Prices referred to in the determination of x must be converted to Rand (ZAR) by using the exchange rate published by South African Reserve Bank (SARB) on the date of advertisement of the bid as indicated in paragraph 3.1 below.

The SABS approved technical specification number SATS 1286:2011 is accessible on http:/www.thedti.gov.za/industrial development/ip.jsp at no cost.

1.6. A bid may be disqualified if this Declaration Certificate and the Annex C (Local Content Declaration: Summary Schedule) are not submitted as part of the bid documentation;

2. The stipulated minimum threshold(s) for local production and content (refer to Annex A of SATS 1286:2011) for this bid is/are as follows:

Description of services, works or goods		Stipulated minimum threshold
Schecdule1	Steel Product	100 %
Schedule 2	Valve Product	70%
Schedule 3	Electrical cable Product	90%

3. Does any portion of the goods or services offered have any imported content?

(***Tick applicable box***)

YES		NO	

3.1 If yes, the rate(s) of exchange to be used in this bid to calculate the local content as prescribed in paragraph 1.5 of the general conditions must be the rate(s) published by SARB for the specific currency on the date of advertisement of the bid.

The relevant rates of exchange information is accessible on www.resbank.co.za

Indicate the rate(s) of exchange against the appropriate currency in the table below (refer to Annex A of SATS 1286:2011):

Currency	**Rates of exchange**
US Dollar	
Pound Sterling	
Euro	
Yen	
Other	

NB: Bidders must submit proof of the SARB rate (s) of exchange used.

4. Where, after the award of a bid, challenges are experienced in meeting the stipulated minimum threshold for local content the dti must be informed accordingly in order for the dti to verify and in consultation with the AO/AA provide directives in this regard.

LOCAL CONTENT DECLARATION
(REFER TO ANNEX B OF SATS 1286:2011)

LOCAL CONTENT DECLARATION BY CHIEF FINANCIAL OFFICER OR OTHER LEGALLY RESPONSIBLE PERSON NOMINATED IN WRITING BY THE CHIEF EXECUTIVE OR SENIOR MEMBER/PERSON WITH MANAGEMENT RESPONSIBILITY (CLOSE CORPORATION, PARTNERSHIP OR INDIVIDUAL)

IN RESPECT OF BID NO. .....

ISSUED BY: (Procurement Authority / Name of Institution):
.....
NB

1 The obligation to complete, duly sign and submit this declaration cannot be transferred to an external authorized representative, auditor or any other third party acting on behalf of the bidder.

2 Guidance on the Calculation of Local Content together with Local Content Declaration Templates (Annex C, D and E) is accessible on http://www.thedti.gov.za/industrial_development/ip.jsp. Bidders should first complete Declaration D. After completing Declaration D, bidders should complete Declaration E and then consolidate the information on Declaration C. **Declaration C should be submitted with the bid documentation at the closing date and time of the bid in order to substantiate the declaration made in paragraph (c) below.** Declarations D and E should be kept by the bidders for verification purposes for a period of at least 5 years. The successful bidder is required to continuously update Declarations C, D and E with the actual values for the duration of the contract.

I, the undersigned, ... (full names), do hereby declare, in my capacity as .... of .....(name of bidder entity), the following:

(a) The facts contained herein are within my own personal knowledge.

(b) I have satisfied myself that:

(i) the goods/services/works to be delivered in terms of the above-specified bid comply with the minimum local content requirements as specified in the bid, and as measured in terms of SATS 1286:2011; and

(c) The local content percentage (%) indicated below has been calculated using the formula given in clause 3 of SATS 1286:2011, the rates of exchange indicated in paragraph 3.1 above and the information contained in Declaration D and E which has been consolidated in Declaration C:

Bid price, excluding VAT (y)	R
Imported content (x), as calculated in terms of SATS 1286:2011	R
Stipulated minimum threshold for local content (paragraph 3 above)	
Local content %, as calculated in terms of SATS 1286:2011	

If the bid is for more than one product, the local content percentages for each product contained in Declaration C shall be used instead of the table above.
The local content percentages for each product has been calculated using the formula given in clause 3 of SATS 1286:2011, the rates of exchange indicated in paragraph 3.1 above and the information contained in Declaration D and E.

(d) I accept that the Procurement Authority / Institution has the right to request that the local content be verified in terms of the requirements of SATS 1286:2011.

(e) I understand that the awarding of the bid is dependent on the accuracy of the information furnished in this application. I also understand that the submission of incorrect data, or data that are not verifiable as described in SATS 1286:2011, may result in the Procurement Authority / Institution imposing any or all of the remedies as provided for in Regulation 14 of the Preferential Procurement Regulations, 2017 promulgated under the Preferential Policy Framework Act (PPPFA), 2000 (Act No. 5 of 2000).

SIGNATURE: _____

WITNESS No. 1 _____ **DATE:** _____

WITNESS No. 2 _____ **DATE:** _____

Annex C

Local Content Declaration - Summary Schedule

(C1)	Tender No.
(C2)	Tender description:
(C3)	Designated product(s)
(C4)	Tender Authority:
(C5)	Tendering Entity name:
(C6)	Tender Exchange Rate:
(C7)	Specified local content %

Note: VAT to be excluded from all calculations

Pula EU GBP

Tender item no's	List of items	Calculation of local content: Tender price - each (excl VAT)	Exempted imported value	Tender value net of exempted imported content	Imported value	Local value	Local content % (per item)	Tender summary: Tender Qty	Total tender value	Total exempted imported content	Total Imported content
(C8)	(C9)	(C10)	(C11)	(C12)	(C13)	(C14)	(C15)	(C16)	(C17)	(C18)	(C19)

Signature of tenderer from Annex B

Date:

(C20) Total tender value	R
(C21) Total Exempt imported content	R
(C22) Total Tender value net of exempt imported content	R
(C23) Total Imported content	
(C24) Total local content	
(C25) Average local content % of tender	

Annex D

Imported Content Declaration - Supporting Schedule to Annex C

(D1)	Tender No.	
(D2)	Tender description:	
(D3)	Designated Products:	
(D4)	Tender Authority:	
(D5)	Tendering Entity name:	
(D6)	Tender Exchange Rate:	Pula

Note: VAT to be excluded from all calculations

EU R 9.00 GBP R 12.00

A. Exempted imported content

Tender item no's	Description of imported content	Local supplier	Overseas Supplier	Calculation of imported content: Forign currency value as per Commercial Invoice	Tender Exchange Rate	Local value of imports	Freight costs to port of entry	All locally incurred landing costs & duties	Total landed cost excl VAT	Summary: Tender Qty	Summary: Exempted imported value
(D7)	(D8)	(D9)	(D10)	(D11)	(D12)	(D13)	(D14)	(D15)	(D16)	(D17)	(D18)

(D19) Total exempt imported value R 0

This total must correspond with Annex C - C 21

B. Imported directly by the Tenderer

Tender item no's	Description of imported content	Unit of measure	Overseas Supplier	Calculation of imported content: Forign currency value as per Commercial Invoice	Tender Rate of Exchange	Local value of imports	Freight costs to port of entry	All locally incurred landing costs & duties	Total landed cost excl VAT	Summary: Tender Qty	Summary: Total imported value
(D20)	(D21)	(D22)	(D23)	(D24)	(D25)	(D26)	(D27)	(D28)	(D29)	(D30)	(D31)

(D32) Total imported value by tenderer R 0

C. Imported by a 3rd party and supplied to the Tenderer

Description of imported content	Unit of measure	Local supplier	Overseas Supplier	Calculation of imported content: Forign currency value as per Commercial Invoice	Tender Rate of Exchange	Local value of imports	Freight costs to port of entry	All locally incurred landing costs & duties	Total landed cost excl VAT	Summary: Quantity imported	Summary: Total imported value
(D33)	(D34)	(D35)	(D36)	(D37)	(D38)	(D39)	(D40)	(D41)	(D42)	(D43)	(D44)

(D45) Total imported value by 3rd party R 0

D. Other foreign currency payments

Type of payment	Local supplier making the payment	Overseas beneficiary	Calculation of foreign currency payments: Foreign currency value paid	Tender Rate of Exchange	Summary of payments: Local value of payments
(D46)	(D47)	(D48)	(D49)	(D50)	(D51)

(D52) Total of foreign currency payments declared by tenderer and/or 3rd party

(D53) Total of imported content & foreign currency payments - (D32), (D45) & (D52) above R 0

This total must correspond with Annex C - C 23

Signature of tenderer from Annex B

Date:

Annex E

Local Content Declaration - Supporting Schedule to Annex C

(E1)	**Tender No.**	
(E2)	**Tender description:**	
(E3)	**Designated products:**	
(E4)	**Tender Authority:**	
(E5)	**Tendering Entity name:**	

Note: VAT to be excluded from all calculations

Local Products (Goods, Services and Works)	Description of items purchased	Local suppliers	Value
	(E6)	*(E7)*	*(E8)*
		(E9) Total local products (Goods, Services and Works)	

(E10) **Manpower costs** (Tenderer's manpower cost)

(E11) **Factory overheads** (Rental, depreciation & amortisation, utility costs, consumables etc.)

(E12) **Administration overheads and mark-up** (Marketing, insurance, financing, interest etc.)

(E13) **Total local content**

This total must correspond with Annex C - C24

Signature of tenderer from Annex B

Date: _____

Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

PA- 40: DECLARATION OF DESIGNATED GROUPS FOR PREFERENTIAL PROCUREMENT

Tender no: DBN22/11/02

Name of Tenderer ..... ☐ EME[1] ☐ QSE[2] ☐ Non EME/QSE (tick applicable box)

1. LIST ALL PROPRIETORS, MEMBERS OR SHAREHOLDERS BY NAME, IDENTITY NUMBER, CITIZENSHIP AND DESIGNATED GROUPS.

Name and Surname #	Identity/ Passport number and Citizenship##	Percentage owned	Black	Indicate if youth	Indicate if woman	Indicate if person with disability	Indicate if living in Rural (R) / Under Developed Area (UD) / Township (T) / Urban (U).	Indicate if military veteran
1.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
2.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
3.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
4.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
5.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
6.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
7.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
8.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
9.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
10.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
11.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
12.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No

\# Where Owners are themselves a Company, Close Corporation, Partnership etc, identify the ownership of the Holding Company, together with Registration number
\## State date of South African citizenship obtained (not applicable to persons born in South Africa)

[1] EME: Exempted Micro Enterprise
[2] QSE: Qualifying Small Business Enterprise

PA- 40: DECLARATION OF DESIGNATED GROUPS FOR PREFERENTIAL PROCUREMENT

Tender no: DBN22/11/02

2. DECLARATION:

The undersigned, who warrants that he/she is duly authorized to do so on behalf of the Tenderer, hereby confirms that:

1 The information and particulars contained in this Affidavit are true and correct in all respects;
2 The Broad-based Black Economic Empowerment Act, 2003 (Act 53 of 2003), Preferential Procurement Policy Framework Act, 2000 (Act 5 of 2000), the Preferential Procurement Regulations, 2017, National Small Business Act 102 of 1996 as amended and all documents pertaining to this Tender were studied and understood and that the above form was completed according to the definitions and information contained in said documents;
3 The Tenderer understands that any intentional misrepresentation or fraudulent information provided herein shall disqualify the Tenderer's offer herein, as well as any other tender offer(s) of the Tenderer simultaneously being evaluated, or will entitle the Employer to cancel any Contract resulting from the Tenderer's offer herein;
4 The Tenderer accepts that the Employer may exercise any other remedy it may have in law and in the Contract, including a claim for damages for having to accept a less favourable tender as a result of any such disqualification due to misrepresentation or fraudulent information provided herein;
5 Any further documentary proof required by the Employer regarding the information provided herein, will be submitted to the Employer within the time period as may be set by the latter;

Signed by the Tenderer

Name of representative	**Signature**	**Date**

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF PUBLIC WORKS

BILLS OF QUANTITIES

FOR

NTUZUMA SAPS:

COMPLETION OF CCTV CONTROL ROOM

WCS NO.: 046725

T2.2: RETURNABLE DOCUMENTS THAT WILL BE INCORPORATED INTO THE CONTRACT

QUANTITY SURVEYOR:

EDGECOMBE & HAYES-HILL
P O Box 25178
Gateway
4320

TEL: 031 566 2977

EMAIL: ianhill@mitsol.co.za

ARCHITECT:

DEPARTMENT OF PUBLIC WORKS
DURBAN REGIONAL OFFICE
Private Bag X54315
Durban
4000
TEL : 031 207 3131

EMAIL: sumesh.govender@dpw.gov.za

STRUCTURAL ENGINEERS:

TGC ENGINEERS
P.O. Box 446
Pavilion
3611

TEL: 031 265 1777

EMAIL: tgc@tgcengineers.co.za

CIVIL CONSULTING ENGINEERS:

BVI CONSULTING ENGINEERS
P.O.BOX 889
Westville
3630

TEL: 031 266 8382

EMAIL: dbn@bvikn.co.za

ELECTRICAL ENGINEERS:

AA POWER
55 Road 718
Chatsworth
4092

TEL: 031 404 3810

EMAIL: aapower@gmail.com

MECHANICAL ENGINEERS:

PARSONS & LUMSDEN
P O Box 800
Kloof
3640

TEL: 031 764 7727

EMAIL: nigel@parsonsandlumsden.com

DEPARTMENT OF PUBLIC WORKS
DURBAN REGIONAL OFFICE
Private Bag X54315
Durban
4000
TEL: 031 314 7105

EMAIL: nkosinathi.mchunu@dpw.gov.za

NOVEMBER 2022

DPW-15 (EC): SCHEDULE OF PROPOSED SUBCONTRACTORS

Project title:	***Ntuzum SAPS: Completion of CCTV Control Room(003)***		
Tender no:	*DBN22/11/02*	**Reference no:**	*6310/1220/26/1*

We notify you that it is our intention to employ the following Subcontractors for work in this contract.

We confirm that all subcontractors who are contracted to construct a house are registered as home builders with the National Home Builders Registration Council.

	Name and address of proposed Subcontractor	Nature and extent of work	Previous experience with Subcontractor
1			
2			
3			
4			
5			

Name of representative	**Signature**	**Capacity**	**Date**

Name of organisation:	

public works
Department:
Public Works
REPUBLIC OF SOUTH AFRICA

DPW-21 (EC): RECORD OF ADDENDA TO TENDER DOCUMENTS

Project title:	***Ntuzuma SAPS: Completion of CCTV Control Room (Contract 003)***		
Tender no:	**DBN22/11/02**	**Reference no:**	**6310/1220/26/1**

1. I / We confirm that the following communications received from the Department of Public Works before the submission of this tender offer, amending the tender documents, have been taken into account in this tender offer: *(Attach additional pages if more space is required)*

	Date	Title or Details
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		

Name of Tenderer	Signature	Date

2. I / We confirm that no communications were received from the Department of Public Works before the submission of this tender offer, amending the tender documents.

Name of Tenderer	Signature	Date

Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

DPW-22 (EC): PARTICULARS OF ELECTRICAL CONTRACTOR

Project title:	***Ntuzuma SAPS: Completion of CCTV Control Room(003)***		
Tender no:	DBN22/11/02	**Reference no:**	**6310/1220/26/1**

Name of Electrical Contractor:	
Address:	
Electrical Contractor registration number at the Department of Labour	

Name of Tenderer	Signature	Date

DEPARTMENT OF PUBLIC WORKS

NTUZUMA SAPS: NEW CCTV BUILDING

ELECTRICAL INSTALLATIONS

COMPREHENSIVE CONTRACT:

PART A: GENERAL ELECTRICAL INSTALLATIONS

PART B: DIESEL ALTERNATOR AND DAY TANK INSTALLATIONS

PART C: UPS INSTALLATION

PART D: FIRE PROTECTION AND DETECTION SYSTEM

INDEX TO PART A: GENERAL ELECTRICAL INSTALLATIONS

NOTICE TO TENDERERS

1. The tenderer for the principal electrical contract shall submit additional information regarding the installers of the Specialist Electrical Installations (Parts B, C and D) together with the returnables enclosed with the tender enquiry documents
2. The Electrical Contractor shall submit the schedules of information for each installation with his tender.
3. Failure to compile / return the schedules may disqualify the Tender as it will not be possible to adjudicate the offer.
4. Drawings accompany this tender and will form part of this Specification.

PART A: GENERAL ELECTRICAL INSTALLATIONS

PART 1: GENERAL

1. TESTS

Upon completion of the works and before first delivery is taken, a full test will be carried out on the installation for a period of sufficient duration, to determine the satisfactory working thereof. During this period, the installations will be inspected and the Contractor shall make good, to the satisfaction of the Representative/Agent, any defects which may arise.

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

2. MAINTENANCE OF INSTALLATIONS

With effect from the date of the First Delivery Certificate the Contractor shall at his own expense undertake the regular servicing of the installation during the maintenance period and shall make all adjustments necessary for the correct operation thereof.

THE NORMAL CONTRACTUAL FREE MAINTENANCE AND GUARANTEE PERIOD INCLUDED IN THIS CONTRACT SHALL BE 12 MONTHS.

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

Should such stoppages however be so frequent as to become troublesome, or should the installations otherwise prove unsatisfactory during the said period the Contractor shall, if called upon by the Representative/Agent or the Director-General, at his own expense replace the whole of the installations or such parts thereof as the Representative/Agent or the Director-General may deem necessary with apparatus specified by the Representative/Agent or the Director-General.

3. REGULATIONS

The installation shall be erected and tested in accordance with the following Acts and regulations:

a) The latest issue of SABS 0142: "Code of Practice for the Wiring of Premises",

b) The Occupational Health and Safety Act, 1993 (Act 85 of 1993) as amended,

c) The Local Government Ordinance 1939 (Ordinance 17 of 1939) as amended and the municipal by-laws and any special requirements of the local supply authority,

d) The Fire Brigade services Act 1993 Act 99 of 1987 as amended,

e) The National Building Regulations and Building Standards Act 1977 (Act 103 of 1977) as amended,

f) The Post Office Act 1958 (Act 44 of 1958) as amended,

g) The Electricity Act 1984 (Act 41 of 1984) as amended, and

h) The Regulations of the local Gas Board where applicable.

4. NOTICES AND FEES

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

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

5. SCHEDULE OF FITTINGS

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

6. QUALITY OF MATERIALS

Only materials of first-class quality shall be used and all materials shall be subject to the approval of the Department. Departmental specifications for various materials to be used on this Contract are attached to and form part of this specification.

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

Materials wherever possible, must be of South African manufacture.

7. CONDUIT AND ACCESSORIES

The type of conduit and accessories required for the service, i.e. whether the conduit and accessories shall be of the screwed type, plain-end type or of the non-metallic type and whether metallic conduit shall be black enamelled or galvanised, is specified in Part 2 of this specification.

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 SABS 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: SABS 1065, parts 1 and 2.

b) Plain-end metallic conduit and accessories: SABS 1065, parts 1 and 2.

c) Non-metallic conduit and accessories: SABS 950.

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

Bushes used for metallic conduit shall be brass and shall be provided in addition to

locknuts at all points where the conduit terminates at switchboards, switch-boxes, draw-boxes, etc.

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

For lighting 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.

Only one manufactured type of conduit and conduit accessories will be permitted throughout the installation.

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

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

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

Bending and setting of conduits 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.

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

All conduit and accessories used in areas within 50 km of the coast shall be galvanised according to SABS 763.

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.

8. CONDUIT IN ROOF SPACES

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

Nail or crampets will not be allowed.

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

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

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

9. SURFACE MOUNTED CONDUIT

Wherever possible, the conduit installation is to be concealed in the building work. However, where unavoidable or otherwise specified under Part 2 of the specification, any conduit installed on the surface must be plumbed or levelled and only straight lengths shall be used.

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

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

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

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

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

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

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

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

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

Painting of surface conduit shall match the colour of the adjacent wall finishes.

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

acceptable.

10. 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. Sharp bends of any nature will not be allowed in concrete slabs.

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

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

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

11. FLEXIBLE CONNECTIONS FOR STOVES, MACHINES, ETC.

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

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

Aluminium and zinc alloy connectors will not be acceptable.

12. WIRING:

Except where otherwise specified in Part 2 of this specification, wiring shall be carried out in conduit throughout. Only one circuit per conduit will be permitted.

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

Unless otherwise specified in Part 2 of this specification or indicated on the service drawings, the wiring of the installation shall be carried out in accordance with the "Wiring Code". Further to the requirements concerning the installation of earth conductors to certain lighting points as set out in the "Wiring Code", it is a specific requirement of this document that where plain-end metallic conduit or non-metallic conduit has been used, earth conductors must be provided and drawn into the conduit with the main conductors to all points, including all luminaires and switches

throughout the installation.

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

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

The wiring shall be done in PVC insulated 600/1000 V grade cable to SABS 150.

Where cable ends connect onto switches, luminaires 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.

13. SWITCHES AND SOCKET OUTLETS

All switches and switch-socket outlet combination units shall conform to the Department Quality Specifications which form part of this specification.

No other than 16A 3 pin sockets are to be used, unless other special purpose types are distinctly specified or shown on the drawings.

All light switches shall be installed at 1,4m above finished floor level and all socket outlets as directed in the Schedule of Fittings which forms part of this specification or alternatively the height of socket outlets may be indicated on the drawings.

14. SWITCHGEAR

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

For uniform appearance of switchboards, only one approved make of each of the different classes of switchgear mentioned in the Quality Specifications shall be used throughout the installations.

15. SWITCHBOARDS

All boards shall be in accordance with the types as specified, be constructed according to the detail or type drawings and must be approved by the Department before installation.

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

Any construction or standard type aboard proposed as an alternative to that specified, must have the prior approval of the Department.

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

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

16. WORKMANSHIP AND STAFF

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

The workmanship shall be of the highest grade and to the satisfaction of the Department.

All inferior work shall, on indication by the Department's inspecting officers, immediately be removed and rectified by and at the expense of the Contractor.

17. CERTIFICATE OF COMPLIANCE

On completion of the service, a certificate of compliance must be issued to the Department's Representative/Agent in terms of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).

18. EARTHING OF INSTALLATION

A. Main earthing

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

Where required an earth mat shall be provided, the minimum size, unless otherwise specified, being 1,0m x 1,0m and consisting of 4mm diameter hard-drawn bare copper wires at 250mm centres, brazed at all intersections.

Alternatively, or additionally, earth rods or trench earths may be required as specified or directed by the Department's authorised representative.

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

Connection from the main earth bar on the main board must be made to the cold water main, the incoming service earth conductor, if any and the earth mat or other

local electrode by means of 12mm x 1,60 mm solid copper strapping or 16 mm² stranded (not solid) bare copper wire or such conductor as the Department's representative may direct. Main earth copper strapping where installed below 3m from ground level, must be run in 20 mm diameter conduit securely fixed to the walls.

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

B. Roofs, gutters and down pipes

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

C. Sub-distribution boards

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

D. Sub-circuits

The earth conductors of fall sub-circuits shall be connected to the earth busbar in the supply board in accordance with SABS 0142.

E. Ring Mains

Common earth conductors may be used where various circuits are installed in the same wire way in accordance with SABS 0142. In such instances the sizes of earth conductors shall be equivalent to that of the largest current carrying conductor installed in the wire way, alternatively the size of the conductor shall be as directed by the Engineer. Earth conductors for individual circuits branching from the ring main shall by connected to the common earth conductor with T-ferrules or soldered. The common earth shall not be broken.

F. Non-metallic Conduit

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

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

G. Flexible Conduit

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

H. Connection

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

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

19. MOUNTING AND POSITIONING OF LUMINAIRES

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

The lay-out of the luminaires as indicated on the drawings must be adhered to as far as possible and must be confirmed with the Department's representative.

Fluorescent luminaires installed against concrete ceilings shall be screwed to the outlet boxes and in addition 2 x 6mm expansion or other approved type fixing bolts are to be provided. The bolts are to be ¾ of the length of the luminaires apart.

Fluorescent luminaires to be mounted on board ceilings shall be secured by means of two 40mm x No. 10 round head screws and washers. The luminaires shall also be bonded to the circuit conduit by means of locknuts and brass bushes. The fixing screws are to be placed ¾ of the length of the fitting apart.

Earth conductors must be drawn in with the circuit wiring and connected to the earthing terminal of all fluorescent luminaires as well as other luminaires exposed to the weather in accordance with the "Wiring Code".

Incandescent luminaires are to be screwed directly to outlet boxes in concrete slabs. Against board ceilings the luminaires shall be secured to the brandering or joists by means of two 40mm x No. 8 round head screws.

PART 2: INSTALLATION DETAILS

1. CABLE SLEEVE PIPES

1.1 Where cables cross under roadways, other services and where cables enter building, the cables shall be installed in ribbed, flexible, 100 ø high density polyethylene pipes.

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

2. NOTICES

The Contractor shall issue all notices and make the necessary arrangements with Supply Authorities, the Postmaster-General, SA Transport Services, Provincial or National Road Authorities and other authorities as may be required with respect to the installation.

3. ELECTRICAL EQUIPMENT

All equipment and fittings supplied must be in accordance with the attached quality specification (Part 3 of this document), suitable for the relevant supply voltage, and frequency and must be approved by the Department's representative.

4. DRAWINGS

4.1. The drawings generally show the scope and extent of the proposed work and shall not be held as showing every minute detail of the work to be executed.

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

5. BALANCING OF LOAD

5.1. The Contractor is required to balance the load as equally as possible over the multiphase supply, at each distribution board and at the main low tension switchboard.

5.2. Test readings are to be submitted in writing to the Department's Representative for their comments and approval.

6. SERVICE CONDITIONS

All plant shall be designed for the climatic conditions as pertaining to the service.

7. SWITCHES AND SOCKET OUTLETS

The installation of switches and socket outlets must conform to clause 13 of Part 1 of this specification.

8. LIGHT FITTINGS AND LAMPS

8.1. The installation and mounting of luminaries must conform to clause 19 of Part 1 of this specification.

8.2. All fittings to be supplied by the Contractor shall have the approval of the Department. Incandescent lamps shall bear the approved mark of the S.A.B.S. and shall have the British light centre length.

8.3. The light fittings must be of the type specified in the Schedule of Luminaires – Clause 37.

9. EARTHING AND BONDING

The Contractor will be responsible for all earthing and bonding of the building and installation. The earthing and bonding is to be carried out strictly as described in clause 18 of Part 1 of this specification and to the satisfaction of the Department's representative.

10. MAINTENANCE OF ELECTRICAL SUPPLY

All interruptions of the electrical supply that may be necessary for the execution of the work, and subsequent repair and maintenance will be subject to prior arrangement between the Contractor and the user Department and the Department's representative.

11. EXTENT OF WORK

11.1. The work covered by this contract comprises the complete electrical installation and handing over in working order, as shown on the drawings and as per this specification, including the supply and installation of all fittings and also the installation of such equipment supplied by the Department. The Contractor is also required to make application for the increased supply to the site, pay all charges and fees and liaise with Durban Municipality as required to facilitate the new supply of 500kVA at a centralised position.

11.2. The development comprises of a new CCTV Building and offices on this site.

11.3. The following electrical elements are to be carried out under this contract:

1 Liaise with the Durban Municipality regarding the upgrade of the power supply to the SAPS.
2 The supply and installation of a new main LV cable feed from the new upgraded power supply of 750A supplied by Durban Municipality i.e. two sites increased supply to existing SAP and a new supply to the new building.
3 The electrical installation in its entirety.
4 Power supply to the air conditioning and mechanical installation.
5 The main L.T. switchboard.
6 Lightning Protection and Earthing Installation (by Specialist sub Contractor).
7 Part B: Specialist 200kVA Diesel alternator installations (by specialist sub contractor)
8 Part C: Specialist 50kVA UPS Installations.(by specialist sub-contractor).
9 Part D: Specialist fire detection, smoke alarm installations (by specialist sub contractor).

The electrical Contractor shall liaise with the Main Contractor and carries out all the above work and installations in accordance with the agreed Works Programme.

11.4. Tenderers shall arrange to inspect the site and familiarise themselves with the conditions on site. Full allowance shall be made as no extras shall be entertained for ignorance of site installations and conditions and location.

12. ELECTRICAL INSTALLATION

12.1. Allow to work in close co-operation with the Main Contractor, provide all required information, materials and equipment to be built into the works as the work progresses.

12.2. Provide suitable supervision on site at all times. Institute quality control and ensure that all workmanship is first class.

12.3. The installation of the new supply is to be carefully co-ordinated with the supply authority (Durban Municipality), allow that this work is effected timeously so that permanent power is available to commission all plant and equipment prior to first delivery.

13. ELECTRICAL SUPPLY AND CONNECTION

13.1. The new supply will be at 400/230 volts 50 Hz of 750A capacity.

13.2. The Electrical Contractor must arrange in good time with the Municipality.

13.3. The Electrical Contractor will supply, install and connect the cable from the new Municipal supply point to the new main LT switchboard in the Court. The cable and earth wire are shown on drawing and measured in the Bills of Quantities.

14. MAIN LOW TENSION SWITCHBOARD

Supply and install the new Main L.T. switchboard in the position as shown on drawings. The switchboard shall be the totally enclosed, accessible unit constructed in accordance with the Department's Technical Specification, equipped as shown on drawings complete with Emergency Standby and Uninterrupted Power Supply Sections, fully labelled as shown on the Single line diagrams. The contractor must work in relation to the single line diagrams and main schematic in the installation of the two main panels and the distribution board layouts.

15. STANDBY EMERGENCY PLANT

15.1. A 200kVA 0.85P.F. outdoor type standby diesel generating set installation complete with sensing output supply panel and battery charging circuitry will be supplied and installed by a specialist Contractor under this contract. This generator will be installed in a room provided as shown on the drawing and it will also be fully ventilated.

15.2. The sound attenuation of the outdoor unit shall comply with Municipal noise criteria for residential areas and the levels specified in this specification and shall be carried out under this Contract.

15.3. The Electrical Contractor shall supply, install, connect and test the cable and earth wire to the Standby Diesel Unit, complete with the reference cable interconnecting the main changeover panel, mounted on the generator

15.4. The respective cables are shown on the single line diagrams, site drawings and measured in the Bills of Quantities.

16. UN-INTERRUPTED POWER SUPPLY UNIT (U.P.S.)

16.1. A 50kVA U.P.S. unit will be supplied and installed by a Specialist under this contract as follows:

16.2. Allow inter-connecting the systems and the U.P.S. sections of the Main UPS Switchboard as shown on the single line diagram, and measured in the Bills of Quantities. The UPS unit ideally to be located in the server room

16.3. Batteries shall be maintenance free, rated for 30, 0 min at full load, supplied with proprietary stand and guaranteed for 5 years.

17. CABLES

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

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

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

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

17.5. In the trenches, the cable shall be laid on a 75mm thick bed of earth and be covered with a 150mm layer of earth before the trench is filled in.

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

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

17.8. On each completed section of the laid and jointed cable, the insulation resistance shall be tested to approval with an approved "Megger" type instrument of not less than 2000V for low tension cables.

17.9. Earth continuity conductors are to be run with all underground cables constituting part of a low tension distribution system. Such continuity conductors are to be stranded bare copper of a cross-sectional area equal to at least half that of one live conductor of the cable, but shall not be less than 4mm² or more than 70mm². A

single earth wire may be used as earth continuity conductor for two or more cables run together, branch earth wires being brazed on where required.

18. POWER TELEPHONE AND DATA TRUNKING

18.1. The Contractor shall be responsible for the supply and installation of the P8000 trunking complete with cover plate corner pieces, end pieces, junction pieces and termination pieces to the respective switchboard, telephone board and data board. All as shown and indicated on drawing.

18.2. The P8000 trunking must comply with SABS 1197. The Contractor must ensure that the trunking is installed to the satisfaction of the Department's representative before commencing with wiring of the trunking.

18.3. The respective trunking from the main switchboard, sub main switchboards, telephone distribution board and data distribution board have been shown on drawing. In those cases where the respective trunkings are to be routed in roof void spaces, they shall be secured to the roof trusses and terminated at the respective electrical, telephone and data boards. The trunkings shall be installed level and parallel/right angles to the roof trusses. No sharp right-angle bends shall be allowed. Corners shall be 45° + 45° protected bends complete.

In those cases where the trunkings are suspended in ceiling voids below the first floor slab, they shall be suspended from the slab by means of suspension rods.

19. TELEPHONE INSTALLATION

Allow to supply and install telephone/data conduits linking the various draw boxes to the telephone points all as called for and indicated on drawing. The conduits for telephone points shall all be fitted with galvanised steel draw wires. The installation of telephone and data cables shall be carried out By Others.

20. DATA INSTALLATION

20.1. Data cabling and boards shall be installed.

20.2. Allow to supply and install data conduits linking the various draw boxes to the telephone points as called for and indicated on drawing. The conduits for data points shall all be fitted with galvanised steel draw wires. The installation of telephone and data cables shall be carried out By Others

21. CONDUIT AND WIRING

21.1. Conduit and conduit accessories shall be black enamelled/galvanised screwed conduit or black enamelled/galvanised plain end conduit in accordance with SABS 162, 763 and 1007 respectively.

21.2. All conduits, regardless of the system employed, shall be installed strictly as described in the applicable paragraphs of clauses 4 to 8 of Part 1 of the specification. Wiring of the installation shall be carried out as directed in clause 9 part 1 of this specification.

21.3. Where plain end conduit is offered, all switches and light fittings must be supplied with a permanent earth terminal for the connection of the earth wire.

21.4. Lugs held by switch fixing screws or self tapping screws will not be acceptable.

22. LIGHTING INSTALLATION

22.1. The Electrical Contractor shall refer to the drawings for the project whereon the lighting layouts have been shown.

22.2. Lighting outlets are shown having letters which form the key to luminaire types to be installed at each outlet.

22.3. For recessed mounted luminaries at each outlet, allow to terminate the conduit and wiring in a 5 amp socket outlet mounted in a 100 x 50 extension surface mounted box, in the roof void adjacent to the luminaires.

22.4. Allow to install, connect and test the luminaries detailed in this specification and as shown on drawing.

22.5. All recessed luminaries shall be supplied with a 3 metre cabtyre flexible cord complete with a 5 ampere plugtop.

22.6. Provide annular rings of tempered masonite for all recessed mounted downlighters (fluorescent or incandescent) to be placed behind the ceiling material to protect the ceiling from the springs securing the luminaire.

22.7. The complete luminaries inclusive of fluorescent lamps, control gear and lamp holders shall be guaranteed for a period of twelve (12) months from date of handover (incandescent lamps excluded).

22.8. A Schedule of luminaries is provided.

23. LIGHTING SWITCHES

23.1. Supply, install, connect and test lighting switches wherever shown on drawings; the switches shall be similar to 20 Ampere "Classic Range" equal and approved manufacture and 0.5 PF rating; where surface installation is required they shall be of the industrial galvanised metal clad type: Where flush mounted they shall be set into pressed metal boxes with overlapping pressed metal cover plates to the Architect's choice. Provide similar boxes and conduit for AC unit switches and fan heater isolators.

23.2. Light and AC unit switches to be mounted 1350mm to the centre of the box from F.F.L. or as otherwise instructed on site to suit the existing installation.

23.3. Where mounted in partition walling, they shall be the mullion type complete with metal cover plate to Architect's choice.

23.4. The luminaries and area lighting situated outside shall be switched by a Photocell unit set to switch in, when the ambient illuminance falls to approximately 35 lux and to switch off when the ambient illuminance rises to approximately 70 lux. The photo cell switches shall embody time delay circuiting to obviate cyclic switching in changeable weather conditions. The photo cell unit shall switch the respective lighting contactors circuits which in turn switch on the outdoor luminaire.

23.5 The light switches for the cells and cell yards shall be installed in the passage and shall be of the watertight rotatable type. The switches for the cells shall be two way switches to allow for the switching of the night lights.

24. POWER TRUNKING

24.1. Supply and install ± 200mm x 100mm channels under the floor with covers which will be used for the installation of the power comm. installation as shown on

drawing. The channel shall be complete with all junctions, corner pieces, end caps etc. for power, telephone and data services.

24.2. Allow to terminate the respective conduits to the draw boxes in the brickwork behind the power skirting, linking the power skirtings. The respective channels are to have grommetted cut-outs at link boxes, where indicated on drawing, to facilitate the drawing in of electrical and communication wiring.

24.3. The various circuits, comprising of standard SSO, clean line SSO, data, telecoms and security are routed via conduits and vertical trunkings to the main trunking and DBS.

24.4. Supply and install 250mm or appropriate blank cover plates where channels passes through walls and partitions.

24.5. Co-ordinate with the Main Contractor, to ensure that all levels are correct, thereafter install the power skirting in a neat and level manner. Allow for the removal and replacement of the channels to permit work by telephone and data sub-contractors.

24.6. Allow for the bonding of each section of channels with a 4mm earth wire and for this earth wire to be terminated in the earth bar at the distribution board.

24.7. All wiring within the power skirting is to be strapped in an approved manner and no excessive slack is to be allowed in the skirting.

25. SINGLE PHASE SWITCHED SOCKET OUTLET

25.1. The switched socket outlets shall be of the standard round three pin, shuttered type, rated at 16A/250V and shall comply with SABS 164 – 1992 as amended and shall bear the SABS mark.

25.2. The plastic insulation around each pin socket shall be raised to protrude through the cover plate which shall be punched with three separate holes for the three pin sockets. The cover plates fed from normal mains power shall be white.

25.3. The terminal screws of the live and neutral sockets shall be recessed so that inadvertent contact with the earth conductor will be impossible when the wired switched socket outlet is pushed back into the wall mounted conduit box during installation.

25.4. The switched socket outlet shall be controlled by means of a white piano type lever which matches those of the light switches.

25.5. The switched socket outlets fed off diesel generator power shall have a "D" shaped earth pin and the plastic insulation around each pin socket shall be red. The cover plates for those switched socket outlets with "D" shaped earth pins, mounted in conduit boxes shall also be red.

25.6. The switched socket outlets fed off UPS power shall have an angled shaved earth pin and the plastic insulation around each pin socket shall be blue. The cover plates on those UPS fed switched socket outlets installed in conduit boxes shall also be blue.

26. GEYSERS

The electrical contractor shall supply and install power supplies to geysers supplied and installed by others.

27. MECHANICAL INSTALLATIONS

27.1. All of the offices are to be air conditioned all of which will be the responsibility of the Air Conditioning Sub-contractor.

27.2. Allow to supply and install the distribution boards for the AC units as well as local isolators or external weatherproof isolators (single phase or three phases) as shown on drawings and the circuitry wiring terminated in the respective board isolators.

27.3. Note that the wiring from the distribution board to the air conditioning isolators shall be routed via conduits or cables as indicated on the relevant drawings. The final connection from the respective isolators to the air conditioning unit and equipment shall be carried out by the Air Conditioning Sub-Contractor.

28. FRESH AIR AND EXTRACT FAN INSTALLTIONS

Allow to supply, wire via the P8000 unistrut, install, connect and test the respective isolators for fans in the roof void as shown on drawing. The final connections to the fans shall be carried out by the Air Conditioning Sub-Contractor.

29. LIGHTNING AND EARTHING INSTALLATION

Employ a Specialist Lightning and Earthing Installation Contractor who shall supply and install all the required conductors and earthing rods required in accordance with SABS 0142. The specialist shall test all earth circuits and provide resistance readings and certificates.

30. FIRE DETECTION INSTALLATION

30.1. Allow to supply and install a system of conduits and outlet boxes (100 x 50mm) as called for and indicated on the fire detection and alarm installation drawings included with the Electrical Drawings.

30.2. The Electrical Contractor shall work in close co-operation with the Fire Detection Sub-Contractor installing the conduits and outlet boxes to their approval.

30.3. Supply and install galvanised steel draw wires in the conduits.

31. SCHEDULE OF DISTRIBUTION BOARDS

In addition to clause 14 and 15 of Part 1 of this Specification the following shall also be applied to switchboards required for this service.

The Contractor shall supply and install the fully equipped distribution switchboards as indicated in the Switchboard single line diagrams and drawings. All distribution switchboard shall comply with the quality specification in Part 3 of this specification and be approved by the Department's representative.

The following types of switchboards are required for this service; scheduled as follows:

1	Incoming Supply	Upgrade to 500kVA required from Municipality Allow for connection fee
3.1	Main L.T. Switchboard at the New CCTV Building	MAIN LT SWITCHBOARD, Floor standing board complete with front access panels. The switchboard is fully inclusive of normal power section/essential.
3.2	Main Emergency L.T. Switchboard	200 KVA with an Automatic Changeover Switch
4	50kVA UPS	Main UPS Switchboard 3 phase with 30min backup and sub –distribution boards
5	Sub Main Distribution Switchboards	
5.1		DB A/DB A -UPS Recessed board with doors. The board incorporating the normal supply section and the UPS supply section.
5.2		DB B/ DB B- UPS Recessed board with doors The board incorporating the normal supply and the UPS supply section.
5.3		DB-C /DB-C UPS Recessed sub board with doors The board incorporating the normal supply section and emergency section.
5.4		DB-D Recessed sub board with doors The board incorporating the normal supply section/emergency section
5.5		DB-E Recessed board with doors. The board incorporating the normal supply section/ emergency section
5.6		DB-F Recessed board with doors The board incorporating the normal supply /emergency section.
5.7		Kiosk 1 Weatherproof kiosk The board incorporating a normal/ emergency section.
5.8		Kiosk 2 Weatherproof kiosk The board incorporating a normal/ emergency section
5.9		Exterior Lighting DB on the LT Board

32. DISTRIBUTION BOARDS AND CIRCUITRY

The Electrical Contractor shall refer to the switchboard single line diagrams/ drawing and main line schematic whereon the respective switchboards have been detailed complete with equipment circuitry wiring, circuit breakers, earth leakage units, isolators and fault levels etc.

The circuitry tie up with the respective lighting, power, geysers, fume cupboards, air conditioning circuits etc as indicated on the layout drawings.

33. SCHEDULE OF CABLES CONDUIT AND WIRING

Supply, install, connect and test the following cables, trunkings, conduit and wiring:

From	To	Size and Type
Eskom Mini substation – 500kVA	Main LV Switchboard	3 x 150mm² 4-core PVC cable and 3 x150mm² earth wire in 2 x 160mm underground sleeves
Main L.T. Room SAPS & Generator	Main LV Switchboard/Emergency	Internal wiring and cabling
L.T. Room & Diesel Gen Set (CCTV Room)	Main L.T. Board and AMF Panel	2 X 150mm² 4 core PVC cable and 2 x 95mm² earth in underground sleeve 2 x 110mm
Main LV DB	DB-A	16mm² 4 core PVC cable and 10mm² earth in underground sleeve.
Main UPS DB	DB-VA (U)	25mm² 4 core PVC cable and 16mm² earth in underground sleeve.
Main LV BD	DB-B	25mm² 4 core PVC cable and 16mm² earth in underground sleeve
Main Emerg Sw BD	DB-VB(U)	16mm² 4 core PVC cable and 10mm² earth in underground sleeve
Main LV BD	DB-C	16mm² 4 core PVC cable and 10mm² earth in underground sleeve
Main UPS Sw Bd	DB-C (U)	4mm² 2 core PVC cable and 2.5mm² insulated isolated earth in sleeve
Main LV BD	DB-E	25mm² 2 core PVC cable and 10mm² earth in underground sleeve
Main LV BD	DB-F	16mm² 2 core PVC cable and 6mm² earth in underground sleeve
Main LV BD	DB-D	16mm² 2 core PVC cable and 6mm² earth in underground sleeve
Kiosk 1	Lighting	6mm² 2 core PVC cable and 4mm² earth in sleeves
Kiosk 2	Lighting	6mm² 2 core PVC cable and 4mm² earth in sleeves

Lighting Switchboard on LV Panel		4mm² 2 core PVC cable with earth in conduit (Wall Fittings) 6mm² 2 core PVC cable and earth in sleeve (Pole Fittings)

34. SCHEDULE OF LUMINAIRES

(to comply with THE DEPARTMENTS QUALITY SPECIFICATION: Part 3)

All fluorescent luminaries listed below to be fitted with electronic control gear; all luminaries to be approved by the architect and engineer and samples to be provided before purchase.

Type A - 1200mm x 600 x 3 lamp x 36W recessed low brightness luminaire fitted with 3m x 2.5mm sq cabtyre and 5A plug top.

Type B - 2 x 58 W 1500mm fluorescent light fitting vandal proof dust proof with diffusers

Type C - Dust, moisture and corrosion proof light fitting Type ICM/INV/DMC/236/S-IP65 complete with lamps or other approved.

Type D - Recessed down lighter fitted with 13W PL Lamp, 3 x 2.5mm e.g. cabtyre and 5Amp plug top

Type E – Bulkhead Fitting with Internal Eyelid and Decorative Skirt with 2 x 36W CCFL Lamps

Type F - Bollard luminaries fitted with 26W PL Lamps and 1m pole.

Type G - BekaLane Post top luminaries with 2 x 26W PL Lamps and 3m GRP pole.

Type H - BekaTorch LED 22W buried version complete with drives and base plate on a 1m Pole.

35. BONDING TRAYS, JUNCTION AND DRAW BOXES

35.1. All junction, trays, draw boxes, etc., must be accessible approved and generally not exposed in finished spaces and clear of other trades. Where necessary, re-route conduits or make other arrangements for concealment as approved. Support tray, junction and draw boxes independently to building structure with no weight bearing on boxes, trays, conduits etc.

35.2. All junction, trays, draw boxes, etc., must be accessible approved and generally not exposed in finished spaces and clear of other trades. Where necessary, re-route conduits or make other arrangements for concealment as approved. Support tray, junction and draw boxes independently to building structure with no weight bearing on boxes, trays, conduits etc.

35.3. Where drawing in of wires not included under these specifications, provide draw boxes in horizontal conduit runs every 30 metres and in accordance with the Code of Practice.

35.4. Outlet boxes for light fittings recessed in hung ceilings shall be accessible through the opening created by the removal of the light fitting.

36. UNWIRED CONDUITS

Where unwired conduits and outlets are called for on drawings, these are to be installed and left complete with draw-wires and cover plates. All conduits for future extensions are to be sealed by means of couplings and plugs.

37. DRAWING SCHEDULE

The following drawings are attached to this tender document:

1) Lighting: EE/046725/L/01

2) Main Power: EE/046725//MP/01

3) Distribution Boards: EE/046725/DB/01

4) Smoke Alarms: EE/046725/SMK/01

5) Electrical Schematic of CCTV Building: EE/046725/DBSC1/01

6) Electrical Schematic Layout of Existing SAP: EE/046725/DBSC2/02

7) Electrical Schematic of Distribution Board Layout: EE/046725/DBSC3/03

8) Lightning Protection and Earthing Layout: EE/04725/LPE/01

9) Ntuzuma Municipality Substation Plan

PW 354

DEPARTMENT OF PUBLIC WORKS

NTUZUMA SAPS

PART A: GENERAL ELECTRICAL INSTALLATION

STANDARD

ELECTRICAL SPECIFICATIONS

SECTION A: PREAMBLE TO STANDARD SPECIFICATIONS

SECTION B: INSTALLATION SPECIFICATIONS

AUGUST 2004

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SECTION A

A.1 PRE-AMBLE TO STANDARD SPECIFICATION FOR ELECTRICAL INSTALLATIONS

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) Screwed metallic conduit - black enamelled and galvanised.

(b) Plain-end metallic conduit - black enamelled and galvanised.

(c) Non-metallic conduit.

(d) 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. Conduits may not touch pipes of other service

installations in order to prevent electrolytic corrosion. Where this is unavoidable, cathodic protection shall be provided.

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 be used in the wiring of buildings.

2.1.2 The installation shall comply with SANS 10142.

2.2 GALVANISED CONDUIT

Galvanised conduit and accessories shall be used in the following:

(a) In damp areas.
(b) In areas exposed to the weather.
(c) For all installations within 50 km of the coast.
(d) In plenum chambers containing humidifying equipment.
(e) For surface mounted conduit installations in kitchens and boiler rooms.
(f) In screeds resting directly on soil.
(g) For connection points to future installations.
(h) For underground conduit containing earthing conductors.
(I) In buildings where animals are housed such as cattle, sheep, dogs, etc.

2.3 TERMINATIONS

2.3.1 Spouted Connections.

Conduits shall be connected directly to draw-boxes with spouted connections. Conduits shall be screwed tightly home and no threads shall be visible.

2.3.2 Switchboards, Power skirting, etc.

Conduits shall be terminated by means of a brass female bush and two locknuts in pressed steel switchboards and distribution boxes, cable ducts, power skirting, etc. The conduit end shall only project far enough through the entry hole to accommodate the bush and locknut. Alternatively the method detailed in 2.3.3 may be used.

2.3.3 Draw-boxes.

A female bush and two locknuts shall be used to terminate conduits at draw-boxes and outlet boxes without spouts, should there be sufficient room in the box. Where there is insufficient room, a coupling, brass male bush and locknut may be used with sufficient allowance for the reduction of the internal diameter by the male bush.

2.3.4 Holes.

Holes to accommodate brass bushes shall be large enough to accommodate the bush with a minimum of clearance.

2.3.5 Bush-nuts.

Bush-nuts for the connection of earth conductors to conduits are not acceptable.

2.4 SCREWS, BOLTS AND NUTS

Steel locknuts of thick gauge steel with milled sides shall be used in all cases. Cadmium-plated bolts and nuts shall be used except where the installation is exposed to the weather in which case brass bolts and

nuts shall be used. Screws shall be installed in all tapped holes in fittings and accessories to prevent damage to the screw thread by concrete or plaster. The screws shall be screwed completely down to prevent damage to the thread on the screw.

2.5 CONDUIT ENDS

Conduit ends shall be cut at right angles to ensure that ends butt squarely at joints. Threads shall not be visible at joints and connections except at running joints. The total length of the thread on the two conduit ends shall not exceed the length of the coupling.

2.6 JOINTS

All conduit ends shall be reamed and all joints tightly screwed. Only approved couplings shall be used. Running joints with long threads shall be kept to a minimum and locknuts shall be provided to ensure a strong mechanical and a continuous electrical joint. Running joints in screwed conduit are to be avoided as far as possible and all conduit systems shall be set or bent to the required angles. The use of normal bends must be kept to a minimum with exception of larger diameter conduits where the use of such bends is essential.

2.7 FINISH

All joints shall be painted with red lead to prevent them from rusting in damp areas, areas within 50 km of the coast and in cases where the installation is exposed to the weather for any length of time. Where the galvanising or black paint has been damaged, the area shall first be cleaned and a coat of zinc base paint applied subsequently. Additional coats of paint shall only be applied after the undercoat has completely dried. All surface mounted non-galvanised metallic conduit must be painted. (Refer to par. 8.8 of Section B1).

2.8 CONTINUITY

Mechanical and electrical continuity shall be maintained throughout the conduit installation.

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 be installed subject to the following additional conditions:

3.1 Bending and setting of plain-end conduit must be done with special benders and apparatus manufactured for this purpose and which are obtainable from the suppliers of the system. Damaged conduit resulting from the use of incorrect bending apparatus shall be completely removed and any wiring already drawn into such damaged conduits shall be completely renewed at the Contractor's expense.

3.2 Screwed conduit must be used in the following instances:

(a) In flameproof installations.
(b) Load bearing conduit.
(c) For the suspension of luminaries.
(d) Surface mounted conduit.

3.3 Plain-end conduit and associated accessories shall be manufactured of mild steel having a minimum thickness of 1,2 mm and shall comply with SANS 1065. Conduit manufactured of lighter gauge material, i.e. 0,97 mm, will not be permitted.

3.4 All conduit and accessories used in areas within 50 km of the coast shall be hot-dip galvanised to SANS 32 & 121. In inland areas Electro-galvanised or cadmium-plated accessories will be accepted.

4. NON-METALLIC CONDUIT

4.1 INSTALLATION CONDITIONS

Where specified for a particular service, non-metallic conduit may 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 a building (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.

(g) In concrete slab unless specified to the contrary.

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

9.4 GALVANISED CONDUIT

Galvanised conduit shall be installed at all free ends intended for future extensions. The conduit shall be treated with a paint, which will prevent corrosion and white rust.

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 or PVC. 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 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 : 8OOmm

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 metal 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 "T" 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. FLUORESCENT LUMINAIRES FIXED TO CONCRETE SLABS

Fluorescent 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, fluorescent 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. FLUORESCENT 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 fluorescent 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 fluorescent 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 B14

B.14 OVERHEAD ELECTRICAL TRANSMISSION LINES

1 GENERAL

1.1 This section covers the supply, delivery, erection and commissioning of overhead transmission lines up to 22 kV on wooden poles.

1.2 An overhead line shall comprise the wooden poles, cross-arms, stays, conductors, insulators, isolators, fuse-links, transformers, lightning arrestors and any other auxiliary equipment specified.

1.3 All materials and fittings used shall be new and of high quality.

1.4 Overhead lines shall be erected in accordance with the "CODE OF PRACTICE FOR OVERHEAD POWER LINES FOR CONDITIONS PREVAILING IN SOUTH AFRICA", issued by the S.A. Institute of Electrical Engineers.

2. STATUTORY REQUIREMENTS

2.1 Occupational Health and Safety act. (1993) Act 85 of 1993 and subsequent amendments and regulations issued thereunder.

2.2 The Post Office Act, No. 44 of 1958 and the Postmaster General's Requirements issued in terms of that Act.

2.3 The Mines and Works Act, No. 27 of 1956 and subsequent amendments and regulations issued thereunder.

2.4 The Electricity Act, (1994) Act 41 of 1984.

2.5 The Fencing Act, No. 31 of 1963.

2.6 The Forest Act, Article 34 of Act No. 72 of 1968.

2.7 The Advertising on Roads and Ribbon Development Act, No. 21 of 1940 and No. 16 of 1962.

2.8 The Air Navigation Regulations promulgated in terms of the Aviation Act, No. 74 of 1962.

2.9 Explosives Act, No. 26 of 1956.

2.10 The South African Transport Services Safety Regulations.

3. RELEVANT SANS SPECIFICATIONS

3.1 SANS 182 : Conductors for overhead electrical transmission lines.

PART3 : Aluminium Conductors, Steel Reinforced.

3.2 SANS 60383 : Ceramic and glass insulators for overhead lines of nominal voltage greater than 1000V.

3.3 SANS 61284 : Non-current-carrying line fittings for overhead power lines.

3.4 SANS 753 : Wooden power transmission poles and cross-arms.

3.5 SANS 470 : Concrete poles for telegraph, telephone, power and lighting purposes (reinforced and prestressed types).

3.6 SANS 61643 : Low voltage lightning arresters.

4. STANDARD DEPARTMENTAL SPECIFICATIONS

4.1 INSULATORS AND FITTINGS FOR OVERHEAD LINES, Section C38.

4.2 DISTRIBUTION TRANSFORMERS, Section C36.

4.3 INSTALLATION OF CABLES, par.3.13, Section B6.

4.4 EARTHING, Section B11.

5. NOTICES AND PRECAUTIONS

5.1 The Contractor shall issue all notices and make the necessary arrangements with Supply Authorities, the Postmaster-General (TELKOM), Transnet, S.A. Transport Services, Provincial or National Road Authorities and other authorities as may be required with respect to the installation of overhead lines.

5.2 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 are not endangered.

5.3 The Contractor shall acquaint himself with the position of all existing services and infrastructure prior to commencing the installation.

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

6. PEGGING THE ROUTE

6.1 The Contractor shall peg out the route for the overhead line but shall maintain close liaison with the Department's representative.

6.2 Should the proposed position of poles appear unsatisfactory due to obstructions, poor soil conditions, rock, etc., the Department's representative shall be consulted and a ruling obtained.

6.3 The Department reserves the right to alter the line route at any time prior to the installation of the overhead wires. Payment in respect of any additional or wasted work involved shall be at the documented rates.

6.4 The removal of obstructions along the route shall be subject to the approval of the Department.

7. LINE IMPULSE LEVEL

The line Basic Impulse Level (B.I.L.) shall be maintained at the full voltage, namely:

Line Voltage (kV)	Impulse Voltage withstand level (kV)
Up to 6,6	75
11	95
22	150

8. LINE CONFIGURATION

8.1 Lines shall generally be configured as indicated in the drawings included in this specification, Fig. B14.1 - B14.7.

8.2 Alternate arrangements shall be submitted to the Department for approval.

9. POLES

9.1 The line configuration and support structure shall be suitable for the proposed route. Refer also to the Occupational Health and Safety Act.

9.2 Wooden poles shall normally be used and shall comply with SANS 753, Group strength "A" and shall bear the SANS mark of approval.

9.3 Preservatives of the poles shall comply with the requirements for Type AI of SANS 1290 and the impregnation shall be carried out in accordance with SANS 10005 using the empty-cell pressure process.

9.4 Poles shall be LOOP TENSION banded at both ends.

9.5 Concrete poles where specified shall comply with SANS 470 and the Detail Technical Specification.

9.6 If the spacing of poles is not more than 80m specified in the Detail Technical Specification, poles for 11 kV and 22 kV lines shall be spaced not more than 80m apart and poles for LV lines shall be spaced not more than 45m apart. The spacing of LV lines in suburban areas shall be arranged to suite the requirements of city blocks and street lighting.

9.7 All the poles shall be installed with the marking tags facing the roadside where applicable or shall face in the same direction where a road does not exist alongside the overhead line.

9.8 The pole minimum dimensions listed in the table below shall be used. Poles not complying with these dimensions shall be removed from site.

Length (m)	Minimum top dia (mm)
9,0	160
10,2	160
12,0	180
13,0	180
16,0	200

9.9 Templates shall be used for drilling holes required to fix cross-arms, brackets, insulators, etc. to the poles. After drilling, the holes shall be coated with a mixture of creosote and tar.

9.10 The poles shall be planted at the following minimum depths :

Length	Planting depth (m)
9,0	1,7
10,0	1,8
12,0	2,0
13,0	2,2
16,0	2,6

9.11 Kicking blocks shall be provided where ground with poor bearing qualities is encountered.

9.12 Poles shall be planted vertically plumb and in line and sufficiently stayed to maintain that position.

10. CROSS-ARMS

10.1 Cross-arms shall be of wood. Steel cross-arms shall only be used when clearly specified in the Detail Technical Specification. Wooden cross-arms are preferred due to their higher electrical resistance and better lightning performance of the line.

10.2 Steel cross-arms where specified shall be manufactured from standard steel sections complying with BS 4360.

10.3 Wooden cross-arms shall comply with SANS 753, Group Strength "A" and shall be straight in grain. Preservatives shall comply with par. 9.2. above. The minimum diameter of cross-arms shall be as follows:

Length (m)	Diameter (mm)	
	min.	Max.
2,4	140	160
3,0	140	160
3,6	160	185
4,5	160	185

10.4 Cross-arms shall be LOOP TENSION banded at both ends.

10.5 Tie straps shall be manufactured of mild steel to Grade 43 of BS 4360.

10.6 Cross-arms shall be long enough to accommodate the insulator spacing specified below.

10.7 Cross-arms and tie straps shall be bolted to poles using galvanised bolts, nuts and washers. Curved wood pole washers shall be fitted between bolt heads and the poles and between cross-arms and the poles. Back straps and U-bolts may be used to attach wooden cross-arms to the poles.

10.8 Curved wood pole washers shall be galvanised malleable cast iron or mild steel with a minimum thickness of 6 mm and shall have a minimum square outside dimension of 63 mm.

11. INSULATORS AND FITTINGS

11.1 Insulators shall be chosen to provide the mechanical strength and insulation level required by the line at every point in accordance with the Department's standard specification for "INSULATORS AND FITTINGS FOR OVERHEAD LINES", Section C38.

11.2 Insulators shall be spaced to provide the conductor clearance required.

11.3 Pin insulators and their pins complying with SANS 60383 shall be used in straight line intermediate positions only.

11.4 Disc insulators shall be used in all strain, tension or angle positions, Clevis-and-tongue or ball-and-socket type insulators complying with SANS 60383 shall be used. Disc insulators may be of glass or porcelain.

11.5 Curved wood pole washers shall be fitted between the collars of insulator pins and the cross-arm or pole and between the pin nut and the cross-arm or the pole, The washers shall comply with par. 10.8 above.

11.6 Insulator hooks shall be of an approved pattern and shall be manufactured from BS 4360 grade 43 mild steel or forged.

11.7 Terminating and yoke straps shall be manufactured from BS 4360 grade 43 steel or forged to a design approved by the Department.

11.8 All steel or ironwork i.e., fittings, cross-arms, bolts, nuts, washers, etc., shall be hot dip galvanised to SANS 32 & 121.

12. CONDUCTORS

12.1 Steel reinforced aluminium conductors to SANS 182, Part 3 shall be used for overhead lines. Should copper conductors be specified, they shall comply with SANS 182, Part 1. The cross-sectional area shall comply with the Detail Technical Specification.

12.2 The spacing between phase conductors shall be increased by 20 % over the spacing determined according to the formula in par. 4.7.5 of the "Code of Practice for Overhead Power times" to compensate for stay movement and other factors and to maintain the B.I.L. of par. 7 above.

The minimum conductor spacing are :

Pole Spacing (m)	SUPPLY VOLTAGE		
	Up to 6,6 kV	11 kV	22 kV
	CONDUCTOR SPACING (mm)		
60	575	635	790
70	635	700	850
80	700	750	910
90	750	810	975

12.3 Manufacturer's stringing and tensioning charts shall be used to erect conductors. Conductors shall not be tensioned to more than 25 % of the breaking strength of the conductor at -5,5"C with no wind.

12.4 Conductor running blocks shall be installed on all pole positions to run out the conductors. Conductors shall not be dragged along the ground. The three conductors shall be tensioned simultaneously using suitably rated chain-ratchet pullers and "come along" specially designed for the particular conductor.

12.5 The minimum conductor to ground clearances as stipulated in Occupational Health and Safety Act shall be closely observed. Allowance shall be made for conductor creepage and subsequent increased sag after a period.

12.6 Conductors shall be prestressed for not less than one hour before binding in.

12.7 Mid span joints shall be kept to a minimum and where unavoidable, shall be made with approved full tension line splices.

12.8 Conductor joints at non-tension points shall be made with two bolt parallel groove clamps of a type approved by the Department. The current carrying capacity of the clamps shall be at least equal to that of the conductor.

Non-oxidising conducting paste shall be liberally applied to the inside of these clamps.

12.9 Where aluminium to copper connections are made, suitable bimetal clamps shall be used.

13. CONDUCTOR TERMINATIONS

13.1 Cold compression, bolted snail clamps or preformed terminations shall be used. Suitable thimble clamps shall be used with the preformed terminations.

13.2 The conductor shall be bound in at pin insulators by a single stirrup and binding. A chafer tape of soft aluminium shall be wrapped around the conductor at the insulator contact area. The conductor shall be bound to the stirrup for a distance of 50mm on either side of the insulator. 5mm diameter hard drawn aluminium wire shall be used for binding.

13.3 Suitably sized preformed wrap lock ties with pads may be used as an alternative method to par. 13.2 above.

13.4 Trails and bridge wires must be neatly disposed and connected with clamps or line taps with a minimum of two per connection or by means of other approved mechanical connectors.

14. STAYS

14.1 The position of stays may or may not be indicated in the instructions for the service, but it is the responsibility of the Contractor to provide staying adequate to maintain correct tension of the line and the verticality of every pole in the line, with or without the additional use of kicking blocks as he may decide.

14.2 Wind stays must also be provided for straight lines in exposed positions. Struts shall not be used if this can be avoided by the use of aerial stays and pillar stays.

14.3 Stay wires shall be spliced and bound in, in the accepted manner. Approved preformed materials may also be used.

14.4 The angle between the stay and the pole must be between 35° and 45°. The stay must be made off on the pole, as near as practicable to the point of resultant stress, with one and a half complete turns around the pole, supported by a suitable clamp.

14.5 For terminal poles of vertical line arrangements, at least two stays shall be used to prevent deformation of the pole, with the stay plates buried at least 1,8 m apart.

14.6 Stay holes shall be vertical, not less than 1,5 m deep and no wider than necessary to accommodate the baseplate, with a narrow side channel cut to embed the rod at the correct angle.

The baseplate and portion of rod within the stay pole shall be firmly packed with hard material or concrete where necessary.

14.7 Stay pillars shall be concreted into the ground with top and bottom kicking blocks where required by the nature of the soil.

14.8 Porcelain stay insulators shall be installed in one stay wire as high as possible above ground level but far enough away from the structure to ensure that the portion of the stay below the insulator does not become alive.

14.9 Stay wire shall be of galvanised steel and the individual steel strands shall have a breaking stress of not less than 695 MPA and shall comply with BS 183 or SANS 182, Part 5. Stay wire make-offs shall be painted with bitumastic paint on completion.

14.10 Stay rods shall comply with BS Pattern 2 and shall be of circular section with tubular type turn buckles. Heavy duty construction, deep contoured type thimbles shall be used.

14.11 Galvanised steel stay plates shall be used.

14.12 Stay guards are required in the vicinity of public paths and roadways.

15. EARTHING OF STRUCTURES

15.1 Earthing requirements for service connections are specified in the Department's standard specification for "EARTHING", Section B11.

15.2 Protective overhead earth wires shall only be provided where specified in the Detail Technical Specification. In cases where overhead earth wires are specified, a low impedance earth as determined by the Basic Impulse Level of the line shall be provided at every pole along the line.

15.3 An earth connection is not required at every pole along a line with wooden poles and without overhead earth wires. Lines with metal poles shall be earthed at every pole.

15.4 Steelwork on wooden poles shall generally not be earthed except at structures for transformers, isolators, fuse-links, cable boxes, lightning arresters or other equipment which impairs the impulse flashover value of the insulation provided by the wooden structure.

15.5 All metalwork to be earthed, shall be bonded together with 1 mm² bare copper conductors. These common bonds shall be connected to a 35mm² bare stranded or solid copper earth down lead conductor.

15.6 The connection between the overhead conductors and lightning arrestors and between the arrestors and the earth down lead shall consist of bare copper conductors of not less than 25mm². The connecting leads shall have smooth bends and shall follow the shortest possible route.

15.7 The earth down lead conductor shall be stapled to the pole at intervals not exceeding 1m. Where atmospheric conditions are likely to cause galvanic action, staples shall be of non-ferrous metal and an earth clip used where possible.

15.8 The earth conductor shall be threaded through a black polyethylene sleeve for at least 2m above the ground.

15.9 The earth conductor shall not be installed in steel conduit nor shall the conductor be wrapped around the pole at any point since this will increase the reactance of the down lead.

15.10 A trench earth shall be installed at earthed structures carrying equipment such as transformers, fuse-links, lightning arresters, etc. extending 10 m on four sides of the structure in the form of a cross. The ends of the earth wires shall be bonded to four earth electrodes of at least 1,8m in length driven into the ground.

15.11 Intermediate earthing for overhead earth wires may consist of wrapping the earth wire 5 - 6 times around the pole below ground level.

15.12 The earth resistance shall be determined following the installation of the trench earth. Earth resistance values specified or required by protective devices shall be checked. The earth resistance values required to maintain the B.I.L. of the line as specified in par. 7 (assuming an average lightning current value of 25 kA), are as follows:

	Impulse Level (kV)	Earth Resistance (ohm)
Up to 6,6	75	3,0
11	95	3,8
22	150	6,0

15.13 Should the earth resistance be higher than specified or required, additional earthing shall be provided. Trench earths shall not exceed 50m. Proprietary clays may be used for soil treatment to improve the earth resistance.

16. EARTH WIRE ON LV SYSTEMS

16.1 Where specified, a continuous earth wire shall be installed along LV (up to 660 V) overhead lines in order to provide earth continuity between installations served by the line (ECC).

16.2 The earth wire shall be connected to every earth along the route in addition to the substation earth. Refer also to par. 4 of the Department's standard specification for "EARTHING", Section B11.

16.3 All metalwork and the top positions of stay wires shall be bonded to the earth wire.

16.4 The earth wire shall be above the conductors.

17. LIGHTNING ARRESTERS

17.1 Lightning arresters shall be of a type approved by the Department.

17.2 Lightning arresters shall be installed at all points where the steelwork has to be earthed and where specified.

17.3 The arresters shall be connected to the overhead conductors by 25mm² (minimum) copper conductors minimum and suitable parallel groove clamps.

17.4 Lightning arresters shall be placed on all the phase conductors at the following points in addition to those specified in the Detail Technical Specification :

(a) As near as possible to the transformer terminals on the transformer side of the fused protection where applicable.

(b) At each termination of a cable on the overhead line.

(c) At every line sectionaliser or recloser.

(d) At each connection point to secondary lines.

17.5 Lightning arresters shall be mounted below the overhead conductors in order to reduce the length of the discharge path.

17.6 An earth shall be supplied and installed at each point where lightning arresters are installed in accordance with par. 15 above.

18. FUSE-LINKS

18.1 Fuse-links shall be of a type approved by the Department.

18.2 Details of fixing methods and mounting shall be submitted to the Department for approval.

18.3 Fuse-links shall be installed at all transformers and where specified.

19. TRANSFORMER MOUNTINGS

19.1 Transformers shall comply with the Department's standard specification for "DISTRIBUTION TRANSFORMERS", Section C36.

19.2 Transformers with a maximum power rating of 25kVA may be mounted on a single pole with the mounting brackets as specified in SANS 780.

19.3 Transformers with a power rating in excess of 25kVA and with a maximum of 200kVA shall be mounted on a platform between two poles.

19.4 The transformer platform for pole mounting shall consist of galvanised steel channels bolted to the two poles. The platforms shall be manufactured and installed in accordance with fig. B14.5 and B14.6.

19.5 All steelwork as well as the bolts, nuts and washers shall be galvanised to SANS 32 & 121.

19.6 An earth wire shall be installed against each pole of the structure and must extend for at least 500mm above the poles. These earth wires shall be bonded across at the top of the poles to shield the transformer.

19.7 Earthing in accordance with par. 15 shall be provided.

20. SUBSTATION EARTH

Substation earths and earths at transformers along the route intended for earth continuity connections to installations served by the line, shall be provided in accordance with the Department's standard specification for "EARTHING", Section B11.

21. ANTI-CLIMBING DEVICES

21.1 Anti-climbing devices shall be fitted to all poles carrying transformers or mechanically operated fuses or switchgear.

21.2 Galvanised barbed wire wound around the poles for at least 1m at a height of 2m above ground may be employed for this purpose.

22. CRADLES

Where HV overhead lines cross roadways, railways and other supply lines, important communication lines and where an HV line is run above an LV line, an earthed cradle shall be installed. The longitudinal wires of the cradle shall not be less than 7,2mm² and the cross-lacing not less than 4mm².

23. DANGER NOTICES (LIGHTNING SIGN)

Danger notices with the wording "DANGER-GEVAAR-INGOZI" shall be fitted to all structures with transformers, mechanically operated switchgear and fuses.

24. EXCAVATIONS

24.1 Excavations for poles, stays and trench earths shall remain open for as short a period as possible. The Contractor shall erect and maintain guards, warning notices and lights at open excavations and soil heaps.

24.2 Excavations shall be classified 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 excavation.

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

24.3 After poles and stays have been planted, the holes shall be backfilled and well compacted. Compaction shall be executed in layers of not more than 300mm to obtain a high compaction density.

24.4 The following dimensions shall be used when calculating the cubic capacity of excavations:

(a) Pole holes: 1,2m x 0,6m x depth

(b) Stay holes: 1,2m x 0,6m x 1,8m

(c) Trench earths: 0,5m x 0,6m x length

24.5 Poles shall be installed in accordance with the Detail Technical Specification of the installation.

24.6 Poles shall not be installed in clayey soil or in swampy conditions without the necessary precautions to stabilise the installation.

24.7 If unsatisfactory conditions for the installation of poles and stays are encountered during the excavations, the Department shall be informed without delay in order to facilitate alteration of the foundation design or alteration of the route of the line.

24.8 Poles and stays shall be installed in undisturbed soil.

24.9 If wooden poles are installed in a concrete or other water retaining foundation, the pole shall protrude through the concrete to ensure adequate natural drainage to prevent rotting of the wooden pole in the foundation due to the accumulation of water between the pole and the foundation.

25. SAMPLES

Samples of equipment, materials and SANS Test Reports proposed for the installation shall be submitted to the Department on request.

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.

DEPARTMENT OF PUBLIC WORKS

NTUZUMA SAPS

PART A: GENERAL ELECTRICAL INSTALLATION

PART 3: SECTION C: QUALITY SPECIFICATIONS FOR MATERIAL AND EQUIPMENT OF ELECTRICAL INSTALLATIONS

C11 **UN-SWITCHED AND SWITCHED SOCKET-OUTLETS**

C12 **LUMINAIRES FOR INTERIOR AND EXTERIOR APPLICATIONS**

C17 **SWITCHBOARDS (UP TO 1 KV)**

C18 **LOW VOLTAGE DISTRIBUTION CUBICLES (KIOSKS)**

SECTION C1

CONDUIT AND CONDUIT ACCESSORIES

1. GENERAL

This section covers the requirements for conduit and conduit accessories for general installations under normal environmental conditions.

The type of conduit and accessories required for the service, i.e. whether the conduit and accessories shall be of the screwed type, plain-end type or of the non-metallic type and whether metallic conduit shall be black enamelled or galvanised, is specified in Part 2 of this specification. 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 SABS 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: SABS 1065 parts 1 and 2.
(b) Plain-end metallic conduit and accessories: SABS 1065 Parts 1 and 2.
(c) Non-metallic conduit and accessories: SABS 950

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

Only one manufacture of conduit and conduit accessories will be permitted throughout the installation.

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

2. SCREWED CONDUIT

2.1 Conduits shall comply with SABS 1065 and shall bear the SABS mark.

2.2 All conduits shall be heavy gauge, welded or solid drawn, hot-dip galvanised or black enamelled, screwed tube.

2.3 Galvanised conduit shall be hot-dipped inside and outside in accordance with SABS 763.

2.4 All conduit ends shall be reamed and threaded on both sides and delivered with a coupling at one end and a plastic cap on the other end.

3. METAL CONDUIT ACCESSORIES

All metal conduit accessories shall be of malleable cast iron or pressed steel with brass bushes in accordance with SABS 1065. Alloy or pressure cast metal accessories or zinc base alloy fittings are not acceptable. All fittings whether galvanised or black enamelled, shall be fitted with brass screws.

4. CIRCULAR TYPE BOXES

4.1 The boxes shall be of the long spout pattern, manufactured of malleable cast iron or pressed steel and stove enamelled jet black or galvanised as required. The two cover fixing holes shall be diametrically opposite each other, drilled and tapped at 50mm centres.

4.2 Junction, draw-in and inspection boxes shall be of adequate size and shall be supplied with heavy gauge metal cover plates.

4.3 Boxes shall comply with SABS 1065.

5. SWITCH BOXES AND SOCKET OUTLET BOXES

5.1 All switch boxes and socket outlet boxes shall be manufactured of pressed galvanised steel of at least 1mm thickness. All boxes shall be fitted with the necessary lugs to suit standard flush mounted switches and socket outlets manufactured in accordance with SABS 518 and SABS 1085.

5.2 Light switch boxes shall be 100 x 50 x 50mm with two 20mm knockouts on the sides, one 20mm knockout on the top, bottom, side and back.

5.3 Socket outlet boxes shall be 100 x 100 x 50mm with two 20mm knockouts each on the top, bottom, sides and back.

5.4 Switch and socket outlet cover plates shall comply with SABS 1084.

6. FLEXIBLE CONDUIT

Flexible steel conduit and adaptors shall comply with BS 731, part 1 where applicable. Flexible conduit shall be of galvanised steel construction and in damp areas of the plastic sheathed galvanised steel type. Flexible conduit shall only be used as specified and shall then be installed in accordance with par. 5.4.4 of SABS 0142.

7. PLAIN-END METALLIC CONDUIT

7.1 As an alternative to the threaded conduit, plain-end (unthreaded) metallic conduit with accessories may be used under the conditions stated in the Department's standard specification for "INSTALLATION AND TERMINATION OF CONDUITS AND CONDUIT ACCESSORIES", par. 3 of Section BI.

7.2 Unthreaded conduit shall be manufactured of mild steel with a minimum thickness of 1,2mm and shall comply with SABS 1007.

7.3 Bending and setting of conduit shall be done with the correct apparatus recommended by the manufacturer of the conduit.

7.4 The Contractor or Supplier shall be responsible for obtaining the approval of local authorities for the use of this system.

7.5 All conduit and accessories used in areas within 50 km of the coast shall be hot-dip galvanised to SABS 763. In inland areas electro-galvanised or cadmium-plated accessories will be accepted.

8. NON-METALLIC CONDUIT

Non-metallic conduit shall comply fully with SABS 950 and shall be installed in accordance with Appendix C of the same specification as well as the Department's standard

specification for "INSTALLATION AND TERMINATION OF CONDUITS AND CONDUIT ACCESSORIES", par. 4 of Section BI.

9. 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.

SECTION C2

WIRING CHANNELS, UNDERFLOOR DUCTING AND POWER SKIRTING

1. WIRING CHANNELS

1.1 General

1.1.1 The channels shall be manufactured of rolled sheet steel.

1.1.2 The minimum thickness of the sheet steel shall be:

(a) 1,6mm for ribbed channels with a maximum width of 42mm.

(b) 2,5mm for unribbed channels with a maximum width of 42mm.

(c) 1,2mm for channels with a width in excess of 42mm.

1.1.3 The channels shall be finished as follows:

(a)	In coastal areas (under all installation conditions)	Hot-dip galvanised to SABS 763 or epoxy powder coated
(b)	Cast in concrete	Pre-galvanised
(c)	False ceiling voids	Pre-galvanised
(d)	Vertical building ducts	Hot-dip galvanised to SABS 763 or epoxy powder coated
(e)	Surface mounted in plant rooms, substations, service tunnels, basements	Epoxy powder coated or electro-galvanised
(f)	Damp areas, exposed to weather, underground runs in contact with earth	Hot-dip galvanised to SABS 763 or epoxy powder coated
(g)	Undercover industrial applications	Hot-dip galvanised to SABS 763 or epoxy powder coated

1.1.4 The above-mentioned finishes shall apply unless specified to the contrary or approved by the Department. Hot-dip galvanised ducts shall be cold galvanised at all joints, sections that have been cut and at places where the galvanising has been damaged. Powder coated ducts shall likewise be touched up at joints, cuts and damaged portions using methods recommended by the manufacturer of the channels.

1.2 Cover Plates

1.2.1 All channels shall be supplied with cover plates,

1.2.2 Channels up to 127mm wide shall have snap-in cover plates of metal or PVC.

1.2.3 For channels wider than 127mm only metal cover plates shall be used.

1.2.4 The finish of steel cover plates shall be the same as the finish of the channels.

1.3 Accessories

All accessories i.e. hangers, brackets etc. shall be purpose made and in general have the same finish as the channels.

1.4 Wiring Supports

Wiring supports shall be provided in order to prevent the wires falling out when cover plates are removed.

2. UNDERFLOOR DUCTING

2.1 General

2.1.1 The ducting shall be manufactured of 2mm thick rolled sheet steel or rectangular tubing. Galvanised steel shall be used or shall be epoxy coated after manufacture.

2.2 Outlets

2.2.1 Outlets shall be provided on a modular basis in the ducting to accommodate pedestal or recessed socket units. Tapped holes shall be provided to fix the pedestal units to the ducting.

2.2.2 Draw boxes at junctions of perpendicular ducts shall have removable barriers for wiring and shall be provided with a heavy gauge cover plate.

2.3 Pedestals

2.3.1 Pedestals shall be manufactured of die-cast aluminium or pressed steel.

2.3.2 The finish of pedestals shall be epoxy powder coating of an approved colour.

3. POWER SKIRTING

3.1 General

3.1.1 The channel and cover shall be manufactured of 1mm thick rolled sheet steel.

3.1.2 The channel and cover shall be epoxy coated after manufacture.

3.2 Outlets

3.2.1 Outlets pre-punched on a modular basis shall be provided to accommodate socket outlets or future socket outlets.

3.2.2 In addition to standard lengths, covers of 250mm length shall be provided for installation on building module lines.

SECTION C4

PVC-INSULATED CABLES - 600/1 000 V GRADE

1. GENERAL

This section covers the requirements for PVC-insulated cables for general installations under normal environmental conditions.

2. CONSTRUCTION

2.1 Cables shall be manufactured in accordance with SABS 150, shall come only from fresh stocks, and shall be constructed as follows:

(a)	Unarmoured cables	PVC-insulated/PVC-sheathed
(b)	Armoured cables	PVC-insulated/PVC-bedded/ armoured/blacl extruded PVC outer sheath
(c)	Single core cables	PVC-insulated/unsheathed

2.2 The conductors shall be of high conductivity annealed stranded copper and the cores may be shaped or circular.

2.3 The insulation shall be general purpose PVC, 600/1 000V Grade.

2.4 The bedding shall consist of a continuous impermeable sheath of PVC extruded to fit the core or cores closely and in the case of multi-core cables, to fill the interstices between the cores.

2.5 Where armouring is specified it shall consist of one layer of galvanised steel wire in the case of multi-core cables and nonmagnetic metallic wire in the case of single core cables. Aluminium strip or tape armouring is not acceptable.

2.6 Where specified, an earth continuity conductor shall be provided in the armouring in accordance with SABS 150.

3. PVC-SHEATHED ALUMINIUM-COVERED CABLES

3.1 Aluminium-covered cables shall comprise PVC-insulated copper conductors protected by an aluminium foil tape screen and a PVC sheath.

3.2 Cable ends shall be made off with compression glands fitted with a neoprene ring to seal the end.

3.3 Aluminium sheathed cable shall be installed on surface only using matching saddles installed at suitable intervals to prevent sagging.

3.4 Where exposed to sunlight, the cable shall have a stabilised black outer sheath.

4. LENGTHS

Cable shall be manufactured and supplied in one length to the lengths specified unless these lengths exceed a standard drum length in which case a ruling shall be obtained from

the Department.

5. TESTS

At the option of the Department, acceptance tests shall be carried out on production runs of the cable in accordance with SABS 150

SECTION C5

GLANDS FOR PVC-INSULATED CABLES

1. Glands to be used for terminating PVC/PVC/SWA/PVC cables shall be of the adjustable type.

2. Glands shall be suitable for general purpose 600/1 000 V Grade cable with steel armouring.

3. The glands shall be made of nickel-plated cadmium plated or in coastal area bronze or brass.

4. The glands shall consist of a barrel carrying a cone bush screwed into one end and a nickel-plated brass nipple carrying a nickel-plated brass or a heavy galvanised steel locknut screwed into the other end. The galvanising shall comply with SABS 763.

5. Non-watertight glands must be easily converted to watertight glands by means of a waterproofing shroud and inner seal kit. On the cable entry side of the barrel a concave groove shall be provided to accommodate the top rim of the waterproofing shroud.

6. The shrouds shall be made of non-deteriorating neoprene or other synthetic rubber, and shall be resistant to water, oil and sunlight. The shrouds shall fit tightly around the glands and cable.

7. Glands shall be provided with ISO threads and shall be suitable for the specified cable sizes.

8. Flameproof glands shall comply with SABS 808, Groups 1, 2a and 2b.

9. Suitable accessories shall be provided with glands to be used on ECC armoured cables to facilitate a bolted lug connection of the earth continuity conductors. Grooves cut into the barrel or cone bush to accommodate the earth continuity conductors are not acceptable.

10. For unarmoured cables the cone bush and compression ring of the gland shall be replaced with a synthetic rubber compression bush and ring to provide the required grip on the outer sheath of the cable.

SECTION C6

CABLE TERMINATIONS AND JOINTS

1. HEAT-SHRINKABLE MATERIALS

1.1 General

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

1.1.2 The complete kit shall be packed in a container that is marked for the type of cable insulation and construction as well as the voltage range for which the materials are suitable.

1.1.3 An illustrated set of instructions for the installation of the materials shall accompany every kit.

1.1.4 The joints and terminations shall make minimal, if any, use of insulating or stress relieving tapes. The use of electrical stress control and insulating tubing that is heat-shrunk onto the termination or joint, is preferred above other methods.

1.1.5 The materials shall comply with VDE 0278 and the supplier shall be called upon to confirm this aspect before acceptance of the materials or installation.

1.1.6 The heat-shrinkable and other materials used for the terminations and joints shall be of a high quality and shall retain their electrical and mechanical properties without deterioration.

1.2 Terminations with Heat-Shrinkable Materials

1.2.1 Terminations shall be made of a material that gives lasting protection against ultraviolet radiation.

1.2.2 The cores of all cables terminated outdoors and the cores of 3,3 kV and higher voltage cables terminated indoors, shall be completely covered with a shrunk-on protective layer against surface tracking, ultraviolet radiation and weathering.

1.2.3 Outdoor terminations shall be designed to prevent flashover under wet or contaminated conditions and to ensure additional mechanical strength. This shall be achieved with shrunk-on insulating spacers and rain shields.

1.3 Joints with Heat-Shrinkable Materials

1.3.1 The electrical continuity of all the conductors, screens and armouring shall not be impaired by the joints and the earth continuity shall be accomplished within the joints, i.e. no external earth continuity conductor that will be subject to corrosion, is acceptable. The joints shall be completely covered by a watertight sheath to prevent corrosion.

1.3.2 In the case of joints in cables with an outer PVC anti-electrolysis sheath, the joints shall be

subject to the same electrical insulation test as the outer sheath of the cable.

2. RESIN FILLED JOINTS

2.1 The resin filled joint kit shall comprise a self sealing plastic mould of high mechanical strength having sufficient connector space.

2.2 The exact amount of cold hardening resin shall be provided in a two-compartment plastic bag.

2.3 The resin shall have absolute minimum shrinkage.

2.4 The mould and resin shall be completely waterproof and non-hygroscopic and shall be resistant to ultraviolet radiation.

2.5 Joint kits shall be of "SCOTCHCAST", "CELLPACK" or similar.

3. CABLE JOINTS BOX

3.1 Cable joint boxes shall be manufactured of die cast aluminium material for normal conditions or glass fibre reinforced thermosetting compound where exposed to corrosive conditions.

3.2 The lid shall provide an absolute moisture barrier.

3.3 Boxes shall contain 2, 3 or 4 entries as required.

3.4 Unused entries shall be sealed with watertight blanking plugs.

3.5 Earth continuity shall be maintained through the box by means of the material of the box in the case of aluminium boxes or by means of earth straps and studs in the case of glass fibre reinforced boxes.

SECTION C9

WIRING TERMINALS

1. Terminal bodies and screws shall be of non-corrosive metal, enclosed in fire resistant, moulded plastic insulating bodies. Terminal bodies or screws shall not project beyond the insulating material and shall afford suitable protection against accidental contact by personnel and against short circuits and tracking.

2. The construction of the terminal block and mounting rail shall be such as to ensure a firm and positive location of the terminal blocks. It shall be possible to add additional terminal blocks within the terminal sequence without having to disconnect or dismantle the terminal strip. The terminal blocks shall be held in position by means of standard end clamps.

3. It shall be possible to intermix terminals of various sizes, i.e. for different sizes of conductors, whilst utilising the same mounting rail. Where smaller terminal blocks occur adjacent to larger terminal blocks, suitable shielding barriers shall be inserted to cover the terminals that might otherwise be exposed.

4. The terminal bodies and clamping screws shall be so constructed as to ensure that conductors are not nicked or severed when the clamping screws are tightened. Screws shall not come in direct contact with the conductors.

5. Terminals shall be sized and rated to match the conductors that are connected to them.

6. Each terminal block shall have provision for clip-in numbering or labelling strips to be installed, together with protective, clear caps over the sheets.

SECTION C10

LIGHT SWITCHES

1. GENERAL

This section covers the requirements for switches for use in general installations under normal environmental conditions.

2. FLUSH AND SURFACE MOUNTED SWITCHES

2.1 All switches shall be suitable for mounting in 100 x 50 x 50mm boxes shall comply with SABS 163 and shall bear the SABS mark.

2.2 Switches shall be of tumbler operated microgap type rated at 16A, 220/250V.

2.3 Switches shall have protected terminals for safe wiring.

2.4 Contacts shall be of silver material.

2.5 On multi-lever switches, it shall be possible to individually change any of its switches.

2.6 The yoke strap shall be slotted to allow for easy alignment.

2.7 The covers of surface mounted switches shall have toggle protectors.

2.8 Where light switches are installed in partitions, they shall, where possible, be of the special narrow type intended for installation into the mullions.

3. WATERTIGHT SWITCHES

3.1 Watertight switches shall be of the microgap type suitable for surface mounting and shall bear the SABS mark.

3.2 The housing shall be of galvanised cast iron or die cast aluminium with watertight cover plate and toggle.

3.3 The switch shall have a porcelain base and a quick acting spring mechanism and shall be rated at 16A, 220/250V.

3.4 The ON/OFF position shall be clearly marked on the switch housing.

4. CEILING SWITCHES

4.1 Ceiling switches shall be rated at 10A, 220/250V and shall be suitable for ceiling mounting on a round conduit box.

4.2 The switch shall be made of high impact strength nylon material.

4.3 Adequate space shall be provided within the unit for ease of wiring.

4.4 The switch colour shall be white and shall be fitted with a nylon cord 1,25m long.

5. COVER PLATES

5.1 Cover plates shall be finished in ivory coloured baked enamel, anodised bronze or aluminium unless otherwise specified.

5.2 Cover plates shall overlap the outlet to cover wall imperfections.

5.3 Cover plates shall comply with SABS 1084.

SECTION C11

UNSWITCHED AND SWITCHED SOCKET-OUTLETS

1. GENERAL

This section covers the requirements for unswitched and switched socket-outlets for use in general installations under normal environmental conditions.

2. FLUSH AND SURFACE MOUNTED SWITCHED SOCKETS

2.1 All switched socket-outlets shall be suitable for mounting in 100 x 100 x 50mm or 100 x 50 x 50mm boxes, shall comply with SABS 164.

2.2 Switches shall be of the tumbler operated microgap type rated at 16A, 220/250V.

2.3 Terminals shall be enclosed for safe wiring.

2.4 Contacts shall be of silver material.

2.5 Safety shutters shall be provided on live and neutral openings.

2.6 The yoke strap shall be slotted to allow for easy alignment.

2.7 The covers of surface mounted switched socket shall have toggle protectors.

2.8 Miniature circuit-breakers shall be used in lieu of a switch where specified.

2.9 Where 13A flat pin switched socket-outlets are specified, these shall comply with BS 1363.

3. WATERTIGHT SWITCHED SOCKETS

3.1 The housing of watertight switched sockets shall be of galvanised cast iron or die cast aluminium with watertight machined joints.

3.2 The switch shall have a porcelain base and a quick-acting spring mechanism and shall be rated at 16A, 220/250V.

3.3 The ON/OFF positions shall be clearly marked on the switch housing.

3.4 The socket openings shall be rendered watertight by means of a gasketed cover plate which is screwed onto the body of the unit. The cover plate shall be secured to the body of the unit by means of a chain.

4. UNSWITCHED SOCKET-OUTLETS

4.1 Unswitched socket-outlets shall only be used in the case of 5A, 220/250V, 3-pin socket-outlets intended for the connection of recessed light fittings installed in false ceilings.

4.2 The socket-outlets shall have shuttered live and neutral openings.

4.3 The socket-outlets shall be suitable for installation in pre-punched wiring channels, deep round conduit boxes, 100 x 50 x 50mm or 100 x 100 x 50mm boxes.

5. THREE-PHASE SWITCHED SOCKET-OUTLETS

5.1 Three-phase switched socket-outlets shall have 5 pins, one for each phase, neutral and earth. The current rating shall be as specified in the Detail Technical Specification.

5.2 The units shall be interlocked to prevent switching on if the plug top is not installed.

5.3 The units shall be supplied complete with plug top.

5.4 The live terminals shall be shrouded and shall be completely safe when the plug top is removed.

5.5 Samples shall be submitted to the Department for approval prior to the installation.

6. SHAVER SOCKETS

6.1 Shaver sockets shall comprise a double wound isolating transformer rated at 20 VA.

6.2 A three hole system shall be provided to provide for 115 V or 230V systems and also to cater for various types of shaver plugs.

6.3 Insertion of a shaver plug shall automatically switch on the unit by energising the primary side of the isolating transformer. Removal shall switch it off.

6.4 The unit shall be protected against overload by a thermal overload device.

6.5 The unit shall comply with BS 3052.

SECTION C12

LUMINAIRES FOR INTERIOR AND EXTERIOR APPLICATIONS

C12.1
TUBULAR FLUORESCENT LAMP LUMINAIRES FOR INTERIOR APPLICATIONS

1. SCOPE

This specification covers the requirements for fluorescent luminaires using tubular fluorescent lamps for general indoor use. The types of luminaires covered are open-channel, industrial, decorative and recessed types and includes luminaires with one or more lamps with standard wattage ratings as specified in the project specification. Luminaires for use in special applications or atmospheres are not included in this specification.

2. GENERAL

2.1 To promote work creation in South Africa, the luminaire should preferably be manufactured within the Republic of South Africa and should have a local content of at least 50%.

2.2 If the luminaire offered is of foreign origin, full specifications on technical performance and quality must be submitted and full reasons shall be given why the unit had to be imported.

2.3 A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.

2.4 Luminaires, associated equipment and control gear shall be new and unused and shall be supplied complete with lamps, control gear, diffusers, mounting brackets, etc. and shall be delivered to site in a protective covering.

2.5 Lamps shall be delivered separately.

3. STANDARDS

The following standard specifications of the South-African Bureau of Standards shall apply to this luminaire specification:

3.1	SABS 1119:	Interior luminaires for fluorescent lamps.
3.2	SABS 1250:	Capacitors for use with fluorescent and other discharge lamp ballasts.
3.3	SABS 890:	Ballast's for fluorescent lamps.
3.4	SABS 1464:	Safety of luminaires.
3.5	SABS 1479:	Glow starters for fluorescent lamps.
3.6	SABS IEC 400:	Lamp holders for tubular fluorescent lamps.
3.7	SABS 1041:	Tubular fluorescent lamps for general service.
3.8	SABS 1247:	Coatings applied by the powder-coating process.
3.9	SABS 783:	Baked enamels.
3.10	SABS 0142:	The wiring of Premises

3.11 Any standard referred to in the above specifications.

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

4.1 AREAS OF APPLICATION: The luminaires are intended for standard indoor use in buildings under the control of the Department of Public Works.

4.2 FIXING: The luminaires shall be suitable for mounting in or against ceilings as described in the project specification.

4.3 ENVIRONMENTAL: Unless otherwise specified in the detail specification the luminaires shall be suitable for operation in ambient temperatures between -10°C and +25°C.

4.4 SAFETY: The luminaire shall bear the SABS 1464 safety mark.

4.5 NOISE: Noisy ballasts will not be accepted and shall be replaced at no cost to the Department. All ballasts shall comply with the requirements of the latest edition of SABS 890, Part 1.

5. GENERAL TECHNICAL REQUIREMENTS

5.1 GENERAL

5.1.1 Tubular fluorescent lamp luminaires shall comply fully with SABS 1119 and all amendments as well as the additional requirements of this specification. Luminaires shall bear the SABS mark, or at least have a SABS Certificate of Compliance.

5.1.2 The Department reserves the right to have samples of luminaires offered tested by the SABS for compliance with SABS 1119. If a sample luminaire is found not to comply with SABS 1119 the cost of such tests shall be borne by the Tenderer.

5.2 CONSTRUCTION

5.2.1 A luminaire shall consist of a ventilated body manufactured of cold rolled sheet steel not less than 0,8mm thick, suitably braced or stiffened to prevent distortion. The body shall be of sufficient strength for the mounting of the entire luminaire.

5.2.2 The luminaire shall be designed to accommodate the control gear, wiring, lamp holders and, where applicable, the diffuser and reflectors. It shall be possible to reach the control gear without disconnecting wiring or removing the luminaire.

5.2.3 Except for mounting holes and/or slots and the required openings in air-return luminaires,

the back of the body channel shall be closed over the full length of the luminaire.

5.2.4 Suitable knockouts shall be provided in the rear of the luminaire body for wire entry.

5.2.5 All components, including screws, bolts and nuts utilised in the construction of the luminaire or fixing of its components, shall be corrosion proof. Cadmium plated or stainless steel materials are preferred.

5.3 INTERNAL WIRING

5.3.1 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body.

5.3.2 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.

5.3.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.

5.3.4 The wiring shall terminate on a suitable terminal block having screw down plates bearing on the wires. Terminals where screws bear down directly on wires will not be acceptable.

5.3.5 An earth terminal, welded to the luminaire body, shall be provided. To ensure good earth continuity the earth terminal shall not be spray painted. The earth conductor shall be connected to this terminal by means of a crimped lug.

5.4 LAMP HOLDERS

Lamp holders shall preferably be of the telescopic spring-loaded type. Where twist-lock type lamp holders are provided, the mounting of the holders shall be able to accommodate the tolerances experienced in the length of lamps and in the manufacture of luminaires.

5.5 CONTROL GEAR

5.5.1 The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted. All luminaires shall operate on a switch-start basis.

5.5.2 Ballasts shall comply with SABS 890 and SABS 891, suitable for operation on 220V to 250V, 50Hz supplies.

5.5.3 Ballasts shall further be suitable for the particular luminaire to ensure that the thermal limits specified in paragraph 3.5 of SABS 1119 are not exceeded.

5.5.4 Starters shall comply with SABS 1479 or with BS 3772 if it is not covered by SABS 1479. Starters with metal cans shall contain integral earthing facilities to earth the can upon insertion.

5.5.5 Starters shall be accessible from the outside of the luminaire, and the replacement of the starter shall not necessitate the removal of lamps.

5.6 CAPACITORS

Capacitors shall comply with SABS 1250. The power factor of each complete fitting shall be corrected to at least 0,85.

5.7 LAMPS

5.7.1 Fluorescent lamps shall be suitable for the control circuitry used. Lamps shall comply with SABS 1041.

5.7.2 If no colour is specified in the Detail Technical Specification, the light colour shall correspond to colour 2 (4 300K) of SABS 1041.

5.7.3 Lamps of the same colour shall be provided for an entire installation unless specified to the contrary.

5.7.4 There shall be no visible flicker in the lamps and lamps shall readily strike when switched on. Faulty lamps or ballasts shall be replaced at no cost to the Department.

6. PHOTOMETRIC DATA

Photometric data sheets of the luminaire as prepared by a laboratory that complies with SABS requirements, shall be submitted with the luminaire.

7. TECHNICAL INFORMATION

The Tenderer shall include full technical particulars regarding the luminaire offered with the tender.

8. CHANNEL LUMINAIRE

8.1 Channel luminaires shall consist of a ventilated, enclosed channel body with one or more lamps as specified in the project specification. The channel body shall house the ballast, capacitor, terminals and internal wiring.

8.2 Provision shall be made for the addition of reflector wings and/or diffusers.

8.3 Three sets of mounting slots and knock-outs suitable for mounting onto standard round conduit boxes and/or 20mm diameter conduit pendant rods, shall be provided in the rear of the channel, one in the centre and one approximately one sixth from each end.

8.4 A knockout suitable for a 20mm diameter conduit entry shall be provided at each end of the channel. The distance between the back of the luminaire and centre of the knockout shall be approximately 25mm.

8.5 The knockouts shall be positioned on the centre line of the channel.

8.6 The body channel shall incorporate a removable cover acting as a reflector, manufactured of cold rolled steel, not less than 0,8mm thick, designed and mounted to completely cover the interior of the body channel and its contents and extending over the full length of the luminaire up to the lamp holders.

8.7 The reflector shall be firmly held in position with a latching device consisting of knurled, coin slot, captive screws. Plastic, used as a spring mechanism, is not acceptable as a fixing device for reflectors. The action of the latching device shall not deteriorate due to use and/or ageing.

9. INDUSTRIAL LUMINAIRES

9.1 Industrial type luminaires shall consist of a basic channel luminaire fitted with detachable side reflectors.

9.2 The reflectors shall be manufactured of cold rolled steel, not less than 0,8mm thick.

9.3 The reflectors shall be designed to improve the downward light output ratio and decrease the upward light output ratio to a value of less than 2%.

10. DECORATIVE LUMINAIRES

10.1 Decorative luminaires shall incorporate an injection moulded prismatic acrylic diffuser or a high-grade optical reflector covering the entire reflecting surface of the luminaire.

10.2 The diffuser shall be hinged or easily removable for maintenance and lamp replacement. Optical reflectors shall be hinged.

10.3 Decorative luminaires with diffusers shall be constructed and so installed to prevent the ingress of dust and insects.

10.4 Highly polished reflectors shall be protected and carefully handled and to prevent fingerprints showing on the surface.

10.5 Surface mounted luminaires on suspended ceilings shall be arranged to suit the grid and shall fit tightly against the ceiling.

11. RECESSED LUMINAIRES

11.1 Recessed luminaires shall be suitable for mounting in the ceiling structure specified in the project specification.

11.2 The attachment of the prismatic diffuser or reflector shall be similar to that specified in paragraph 10 above.

11.3 The diffuser or reflector shall fit flush with the ceiling and the only visible portion shall be the reflector or diffuser.

11.4 Should the luminaire be so designed that a surrounding frame is visible, then this frame shall be manufactured of anodised aluminium. The frame shall form a neat trim with the ceiling. The corners of the surrounding frame shall be mitred and reinforced.

12. LOW-BRIGHTNESS LUMINAIRES

12.1 The luminaire shall be provided with an aluminium louver with V-shaped longitudinal vanes and extruded stepped cross-shielding plates.

12.2 Louvers shall be constructed from high purity aluminium (99,98%), chemically brightened and anodised.

12.3 The total Light Output Ratio (LOR) shall be 62% or better. In the plane between 60(and 90(from the vertical, the LOR shall be below 3%.

13. LOW GLARE LUMINAIRES

13.1 The luminaire shall be provided with a die-formed, bright anodised high-purity aluminium (99,98%) louver with parabolic reflecting surfaces in both directions.

13.2 The total LOR shall be 62% or better. In the plane between 60 and 90(from the vertical), the LOR shall be less than 1,3%

14. LUMINAIRES FOR USE IN AREAS WITH VISUAL DISPLAY TERMINALS

14.1 The luminaire shall have anodised specular louvers to provide the brightness control required for this type of application.

14.2 At angles between 60 and 90(from the vertical) the luminance shall not exceed 200cd/m2.

14.3 At the above angles the LOR shall be less than 0,6%. At angle between the vertical and 60 the LOR shall be 61% or better.

SECTION C12.2

PRISON CELL LUMINAIRE

1. SCOPE

This specification covers the requirements for a fluorescent luminaire for use in prison cells and prison ablution areas. The luminaire shall be suitable for operation with 1 or 2 fluorescent lamps of 36W or 58W each, with an optional 9W compact fluorescent night-light. The exact requirements will be stated in the project specification.

2. GENERAL

2.1 To promote work creation in South Africa, the luminaire should preferably be manufactured within the Republic of South Africa and should have a local content of at least 50%.

2.2 If the luminaire offered is of foreign origin, full specifications on technical performance and quality must be submitted and full reasons shall be given why the unit had to be imported.

2.3 A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.

3. STANDARDS

The following standard specifications of the South-African Bureau of Standards shall apply to this luminaire specification:

3.1 SABS 1119: Interior luminaires for fluorescent lamps.
3.2 SABS 1250: Capacitors for use with fluorescent and other discharge lamp ballasts.
3.3 SABS 890: Ballasts for fluorescent lamps.
3.4 SABS 1464: Safety of luminaires.
3.5 SABS 1479: Glow starters for fluorescent lamps
3.6 SABS IEC 400: Lamp holders for tubular fluorescent lamps.
3.7 SABS 1041: Tubular fluorescent lamps for general service.
3.8 SABS 1247: Coatings applied by the powder-coating process.
3.9 Any other standards referred to in the above specifications.

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

4.1 AREA OF APPLICATION: The luminaire is to be used inside prison cells and in the ablution areas of prison cells.

4.2 FIXING: The luminaire shall be of the surface-mounted type. The main body of the luminaire shall be rigid and so designed that it can be firmly fixed flush onto the mounting surface without exposing gaps into which flat objects can be inserted.

4.3 TAMPERING: Due to the location of the luminaire special attention is required to render the luminaire tamper-proof and materials used shall be vandal resistant.

4.4 ENVIRONMENTAL REQUIREMENTS

4.4.1 The luminaire shall have an ingress protection rating of IP65 and this shall be substantiated by a certificate of the South African Bureau of Standards.

4.4.2 The luminaire shall have no dust-collecting or sharp edges and corners on the accessible side of the luminaire.

4.4.3 The luminaire shape shall be designed so as to prevent the manual gripping of the luminaire to prevent persons from hanging onto the body of the luminaire.

4.5 THERMAL: The luminaire must be able to withstand an ambient temperature of 45°C. To this end internal electrical and mechanical components shall not be allowed to exceed their maximum temperature ratings. Test reports from an independent authorised testing facility proving this requirement shall be made available to the Department on request.

4.6 SAFETY: The luminaire shall bear the SABS 1464 safety mark.

4.7 NOISE: Due to the sensitive environment in which the luminaire is used, the noise level emitted from the luminaire shall be kept as low as possible. The ballasts shall, therefore, comply fully with the requirements of the latest edition of SABS 890 Part 1.

5. CONSTRUCTION

5.1 BODY: Nominal dimensions shall be 1 310 x 140 x 120mm (for the 36W model) or 1610 x 140 x 120mm (for the 58W model). The luminaire shall have a rigid high-pressure die-cast aluminium body at least 1mm thick, or, alternatively shall be made from 0,8mm thick cold rolled mild steel. The body shall have a minimum of four holes for mounting flush to the mounting surface by means of expansion bolts. The body shall be suitable to house 2 fluorescent lamps of 36W or 58W each plus a 9W PL fluorescent lamp when fully equipped.

5.2 MOUNTING MATERIALS: Mounting studs and materials shall be provided with each luminaire, including installation instructions as necessary.

5.3 DIFFUSER

5.3.1 The diffuser shall consist of a one-piece injected moulding of clear ultra-violet-stabilised polycarbonate of high-impact resistance. The light control shall be achieved by internal prisms moulded longitudinally as part of the diffuser. The outer surface of the diffuser shall be completely smooth and shall be shaped to prevent persons from obtaining a firm handgrip on the diffuser.

5.3.2 The diffuser shall be provided with a replaceable neoprene gasket and the diffuser shall be fixed to the luminaire body by means of tamper-proof stainless steel bolts with stainless steel washers. The bolt-heads shall preferably be of a flat construction with two pinholes for the insertion of a special tool for fastening or loosening. Sunken hex-heads (for Allen keys) shall preferably not be used. Other tamper-proof proposals may be submitted to the Department for approval.

5.3.3 The diffuser and body shall be manufactured within close tolerances so that no gaps exist between the body and the diffuser when the diffuser is screwed down.

5.4 GEAR TRAY

5.4.1 The control gear tray shall also act as a reflector and shall be manufactured from sheet steel of at least 0,7mm thickness. The gear tray shall be white epoxy powder coated after all cutouts and holes have been prepared on the tray. Alternatively, the gear tray may be made from bright anodised extruded aluminium.

5.4.2 The gear tray shall be mounted to the body by means of identical tamper-proof bolts to those holding the diffuser. The mounting shall, however, be provided with a slide-in facility so that the gear tray can be easily removed without unscrewing the bolts completely. The gear tray shall be completely removable for workshop maintenance and interchangeability.

5.4.3 The gear-tray shall be provided with restraining devices to prevent the tray from falling when the gear-tray is slid out. These restraints shall be unhooked for removal of the tray.

5.4.4 The gear-tray shall house the ballast, capacitors and glow-starters in the top section, whilst the lamp holders and lamps must occupy the bottom side of the reflector plate.

5.4.5 The gear tray should be equipped with control gear and circuits to operate one or two 36W (or 58W) fluorescent lamps on a switch-start basis. However, the gear tray shall be pre-punched to accommodate one 9W PL fluorescent lamp and control gear that can be separately switched as a night light. Equipping for this option is specified in the detail specification if it is required.

5.4.6 Preparation of all metal surfaces for the painting or epoxy powder coating thereof shall be done in accordance with SABS 1274.

5.5 ELECTRICAL REQUIREMENTS

5.5.1 The luminaire shall be suitable for operation on a 230V, single-phase 50Hz mains supply.

5.5.2 Power factor capacitors shall be supplied to correct the power factor to at least 0,85 in the cases of operating either one 36W (or 58W) lamp alone or one 9W lamp alone or one

36W (or 58W) plus one 9W lamp together. Similarly a combination of two 36W (or 58W) lamps together or two 36W (or 58W) lamps plus one 9W lamp or one 9W lamp alone shall apply if the luminaire is fully equipped.

5.5.3 Each luminaire shall be supplied with all lamps required and specified in the project specification.

5.5.4 The luminaire shall be provided with a 20mm diameter back-entry for wiring access.

5.5.5 Internal wiring of the luminaire shall be in accordance with SABS 1119.

5.5.6 Terminals for connection of the mains supply and on ballasts and other internal equipment shall have screw-down plates bearing on the wires. Terminals where screws bear down directly on the wires will not be acceptable.

5.5.7 The luminaire shall be marked with identification labels stating the brand name and model and shall bear the SABS mark or shall at least have an SABS certificate of compliance.

6. LUMINAIRE PERFORMANCE

6.1 The luminaire diffuser shall be so designed as to reduce the luminance (glare) of the luminaire to maximise the comfort of the room occupants.

6.2 The total light output ratio of the luminaire shall be 56% or better.

7. MAINTENANCE REQUIREMENTS

7.1 For ease of maintenance it is imperative that the gear-tray should be completely removable with ease, including the disconnection of the electrical supply internally. Removal of the diffuser and gear tray must only be possible by means of a special unscrewing tool.

7.2 The connection between the gear tray equipment and the incoming mains shall preferably be via a suitable sturdy plug and socket for easy disconnection.

7.3 LAMP HOLDERS

Lamp holders shall preferably be of the telescopic spring-loaded type. Where twist lock type lamp holders are provided, the mounting of the holders shall be able to accommodate the tolerances experienced in the length of lamps and in the manufacture of luminaires.

8. PHOTOMETRIC DATA

Photometric data sheets of the luminaire as prepared by a laboratory that complies with SABS requirements shall be submitted with the luminaire.

9. TECHNICAL INFORMATION

The tenderer shall include full technical particulars regarding the luminaire offered with the tender.

SECTION C12.3

BULKHEAD LUMINAIRES FOR USE WITH COMPACT FLUORESCENT OR TUNGSTEN FILAMENT LAMPS FOR INTERIOR AND EXTERIOR APPLICATIONS

1. SCOPE

This specification covers the requirements for bulkhead type luminaires, using compact fluorescent or tungsten filament lamps, for general indoor and outdoor use. The types of luminaires covered are decorative round, rectangular or square surface-mounted and recessed types and include luminaires with one or more lamps with standard wattage ratings as specified in the project specification. Luminaires for use in special applications or atmospheres are not included in this specification.

2. GENERAL

2.1 To promote work creation in South Africa, the luminaire should preferably be manufactured within the Republic of South Africa and should have a local content of at least 50%.

2.2 If the luminaire offered is of foreign origin, full specifications on technical performance and quality must be submitted and full reasons shall be given why the unit had to be imported.

2.3 A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.

2.4 Luminaires, associated equipment and control gear shall be new and unused and shall be supplied complete with lamps, control gear, diffusers, mounting brackets, etc. and shall be delivered to site in a protective covering.

2.5 Lamps shall be delivered separately.

3. STANDARDS

The following standard specifications of the South-African Bureau of Standards and the International Electro technical Commission shall apply to this luminaire specification:

3.1 SABS 1119: Interior luminaires for fluorescent lamps. Note: The latest Amendments whereby luminaires with compact fluorescent lamps are covered, shall apply.
3.2 SABS 1250: Capacitors for use with fluorescent and other discharge lamp ballasts.
3.3 SABS 890, IEC 920 and IEC 921 : Ballasts for fluorescent lamps.
3.4 SABS 1464: Safety of luminaires.
3.5 SABS 1479: Glow starters for fluorescent lamps.
3.6 SABS IEC 400: Lamp holders for tubular fluorescent lamps.
3.7 SABS 1041, IEC 81 and IEC 901 : Tubular fluorescent lamps for general service.
3.8 SABS 1247: Coatings applied by the powder-coating process.
3.9 SABS 783: Baked enamels.
3.10 SABS 0142: The wiring of Premises
3.11 SABS 56: Incandescent lamps
3.12 Any standard referred to in the above specifications.

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

4.1 AREAS OF APPLICATION: The luminaires are intended for standard indoor and exterior use in buildings under the control of the Department of Public Works.

4.2 FIXING: The luminaires shall be suitable for mounting against ceilings or walls as described in the project specification.

4.3 ENVIRONMENTAL: Unless otherwise specified in the detail specification the luminaires shall be suitable for operation in ambient temperatures between -10°C and +45°C.

4.4 SAFETY: The luminaire shall bear the *SABS 1464* safety mark.

4.5 NOISE: Noisy ballasts will not be accepted and shall be replaced at no cost to the Department. All ballasts shall comply with the requirements of the latest edition of SABS

890, Part 1 or IEC 920 and 921.

5. GENERAL TECHNICAL REQUIREMENTS

5.1 General

5.1.1 Compact fluorescent lamp luminaires shall comply fully with SABS 1119 and all amendments as well as the additional requirements of this specification. Luminaires, which bear the SABS mark, are preferred. Luminaires shall at least have an SABS Certificate of Compliance.

5.1.2 The Department reserves the right to have samples of luminaires offered tested by the SABS for compliance with SABS 1119. If a sample luminaire is found not to comply with SABS 1119 the cost of such tests shall be borne by the Tenderer.

5.1.3 Luminaires for tungsten filament lamps shall not materially differ from those for compact fluorescent lamps, but shall be capable of dissipating the extra heat generated without deterioration in the luminaire materials.

5.2 Construction

5.2.1 A luminaire shall consist of a ventilated body manufactured from die-cast aluminium. The body shall be of sufficient strength for the mounting of the entire luminaire.

5.2.2 The luminaire shall be designed to accommodate the control gear, wiring, lamp holders, the diffuser and reflectors. It shall be possible to reach the control gear without disconnecting wiring or removing the luminaire.

5.2.3 Except for mounting holes and/or slots, the back of the body shall be closed over the full extent of the luminaire.

5.2.4 Suitable knockouts shall be provided in the rear of the luminaire body for wire entry.

5.2.5 All components, including screws, bolts and nuts utilised in the construction of the luminaire or fixing of its components, shall be corrosion proof. Cadmium plated or stainless steel materials are preferred.

5.2.6 The luminaire shall, as an option, be available with a high-pressure die-cast aluminium skirt, which shall be designed in such a way that it covers the base completely when mounted. The skirt shall be mounted onto the body by means of at least three screws.

5.3 Internal wiring

5.3.1 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body.

5.3.2 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.

5.3.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.

5.3.4 The wiring shall terminate on a suitable terminal block having screw down plates bearing on the wires. Terminals where screws bear down directly on wires will not be acceptable.

5.3.5 An earth terminal, welded to the luminaire body, shall be provided. To ensure good earth continuity the earth terminal shall not be spray painted. The earth conductor shall be

connected to this terminal by means of a crimped lug.

5.4 Lamp holders

Lamp holders shall be of the type suitable for the relevant compact fluorescent or general lighting service lamp. The following standard lamps and lamp holders shall apply:

5.4.1

LAMP	HOLDER	LAMP	HOLDER
7W PL	2G11	13W PLC	G24d-1
9W PL	2G11	16W 2D	GR10q
11W PL	2G11	18W PLC	G24d-2
60/100W GLS	E27, porcelain		

5.5 Control gear

5.5.1 The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted. All fluorescent luminaires shall operate on a switch-start basis where external starters are employed.

5.5.2 Ballasts shall comply with SABS 890 and SABS 891, or IEC 920 and IEC 921 as applicable and shall be suitable for operation on 220V to 250V, 50Hz supplies.

5.5.3 Ballasts shall further be suitable for the particular luminaire to ensure that the thermal limits specified in paragraph 3.5 of SABS 1119 are not exceeded.

5.5.4 Starters shall comply with SABS 1479 or with BS 3772 if it is not covered by SABS 1479. Starters with metal cans shall contain integral earthing facilities to earth the can upon insertion.

5.5.5 Starters shall be accessible from the outside of the luminaire, and the replacement of the starter shall not necessitate the removal of lamps.

5.5.6 The luminaire reflector shall act as the gear/mounting tray and shall be manufactured from sheet steel at least 0,7mm thick. The gear tray shall preferably be white epoxy powder coated after all the cut-outs and holes have been made on the tray. The tray shall be mounted to the body of the luminaire by means of screws and the tray shall be provided with a hole through which the screw head can pass plus a slot of the same width as the screw thickness so that the tray can be removed without removing the screws completely.

5.5.7 The gear tray shall be equipped with the components suitable for the luminaires specified in the project specification.

5.6 Capacitors

Capacitors shall comply with SABS 1250. The power factor of each complete fitting shall be corrected to at least 0,85.

5.7 Lamps

5.7.1 Fluorescent lamps shall be suitable for the control circuitry used. Lamps shall comply with the applicable clauses of SABS 1041 and, where it does not apply, the lamps shall comply with IEC 81 or IEC 901.

5.7.2 If no colour is specified in the Detail Technical Specification, the light colour shall

correspond to colour 2 (4 300K) of SABS 1041.

5.7.3 Lamps of the same colour shall be provided for an entire installation unless specified to the contrary.

5.7.4 There shall be no visible flicker in the lamps and lamps shall readily strike when switched on. Faulty lamps or ballasts shall be replaced at no cost to the Department.

5.7.5 The following standard lamps shall be used for the purposes of this specification:

PL lamps: 7W, 9W AND 11W
PLC Lamps: 13W
2D Lamps: 16W
GLS Lamps: 60 and 100W

5.8 Diffuser

5.8.1 The diffuser shall consist of a high-impact resistant ultra-violet stabilised acrylic moulding. The diffuser shall be either transparent or opaque as described in the project specification. Where transparent diffusers are required, these shall be moulded with internal prismatic refractors and the outer surface shall be smooth.

5.8.2 The diffuser shall be mounted to the body by means of an external mounting ring and at least three screws, which should preferably not pass through the diffuser body as well. A silicon sponge gasket which fits into a groove on the diffuser shall be used to allow breathing of the luminaire whilst prohibiting the ingress of insects.

6. PHOTOMETRIC DATA

Photometric data sheets of the luminaire as prepared by a laboratory that complies with SABS requirements, shall be submitted with the luminaire.

7. TECHNICAL INFORMATION

The Tenderer shall include full technical particulars regarding the luminaire offered with the tender.

SECTION C12.4

POST TOP LUMINAIRES FOR EXTERIOR APPLICATIONS

1. SCOPE

This specification covers the requirements for post top type luminaires, using tungsten filament, compact fluorescent, mercury vapour, sodium vapour or metal halide lamps, for

general outdoor and indoor use. The luminaires covered are decorative types and include luminaires with one or more lamps with standard wattage ratings as specified in the project specification.

2. **GENERAL**

2.1 To promote work creation in South Africa, the luminaire should preferably be manufactured within the Republic of South Africa and should have a local content of at least 50%.

2.2 If the luminaire offered is of foreign origin, full specifications on technical performance and quality must be submitted and full reasons shall be given why the unit had to be imported.

2.3 A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.

2.4 Luminaires, associated equipment and control gear shall be new and unused and shall be supplied complete with lamps, control gear, diffusers, mounting brackets, etc. and shall be delivered to site in a protective covering.

2.5 Lamps shall be delivered separately.

3. STANDARDS

The following standard specifications of the South-African Bureau of Standards and the International Electro technical Commission shall apply to this luminaire specification:

3.1	SABS 1421:	High-pressure mercury vapour lamps.
3.2	SABS IEC 662:	High-pressure sodium vapour lamps
3.3	IEC 61167:	Metal Halide lamps
3.4	SABS 56:	Incandescent lamps
3.5	SABS 1250:	Capacitors for use with fluorescent and other discharge lamp Ballasts.
3.6	SABS 1464:	Safety of luminaires.
3.7	SABS IEC 922 and SABS IEC 923:	Ballasts for discharge lamps.
3.8	SABS IEC 926 and SABS IEC 927:	Starting devices (other than glow starters).
3.9	SABS 890, IEC 920 And IEC 921:	Ballasts for fluorescent lamps
3.9	SABS IEC 400:	Lamp holders for fluorescent lamps
3.10	SABS 1247:	Coatings applied by the powder-coating process.
3.11	SABS 783:	Baked enamels.
3.12	SABS 0142:	The wiring of Premises
3.13	SABS 1507:	Electric cables with extruded solid dielectric insulation for fixed installations.
3.14	SABS 165 and: VC 8011	Lamp holders
3.15	SABS 1277:	Street lighting luminaires.
3.16	SABS 1088:	Luminaire entries and spigots
3.17	Any standard referred to in the above specifications.	

4. **PHYSICAL AND ENVIRONMENTAL REQUIREMENTS**

4.1 AREAS OF APPLICATION: The luminaires are intended for standard exterior use on premises under the control of the Department of Public Works.

4.2 FIXING: The luminaires shall be suitable for mounting on vertical poles. Spigot entries

shall have an internal diameter of 76mm and shall be 75mm deep in accordance with SABS 1088 Table 1 (Type 2).

4.3 ENVIRONMENTAL: Unless otherwise specified in the detail specification the luminaires shall be suitable for operation in ambient temperatures between -10°C and +45°C. The luminaire shall have an ingress protection rating of IP55 in order to prevent air from entering the lamp compartment and this rating shall be certified by a SABS report.

4.4 SAFETY: The luminaire shall bear the *SABS 1464* safety mark.

4.5 NOISE: Noisy ballasts will not be accepted and shall be replaced at no cost to the Department. All ballasts shall comply with the requirements of the latest edition of SABS IEC 920, 921, 922 and 923.

5. GENERAL TECHNICAL REQUIREMENTS

5.1 General

5.1.1 The internal components of the luminaire shall be able to withstand internal temperatures of at least 45°C without resulting in any electrical or mechanical component exceeding its maximum rated operating temperature. Certified proof from an authorised testing facility shall be presented on request.

5.1.2 The luminaire colour shall be as specified in the project specification.

5.1.3 The luminaire shall bear the SABS 1277 mark.

5.2 Construction

5.2.1 The luminaire shall consist of a spigot base manufactured from high-pressure die-cast aluminium, a lamp compartment with integral control gear as applicable, and a prismatic diffuser and top canopy. The base shall be of sufficient strength for the mounting of the entire luminaire.

5.2.2 The luminaire shall be designed to accommodate the control gear, wiring, lamp holders, the diffuser and reflectors where applicable. It shall be possible to reach the control gear without disconnecting wiring or removing the luminaire.

5.2.3 All components, including screws, bolts and nuts utilised in the construction of the luminaire or fixing of its components, shall be corrosion proof. Cadmium plated or stainless steel materials are preferred.

5.2.4 The luminaire spigot shall be provided with at least three M8 stainless steel Allen grub screws for mounting onto the pole.

5.3 Internal wiring

5.3.1 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body or control gear trays.

5.3.2 The wiring shall preferably be totally metal enclosed to prevent any possible contact with live components while changing lamps.

5.3.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.

5.3.4 The wiring shall terminate on a suitable terminal block having screw down plates bearing on the wires. Terminals where screws bear down directly on wires will not be acceptable.

5.3.5 An earth terminal, forming part of the luminaire body, shall be provided. To ensure good earth continuity the earth terminal shall not be spray painted. The earth conductor shall be connected to this terminal by means of a crimped lug.

5.4 Lamp holders

Lamp holders shall be of the type suitable for the relevant lamp used. Lamp holders shall not deteriorate as a result of normal operating temperatures in the luminaire.

5.5 Control gear

5.5.1 The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted

5.5.2 Ballasts shall comply with SABS IEC 920, 921, 922 and 923 as applicable and shall be suitable for operation on 220V to 250V, 50Hz supplies.

5.5.3 Ballasts shall further be suitable for the particular luminaire to ensure that the thermal limits specified in Clause 5.1.1 above are not exceeded.

5.5.4 The luminaire control gear shall be mounted onto a control gear mounting assembly which also contains the lamp holder. The assembly shall be mounted on the spigot base and the whole assembly shall be removable as a unit without dismantling the luminaire as such.

5.5.5 The luminaire body shall be equipped with the components suitable for the luminaires and lamps specified in the project specification.

5.5.6 In those applications where ignitors are used, these shall be of the superposed pulse type.

5.5.7 The reflector, if specified in the project specification, shall be mounted on a white epoxy powder coated steel mounting plate at least 0,7mm thick, which shall be mounted to the spigot body. The reflector shall be made from highly polished anodised aluminium plate and shall be manufactured to give optimum performance with the prismatic diffuser.

5.6 Capacitors

Capacitors shall comply with SABS 1250. The power factor of each complete fitting shall be corrected to at least 0, 85.

5.7 Lamps

5.7.1 The following standard lamps shall be used for the purposes of this specification:

Lamp	**Lamp holder**
Mercury Vapour	
50W, 80W and 125W	E27

Lamp	**Lamp holder**
Sodium Vapour	
50W and 70W	E27
100W and 150W	E40

All lamps shall be of the elliptical coated type.

Metal halide lamps

70W and 150W	(tubular)	RX7s
100W (elliptical)		E27

Fluorescent lamps

PL 24W	2G11
PL C 18W	G24d-2
PL C 26W	G24d-3

Incandescent lamps

100W	E27

5.7.2 The lamps shall be prevented from loosening in the holders as a result of vibrations under normal working conditions.

5.8 Diffuser

5.8.1 The diffuser shall consist of a high-impact resistant ultra-violet stabilised acrylic moulding with internal prismatic refractors and the outer surface shall be smooth. The prisms shall be designed to work in conjunction with the reflectors to provide the optimum light output.

5.8.2 The diffuser shall be mounted to the body by means of a round ring surface at the bottom which fits onto the spigot base with a neoprene gasket. A drip ridge shall be provided at the bottom edge to prevent direct contact by rainwater with the gasket. The diffuser top shall be formed in such a manner that the top canopy-cover fits over the diffuser.

5.8.3 The top canopy cover shall be manufactured from a robust material that is highly resistant to weather, hail, corrosion and vandalism. The inside of the canopy shall be provided with ribbed struts, formed as part of the moulding, to provide additional strength to the canopy. The canopy shall be provided with an internal groove into which the diffuser top edge shall fit and this shall be sealed by means of a neoprene gasket. The cover shall be bolted down onto the body by means of a single central nut on top of the cover.

6. PHOTOMETRIC DATA

Photometric data sheets of the luminaire as prepared by a laboratory that complies with SABS requirements, shall be submitted with the luminaire.

7. TECHNICAL INFORMATION

The Tenderer shall include full technical particulars regarding the luminaire offered with the tender.

SECTION C12.5

SECURITY LUMINAIRES FOR USE WITH DISCHARGE LAMPS OR COMPACT FLUORESCENT LAMPS FOR PRISON APPLICATIONS

1. SCOPE

This specification covers the requirements for bulkhead type luminaires and pole mounted luminaires, using sodium vapour or compact fluorescent lamps for outdoor use at prisons. The luminaires covered are of the decorative rectangular or polygonal surface-mounted type as well as streetlight and floodlight luminaires and include luminaires with one or more lamps with standard wattage ratings as specified in the project specification.

2. GENERAL

2.1 To promote work creation in South Africa, the luminaire should preferably be manufactured within the Republic of South Africa and should have a local content of at least 50%.

2.2 If the luminaire offered is of foreign origin, full specifications on technical performance and quality must be submitted and full reasons shall be given why the unit had to be imported.

2.3 A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.

2.4 Luminaires, associated equipment and control gear shall be new and unused and shall be supplied complete with lamps, control gear, diffusers, mounting brackets, etc. and shall be delivered to site in a protective covering.

2.5 Lamps shall be delivered separately.

STANDARDS

The following standard specifications of the South-African Bureau of Standards and the International Electrotechnical Commission shall apply to this luminaire specification:

3.1	SABS 098:	Code of practice for public lighting.
3.2	SABS 0142:	The wiring of Premises.
3.3	SABS 165: and VC8011	Lamp holders
3.4	SABS 783:	Baked enamels.
3.5	SABS 1119:	Interior luminaires for fluorescent lamps (clauses applicable to compact fluorescent lamps).
3.6	SABS 1222:	Enclosures for electrical equipment.
3.7	SABS 1247:	Coatings applied by the powder-coating process.
3.8	SABS 1250:	Capacitors for use with fluorescent and other discharge lamp ballasts.
3.9	SABS 1277:	Street-lighting luminaires.
3.10	SABS 1279:	Floodlighting luminaires.
3.11	SABS 1464:	Safety of luminaires.
3.12	SABS 1507: Installation.	Electric cables with extruded solid dielectric insulation for fixed
3.13	SABS IEC 662:	High-pressure sodium vapour lamps.
3.14	SABS IEC 922 and SABS IEC 923:	Ballasts for discharge lamps.
3.15	SABS IEC 926 and SABS IEC 927:	Starting devices (other than glow starters).

3.16 Any standard referred to in the above specifications.

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

4.1 AREAS OF APPLICATION: The luminaires are intended for exterior use in establishments under the control of the Department of Public Works.

4.2 FIXING: The luminaires shall be suitable for mounting against horizontal or vertical surfaces, walls, perimeter fences or on poles as described in the project specification.

4.3 ENVIRONMENTAL: Unless otherwise specified in the detail specification the luminaires shall be suitable for operation in ambient temperatures between -10°C and +45°C. The luminaire shall have an ingress protection rating as indicated below and this shall be certified in a SABS report.

4.4 SAFETY: The luminaire shall bear the SABS 1464 safety mark.

4.5 NOISE: Noisy ballasts will not be accepted and shall be replaced at no cost to the Department. All ballasts shall comply with the requirements of the latest edition of SABS IEC 922 and 923.

5. GENERAL TECHNICAL REQUIREMENTS

5.1 General

The internal components of the luminaire shall be able to withstand internal temperatures of at least 45°C without resulting in any electrical or mechanical component exceeding its maximum rated operating temperature. Certified proof from an authorised testing facility shall be presented on request.

Bulkhead luminaires shall also be available with an optional wire guard and a decorative skirt of the same material and finish as the luminaire body.

6 Construction

6.1 Bulkhead or bracket-mounted light.

1. The luminaire shall consist of a body manufactured from high-pressure die-cast aluminium, with a transparent prismatic diffuser. The body shall be of sufficient strength for the mounting of the entire luminaire.

2. The luminaire shall be designed to accommodate the control gear, wiring, lamp holders, the diffuser and reflectors. It shall be possible to reach the control gear without disconnecting wiring or removing the luminaire.

3. Except for mounting holes and/or slots, the back of the body shall be closed over the full extent of the luminaire. At least three mounting holes shall be provided.

4. All components, including screws, bolts and nuts utilised in the construction of the luminaire or fixing of its components, shall be corrosion proof. Cadmium plated or stainless steel materials are preferred.

5. The luminaire shall be provided with a cable entry at the back of the luminaire by means of a plastic gland. However, it shall be possible to provide 20mm diameter conduit entries or cable entries from the sides of the luminaire and suitable drilling indents or knockouts shall be furnished on the luminaire body.

6. A heavy gauge galvanised steel stirrup bracket for mounting the luminaire shall be supplied with the luminaire unless omitted in the project specification.

7. The luminaire shall be suitable for use with 2 x 24W PL or 2 x 26W PLC or 1 x 250W elliptical HPS lamp.

8. The luminaire shall have an ingress protection rating of at least IP55.

6.2 Flood-lights

1. The luminaire shall consist of a body manufactured from either high-pressure die-cast aluminium or ultra-violet stabilised glass-fibre reinforced polyester material. The body shall be hail-proof, weatherproof and corrosion and vandal resistant.

2. The housing shall be equipped with either a flat armoured glass fixed in a sturdy, hinged die-cast frame with a silicon-rubber gasket or a clear transparent high-impact resistant acrylic bowl, treated against discolouring due to UV and lamp radiation, with a silicon-rubber gasket. The glass frame or dome shall preferably be hinged and mounted with stainless steel clips.

3. The luminaire shall be equipped with integral control gear mounted internally. Alternatively, the control gear may be mounted in a separate control gear compartment, in which case the compartment shall have the same IP rating as the luminaire.

4. The luminaire shall be suitable for 2 x 24W PLC lamps or 1 x 250W tubular HPS lamp.

5. The luminaire shall have an ingress protection rating of at least IP43.

6. A heavy gauge hot-dipped galvanised steel mounting-stirrup with pre-punched holes shall be supplied with the luminaire unless otherwise specified in the project specification.

6.3. **Street-light type luminaires**

1. Luminaires must bear the SABS 1277 mark.

2. The luminaire shall consist of a high-pressure die-cast aluminium body or a body manufactured from UV stabilised filled polypropylene. The body shall be hail, weather and corrosion proof and shall be vandal resistant.

3. The body shall preferably consist of a single unit with two compartments, viz. a lamp compartment and a control gear compartment.

4. The luminaries' diffuser shall be suitable for Class B roads in terms of SABS 098. The clear high-impact acrylic bowl shall be hinged and attached to the body by means of at least three clips of either stainless steel or other durable material. The diffuser shall be sealed on the lamp compartment by means of a silicon-sponge rubber gasket in a tongue and groove arrangement.

5. The control gear compartment shall have a hinged cover for bottom access. The control gear, capacitor and ignite, where fitted, shall be mounted on a removable gear tray.

6. The light fitting shall be provided with a bottom spigot entry in compliance with SABS 1088, Table 1, Type 2: 76mm diameter x 75mm deep.

6.4 Internal wiring

6.4.1 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body or control gear trays.

6.4.2 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.

6.4.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.

6.4.4 The wiring shall terminate on a suitable terminal block having screw down plates bearing on the wires. Terminals where screws bear down directly on wires will not be acceptable.

6.4.5 An earth terminal, forming part of the luminaire body, shall be provided. To ensure good earth continuity the earth terminal shall not be spray painted. The earth conductor shall be connected to this terminal by means of a crimped lug.

6.5 Lamp holders

6.5.1 Lamp holders shall be of the type suitable for the relevant lamp used. Lamp holders shall not deteriorate as a result of normal operating temperatures in the luminaire. Lamp holders shall comply with SABS VC8011 and shall be able to withstand a temperature of 240° C

6.6 Control gear

6.6.1 The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted

6.6.2 Ballasts shall comply with SABS IEC 922 and 923 as applicable and shall be suitable for operation on 220V to 250V, 50Hz supplies.

6.6.3 Ballasts shall further be suitable for the particular luminaire to ensure that the thermal limits specified in Clause 5.1.1 above are not exceeded.

6.6.4 The luminaire control gear shall be mounted onto the inside of the control gear compartment of the body on a separate mounting plate. The gear-mounting tray shall be manufactured from sheet steel at least 0,7mm thick and shall be epoxy powder coated.

6.6.5 The gear tray and luminaire body shall be equipped with the components suitable for the luminaires and lamps specified in the project specification.

6.6.6 In those applications where ignitors are used, these shall be of the superposed pulse type.

6.6.7 The reflector shall be mounted on the luminaire body. The reflector shall be made from highly polished 99, 98% pure specular anodised aluminium plate and shall be manufactured to give optimum performance with the prismatic diffuser as applicable.

6.7 Capacitors

Capacitors shall comply with SABS 1250. The power factor of each fitting shall be corrected to at least 0,85.

6.8 Lamps

6.8.1 The following standard lamps shall be used for the purposes of this specification:

1.	LAMP	LAMP HOLDER	
	Sodium Vapour 150W or 250W	E40	(All lamps shall be of the tubular clear type.)

Compact fluorescent types:

24W PL	2G11
26W PLC	G24d-3

7. PHOTOMETRIC DATA

Photometric data sheets of the luminaire as prepared by a laboratory that complies with SABS requirements shall be submitted with the luminaire.

8. TECHNICAL INFORMATION

The Tenderer shall include full technical particulars regarding the luminaire offered with the tender.

SECTION C12.6

STREET-LIGHT LUMINAIRES

1. SCOPE

This specification covers the requirements for street-light luminaires using sodium vapour, mercury vapour or compact fluorescent lamps with standard wattage ratings as specified in the project specification.

2. GENERAL

2.1 To promote work creation in South Africa, the luminaire should preferably be manufactured within the Republic of South Africa and should have a local content of at least 50%.

2.2 If the luminaire offered is of foreign origin, full specifications on technical performance and quality must be submitted and full reasons shall be given why the unit had to be imported.

2.3 A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.

2.4 Luminaires, associated equipment and control gear shall be new and unused and shall be supplied complete with lamps, control gear, diffusers, mounting brackets, etc. and shall be delivered to site in a protective covering.

2.5 Lamps shall be delivered separately.

3. STANDARDS

The following standard specifications of the South-African Bureau of Standards and the International Electro technical Commission shall apply to this luminaire specification:

3.1	SABS 098:	Code of practice for public lighting.
3.2	SABS 0142:	The wiring of Premises.
3.3	SABS 165: and VC8011	Lamp holders
3.4	SABS 783:	Baking enamels.
3.5	SABS 1119:	Interior luminaires for fluorescent lamps (clauses applicable to compact fluorescent lamps).
3.6	SABS 1222:	Enclosures for electrical equipment.
3.7	SABS 1247:	Coatings applied by the powder-coating process.
3.8	SABS 1250:	Capacitors for use with fluorescent and other discharge lamp ballasts.
3.9	SABS 1277:	Street-lighting luminaires.
3.10	SABS 1464:	Safety of luminaires.

3.11	SABS 1507:	Electric cables with extruded solid dielectric insulation for fixed Installations.
3.12	SABS IEC 662:	High-pressure sodium vapour lamps.
3.13	SABS 1421	Mercury vapour lamps
3.14	SABS IEC 922 and SABS IEC 923:	Ballasts for discharge lamps.
3.15	SABS IEC 926 and SABS IEC 927:	Starting devices (other than glow starters).

3.16 Any standard referred to in the above standards.

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

4.1 AREAS OF APPLICATION: The luminaires are intended for exterior use in establishments under the control of the Department of Public Works.

4.2 FIXING: The luminaires shall be suitable for mounting on brackets against horizontal or vertical surfaces, walls, perimeter fences or on poles as described in the project specification.

4.3 ENVIRONMENTAL: Unless otherwise specified in the detail specification the luminaires shall be suitable for operation in ambient temperatures between -10°C and +45°C.
The luminaire shall have an ingress protection rating of IP 65 for the lamp compartment and IP23 for the control gear compartment and this shall be certified in a SABS report.

4.4 SAFETY: The luminaire shall bear the SABS 1464 safety mark.

4.5 NOISE: Noisy ballasts will not be accepted and shall be replaced at no cost to the Department. All ballasts shall comply with the requirements of the latest edition of SABS IEC 922 and 923.

5. GENERAL TECHNICAL REQUIREMENTS

5.1 The internal components of the luminaire shall be able to withstand internal temperatures of at least 45°C without resulting in any electrical or mechanical component exceeding its maximum rated operating temperature. Certified proof from an authorised testing facility shall be presented on request.

5.2 All metal components shall be manufactured from corrosion-resistant materials or shall be treated to prevent corrosion.

5.3 All screws and other components must be easily reachable and must be mounted on the luminaire body.

5.4 Luminaires shall bear the SABS 1277 mark.

6. CONSTRUCTION

6.1 BODY

6.1.1 The luminaire shall consist of a high-pressure die-cast aluminium body or a body manufactured from UV stabilised filled polypropylene. The body shall be hail, weather and corrosion proof, it shall be vandal resistant and the ingress of insects shall be prevented. The body shall also be equipped with an effective air-filter.

6.1.2 The body shall preferably consist of a single body with two compartments, viz. a lamp

compartment and a control gear compartment.

6.1.3 Provision shall be made for the effective dissipation of heat emanating from the lamp and the control gear.

6.1.4 The luminaire shall be provided with a spigot entry in compliance with SABS 1088 and shall nominally be 42mm with a length of 125mm for side entry and 76mm with a length of 75mm for bottom entry. The requirements shall be as mentioned in the project specification.

6.2 DIFFUSER

6.2.1 The diffuser shall be manufactured from heat-resistant glass or high-impact acrylic non-discolouring material.

6.2.2 The size and shape of the diffuser shall be designed so that it neatly fits onto the luminaire body and it shall be of sufficient size to house the lamp or lamps.

6.2.3 The diffuser shall preferably be mounted in a sturdy hinged metal frame, which prevents warping or cracking of the diffuser when the diffuser is sealed onto the body.

6.2.4 Prisms shall form and integral part of the diffuser itself.

6.2.5 The diffuser frame shall be hinged on one side and shall be attached to the body in the closed position by means of at least three quick-release clips made from stainless steel or other durable material.

6.2.6 The diffuser frame shall be sealed on the body by means of a silicon-sponge rubber gasket in a tongue and groove arrangement

6.3 REFLECTOR

6.3.1 The reflectors shall be manufactured from high-purity aluminium, anodised in accordance with BS 1615.

6.3.2 The reflector shall be sufficiently rigid to ensure that it does not bend or distort as a result of heat developed within the luminaire.

6.3.3 The reflective properties of the reflector shall not change as a result of periodic cleaning by maintenance personnel. No part of the reflector shall become detached or distorted as a result of normal handling of the luminaire or vibration under working conditions.

6.3.4 The reflectors shall be manufactured with such close tolerances that all luminaires of the same type have the same light distribution characteristics.

6.4 CONTROL GEAR

6.4.1 The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted

6.4.2 Ballasts shall comply with SABS IEC 922 and 923 as applicable and shall be suitable for operation on 220V to 250V, 50Hz supplies.

6.4.3 Ballasts shall further be suitable for the particular luminaire to ensure that the thermal limits specified in Clause 5.1 above are not exceeded.

6.4.4 The luminaire control gear shall be mounted inside a separate control gear compartment.

The gear-mounting tray shall be manufactured from sheet steel at least 0,7mm thick and shall be epoxy powder coated. The gear-mounting tray shall be hinged and shall open under gravitational force when the luminaire is in its normal mounted position.

6.4.5 The gear tray and luminaire body shall be equipped with the components suitable for the luminaires and lamps specified in the project specification.

6.4.6 In those applications where ignitors are used, these shall be of the superposed pulse type.

6.4.7 Capacitors shall comply with SABS 1250. The power factor of each complete luminaire shall be corrected to at least 0,85.

6.5 INTERNAL WIRING

6.5.1 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body or control gear trays.

6.5.2 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.

6.5.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.

6.5.4 The wiring shall terminate on a suitable terminal block having screw down plates bearing on the wires. Terminals where screws bear down directly on wires will not be acceptable. The terminal block shall be mounted in the control gear compartment.

6.5.5 An earth terminal, forming part of the luminaire body, shall be provided. To ensure good earth continuity the earth terminal shall not be spray painted. The earth conductor shall be connected to this terminal by means of a crimped lug.

6.5.6 All circuits that require ignitors shall have an insulated wire between the ignitor and the lamp holder, suitable to withstand a voltage of at least 5kV.

6.6 LAMP HOLDERS

6.6.1 Lamp holders shall be of the type suitable for the relevant lamp used. Lamp holders shall not deteriorate as a result of normal operating temperatures in the luminaire. Lamp holders shall comply with SABS VC8011 and shall be able to withstand a temperature of 240° C.

6.6.2 Lamp holders shall be adjustable for cut-off or semi-cut-off light distribution characteristics.

6.6.3 Lamp holders shall not degenerate under normal working conditions and shall not work loose as a result of vibration.

6.7 LAMPS

6.7.1 The following standard lamps shall be used for the purposes of this specification:

LAMP	LAMP HOLDER	
Sodium Vapour		
70W	E27	(This lamp shall be of the elliptical type)
150W	E40	
250W	E40	(These lamps shall be of the tubular clear type.)

400W	E40

Compact fluorescent

26W PLC	G24d-3

Mercury vapour

80W	E27
125W	E27
250W	E40
400W	E40

(All mercury vapour lamps shall be of the elliptical coated type.)

7. ELECTRICAL SUPPLY

7.1 The luminaires shall be suitable for connection to a single-phase electricity supply with a nominal voltage of 220V to 250V at 50Hz.

7.2 The actual voltage will be furnished in the project specification.

8. PHOTOMETRIC DATA

Photometric data sheets of the luminaire as prepared by a laboratory that complies with SABS requirements, shall be submitted with the luminaire.

9. TECHNICAL INFORMATION

The Tenderer shall include full technical particulars regarding the luminaire offered with the tender.

SECTION C12.7

HIGH BAY LUMINAIRES

1. SCOPE

This specification covers the requirements for high bay luminaires using sodium vapour, mercury vapour or metal halide lamps with standard wattage ratings as specified in the project specification.

2. GENERAL

2.1 To promote work creation in South Africa, the luminaire should preferably be manufactured within the Republic of South Africa and should have a local content of at least 50%.

2.2 If the luminaire offered is of foreign origin, full specifications on technical performance and quality must be submitted and full reasons shall be given why the unit had to be imported.

2.3 A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.

2.4 Luminaires, associated equipment and control gear shall be new and unused and shall be supplied complete with lamps, control gear, diffusers, mounting brackets, etc. and shall be delivered to site in a protective covering.

2.5 Lamps shall be delivered separately.

4. STANDARDS

The following standard specifications of the South-African Bureau of Standards and the International Electro technical Commission shall apply to this luminaire specification:

3.1	SABS 0142:	The wiring of Premises.
3.2	SABS 165: and VC8011	Lamp holders
3.3	SABS 783:	Baking enamels.
3.4	SABS 1222:	Enclosures for electrical equipment.
3.5	SABS 1247:	Coatings applied by the powder-coating process.
3.6	SABS 1250: ballasts.	Capacitors for use with fluorescent and other discharge lamp
3.7	SABS 1464:	Safety of luminaires.
3.8	SABS 1507:	Electric cables with extruded solid dielectric insulation for fixed Installations.
3.9	SABS IEC 662:	High-pressure sodium vapour lamps.
3.10	SABS 1421	Mercury vapour lamps
3.11	IEC 61167	Metal halide lamps
3.12	SABS IEC 922 and SABS IEC 923:	Ballasts for discharge lamps.
3.13	SABS IEC 926 and SABS IEC 927:	Starting devices (other than glow starters).

3.14 Any standard referred to in the above standards.

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

4.6 AREAS OF APPLICATION: The luminaires are intended for interior use in establishments under the control of the Department of Public Works.

4.7 FIXING: The luminaires shall be suitable for mounting against horizontal surfaces or beams or as described in the project specification.

4.8 ENVIRONMENTAL: Unless otherwise specified in the detail specification the luminaires shall be suitable for operation in ambient temperatures between -10°C and +45°C.
The luminaire shall have an ingress protection rating of IP 22 for the control gear compartment and this shall be certified in a SABS report.

4.9 SAFETY: The luminaire shall bear the *SABS 1464* safety mark.

4.10 NOISE: Noisy ballasts will not be accepted and shall be replaced at no cost to the Department. All ballasts shall comply with the requirements of the latest edition of SABS IEC 922 and 923.

5. GENERAL TECHNICAL REQUIREMENTS

5.5 The internal components of the luminaire shall be able to withstand internal temperatures of at least 45°C without resulting in any electrical or mechanical component exceeding its maximum rated operating temperature. Certified proof from an authorised testing facility shall be presented on request.

5.6 All metal components shall be manufactured from corrosion-resistant materials or shall be treated to prevent corrosion.

5.7 All screws and other components must be easily reachable and must be mounted on the luminaire body.

5.8 Luminaires shall preferably bear the SABS mark.

6. CONSTRUCTION

6.1 BODY

6.7.2 The luminaire shall consist of two components, viz. a reflector housing the lamp and a control gear compartment onto which the lamp holder is fixed.

6.7.3 Provision shall be made for the effective dissipation of heat emanating from the lamp and the control gear.

6.7.4 The overall height of the luminaire shall not exceed 550mm.

6.7.5 The mass of the complete luminaire shall not exceed 12kg.

6.8 REFLECTOR

6.8.1 The reflector shall be of a spun-aluminium construction. The aluminium shall be of high purity and shall be brightened and anodised.

6.8.2 The size and shape of the reflector shall be designed so that it neatly fits onto the control gear body and it shall be of sufficient size to house the lamp. The reflector shall preferable be adjustable to accommodate the particular type of lamp used.

6.8.3 The reflector shall be shaped to provide the maximum light output and shall minimise glare. The reflector shall have a maximum diameter of not more than 540mm.

6.8.4 The reflector shall be sufficiently rigid to ensure that it does not bend or distort as a result of heat developed by the lamp or control gear.

6.8.5 The reflective properties of the reflector shall not change as a result of periodic cleaning by maintenance personnel. No part of the reflector shall become detached or distorted as a result of normal handling of the luminaire or vibration under working conditions.

6.8.6 The reflectors shall be manufactured with such close tolerances that all luminaires of the same type have the same light distribution characteristics.

6.9 CONTROL GEAR

6.9.1 The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted and for the lamps specified in the project specification.

6.9.2 Ballasts shall comply with SABS IEC 922 and 923 as applicable and shall be suitable for operation on 220V to 250V, 50Hz supplies.

6.9.3 Ballasts shall further be suitable for the particular luminaire to ensure that the thermal limits specified in Clause 5.1 above are not exceeded.

6.9.4 The luminaire control gear shall be mounted inside a separate control gear compartment. The control gear housing shall consist of two parts. The top part shall be provided with 20mm diameter conduit entry knock-outs and mounting facilities to enable the mounting of this part of the control gear compartment by means of mounting brackets, vibration-proof mounting bolts or suspension hooks as detailed in the project specification.

6.9.5 The bottom part of the control gear compartment shall be hooked or hinged onto the top portion so that it can be fixed onto the top portion after prior installation of the top part. The bottom section shall house the control gear, which shall be mounted on a removable gear tray.

6.9.6 The gear-mounting tray shall be manufactured from sheet steel at least 0,7mm thick and shall be epoxy powder coated.

6.9.7 In those applications where ignitors are used, these shall be of the superposed pulse type. The wire between the ignitor and the lamp holder shall be insulated to withstand a voltage of at least 5kVDC.

6.9.8 Capacitors shall comply with SABS 1250. The power factor of each complete luminaire shall be corrected to at least 0,85.

6.10 INTERNAL WIRING

6.10.1.1. Luminaires shall be completely wired internally. Conductors shall be protected with grommets
where they pass through holes in the body or control gear trays.

6.10.1 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.

6.10.2 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration. Silicon insulation shall be used throughout.

6.10.3 The wiring shall terminate on a suitable terminal block having screw down plates bearing on the wires. Terminals where screws bear down directly on wires will not be acceptable. The terminal block shall be mounted in the control gear compartment.

6.10.4 An earth terminal, forming part of the luminaire body, shall be provided. To ensure good earth continuity the earth terminal shall not be spray painted. The earth conductor shall be connected to this terminal by means of a crimped lug.

6.10.5 All circuits that require ignitors shall have an insulated wire between the ignitor and the lamp holder, capable of withstanding a voltage of at least 5kV.

6.11 LAMP HOLDERS

6.11.1 Lamp holders shall be of the type suitable for the relevant lamp used. Lamp holders shall not deteriorate as a result of normal operating temperatures in the luminaire. Lamp holders shall comply with SABS VC8011 and shall be able to withstand a temperature of 240° C.

6.11.2 Lamp holders shall not degenerate under normal working conditions and shall not work loose as a result of vibration.

6.12 LAMPS

6.12.1 The following standard lamps shall be used for the purposes of this specification:

LAMP	LAMP HOLDER
Sodium Vapour	(These lamps shall be of the tubular clear type.)
150W	E40
250W	E40
400W	E40
Mercury vapour	(All mercury vapour lamps shall be of the elliptical coated type.)
250W	E40

400W	E40
Metal Halide	(These lamps shall be of the elliptical coated type.)
250W	E40
400W	E40

7. ELECTRICAL SUPPLY

7.3 The luminaires shall be suitable for connection to a single-phase electricity supply with a nominal voltage of 220V to 250V at 50Hz.

7.4 The actual voltage will be furnished in the project specification.

8. PHOTOMETRIC DATA

Photometric data sheets of the luminaire as prepared by a laboratory that complies with SABS requirements, shall be submitted with the luminaire.

9. TECHNICAL INFORMATION

The Tenderer shall include full technical particulars regarding the luminaire offered with the tender.

SECTION C12.8

FLOODLIGHT LUMINAIRES

1. SCOPE

This specification covers the requirements for floodlight luminaires, for outdoor applications, using high-pressure sodium vapour, mercury vapour or metal halide lamps with standard wattage ratings as specified in the project specification.

2. GENERAL

2.1 To promote work creation in South Africa, the luminaire should preferably be manufactured within the Republic of South Africa and should have a local content of at least 50%.

2.2 If the luminaire offered is of foreign origin, full specifications on technical performance and quality must be submitted and full reasons shall be given why the unit had to be imported.

2.3 A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.

2.4 Luminaires, associated equipment and control gear shall be new and unused and

shall be supplied complete with lamps, control gear, reflectors, mounting brackets, etc. and shall be delivered to site in a protective covering.

2.5 Lamps shall be delivered separately.

5. STANDARDS

The following standard specifications of the South-African Bureau of Standards and the International Electrotechnical Commission shall apply to this luminaire specification:

3.1	SABS 0142:	The wiring of Premises.
3.2	SABS 165: and VC8011	Lamp holders
3.3	SABS 783:	Baking enamels.
3.4	SABS 1222:	Enclosures for electrical equipment.
3.5	SABS 1247:	Coatings applied by the powder-coating process.
3.6	SABS 1250:	Capacitors for use with fluorescent and other discharge lamp ballasts.
3.7	SABS 1279:	Floodlighting luminaires.
3.8	SABS 1464:	Safety of luminaires.
3.9	SABS 1507:	Electric cables with extruded solid dielectric insulation for fixed installations.
3.10	SABS IEC 662:	High-pressure sodium vapour lamps.
3.11	SABS 1421:	Mercury vapour lamps
3.12	IEC 61167:	Metal halide lamps
3.13	SABS IEC 922 and SABS IEC 923:	Ballasts for discharge lamps.
3.14	SABS IEC 926 and SABS IEC 927:	Starting devices (other than glow starters).
3.15	Any standard referred to in the above standards.	

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

4.11 AREAS OF APPLICATION: The luminaires are intended for exterior use in establishments under the control of the Department of Public Works.

4.12 FIXING: The luminaires shall be suitable for mounting against horizontal or vertical surfaces, walls, perimeter fences or on poles as described in the project specification.

4.13 ENVIRONMENTAL: Unless otherwise specified in the detail specification the luminaires shall be suitable for operation in ambient temperatures between -10°C and +45°C.
The luminaire shall have an ingress protection rating as indicated below and this shall be certified in a SABS report.

4.14 SAFETY: The luminaire shall bear the *SABS 1464* safety mark.

4.15 NOISE: Noisy ballasts will not be accepted and shall be replaced at no cost to the Department. All ballasts shall comply with the requirements of the latest edition of SABS IEC 922 and 923.

5. GENERAL TECHNICAL REQUIREMENTS

5.9 General

5.9.1 The internal components of the luminaire shall be able to withstand internal temperatures of at least 45°C without resulting in any electrical or mechanical component exceeding its

maximum rated operating temperature. Certified proof from an authorised testing facility shall be presented on request.

5.1.2 The luminaire shall bear the SABS 1279 and SABS 1464 marks.

5.10 Construction

A. Floodlight for use with 150/100/70W HPS or 125/80W MV lamps.

1. The luminaire shall consist of a body manufactured from high-pressure die-cast aluminium, or from filled ultra-violet stabilised glass-fibre reinforced polyester with a transparent prismatic diffuser.
2. The housing shall be equipped with a clear transparent high-impact resistant acrylic bowl, treated against discolouring due to UV and lamp radiation, with a silicon-rubber gasket. The dome shall preferably be hinged and mounted with stainless steel clips.

3. The luminaire shall be designed to accommodate the control gear, wiring, lamp holders, the diffuser and reflectors. It shall be possible to reach the control gear without disconnecting wiring or removing the luminaire.

4. The reflector shall be mounted on the luminaire body. The reflector shall be made from highly polished 99,98% pure specular anodised aluminium plate and shall be manufactured to give optimum performance with the prismatic diffuser as applicable. For wider beam spread, a hammered finish shall be provided.

5. All components, including screws, bolts and nuts utilised in the construction of the luminaire or fixing of its components, shall be corrosion proof. Cadmium plated or stainless steel materials are preferred.

6. The luminaire shall be provided with a cable entry at the back of the luminaire by means of a plastic gland. However, it shall be possible to provide 20mm diameter conduit entries or cable entries from the sides of the luminaire and suitable drilling indents or knockouts shall be furnished on the luminaire body.

7. A heavy gauge galvanised steel stirrup bracket for mounting the luminaire shall be supplied with the luminaire unless omitted in the project specification.

8. The luminaire shall be suitable for use with 1 x 150W (tubular) or 100W or 70W (both elliptical) high-pressure sodium vapour lamp or 1 x 125W or 80W (both elliptical) mercury vapour lamp.
The lamps required shall be as specified in the project specification.

9. The luminaire shall have an ingress protection rating of at least IP43.

Flood-lights for use with 400/250/150W HPS or 400/250W MH or 400/250W MV lamps:

1. The luminaire shall be consisting of a body manufactured from high-pressure die-cast aluminium. The body shall be hail-proof, weatherproof and corrosion and vandal resistant.

2. The housing shall be equipped with a flat armoured glass fixed in a sturdy, die-cast frame with a silicon-rubber gasket. The glass frame shall be hinged and mounted with stainless steel screws and mounting plates.

3. The luminaire shall be equipped with integral control gear mounted in a separate control gear compartment.

4. The reflector shall be mounted on the luminaire body. The reflector shall be made from highly polished 99, 98% pure specular anodised aluminium plate and shall be manufactured to give optimum performance with the prismatic diffuser as applicable. For wider beam luminaires, a hammered finish shall be provided.

5. The luminaire shall be suitable for the following lamps, the replacement of which shall be by means of a removable side-mounted cast aluminium lamp holder housing with a heat-resistant water-proof gasket :

   High-pressure sodium: 400W, 250W or 150W tubular type and 400W, 250W and 150W Elliptical type

   Metal-halide lamps: 400W or 250W tubular type and 400W or 250W elliptical type

   Mercury vapour lamps: 400W or 250W elliptical type

   The lamps required shall be as stated in the project specification.

6. The luminaire shall have an ingress protection rating of at least IP65.

7. A heavy gauge hot-dipped galvanised steel mounting-stirrup with pre-punched holes shall be supplied with the luminaire unless otherwise specified in the project specification.

5.11 Internal wiring

5.11.1 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body or control gear trays.

5.11.2 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.

5.11.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.

5.11.4 The wiring shall terminate on a suitable terminal block having screw down plates bearing on the wires. Terminals where screws bear down directly on wires will not be acceptable.

5.11.5 Where circuits requiring the use of ignitors are used the wire between the ignitor and the lamp holder shall be insulated to withstand at least 5kV.

5.11.6 An earth terminal, forming part of the luminaire body, shall be provided. To ensure good earth continuity the earth terminal shall not be spray painted. The earth conductor shall be connected to this terminal by means of a crimped lug.

5.12 Lamp holders

5.12.1 Lamp holders shall be of the type suitable for the relevant lamp used. Lamp holders shall not deteriorate as a result of normal operating temperatures in the luminaire. Lamp holders shall comply with SABS VC8011 and shall be able to withstand a temperature of 240° C.

5.13 Control gear

5.13.1 The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted

5.13.2 Ballasts shall comply with SABS IEC 922 and 923 as applicable and shall be suitable for operation on 220V to 250V, 50Hz supplies.

5.13.3 Ballasts shall further be suitable for the particular luminaire to ensure that the thermal limits specified in Clause 5.1.1 above are not exceeded.

5.13.4 The luminaire control gear shall be mounted onto the inside of the control gear compartment of the body on a separate mounting plate. The gear-mounting tray shall be manufactured from sheet steel at least 0,7mm thick and shall be epoxy powder coated.

5.13.5 The gear tray and luminaire body shall be equipped with the components suitable for the luminaires and lamps specified in the project specification.

5.13.6 In those applications where ignitors are used, these shall be of the superposed pulse type.

5.14 Capacitors

Capacitors shall comply with SABS 1250. The power factor of each complete fitting shall be corrected to at least 0,85.

5.15 Lamps

5.15.1 The following standard lamps shall be used for the purposes of this specification:

LAMP	LAMP HOLDER	LAMP TYPE
HP Sodium Vapour		
400W, 250W, 150W or 100W	E40	Tubular clear or coated elliptical
70W	E27	Coated elliptical
Metal halide		
400W or 250W	E40	Tubular clear or coated elliptical
Mercury vapour		
400W and 250W	E40	Coated elliptical
125W and 80W	E27	Coated elliptical

5.7.2 The actual lamp ratings and types shall be as specified in the project specification.

6. LIGHT DISTRIBUTION

The floodlights shall be available with at least three types of symmetrical light distribution characteristics. These shall be:

6.1 Wide beam
6.2 Medium beam
6.3 Narrow beam

7. PHOTOMETRIC DATA

Photometric data sheets of the luminaire as prepared by a laboratory that complies with SABS requirements shall be submitted with the luminaire.

8. TECHNICAL INFORMATION

The Tenderer shall include full technical particulars regarding the luminaire offered with the tender.

SECTION C12.9

PENDANT LUMINAIRES FOR USE WITH COMPACT FLUORESCENT OR TUNGSTEN FILAMENT LAMPS FOR INTERIOR APPLICATIONS

1. SCOPE

This specification covers the requirements for pendant type luminaires, using compact fluorescent or tungsten filament lamps, operating at a nominal voltage of 230V, for general indoor use. The types of luminaires covered are decorative types with metal, acrylic and glass shades and include luminaires with one or more lamps with standard wattage

ratings as specified in the project specification.

2. GENERAL

2.1 To promote work creation in South Africa, the luminaire should preferably be manufactured within the Republic of South Africa and should have a local content of at least 50%.

2.2 If the luminaire offered is of foreign origin, full specifications on technical performance and quality must be submitted and full reasons shall be given why the unit had to be imported.

2.3 A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.

2.4 Luminaires, associated equipment and control gear shall be new and unused and shall be supplied complete with lamps, control gear, diffusers, mounting brackets, etc. and shall be delivered to site in a protective covering.

2.5 Lamps shall be delivered separately.

6. STANDARDS

The following standard specifications of the South-African Bureau of Standards and the International Electro technical Commission shall apply to this luminaire specification:

6.1 SABS 1119: Interior luminaires for fluorescent lamps. Note: The latest amendments whereby luminaires with compact fluorescent lamps are covered, shall apply.
6.2 SABS 1250: Capacitors for use with fluorescent and other discharge lamp ballasts.
6.3 SABS 890, IEC 920 and IEC 921: Ballasts for fluorescent lamps.
6.4 SABS 1464: Safety of luminaires.
6.5 SABS 1479: Glow starters for fluorescent lamps.
6.6 SABS 1247: Coatings applied by the powder-coating process.
6.7 SABS 783: Baking enamels.
6.8 SABS 0142 : The wiring of Premises
6.9 SABS 56: Incandescent lamps
6.10 SABS 165: Lamp holders And VC8011
6.11 Any standard referred to in the above standards.

7. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

7.1 AREAS OF APPLICATION: The luminaires are intended for standard indoor use in buildings under the control of the Department of Public Works.

7.2 FIXING: The luminaires shall be suitable for mounting against ceilings as described in the project specification.

7.3 ENVIRONMENTAL : Unless otherwise specified in the detail specification the luminaires shall be suitable for operation in ambient temperatures between -10°C and +45°C.

7.4 SAFETY: The luminaire shall bear the SABS 1464 safety mark.

7.5 NOISE: Noisy ballasts will not be accepted and shall be replaced at no cost to the Department. All ballasts shall comply with the requirements of the latest edition of SABS

890, Part 1 or IEC 920 and 921.

8. GENERAL TECHNICAL REQUIREMENTS

8.1 General

8.1.1.1 Compact fluorescent lamp luminaires shall comply fully with SABS 1119 and all amendments as well as the additional requirements of this specification. Luminaires which bear the SABS mark are preferred. Luminaires shall at least have an SABS Certificate of Compliance.

8.1.2 The Department reserves the right to have samples of luminaires offered tested by the SABS for compliance with SABS 1119. If a sample luminaire is found not to comply with SABS 1119 the cost of such tests shall be borne by the Tenderer.

8.1.3 Luminaires for tungsten filament lamps shall not materially differ from those for compact fluorescent lamps, but shall be capable of dissipating the extra heat generated without deterioration in the luminaire materials.

8.2 Construction

8.2.1 The luminaire shall consist of the following basic parts:

5.2.2 A mounting bracket which fits onto a standard round conduit ceiling box by means of two screws.

5.2.3 A suspension hook from which the luminaire cable is suspended to prevent the luminaire from hanging from the connector block.

5.2.4 A connector block for wiring the luminaire to the mains wiring.

5.2.5 A ceiling cup which can be moved upwards over the luminaire cable to cover the connections at the ceiling.

5.2.6 A white heat-resistant three-core flexible cable with a nominal length of 1,5m connected onto the terminal block in the ceiling box, and the other end factory-connected to the lamp holder or control circuit of the luminaire.

5.2.7 A shade of either metal, non-discolouring acrylic material or glass as specified in the project specification.

5.2.8 All components, including screws, bolts and nuts utilized in the construction of the luminaire or fixing of its components, shall be corrosion proof. Cadmium plated, brass or stainless steel materials are preferred.

5.2.9 Where the mass of the luminaire exceeds 1,5kg a separate stainless steel suspension cable to support the luminaire shall be provided.

5.3 Internal wiring

5.3.1.1 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in metal parts.

5.3.2 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.

5.3.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire

body without deterioration.

5.3.4 The wiring shall terminate on a suitable terminal block having screw down plates bearing on the wires. Terminals where screws bear down directly on wires will not be acceptable.

5.3.5 An earth terminal, welded to the luminaire body, shall be provided. To ensure good earth continuity the earth terminal shall not be spray painted. The earth conductor shall be connected to this terminal by means of a crimped lug.

5.4 Lamp holders

Lamp holders shall be of the type suitable for the relevant compact fluorescent or general lighting service lamp. For incandescent lamps brass holders with porcelain galleries shall be provided. The following standard lamps and lamp holders shall apply:

5.4.1

LAMP	HOLDER
7W PL	2G11
9W PL	2G11
13W PLC	G24d-1
60/100W GLS	E27 or Bayonet Cap, porcelain

5.5 Control gear

5.5.1 Where applicable, the control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted. All fluorescent luminaires shall operate on a switch-start basis where external starters are employed.

5.6 Lamps

5.6.1 Fluorescent lamps shall be suitable for the control circuitry used. Lamps shall comply with the applicable clauses of SABS 1041 and, where it does not apply, the lamps shall comply with IEC 81 or IEC 901. If no colour is specified in the Detail Technical Specification, the light colour for fluorescent lamps shall correspond to colour 2 (4 300K) of SABS 1041.

5.6.2 Lamps of the same colour shall be provided for an entire installation unless specified to the contrary.

5.6.3 There shall be no visible flicker in the lamps and lamps shall readily strike when switched on. Faulty lamps or ballasts shall be replaced at no cost to the Department.

5.6.4 The following standard lamps shall be used for the purposes of this specification:

PL lamps: 7W, and 9W
PLC Lamps: 13W
GLS Lamps: 60 and 100W

5.7 Lamp Shades

5.7.1 Metal Lamp Shades:

The metal shade shall be manufactured from aluminium and shall be spun into a pleasing decorative shape which shall provide a circular distribution pattern with an angle of approximately 60° to the vertical in all directions.

5.7.1.1 The shade shall be epoxy-powder coated inside and outside and shall be white on the inside. The outside colour shall be as described in the project specification.

5.7.1.2 The shade shall be suitable ventilated to prevent the building-up of excessive heat.

5.7.2 Acrylic Lamp Shades:

5.7.2.1 The shade shall consist of a high-impact resistant ultra-violet stabilised acrylic moulding which will not discolour as a result of the heat or the particular radiation of the lamp used in the luminaire. The shade shall be either transparent or opaque as described in the project specification and shall have a pleasing decorative shape.

5.7.2.2 The shade shall provide sufficient upward light to make full use of ceiling reflection.

5.7.3 Glass lamp shades:

5.7.3.1 The shade shall be made from frosted opaque white glass (unless otherwise specified in the project specification) and shall be manufactured with a pleasing shape.

5.7.3.2 The shade shall provide sufficient upward light to make full use of ceiling reflections.

6. PHOTOMETRIC DATA

Photometric data sheets of the luminaire as prepared by a laboratory that complies with SABS requirements, shall be submitted with the luminaire.

7. TECHNICAL INFORMATION

The Tenderer shall include full technical particulars regarding the luminaire offered with the tender.

1. SCOPE

This specification covers the requirements for infra-red units or luminaires used as heating sources in the rearing of broiler chickens in enclosed chicken pens, with wattage ratings as specified.

2. GENERAL

2.1 To promote work creation in South Africa, the units or luminaires should preferably be manufactured within the Republic of South Africa and should have a local content of at least 50%.

2.2 If the equipment offered is of foreign origin, full specifications on technical performance and quality must be submitted and full reasons shall be given why the unit had to be imported.

2.3 A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.

2.4 Units/luminaires and associated equipment shall be new and unused and shall be supplied complete with infrared source/lamp, mounting brackets, etc. and shall be delivered to site in a protective covering.

2.5 Lamps, where applicable, shall be delivered separately.

3 STANDARDS

The following standard specifications of the South-African Bureau of Standards and the International Electrotechnical Commission shall apply to this specification:

3.1	SABS 0142:	The wiring of Premises.
3.2	SABS 165: and VC8011	Lamp holders
3.3	SABS 1222:	Enclosures for electrical equipment.
3.4	SABS 1247:	Coatings applied by the powder-coating process.
3.5	SABS 1464:	Safety of luminaires.
3.6	SABS 1507:	Electric cables with extruded solid dielectric insulation for fixed Installations.

3.7 Any standard referred to in the above standards.

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

4.1 AREAS OF APPLICATION: The units/luminaires are intended for interior use in establishments under the control of the Department of Public Works.

4.2 FIXING: The units/luminaires shall be suitable for mounting on brackets against horizontal or vertical surfaces, or for suspension from chains or cables from roof structures as described in the project specification.

4.3 ENVIRONMENTAL: Unless otherwise specified in the detail specification the units/luminaires shall be suitable for operation in ambient temperatures between -10°C and +45°C.
To enable cleaning of the enclosures by means of water spraying, the unit/luminaire shall preferably be splash proof. Where luminaires are offered, these shall have an ingress protection rating of at least IP 23.

4.4 SAFETY: If luminaires are offered, these shall bear the SABS 1464 safety mark.

5. GENERAL TECHNICAL REQUIREMENTS

5.1 The internal components of the unit or luminaire shall be able to withstand internal temperatures of at least 45°C without resulting in any electrical or mechanical component exceeding its maximum rated operating temperature. Certified proof from an authorised testing facility shall be presented on request.

5.2 All metal components shall be manufactured from corrosion-resistant materials or shall be treated to prevent corrosion.

5.3 All screws and other components must be easily reachable and must be mounted on the unit/luminaire body.

6. CONSTRUCTION

6.1. GENERAL:

The energy source required may be either a heat source making use of an open IR source or a luminaire utilising an infrared lighting source.

6.2. OPEN SOURCE DEVICES:

6.2.1 The body shall consist of an enclosed connection box, manufactured form epoxy powder-coated or galvanised sheet-metal, equipped with an aluminium reflector and a wound IR source.

6.2.2 The connection box shall be provided with an eyebolt or hook for suspension and mounting of the unit.

6.2.3 The unit shall be provided with 2 metres of cabtyre cable and a connected 15A plug-top.

6.2.4 The unit shall have a maximum height of 210mm and the reflector shall have a diameter of not more than 390mm. The mass of the unit shall not exceed 1,7kg.

6.2.5 The reflector shall be manufactured from high-purity anodised aluminium.

6.2.6 The infrared source shall be on a porcelain base and shall have a maximum rating of not more than 550W on a 230V power supply.

6.2.7 The IR source shall emit infrared radiation with more than 60% in the 3 700nanometre range.

6.2.8 To facilitate cleaning, it shall be possible to immerse the whole unit in water when the power supply is disconnected.

6.3 LIGHT SOURCE DEVICES

6.3.1 The luminaire shall consist of a non-corrosive metal body shaped as to house the infrared lamp. The inside and outside of the housing shall preferably be epoxy powder coated and shall be of a neutral colour such as grey.

6.3.2 The housing shall be suitable for use with PAR 38 lamps with E27 bases.

6.3.3 The housing shall be equipped with a heat-resistant lamp holder, capable of withstanding

the operating temperature of the lamp in the ambient conditions as described in clause 4 above.

6.3.4 The housing shall be equipped with a wire grille to prevent accidental contact with the lamp.

6.3.5 The luminaire shall be provided with a suitable suspension hook for vertical mounting of the luminaire or as described in the project specification.

6.3.6 The luminaire shall be provided with an integral connection box and 2m of cabtyre cable with a 15A plug-top mounted on the free end.

6.3.7 The lamp shall be constructed from hardened glass to withstand water droplets while in operation. The lamp rating shall be 100W at 230V.

6.3.8 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body or control gear trays.

6.3.9 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.

6.3.10 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.

6.3.11 The wiring shall terminate on a suitable terminal block having screw down plates bearing on the wires. Terminals where screws bear down directly on wires will not be acceptable.

6.3.12 An earth terminal, forming part of the luminaire body, shall be provided. To ensure good earth continuity the earth terminal shall not be spray painted. The earth conductor shall be connected to this terminal by means of a crimped lug.

7. ELECTRICAL SUPPLY

7.5 The luminaires shall be suitable for connection to a single-phase electricity supply with a nominal voltage of 220V to 250V at 50Hz.

7.6 The actual voltage will be furnished in the project specification.

8. TECHNICAL INFORMATION

The Tenderer shall include full technical particulars regarding the luminaire offered with the tender.

SECTION C12.11

BULKHEAD LUMINAIRES FOR USE WITH DISCHARGE LAMPS FOR INTERIOR AND EXTERIOR APPLICATIONS

1. SCOPE

This specification covers the requirements for bulkhead type luminaires, using mercury vapour, sodium vapour or metal halide lamps, for general outdoor and indoor use. The luminaires covered are decorative rectangular or polygonal surface-mounted types and include luminaires with one or more lamps with standard wattage ratings as specified in the project specification. Luminaires for use in special applications or atmospheres are not included in this specification.

2. GENERAL

2.1 To promote work creation in South Africa, the luminaire should preferably be manufactured within the Republic of South Africa and should have a local content of at least 50%.

2.2 If the luminaire offered is of foreign origin, full specifications on technical performance and quality must be submitted and full reasons shall be given why the unit had to be imported.

2.3 A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.

2.4 Luminaires, associated equipment and control gear shall be new and unused and shall be supplied complete with lamps, control gear, diffusers, mounting brackets, etc. and shall be delivered to site in a protective covering.

2.5 Lamps shall be delivered separately.

3. STANDARDS

The following standard specifications of the South-African Bureau of Standards and the International Electro technical Commission shall apply to this luminaire specification:

3.1	SABS 1421:	High-pressure mercury vapour lamps.
3.2	SABS IEC 662:	High-pressure sodium vapour lamps.
3.3	IEC 61167:	Metal Halide lamps.
3.4	SABS 1250:	Capacitors for use with fluorescent and other discharge lamp ballasts.
3.5	SABS 1464:	Safety of luminaires.
3.6	SABS 1278:	Interior luminaires for low pressure sodium vapour and high intensity Discharge lamps.
3.7	SABS IEC 922 and SABS IEC 923:	Ballasts for discharge lamps.
3.8	SABS IEC 926 and SABS IEC 927:	Starting devices (other than glow starters).
3.9	SABS 1247:	Coatings applied by the powder-coating process.
3.10	SABS 783:	Baked enamels.
3.11	SABS 0142:	The wiring of Premises

3.12 SABS 1507: Electric cables with extruded solid dielectric insulation for fixed installations.

3.13 SABS 165: and VC8011 Lamp holders

3.14 Any standard referred to in the above specifications.

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

4.1 AREAS OF APPLICATION: The luminaires are intended for standard indoor and exterior use in buildings under the control of the Department of Public Works.

4.2 FIXING: The luminaires shall be suitable for mounting against horizontal or vertical surfaces and walls as described in the project specification.

4.3 ENVIRONMENTAL: Unless otherwise specified in the detail specification the luminaires shall be suitable for operation in ambient temperatures between -10°C and +45°C. The luminaire shall have an ingress protection rating of IP66.

4.4 SAFETY: The luminaire shall bear the *SABS 1464* safety mark.

4.5 NOISE: Noisy Ballasts will not be accepted and shall be replaced at no cost to the Department. All Ballasts shall comply with the requirements of the latest edition of SABS IEC 922 and 923.

5. GENERAL TECHNICAL REQUIREMENTS

5.1 General

5.1.1 The internal components of the luminaire shall be able to withstand internal temperatures of at least 45°C without resulting in any electrical or mechanical component exceeding its maximum rated operating temperature. Certified proof from an authorised testing facility shall be presented on request.

5.1.2 The luminaire shall also be available with an optional wire guard and a decorative skirt of the same material and finish as the luminaire body.

5.2 Construction

5.2.1 The luminaire shall consist of a body manufactured from high-pressure die-cast aluminium, with a transparent prismatic diffuser. The body shall be of sufficient strength for the mounting of the entire luminaire.

5.2.2 The luminaire shall be designed to accommodate the control gear, wiring, lamp holders, the diffuser and reflectors. It shall be possible to reach the control gear without disconnecting wiring or removing the luminaire.

5.2.3 Except for mounting holes and/or slots, the back of the body shall be closed over the full extent of the luminaire. At least three mounting holes shall be provided.

5.2.4 All components, including screws, bolts and nuts utilised in the construction of the luminaire or fixing of its components, shall be corrosion proof. Cadmium plated or stainless steel materials are preferred.

5.2.5 The luminaire shall be provided with a cable entry at the back of the luminaire by means of a plastic gland. However, it shall be possible to provide 20mm diameter conduit entries or cable entries from the sides of the luminaire and suitable drilling indents or knockouts shall

be furnished on the luminaire body.

5.3 Internal wiring

5.3.1 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body or control gear trays.

5.3.2 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.

5.3.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.

5.3.4 The wiring shall terminate on a suitable terminal block having screw down plates bearing on the wires. Terminals where screws bear down directly on wires will not be acceptable.

5.3.5 An earth terminal, forming part of the luminaire body, shall be provided. To ensure good earth continuity the earth terminal shall not be spray painted. The earth conductor shall be connected to this terminal by means of a crimped lug.

5.4 Lamp holders

Lamp holders shall be of the type suitable for the relevant lamp used. Lamp holders shall not deteriorate as a result of normal operating temperatures in the luminaire.

5.5 Control gear

5.5.1 The control gear, Ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted

5.5.2 Ballasts shall comply with SABS IEC 922 and 923 as applicable and shall be suitable for operation on 220V to 250V, 50Hz supplies.

5.5.3 Ballasts shall further be suitable for the particular luminaire to ensure that the thermal limits specified in Clause 5.1.1 above are not exceeded.

5.5.4 The luminaire control gear shall be mounted onto the inside of the body and not on a separate mounting plate.

5.5.5 The luminaire body shall be equipped with the components suitable for the luminaires and lamps specified in the project specification.

5.5.6 In those applications where ignitors are used, these shall be of the superposed pulse type.

5.5.7 The reflector shall be mounted on a white epoxy powder coated steel mounting plate at least 0,7mm thick, which is mounted to the body by means of four screws. The reflector shall be made from highly polished anodised aluminium plate and shall be manufactured to give optimum performance with the prismatic diffuser.

5.6 Capacitors

Capacitors shall comply with SABS 1250. The power factor of each complete fitting shall be corrected to at least 0,85.

5.7 Lamps

5.7.1 The following standard lamps shall be used for the purposes of this specification:

LAMP	LAMP HOLDER
Mercury Vapour (50W, 80W and 125W)	E27
Sodium Vapour	
50W and 70W	E27
100W and 150W	E40

NB. All lamps shall be of the elliptical coated type.

LAMP		LAMP HOLDER
Metal halide lamps		
70W and 150W	(tubular)	RX7s
100W	(elliptical)	E27

5.8 Diffuser

5.8.1 The diffuser shall consist of a high-impact resistant ultra-violet stabilised acrylic moulding with internal prismatic refractors and the outer surface shall be smooth. The prisms shall be designed to work in conjunction with the reflectors to provide the optimum light output.

5.8.2 The diffuser shall be mounted to the body by means of an external mounting ring and at least four Allen screws, which should preferably not pass through the diffuser body as well. The diffuser shall be attached to the mounting frame by means of screw-down holding plates.

5.8.3 A silicon sponge gasket which fits into a groove on the body shall be used to allow breathing of the luminaire whilst prohibiting the ingress of insects.

6. PHOTOMETRIC DATA

Photometric data sheets of the luminaire as prepared by a laboratory that complies with SABS requirements shall be submitted with the luminaire.

7. TECHNICAL INFORMATION

The Tenderer shall include full technical particulars regarding the luminaire offered with the tender.

SECTION C17

SWITCHBOARDS (Up to 1 kV)

1. GENERAL

1.1 Scope

This section covers the manufacturing and testing of flush mounted, surface mounted and floor standing switchboards for general installations in normal environmental conditions and for system voltages up to 1 kV.

1.2 Size

All switchboards shall be of ample size to accommodate the specified switchgear and provide space for future switchgear. For every 4 (or part of 4) 5kA circuit-breakers on a switchboard, space for an additional 5kA circuit breaker shall be allowed unless future space requirements are clearly specified. For circuit breakers above 5kA, this factor shall be 15 %. The clearance between adjoining switchgear openings shall be as specified in par. 6.2.

1.3 External Dimensions

The maximum allowable height of free standing switchboards is 2,2 m. Cubicle type boards may be up to 2,4 n high if they can be fully dismantled into individual cubicles. Where, due to space restrictions, a board exceeds 2,4m in height, equipment not normally requiring access, shall be installed in the top section, enabling equipment normally requiring access to be installed lower down in the board. All other specified external dimensions for switchboards shall be strictly adhered to. If the clearances specified in par. 6.2 cannot be adhered to as a result of restricting external dimensions, the Contractor shall obtain the approval of the Department before manufacturing the switchboards.

1.4 Moisture and Vermin

All switchboards shall be rendered moisture proof and vermin proof and shall be adequately ventilated. Refer to par. 4.10 and 4.11.

1.5 Load Balance

The load shall be balanced as equally as possible across multiphase supplies.

2. CONSTRUCTION OF FLUSH MOUNTED SWITCHBOARDS

2.1 Standard

Flush mounted switchboards shall comply fully with SABS 1180, part I. Unless the depths of the switchboards are specified, the depths shall be determined in accordance with par. 6.

2.2 Expanded Metal

Where switchboards are to be built into 115 mm thick walls, expanded metal shall be spot-welded to the rear of the bonding trays. The expanded metal shall protrude at least 75 mm on each tray side to prevent plaster from cracking.

2.3 Knock-outs

Knock-outs shall be provided in the top and bottom ends of each switchboard tray to allow for the installation of conduits for the specified and future circuits. Knock-outs shall be provided for an equal number of 20 mm and 25 mm dia. conduits.

2.4 Panel

Front panels shall have machine punched slots for housing the specified and future flush mounted switchgear. The distance between the inside of the closed doors and the panel shall not be less than 20 mm. No equipment nay be mounted on the panel unless the panel is permanently hinged to the switchboard frame.

2.5 Fixing of Front Panels

The front panel shall be secured to the architrave frame by means of 6mm studs and chromium-plated hexagonal domed nuts, hank nuts or captive fasteners. Alternatively the panel may be secured to the architrave frame by means of two pins at the bottom and a latch or lock at the top of the panel. Self-tapping screws will not be allowed. All front panels shall be provided with a minimum of one chrome plated handle.

2.6 Door Handles and Catches

Switchboard doors shall be equipped with handles and catches. Locks shall only be provided when specified. In all cases where lockable doors are required and in all cases where the switchboard doors are higher or wider than 450 mm, handles consisting of a push-button-and-handle combination with spring loaded catch or rotary handle-and-catch combination shall be installed. Switchboard doors smaller than 450 mm in height and width may be equipped with spring loaded flush mounted ring type latches. Square key operated catches are not acceptable unless specified.

3. CONSTRUCTION OF SURFACE MOUNTED SWITCHBOARDS

3.1 Standard

Surface mounted switchboards shall comply with SABS 1180, Part II.

3.2 Switchboard Tray

Surface mounted switchboards shall be equipped with a 1,6mm minimum sheet steel reinforced tray, suitably braced and stiffened to carry the chassis, door and equipment. Lugs to secure the switchboard to a vertical surface shall be provided.

3.3 Construction

All joints shall be welded or securely bolted. The tray shall be square and neatly finished without protrusions. The front tray sides shall be rounded with an edge of at least 20mm to accommodate flush doors.

3.4 Chassis

A sheet steel chassis for the mounting of equipment shall be bolted to the tray and shall comply with the requirements of par. 6.1 and 6.3.

3.5 Front Panel and Door

The front panel and door shall comply with par. 2.4 to 2.6 above. Doors shall fit flush in the tray when closed.

3.6 Dimensions

Unless the depth of the switchboards is specified, the dimensions shall be determined in accordance with the requirements of par. 6.2 and 6.3.

4. CONSTRUCTION OF FREE STANDING SWITCH BOARDS

4.1 Framework

A metal framework for free standing switchboards shall be manufactured from angle iron, channel iron or 2mm minimum folded metal. A solid U-channel base frame, sufficiently braced to support all equipment and span floor trenches and access holes shall be provided. Switchboards shall be of cubicle design with 2mm side panels forming divisions between cubicles. The maximum allowable cubicle width is 1,5m. (Refer also to par. 4.7). Joints shall be non-continuously butt-welded. Welds shall be ground smooth and the joint wiped with plumber's metal in order to provide a smooth finish. Switchboards wider than 2m shall be fitted with screwed eye-bolts attached to the framework to facilitate loading and transportation of the board.

4.2 Rear and Side Panels

The rear panels shall be removable and shall be manufactured from 2mm minimum sheet steel. The panels shall have returned edges which are recessed in the frame or which fit over lips on the switchboard frame. The panels shall be secured to the frame by means of studs and chromium-plated hexagonal domed brass nuts or hank nuts or captive fasteners equal or similar to "DZUS" or "CAMLOC". Where switchboards are intended for installation in vertical building ducts or against walls, the rear and side panels may consist of a single folded sheet which is either bolted or welded to the frame or which forms part of the folded metal frame.

4.3 Front Panels

4.3.1 The front panels of floor standing switchboards shall preferably be hinged except where flush mounted equipment prevents this. Alternatively, panels shall be secured by means of the methods described in par. 2.5. The panels shall be arranged in multi-tiered fashion to allow for the logical grouping of equipment in accordance with par. 6.

4.3.2 The hinged front panels shall have a dished appearance with 20mm upturns which fit over a lip on the switchboard frame. Alternatively the hinged panels shall have folded edges and shall be fitted flush or slightly recessed in the switchboard frame. The latter method shall

be used where doors are required. (Also refer to par. 4.6). Corners shall be welded and smoothed.

4.3.3 The panels shall be of 2mm minimum sheet steel with machine punched slots to allow for the flush mounting of instrumentation, switchgear toggles and operating handles. A minimum clearance of 50mm shall be maintained between the rear of equipment mounted on the panels (taking into account terminals or other projections) and the frame and chassis of the switchboard. Separate panels shall preferably be provided for the mounting of instrumentation and for covering flush mounted switchgear. Enclosed switchgear with front panels e.g. combination fuse-switch units, may be flush mounted in the board in lieu of separate hinged panels.

4.3.4 Hinged panels shall be suitably braced and stiffened to carry the weight of flush mounted equipment and to prevent warping.

4.3.5 Hinged panels with flush mounted equipment and panels higher than 600mm shall be supported by hinges of adequate strength to ensure smooth and reliable operation. 16mm pedestal or similar heavy duty hinges with single fixing bolts may be used on panels smaller than 600mm. On the larger panels long pedestal type hinges with two fixing bolts per hinge are preferred. Piano hinges are not acceptable for this application.

4.3.6 A tubular chromium-plated handle shall be fitted on each panel. The handle may be omitted if "DZUS" or "CAMLOC" fasteners are used.

4.3.7 Blanking plates shall be fitted over slots intended for future equipment. These plates shall be fixed in a manner which does not require the drilling of holes through the front panel. Dummy circuit-breakers may be fitted where applicable.

4.3.8 Front panels containing live equipment such as instrumentation or control switches, shall be bonded to the switchboard frame with a braided copper earth trap with an equivalent cross-sectional area of at least 4mm^2.

4.4 Securing of Front Panels

Hinged panels shall be secured in position by means of square key operated non-ferrous fasteners designed to draw the panels closed or similar quick-release fasteners. Self-tapping screws are not acceptable. Where non-hinged removable panels are specified, they shall be secured in position by means of 6mm studs and hexagonal chromed brass dome nuts and washers or hank nuts. Non-hinged removable panels may alternatively be secured in position by means of two pins at the bottom and a latch or lock at the top.

4.5 Chassis

A suitably braced chassis for the mounting of switchgear and equipment shall be firmly secured to the frame of the switchboard. The chassis shall be designed so that the switchgear can be installed in accordance with par. 6. Circuit-breakers and isolating switches which are not of the moulded-case air-break type and the insulators of busbars for ratings of 200 A and more may be secured directly to the framework. (Refer to par. 6.1).

4.6 Doors

(a) Doors need only be provided when specified. Doors shall be arranged in multi-tiered fashion to allow for the logical grouping of equipment in accordance with par. 6.

(b) Doors shall have a dished appearance with a minimum of 20 mm upturns which fit over a lip on the switchboard frame or shall fit flush in the switchboard frame. Corners shall be welded and smoothed.

(c) Doors shall be of aluminium sheet steel with machine punched slots to allow for the flush mounting of instrumentation, control and protection equipment. Switchgear shall be flush mounted in the front panels behind the doors unless specified to the contrary. A minimum clearance of 50mm shall be allowed between the rear of equipment mounted on doors (including terminals and projections) and the frame, front panel and chassis.

(d) Doors shall be suitably braced and stiffened to carry the weight of the equipment and to prevent warping.

(e) Hinges for doors shall be provided as described in par. 4.3.5. At least three hinges shall be provided on doors higher than 1,2m.

(f) Doors shall be fitted with handles consisting of a pushbutton-and-handle combination with springloaded catch or a rotary handle-and-catch combination. Flush mounted ring type handles or square key operated latches are not acceptable. The same key shall fit all locks on the switchboard in cases where locks are required.

(g) Doors shall be fitted with hypalon or neoprene seals.

(h) Doors containing any electrical equipment shall be bonded to the switchboard frame with a braided copper earth w re with an equivalent cross-sectional area of at least 4mm².

4.7 Sections

For ease of transportation and to facilitate access to the allocated accommodation, switchboards may be dismantled into cubicles or sections. Each section shall be rigidly manufactured to ensure that damage to the switchgear will not occur during transportation and handling. Where required, switchboards shall have temporary wood or steel bracing to protect switchgear and facilitate handling.

4.8 Grouping of Switchgear

The switchgear shall be logically arranged and grouped as described in par. 6. Depending upon the number and size of components, a common front panel may be installed over one or more groups of equipment. All equipment shall be installed in accordance with the requirements of par. 6.

4.9 Cable Gland Plate

A cable gland plate shall be installed across the full width of each power cubicle at a minimum height of 3OOmm above the bottom of the switchboard to house the cable glands. A Steel cable channel or other approved support shall be provided to carry the weight of the cable and remove mechanical stress from the cable glands. A minimum distance as required by the bending radius of outgoing cables shall be provided between the lowest terminals of major equipment and the gland plate.

4.10 Ventilation

Switchboards shall be properly ventilated, especially cubicles containing contactors, transformers, motor starters, lighting dimmers and other heat producing equipment. Louvres shall be fitted to provide adequate upward or cross ventilation. All louvres shall be vermin proofed with 1,5mm brass mesh or perforated steel plate internally spot welded over the louvres. The internal ambient temperature shall not exceed 40 C.

4.11 Vermin Proofing

Free standing boards shall be protected against vermin, especially from below- Where cables have to pass through the gland plate, rubber grommets shall be provided and enough non-hardening compounds shall be delivered with the board so that these holes can be sealed properly after installation of the cables.

5. CONSTRUCTION OF MAIN LOW TENSION SWITCHBOARDS

Main low tension switchboards and sub-main low tension switchboards heavily equipped shall comply with par. 4.1 to 4.11 as well as the following exceptions or additions:

(a) These boards shall be fully extensible with removable busbar cover plates in the side panels.

(b) Doors shall not be supplied unless specifically called for.

(c) Switchgear and equipment shall be installed in accordance with the requirements of par. 6.

(d) Provision for metering equipment shall be made in accordance with requirements of local authorities where applicable.

6. MOUNTING OF EQUIPMENT

6.1 The mounting of equipment shall comply with SABS 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 2,5 mm. The latter method shall not be used where boards will be subject to vibration or mechanical shocks. Self-tapping screws will not be accepted.

6.2 Space Requirements

In designing the switchboards the following requirements shall be strictly adhered to:-

(a) A minimum of 50 mm between any piece of equipment and the frame or internal partitioning. This minimum space is required on all sides of the equipment. In the case of a single row of single-pole circuit-breakers the spacing on one side of the row may be reduced to 25 mm if the incoming side of the circuit-breakers is busbar connected.

(b) A minimum of 75 mm between horizontal rows of equipment. The maximum outside dimensions of equipment shall be considered.

(c) Circuit-breakers up to a fault rating of 10 kA may be installed adjacent to each other. For higher ratings a minimum of 40 mm shall be allowed between circuit-breakers or isolators.

(d) Sufficient space shall be provided for wiring allowing for the appropriate bending radius.

(e) Space for future equipment shall be allowed as described in par. 1.2.

6.3 Mounting of Chassis

The chassis of flush mounted and smaller surface mounted boards shall be mounted in accordance with SABS 1180. For all free standing switchboards and surface mounted

switchboards where the main switch rating exceeds 100 A (triple-pole), space for wiring shall be provided between the chassis and tray. This space shall be adequate to install the supply cable behind the chassis and terminate on the main switch without sharp bends in the cable cores.

6.4 Grouping of equipment

6.4.1 Equipment shall be arranged and grouped in logical fashion as follows:

(a) Main switch - to be installed either at the top or bottom of the board.

(b) Short circuit protection equipment - fuse gear or fuse-switches.

(c) Change-over contactors or other contactors controlling the supply.

(d) Motor supplies.

(e) Fuse-switches for outgoing circuits.

(f) Other circuits and equipment.

6.4.2 Where a portion of the equipment on the switchboard is supplied from a standby power source, the change-over contactor and the associated equipment shall be grouped in a separate compartment.

6.4.3 Where earth leakage units are required, the associated circuit-breakers shall be installed adjacent to the unit.

6.5 Mounting of Circuit-Breakers

All moulded-case circuit-breakers shall be flush mounted with only the toggles protruding. Miniature circuit-breakers may be installed in clip-in trays mounted on the frame. All other circuit-breakers shall be bolted to the chassis. Special provision shall be made for large main switches when designing the framework. Care shall be exercised that the rear studs of circuit-breakers are properly insulated from the steel chassis. Where necessary, insulating material shall be installed between the rear studs and the chassis. Circuit-breakers shall be installed so that the toggles are in the up position when "ON" and down when "OFF".

6.6 Instrumentation

All metering instruments shall be flush mounted in the front panel or door. The rear terminals of instruments mounted on doors shall be covered with an insulating material to prevent accidental contact. Current transformers for metering shall be mounted so that the rating plate is clearly visible. Fuses for instrumentation shall be mounted in an easily accessible position and clearly marked.

6.7 Mounting of Fuses

6.7.1 Fuse holders shall be mounted semi-recessed in the front panel so that fuses can readily be changed without removing the front panel. Busbar mounted fuses for instrumentation shall be used as far as possible.

6.7.2 Where equipment requiring fuses is specified on a board (fuse switches etc), a ruling shall be obtained from the Department on the quantity of spare fuses to be provided.

6.8 Equipment in Main Boards

Equipment in main low tension switchboards and sub-main boards shall be grouped in individual compartments. Equipment shall be installed as follows:

6.8.1 Rack-out type air circuit-breakers shall be mounted in the bottom section, flush behind the panel with the handle only protruding. If this is not possible, the panel shall be omitted and the air circuit-breakers installed behind a door.

6.8.2 If the main switch is a moulded-case circuit-breaker or isolator it shall be flush mounted.

6.8.3 Contactors controlling the supply shall be installed behind separate front panels.

6.8.4 All metering, protection and indicating equipment shall be clearly visible from the front of the board. Current transformer ratios and multiplication factors shall be clearly marked. Where doors are specified the equipment shall be installed flush in the doors and covered as described in par. 6.6.

6.8.5 All circuit-breakers and fuses (with the exception of fuse-switches) may be grouped together behind one or more panels as described in par. 4.8.

6.8.6 Fuses or fuse-switches providing back-up protection for circuit breakers shall be grouped with the associated circuit-breakers. Exposed surfaces of fuse-switches shall be of the same finish and colour as the rest of the board where practical.

6. 9 Standby Supplies

6.9.1 Where standby power from a diesel-generator set or other sources is available and has to be connected to some of the equipment on a switchboard, the switchboard shall be divided into separate sections with sheet metal divisions to isolate standby power and mains power sections.

6.9.2 Standby and normal supply shall each have its own incoming isolator or circuit-breaker.

6.9.3 The two sections of the switchboard shall be labelled "ESSENTIAL" and "NON-ESSENTIAL" respectively.

6.9.4 The front panels of standby and no-break supply sections shall be painted in distinctive colours as follows:

(a)	Normal supply	"LIGHT ORANGE", colour B26 of SABS 1091
(b)	Standby power	"SIGNAL RED", colour All of SABS 1091
(c)	No-break supply	"DARK VIOLET", colour F06 or "OLIVE GREEN", colour H05 of SABS 1091

7. BUSBARS IN SWITCHBOARDS

7.1 Application

7.1.1 Busbars shall be manufactured of solid drawn high conductivity copper with a rectangular cross-section in accordance with SABS 784, SABS 1195 and BS 159 and BS 1433, where applicable.

7.1.2 Although SABS 784 refers only to overhead or rising busbars, busbars in switchboards shall comply with applicable sections of this specification especially as far as insulation and

clearance values, creepage distance, joints, insulation resistance, dielectric strength, deflection test, absorption resistance and rated short time withstand current are concerned.

7.1.3 Busbars shall be supplied for the following applications :

(a) Distribution of supply voltage.

(b) Connection of equipment with ratings exceeding the current rating of 70mm² conductors (par. 8.6).

(c) Connection of outgoing circuits with current ratings in excess of that allowed for 70mm² conductors (par. 7.8).

(d) Collector bars for parallel cables (par. 8.1).

(e) Connection bars for neutral conductors (par. 7.9).

(f) Earth busbars (par. 7.10).

(g) Connections to miniature circuit-breakers (par. 8.6).

7.2 See Part C15 for further details.

8. WIRING

8. 1 Cabling

Cables connected to incoming or outgoing circuits shall be terminated on the gland plate supplied for this purpose. (Refer to par. 4.9). Power cables up to and including 70 mm² may terminate on clamp type terminals where the clamping screws are not in direct contact with the conductor. Connection to the equipment can then be made with cables that are similarly connected to the clamp terminal. All power cables larger than 70mm² terminate on busbars that are connected to the associated equipment. Parallel incoming or outgoing cables shall be connected to a collector busbar without crossing the conductors.

8.2 Terminal Strips

External wiring for low voltage, control, interlocking, alarm, measuring and DC circuits shall terminate on numbered wiring terminals complying the with Department's standard specification for "WIRING TERMINALS", Section C9. The correct terminal size as recommended by the manufacturer for each conductor to be connected shall be used throughout. The terminal numbers shall appear on the wiring diagrams of the switchboard. Terminals for power wiring shall be separated from other terminals. Terminals for internal wiring shall not be interposed with terminals for external circuits. All connections to terminals shall be identified as described in par. 8.8. Where switchboards consist of separate sections, the control wiring passing between sections shall be terminated on strips in each section so that control wiring can be readily re-instated when reassembling the board.

8.3 Current Ratings

The current rating of conductors for the internal wiring shall be sufficient for the maximum continuous current that can occur in the circuit. This value shall be determined from the circuit-breaker or fuse protection of the circuit.

TABLE 17.3

CURRENT RATING FOR INTERNAL WIRING

Nominal cross-section mm²	CONDUCTOR RATING (A)				
	Number of conductors in bunch				
	1	2 - 3	4 - 5	6 - 9	10 and more
2,5	28	25	22	19	16
4	37	33	30	26	22
6	47	42	38	33	28
10	64	54	51	44	38
16	85	76	68	59	51
25	112	101	89	78	67
35	138	124	110	96	88
50	172	154	137	120	103
70	213	191	170	149	127

The above table shall be applied for ambient temperatures up to 30 C. (Refer to table 41.2 in VDE 0100). For higher ambient temperatures the values shall be derated as prescribed by SABS 0142, Table 10.

8.4 Internal Wiring

(a) Standard 600/1 000 V grade PVC-insulated stranded annealed copper conductors to SABS 150 shall be employed for the internal power wiring of switchboards. The smallest conductor size to be used for power wiring in switchboards shall be 2,5mm². Flexible cord of minimum size 1,0mm² may be used for control wiring.

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

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

(d) Bunched conductors shall be neatly formed to present a uniform appearance without twisting or crossing the conductors. Conductors leaving the harnesses shall be so arranged that they are adjacent to the chassis.

(e) Conductors to hinged panels and doors shall be secured on both the door and the frame and shall be looped between the two points. The loop shall be arranged to produce a twisting motion when the door is opened or closed. A flexible protection sleeve shall be installed over the conductors.

(f) Where wiring channels are used, they shall be installed horizontally and vertically. Under no circumstances may power and control circuit wiring be installed in the same wiring channels. Channel shall not be more than 40% full.

(g) All wiring between different Panels within the same switchboard shall be installed in wiring channels.

(h) Grommets shall be installed in each hole in the metalwork through which conductors

pass.

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

(j) Conductors may be jointed at equipment terminals or numbered terminal strips only. No other connections are allowed.

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

(l) Where screened cables are specified, the screening shall be earthed in the switchboard or control board only unless clearly specified to the contrary, Screened cables entering control boxes through pressed knock-outs, shall terminate in compression glands. Conductors shall as far as possible remain inside the screening at terminations. Where conductors have to separate from the screen, the braiding shall be separated and the conductors drawn through the braid without damaging the braiding. The conductors shall then be connected to their respective terminals and the screening smoothed and connected to the earth terminal.

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

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

(o) A maximum of two conductors will be allowed per equipment terminal. Where more conductors must be connected to the same equipment terminal (e.g. a main circuit-breaker feeding other circuit-breakers), stub busbars shall be provided for the various conductors. Refer also to par. 8.6.

8. 5 Load End Connections

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

8.6 Wiring to Circuit-breakers

Equipment with a rating exceeding the current rating of 70mm^2 conductors shall be connected by means of busbars to the main busbars. Looped connections may only be installed for a maximum of two outgoing circuits. Where there are more than two outgoing circuits, busbars shall be used and equipment connected individually to the busbars. Where miniature circuit-breakers are mounted in continuous rows and supplied by busbars connected to each MCB, each busbar shall be supplied by a separate conductor. This conductor shall be connected to the busbar by means of a separate lug and not via an MCB terminal.

8.7 Conductor Terminations

Conductors connected to terminals complying with the Department's standard specification

for "WIRING TERMINALS", Section C9, need not be soldered or ferruled. Connections to circuit-breakers, isolators or contactors shall be made by one of the following methods:

(a) A ferrule of the correct size,

(b) Soldering the end of the conductor, or

(c) winding a conductor strand tightly around the end to totally cover the end.

All conductors terminating on meters fuse holders and other equipment with screwed terminals shall be fitted with lugs. The lugs shall be soldered or crimped to the end of the conductor. The correct amount of insulation shall be stripped from the end to fit into the terminal. Strands may not be cut from the end of the conductor.

8.8 Identification

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

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

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

8.8.4 The numbers on the markers shall be shown on the wiring diagrams.

9. PAINT FINISH

Metal components of the framework, panels and chassis shall be painted in accordance with the Department's "STANDARD PAINT SPECIFICATION", Section C39.

10. LABELLING

10.1 Care shall be taken to ensure that all equipment is fully labelled and that accurate descriptions and safety warning notices appear in both official languages.

10.2 Material

Engraved plastic or ivory sandwiched strips shall be used throughout. The strips shall bear white lettering on a black background for normal labels and red letters on a white or yellow background for danger notices.

10.3 Main Switchboards

Main switchboards and sub-main switchboards shall be supplied with the following bilingual labels:

(a) Number and allocation of switchboard.
Example:

CONTROL BOARD A4
BEHEERBORD A4

Lettering: at least 10 mm high. prominent position. Label on the outside in a prominent position.

(b) Designation of busbar sections.
Example:

BUSBAR SECTION 2
GELEISTAMSEKSIE 2

Lettering: at least 10mm high. Label on the outside in a prominent position.

(c) Designation of all switchgear including circuit-breakers, isolators, contactors, etc. If the current rating of circuit-breakers is not clearly marked on the equipment, the value shall be indicated on the engraved label.
Example:

SUPPLY TO BOARD C3
TOEVOER NA BORD C3

PUMP SUPPLY
POMPTOEVOER

Letters at least 5mm high. Label on the outside of the switchboard.

(d) All other equipment including meters, instruments, indicator lights, switches, push-buttons, circuit-breakers, fuses, contactors, control relays, protection relays, etc. shall be identified. The function of the equipment and circuits shall be clearly indicated. The main switch shall be labelled as such and designated :

"SWITCH OFF IN CASE OF EMERGENCY"
"SKAKEL AF IN NOODGEVAL"

Flush mounted equipment within doors or front panels shall be identified with labels fixed to the doors or front panels respectively. The labels for equipment installed behind panels, shall be fixed to the chassis close to the equipment. If this equipment is positioned too close together to accommodate descriptive engraved labels, the equipment may be identified by a code or number on an engraved label which shall be fixed close to the equipment. The code number shall be identified on a legend card which shall be installed on the switchboard behind a plastic or other protective cover.

10.4 Other Switchboards

All equipment on switchboards shall be identified with the necessary bilingual labels. The circuit numbers shall appear at grouped single-pole circuit-breakers. The circuit numbers shall correspond to the circuit numbers on the final installation drawings. The above-mentioned circuits shall be identified on a legend card, which shall be installed on the inside of the switchboard door, or in any other position where it can conveniently be observed. All fuses, including instrument fuses, shall have labels stating function, fuse rating and duty or type where applicable. All other equipment shall be identified separately and their functions shall be clearly indicated.

10.5 Fixing of Labels

10.5.1 Labels shall not be fixed to components or trunking but to doors, panels, chassis or other permanent structures of the switchboard.

10.5.2 Engraved strips shall be secured to facilitate a neat alteration of the designation of the labels. Sufficient fixing points shall be provided to prevent labels from warping. Labels in

slotted holders shall be secured in position to prevent unauthorised removal. Labels may be secured by the use of brass bolts and nuts, self-tapping screws, slotted label holders or pop-rivets.

11. TESTS

11.1 The Department shall be notified when the mechanical construction of the switchboard, i.e. frame, panels and base frame, is complete in order that it may be inspected at the factory.

11.2 Function tests of all equipment, control and interlocking circuits shall be conducted to the satisfaction of the Department. Testing equipment and facilities including instruments, dummy loads and additional switchgear and cables shall be provided by the Contractor at no extra cost. The Department shall be notified in writing two weeks in advance of any test to be conducted, to allow its representative to be present at such tests. A complete report on the tests shall be handed to the Department.

DRAWINGS

12.1 Drawings for Approval

A set of three prints of the shop drawings for the switchboards shall be submitted to the Department for approval before the boards are manufactured. The following information shall be presented:

(a) A complete wiring diagram of the equipment on the boards.

(b) A complete layout of the arrangement of the switchboards indicating all equipment dimensions and the construction of the boards. The positions and method of fixing and sizes of busbars shall be shown.

(c) All labelling information in both the official languages on a separate sheet.

(d) The make, catalogue number and capacity of all equipment such as isolators, circuit-breakers, fuses, contactors, etc.

The approval of drawings shall not relieve the Contractor of his responsibility to the Department to supply the switchboards according to the requirements of this Specification.

12.2 Final Drawings

A complete set of "as-built" transparent drawings of all switchboards shall be submitted to the Department within two weeks after delivery of the boards. The following information shall be presented:

(a) Item (a) to (d) of the previous paragraph.

(b) Terminal strip numbers, numbers and colours of conductors connected to the terminal strips and numbers and colours of the conductors utilised for the internal wiring.

(c) A separate schedule of all equipment.

12.3 Manuals

Three sets of manuals for all specified main and sub-main switchboards shall be supplied to the Department at no extra cost. These manuals shall include the following information :

(a) Complete information on the operation of the equipment.
(b) Complete information for maintenance of the equipment.
(c) Brochures and ordering information.
(d) A complete equipment list indicating quantities and relevant catalogue numbers.

12.4 Completion

The supply contract shall be regarded as incomplete until all tests have been conducted successfully and all drawings and manuals have been handed to the Department

SECTION C18

LOW VOLTAGE DISTRIBUTION CUBICLES (KIOSKS)

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, 400/231V, 50 Hz systems.

2. SIZE

Kiosks shall be of ample size to accommodate the specified equipment and provide space for future requirements as specified.

3. MOISTURE AND VERMIN

3,1 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.

3.2 The roof shall be constructed with an overhang above non continuous panelling and shall be provided with a drip-edge.

4. VENTILATION

4.1 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.

4.2 The construction of the grilles shall prevent the ingress of rain or water.

5. FIBREGLASS CANOPIES

5.1 Application

Where specified and for all kiosks to he installed within 50 km of the coast and in corrosive industrial atmospheres, the canopy and doors shall be manufactured of fibreglass.

5.2 Construction

5.2.1 The laminate shall be constructed to SABS 141.

5.2.2 An outer isophalec resin gelcoat with a minimum thickness of 0,4mm and ultraviolet absorption properties to prevent degradation of the surface from exposure to the sun shall be provided.

5.2.3 The gelcoat shall be backed by multiple layers of chopped strand mat glass rendering not less than 1,2 kg/m². The strength shall be increased to 1,35 kg/m² on kiosks with panelling larger than 500 x 500mm.

5.2.4 The fibreglass shall be thoroughly impregnated with polyester resin. The resin should preferably be clear.

5.2.5 The resin to fibreglass ratio shall not be less than 2,5 : 1 and not more than 3,0 : 1.

5.2.6 Air entrapped between the glass mat layers shall be thoroughly worked out. The laminate must be free of air bubbles and voids.

5.2.7 All edges shall be reinforced with an additional 700 g/m² of fibreglass.

5.2.8 All large surfaces, wider than 300 mm, shall be reinforced or panelled to improve stiffness and rigidity.

5.2.9 A resin coat shall be applied to the inside of the kiosk to cover the fibre pattern.

5.2.10 Brass or steel backing plates shall be laminated into the fibreglass at hinge points, locking mechanism catch support areas, door restraint fixing points and all other points which will be subjected to mechanical stresses.

5.2.11 Doors shall be adequately braced, reinforced, ribbed or double laminated with an air gap

between the two layers of laminate to ensure rigidity.

5.2.12 The fibreglass canopy shall be fixed to the internal equipment support frame with bolts accessible through the door only.

5.3 Finish and Colour of Fibreglass Kiosks

5.3.1 The outside surface of the kiosk shall nave a glossy, smooth finish to ensure good weathering. To obtain this the manufacturer shall ensure that the mould is smooth, free of voids, hairline cracks, pores or other defects.

5.3.2 Compound rubbing or sanding of the outside surface will not be permitted.

5.3.3 Pigments shall be added to the outer gelcoat to obtain a matching colour to SABS 1O91 "AVOCADO GREEN" colour C12 or "LIGHT STONE", colour C37.

5.3.4 Fibreglass kiosks shall not be painted.

6. SHEET STEEL CANOPIES

6.1 Where specified the canopy and doors shall be manufactured of either mild steel as 3Cr12 stainless steel to the following requirements:

6.1.1 A metal framework shall be manufactured from solid angle iron, channel iron or 2,5mm minimum folded sheet steel.

6.1.2 Joints shall be non-continuously butt welded. Welds shall be ground smooth and the joint wiped with plumber's metal in order to provide a smooth finish.

6.1.3 Side panels, doors and the roof shall be manufactured from 2 mm 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 to the frame or form part of the folded metal frame.

6.1.4 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.

6.1.5 All panels and doors shall be suitably braced and stiffened to ensure rigidity and to prevent warping.

6.1.6 The steel canopy and framework shall be fixed to the base frame by four M16 high tensile steel bolts.

6.2 Finish and Colour of Sheet Steel Kiosks

6.2.1 Metal components of the framework, panels and doors shall be painted in accordance with the Department's "STANDARD PAINTING SPECIFICATION", Section C39.

6.2.2 The colour shall be "AVOCADO GREEN", colour C12 or "LIGHT STONE", colour C37 of SABS 1091. A tin of matching touch-up paint (not smaller than 500 ml) shall be provided with each consignment.

7. CAST IRON KIOSKS

7.1 Where specified the cubicle panels and doors shall be manufactured from cast iron to the following requirements :

7.1.1 A metal framework shall be manufactured from solid angle iron or channel iron.

7.1.2 Cast iron panels shall be bolted to the frame work and shall be replaceable with standard cast iron panels.

7.1.3 The panels shall be bolted to the frame from the inside of the cubicle. Bolts or nuts on the outside of the cubicle are not acceptable.

7.1.4 The roof of the cubicle shall be one casting and shall be bolted in position from inside the cubicle.

7.1.5 The minimum thickness of the cast iron panels and doors shall be 6 mm.

7.1.6 All cast iron panels and doors shall be fettled prior to painting.

7.2 Finish and Colour of Cast Iron Kiosk :

7.2.1 Metal components of the framework, panels and doors shall be painted in accordance with the Department's "STANDARD PAINTING SPECIFICATION", Section C39.

7.2.2 The colour shall be "AVOCADO GREEN",colour C12 or "LIGHT STONE", colour C37 of SABS 1091. A tin of matching touch-up paint (not smaller than 500 ml) shall be provided with each consignment.

8. DOORS

8.1 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.

8.2 Doors shall have well returning edges to fit into the channel of the door entry surrounds. Refer to par. 3.1 and 6.1.3.

8.3 Doors shall swivel through 135.

8.4 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.

8.5 Doors shall be fitted with lever locks 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 lockable by padlocks. Padlocks will be provided by the Department.

8.6 The locking mechanism shall be made of brass or stainless steel.

8.7 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.

8.8 At least three hinges shall be supplied on steel doors higher than 1, 2 m.

8.9 Doors shall be fitted with neoprene or equivalent seals.

8.10 Metal doors shall be earth bonded to the frame by means of a copper braided strap, tooth washers, bolts and nuts.

9. EQUIPMENT SUPPORT FRAME

9.1 A free standing, angle iron or similar type rigid support framework shall be provided.

9.2 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 may be bolted to the canopy framework.

9.3 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.

9.4 The gland plate shall be suitably punched to accept the number and size of cables specified.

9.5 All steelwork shall be hot-dip galvanised in accordance with SABS 763.

9.6 A panel of 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.

9.7 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. Miniature circuit-breakers may be installed in clip-in trays mounted on the frame.

10. CONCRETE BASES AND BASE FRAMES

10.1 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 into the bottom of the cable trench.

10.2 The base frame shall be constructed of angle iron, at least 50 x 4 mm thick and shall be of welded construction hot-dip galvanised and coated with epoxy resin tar.

10.3 The vertical height of the box frame shall be at least 900 mm and the construction shall be such as to provide a rigid support for the kiosk.

10.4 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.

10.5 The base frame shall be secured by at least four M16 bolts to the support frame of the kiosk and four M16 anchor bolts and nuts to the concrete base. The bolts, nuts and washers shall be galvanised and supplied with the kiosk.

10.6 All galvanising shall be to SABS 763.

10.7 The kiosk manufacturer shall supply a detailed drawing of the base frame and the concrete base required.

10.8 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 Department.

11. BUSBARS

See Section C15 for details.

12. WIRING

See Section 17.8 for details

13. MOUNTING OF EQUIPMENT

13.1 The mounting of equipment shall comply with SABS 1180 where applicable. Equipment shall be fixed to the support panel with bolts, nuts, washers and spring washers or self locking nuts with washers. Self-tapping screws are not acceptable.

13.2 Equipment shall be arranged and grouped in a logical fashion.

13.3 All equipment shall be flush mounted behind panels with only circuit-breaker and isolator toggles and meter faces protruding. The front panels shall be secured in position by 6mm studs and hexagonal chromed brass dome nuts and washers or hank nuts fasteners. Self-tapping or similar screws are not acceptable.

13.4 Blanking plates shall be fitted over slots intended for future equipment. These plates shall be fixed so that fixing holes do not need to be drilled through the front panel.

14. ACCESS

All equipment, busbars and wiring shall be completely accessible with the door open and the back door and front panel removed. In the case of fibreglass kiosks, the complete canopy shall be removable.

15. LABELLING

15.1 All equipment shall be fully labelled and accurate descriptions shall be given in both official languages.

15.2 Engraved brass shall be used for labels. The labels shall be riveted to the kiosks.

15.3 The following labels shall be supplied as a minimum requirement:

15.3.1 Number and allocation of kiosk, e.g. KIOSK B26

(Lettering: At least 10mm high. Label on the outside in a prominent position).

15.3.2 Designation of circuit i.e. circuit-breaker, isolator, meter, etc. e.g.

HOUSE 473

(Lettering: At least 5mm high. One label installed directly below each item of equipment pertaining to the particular circuit shall be provided).

15.3.3 The main switch shall be marked in accordance with the regulations.

15.3.4 The function and circuits of all other equipment shall be clearly identified. Flush mounted equipment within the front panel shall be identified by labels fixed to the front panel. The labels for all equipment installed behind panels shall be fixed to the support panel close to the equipment.

15.3.5 The labels shall be secured by means of rivets. Self-tapping screws are not acceptable. Labels shall not be glued to their mounting positions. Sufficient rivets shall be provided to prevent labels from warping.

15.3.6 All label designations shall be confirmed with the Department before manufactured.

16. NOTICES

At least one with the words "DANGER/INGOZI/GEVAAR" shall be mounted outside on the front of the kiosk. This notice shall be riveted to the steel or cast iron door so that it cannot easily be removed. Brass rivets shall be used. The notice shall be laminated into the fibreglass door in the case of fibreglass kiosks.

17. INSPECTION

The Department shall be notified at least two weeks in advance of the completion of the kiosks in order that an inspection may be carried out before delivery.

18. DRAWINGS

18.1 Drawings for Approval

18.1.1 A set of three prints of the shop drawings of the cubicles shall be submitted to the Department for approval before the cubicles are manufactured. The following information shall be presented:

(a) Schematic and wiring diagrams of the cubicles.

(b) A complete layout of the arrangement of the cubicles showing all equipment dimensions and constructional details. The positions and method of fixing of busbars shall be shown.

(c) All labelling information in both the official languages on a separate sheet.

(d) The makes, catalogue numbers and capacities of all equipment.

(e) A detail drawing of the concrete plinth, showing concrete mixes, dimensions, opening sizes, steel reinforcing details and holding-down bolt fixing details.

18.1.2 The approval of drawing shall not relieve the Contractor of his responsibility to the Department to supply the cubicles according to the requirements of this Specification.

18.2 Final Drawings

A complete set of "as built" drawings of the cubicles shall be submitted to the Department within two weeks after delivery of the kiosks. The information contained in par.18.1.1 shall be provided.

18.3 Completion

The supply contract shall be regarded as incomplete until all drawings have been handed to the Department.

SECTION C20

MOULDED-CASE CIRCUIT-BREAKERS

1. This section covers single or multi pole moulded case circuit breakers for use in power distribution systems, suitable for panel mounting, for ratings up to 1 000 A, 600 V, 50 Hz.

2. The circuit breakers shall comply with SABS 156.

3. The continuous current rating, trip rating and rupturing capacity shall be as specified.

4. The contacts shall be silver alloy and shall close with a high pressure wiping action.

5. Where specified, the circuit breaker shall be capable of accommodating factory fitted shunt trip or auxiliary contact units or similar equipment.

6. The operating handle shall provide clear indication of "ON", "OFF" and "TRIP" positions.

7. The mechanism shall be of the TRIP-FREE type preventing the unit from being held in the ON position under overload conditions.

8. All moulded case circuit breakers in a particular installation shall as far as is practical be supplied by a single manufacturer.

9. The incoming terminals of single pole miniature circuit breakers shall be suitable for connection to a common busbar.

10. The circuit breaker shall have a rating plate indicating the current rating, voltage rating and breaking capacity.

11. Extension type operating handles shall be provided for units of 600 A rating and above.

DIRECT ACTING INDICATING INSTRUMENTS

This section covers direct acting indicating instruments suitable for flush mounting in switchboards or instrument panels.

1. GENERAL REQUIREMENTS

1.1 Instruments shall be suitably rated for the supply voltage and frequency to be applied, which shall be 400/230 V, 50 Hz unless specified to the contrary.

1.2 All the instruments used for a particular application or a specific project shall be from the range of a single reputable supplier and shall have the same face dimensions. The face dimensions shall be square and not less than 96 x 96 mm.

1.3 All instruments shall comply with BS 89 and/or IEC 51.

1.4 Instruments shall be screened against magnetic interference and shall have anti static, impact-resistant glass faces.

1.5 Preference will be given to locally manufactured instruments.

1.6 Instruments shall be insulated to achieve a 2 kV insulation resistance to earth.

1.7 All instruments shall be splash proof and dustproof unless more stringent requirements are specified for hazardous locations.

1.8 Instruments shall be sufficiently resistant to vibration that may be encountered in the specific application.

1.9 For normal environmental and supply conditions, instruments shall be suitable for use inside the limits specified in Tables III and VI of IEC 51.

1.10 All instruments shall be capable of withstanding overloads of continuous or short duration in accordance with section 8.3 of IEC 51.

1.11 Instruments shall be provided with studs for rear connection. Shrouds shall be provided to prevent accidental contact where instruments are to be installed in hinged panels of switchboards.

2. VOLTMETERS AND VOLTMETER SELECTOR SWITCHES

2.1 Unless specified to the contrary, voltmeters shall be scaled from 0 - 250V in the case of LV applications.

2.2 Voltmeters shall be of the moving iron type with class 1,5 accuracy as specified in IEC 51.

2.3 A zero adjustment screw shall be provided.

2.4 Unless specified to the contrary, a single voltmeter and selector switch shall be provided. The voltmeter switch shall have an "OFF" and three metering positions to indicate readings between neutral and each of the three phases.

2.5 The markings shall be indicated clearly on the face plate of the selector switch and the handle position shall be accurate in relation to the markings on the face plate.

2.6 The selector switch shall be of the cam-actuated or wiping air break type with two breaks per pole.

3. AMMETERS

3.1 Ammeters shall have a moving coil element to indicate instantaneous values.

3.2 Direct reading ammeters up to a maximum rating of 60 A may be used. Current transformer operated ammeters shall be 5 A full scale, calibrated to read actual primary circuit currents. The current transformer ratio shall be indicated on the face plate.

3.3 A zero adjustment screw shall be provided.

3.4 Where combined maximum demand and indicating ammeters are specified, a bimetallic spiral element shall be provided in the same housing to indicate mean value over a 15 minute period.

3.5 The bimetal element shall drive a residual pointer to indicate maximum mean current between resettings. This pointer shall operate on the main scale and shall be of a distinctive colour. The pointer shall be resettable from the face of the meter.

3.6 The bimetal element shall be designed to compensate for limits of ambient temperature between -20 C and 70 C.

3.7 Full load or rated current shall be clearly indicated, preferably with a red line. Unless specified to the contrary, a 100 % condensed over scale shall be provided for instantaneous reading instruments and no over scale for combined maximum demand ammeters.

3.8 The intrinsic error, expressed in terms of the fiducial value in accordance with IEC 51, shall be class 1,5 for the instantaneous readings and class 2,5 for the mean maxima.

3.9 Where saturation current transformers are required, these shall form an integral part of the meter. Separate saturation current transformers are unacceptable to the Department.

4. KILOWATT-HOUR METERS

4.1 Unless specified to the contrary, kilowatt-hour meters shall be suitable for operation on 220/250 V, 50 Hz systems.

4.2 Meter elements shall be of the inductor disc type and designed to carry the rated current continuously.

4.3 Kilowatt-hour meters shall comply with the relevant parts of BS 37 and BS 5685.

4.4 The integrating period on maximum demand meters shall be 30 minutes unless specified to the contrary.

4.5 The registering mechanism shall be of the cyclometer type, providing a six digit readout with the sixth digit indicating one-tenth of a unit.

4.6 Unless specified to the contrary, the meters shall conform to accuracy Class 1 as specified in IEC 51.

4.7 Kilowatt-hour meters shall be graded and calibrated for the specific application to avoid the application of multiplication factors where possible. Where multiplication factors are unavoidable this shall be clearly indicated in unit form and not as a combination of several factors. Current transformer ratios shall be incorporated in the factor.

4.8 The kilowatt-hour meter shall preferably be provided with a magnetic type of bearing for the disc spindle.

4. 9 Facilities for a security seal shall be provided on the fixing screws of the cover.

5. FREQUENCY METERS

5.1 Frequency meters may be of the vibrating reed type or the direct indicating type consisting of a moving coil milli-ammeter and a current/frequency transducer.

5.2 Unless specified to the contrary, the indicating range shall be 45 HZ - 55 Hz.

5.3 The accuracy class shall be class 0,5 in accordance with IEC 51 unless otherwise specified.

5.4 Where required an adjustable speed alarm contact shall be provided, adjustable over the complete scale length.

6. RUNNING HOUR-METERS

6.1 Running hour-meters shall be of the electrically operated cyclometer type, suitable for flush mounting.

6.2 Numerals shall be clearly defined white on a black background.

6.3 The range of hour-meters shall be five digits, the fifth digit indicating one-tenth of an hour, i.e. from 0 to 9999,9 hours.

6.4 The accuracy class shall be class 1 in accordance with IEC 51 unless otherwise specified.

SECTION C24

EARTH LEAKAGE RELAYS

1. Earth leakage relays shall be single or three-phase units with a sensitivity of 30mA, with associated circuit breaker or on-load switch for use on 220/250V single phase or 380/433 V three phase, 50 Hz, supplies.

2. The units shall be suitable for installation in switchboards in clip-in trays or bolted to the chassis.

3. The earth leakage relay shall function on the current balance principle and shall comply with SABS 767 as amended, and shall bear the SABS mark. Integral test facilities shall be incorporated in the unit.

4. Circuit breakers with trip coils used integrally with earth leakage units (two pole for single phase units and three pole for three phase units) shall comply with SABS 156.

5. On-load switches used integrally with earth leakage units (two pole for single-phase units and three pole for three phase units) shall comply with SABS 152.

6. The fault current rating of the unit shall be 2,5kA or 5kA as required, when tested in accordance with SABS 156.

SECTION C25

MICRO-GAP SWITCHES

1. Micro-gap switches shall be suitable for ratings up to 400 A at 660 V (triple pole) and may be used for main and distribution switches in domestic applications, offices, small factories and similar applications.

2. Double pole switches shall be suitable for voltages up to 230V ± 10%.

3. The switches shall comply with SABS 152.

4. Micro-gap switches may be used on AC circuits only.

5. Metal clad and moulded casings are acceptable.

6. Micro-gap switches shall be capable of carrying rated current continuously and making and breaking rated current.

7. Heavy, fully accessible, brass terminals with two screws each shall be provided to facilitate easy wiring. Contacts shall have large contact surfaces, made from high quality material such as solid silver.

8. The "ON" and "OFF" positions and the rating of the switch shall be clearly and indelibly marked.

SECTION C26

CURRENT TRANSFORMERS

1. GENERAL

Current transformers shall comply with the requirements of BS 3938 and IEC 185 with the exception of the required impulse test level, par.6 below.

2. RATINGS

2.1 Current transformers shall be suitable for the primary currents listed hereunder and their decimal multiples:

10, 12.5, 15, 20, 25, 30, 40, 50, 60 and 75.

The preferred values are:

10, 15, 20, 30, 50 and 75.

2.2 Current transformers shall have secondary ratings of 1, 2 and 5A, with 5A being preferred.

2.3 Current transformers shall have standard outputs of 2, 5, 5, 10, 15 or 30 VA as applicable in terms of the burden of the instruments and interconnecting wiring. The current transformer output shall match the actual instrument burden as closely as possible in order not to introduce unnecessary errors.

3. ACCURACY CLASS

3.1 For metering applications, accuracy classes of 0.1, 0.2, 0.5, 1, 3 or 5 are applicable. Where no accuracy class has been specified, the following table may be used as a guide:

Application	Primary Current	Suggested Class
Indicating Instruments	All	5
Metering Applications	Up to 200 A	1
Metering Applications	250 to 600 A	0.5
Metering Applications	800 A and above	0.2

3.2 Where ring type current transformers are specified, the aperture shall not be unnecessarily large as accuracy is thereby reduced.

3. 3 The classes for protection are 5P, 10P, 15P, 20P or 30P with 5P and 10P being standard. Turns compensation shall not be employed on protection current transformers for ratios greater than 150/5.

3.4 Class X current transformers shall be used in differential protection systems.

3.5 Manufacturers shall supply the magnetisation curve details and saturation factors for each

different transformer ratio.

4. MARKINGS

All current transformers shall come complete with a label on which the following information is indelibly stamped:

Manufacturer.

Serial No. or Type.

Rated primary and secondary current.

Rated frequency.

Rated output and accuracy class.

Highest system voltage.

Rated insulation level.

5. FAULT CURRENT

Current transformers shall be capable of withstanding the dynamic forces resulting from the maximum through-fault current which may be encountered at the point where they are installed. The short time current rating of current transformers shall be at least equal to that of the associated circuit breaker.

6. IMPULSE LEVEL

Current transformers used in system voltages in excess of 660 V shall withstand an impulse test level of 95 kV. Impulse levels for current transformers used in system voltages up to 660 V shall comply with BS 3938.

7. TESTS

7.1 One protection current transformer of each type used in a contract shall be tested to confirm the estimated characteristics. The following results shall be submitted:

(a) Magnetisation Curve
(b) Secondary resistance
(c) Secondary leakage reactance, if not negligible or if required by the Department.

7.2 The power frequency, secondary to earth and over voltage inter-turn tests in accordance with BS 3938 shall be conducted on all current transformers. Impulse tests shall be conducted on all current transformers intended for use in system voltages in excess of 660 V.

SECTION C28

TRIPLE POLE ON-LOAD ISOLATORS

1. This section covers switches suitable for panel mounting for use in power distribution systems up to 600 V, 50 Hz. Switches for motor isolation are included.

2. The switches shall be of the triple pole, hand operated type complying with SABS 152.

3. The switches shall have a high speed closing and opening feature.

4. The switches shall be suitably rated for the continuous carrying, making and breaking of the rated current specified as well as the through-fault current capacity as specified.

5. To distinguish the switches from circuit breakers the operating handles shall have a distinctive colour and/or the switch shall be clearly and indelibly labelled "ISOLATOR".

SECTION C30

TIME SWITCHES

1. Time switches shall be of single-pole type, suitable for 220/250 V systems, with contacts rated for the duty to be performed with a minimum rating of 15A. Contacts shall be of high quality material, e.g. silver-plated or solid silver.

2. The clock shall be driven by a self-starting, hysteresis synchronous motor, keeping accurate mains time. All clocks shall be controlled by an electrically wound escapement providing the main spring with a minimum of 15 hours reserve in case of a power failure. The main spring shall be kept fully wound without the use of slipping clutch devices that may wear and fall out of adjustment.

3. The main spring shall have a minimum of 15 hours reserve under full load and if fully discharged, shall be completely rewound within 15 minutes of the restoration of power.

4. An external manual bypass switch shall be provided to permit the circuit to be switched "ON" or "OFF" manually without affecting the operation of the time switch.

5. The time switch shall have a 24 hour dial, with day and night indication, that can be set to switch in 30 minute steps. The dial shall be fitted with 48 tappets corresponding to 48 change-over operations in a 24 hour period.

6. The time switch shall be fitted with a day omission dial comprising a total of 14 tappets which can be set to switch in 12 hour steps.

7. The time switch shall be housed in a dust-tight moulded plastic or metal case, consisting of a plastic clip-on front cover and a moulded plastic or metal base. Time switches to be used for surface mounting on walls shall be provided with a suitably positioned 20mm conduit knock-out.

SECTION C31

CONTACTORS

1. Contactors shall be of the open or totally enclosed, triple- or double-pole, electromechanically operated, air-break type suitable for 380/433 V or 220/250 V supplies and shall comply with SABS 1092.

2. Contactors shall have the following characteristics:

   (a) Enclosed coil easily replaceable.

   (b) A permanent air gap in the magnetic circuit to prevent sticky operation.

   (c) Provision for quick and simple inspection of contacts.

   (d) Clearly marked main and auxiliary terminals.

3. All parts shall be accessible from the front.

4. Contactors which are not located in switchboards shall be housed in enclosures which comply with IP 54 of IEC 144.

5. The current rating of the contactor shall be as specified for the circuit with a switching duty in accordance with the SABS 1092 or IEC 158-1, utilisation category ACl for lighting and power circuits and utilisation category AC3 for motor starting.

6. In addition to the required current carrying capacity and switching duty of a contactor, the contactor chosen for a particular application shall be rated for the maximum through fault current allowed by the back-up protection devices at the point where the contactor is installed. Careful co-ordination of short circuit devices shall take place.

7. All laminations of the magnetic system of the contactor shall be tightly clamped. Noisy contactors will not be accepted.

8. Non-current-carrying metallic parts shall be solidly interconnected and a common screwed earth terminal shall be provided. The contactor shall be earthed to the switchboard earth bar.

9. Latched contactors shall be provided with a trip coil and a closing coil. The contactor shall remain closed after de-energising the closing coil and shall only trip on energising the trip

coil.

10. Contactor operating coils shall have a voltage rating as required by the control circuitry and shall have limits of operation and temperature rise as specified in Clause 7.5 and Table IV of IEC 158-1. Latched contactors shall be capable of being tripped at 50 % of the rated coil voltage.

11. Contactors for normal/standby changeover circuits shall be electrically and mechanically interlocked. Contactors in star-delta starters shall be electrically interlocked.

12. Contactors with provision to add auxiliary contacts and convert auxiliary contacts on site are preferred. Contactors with permanently fixed auxiliary contacts shall have at least 1 x N/0 and 1 x N/C spare auxiliary contacts in addition to the contacts specified for control purposes and in addition to contacts required for self-holding operations or economy resistances. Where the number of auxiliary contacts required is greater than the number of contacts that can be accommodated on the contactor, an auxiliary relay or additional contactor shall be provided to supply the additional contacts.

13. It shall be possible to replace main contacts without disconnecting wiring.

14. Auxiliary contacts shall be capable of making, carrying continuously and breaking 6A at 230V AC, unity power factor for contactors used on 380-433/220-250 V systems.

15. Auxiliary contact functions required e.g. "lazy" contacts, late-make, late-break, make-before-break, etc. shall be inherent in the contact design. Under no circumstances may these functions be improvised by bending contacts, loading contacts, etc. These functions shall be available in all contactors.

16. Spare auxiliary contacts shall be wired to numbered terminal strips in the switchboard and shall appear on the switchboard drawings.

17. All contactors on a specific project shall be from a standard range of one single manufacturer, unless specified to the contrary.

SECTION C33

INDOOR SURGE ARRESTORS

1. Surge arrestors shall comply with the requirements of SABS 171 or VDE 0675.

2. Surge arrestors shall be suitable for installation at altitudes of up to 1800m above sea level.

3. The unit shall be contained within a thermoplastic or cast resin housing and all internal components shall be fully sealed in.

4. The unit shall be supplied complete with a galvanised steel mounting bracket for convenient mounting onto the metalwork or tray of a switchboard.

5. Alternatively, the unit shall be of the type which can be mounted into the clip-tray of a switchboard.

6. Surge arrestors shall be provided in all cases where a switchboard is supplied directly from an overhead line.

7. In other cases, surge arrestors, if required, will be specified in the Detail Technical Specification.

SECTION C39

STANDARD PAINT SPECIFICATION

1. FINISH REQUIRED

Metalwork of electrical equipment such as switchboards, equipment enclosures, sheet steel luminaire components, purpose-made boxes, etc. shall be finished with a high quality paint applied according to the best available method. Baked enamel, electrostatically applied powder coating or similar proven methods shall be used.

2. CORROSION RESISTANCE

Painted metal shall be corrosion resistant for a period of at least 168 hours when tested in accordance with SABS Method 155.

3. EDGES

Care shall be taken to ensure that all edges and corners are properly covered.

4. SURFACE PREPARATION

Surface preparation shall comply with SABS 064. Prior to painting, all metal parts shall be thoroughly cleaned of rust, mill scale, grease and foreign matter to a continuous metallic finish. Sand or shot blasting or acid pickling and washing shall be employed for this purpose.

5. BAKED ENAMEL FINISH

5.1 Immediately after cleaning all surfaces shall be covered by a rust inhibiting, tough, unbroken metal-phosphate film and then thoroughly dried.

5.2 Within forty eight (48) hours after phosphatising, a passivating layer consisting of a high quality zinc chromate primer shall be applied, followed by two coats of high quality alkyd-based baked enamel.

5.3 The enamel finish on metal luminaire components shall comply with SABS 783, Type III.

5.4 Other metal parts e.g. switchboard panels, etc., shall comply with SABS 783, Type IV with a minimum paint thickness after painting of 0,06mm. In coastal areas, the dry film thickness shall be increased to at least 0,1mm.

5.5 The paint shall have an impact resistance of 5,65 J on cold-rolled steel plate and a scratch resistance of 2 kg.

6. POWDER COATED FINISH (NOT TO BE USED LESS THAN 50km FROM SEASIDE)

6.1 Immediately after cleaning the metal parts shall be pre-heated and then covered by a microstructure paint powder applied electrostatically.

6.2 The paint shall be baked on and shall harden within 10 minutes at a temperature of 190 C.

6.3 The minimum paint thickness after baking shall be 0,05 mm. The dry film thickness shall be increased in coastal areas. The paint cover shall have an impact resistance of 5,65 J on cold-rolled steel plate and a scratch resistance of 2kg.

7. TOUCH-UP PAINT

In the case of switchboards and larger equipment enclosures, a tin of matching touch-up paint not smaller than 1 litre shall be provided.

8. COLOURS

8.1 The colour of HV switchboards and HV switchgear enclosures shall be "DARK ADMIRALTY GREY", colour G12 of SABS 1091.

8.2 The colour of LV switchboards and equipment enclosures in buildings shall be "LIGHT ORANGE", colour B26 of SABS 1091 as recommended in SABS 0140, Part II unless specified to the contrary.

8.3 The colour of LV distribution kiosks and miniature substations shall be "AVOCADO GREEN", colour C17 or "LIGHT STONE", colour C37 of SABS 1091.

8.4 The standby power section of LV switchboards in buildings shall be coloured "SIGNAL RED", colour All of SABS 1091.

8.5 Switchboards for No-Break Power Supplies or sections of switchboards containing No-break power supplies, shall be coloured "DARK VIOLET", colour FO6 or "OLIVE GREEN", colour HO5 of SABS 1091.

PART 4: RETURNABLE SCHEDULES

ITEM 1: ELECTRICAL WORK - MATERIAL SCHEDULE

The contractor shall complete the following schedules and submit them with his tender.

The schedules will be scrutinised by the Representative/Agent and should any material offered not comply with the requirements contained in the specification, the Contractor will be required to supply material in accordance with the contract at no additional cost.

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

Item	Material	Make or trade name	Supplier
1.	Distribution boards		
2.	Circuit breakers 1P, 2P, 3P		
3.	On load isolators without trips		
4.	Contactors 1P, 2P, 3P		
5.	Earth leakage relays 2 & 3 phase		
6.	Current transformers		
7.	Voltmeter		
8.	Maximum demand ammeter		
9.	Daylight sensitive switch		
10.	Conduit		
11.	Conduit boxes		
12.	Power skirting		
13.	Ducting		
14.	Surface switches		
15.	Watertight switches		
16.	16A flush socket outlets		
17.	16A surface socket outlets		
18.	16A watertight socket outlets		
19.	Internal surface mounted isolators		
20.	External surface mounted isolators		
21.	Fluorescent luminaries		
	Type A		
	Type B		
	Type C		
	Type D		
	Type E		
	Type F		
	Type G		
	Type H		
22	PVC cables		
23	Fire Detection system		
24	Fire Cabling		

NOTE:

Should the contractor wish to supply materials other than that originally offered, prior written approval must be obtained from the Representative/Agent before any orders are placed

CONTRACTOR: _____

SIGNED: _____

DATE: _____

ITEM 2: DIESEL PLANT INSTALLATION

SCHEDULE OF INFORMATION
(To be completed by Tenderer)

A: ENGINE

NO	ITEM	REMARKS
1.	Manufacturer's Name	
2.	Country of Origin	
3.	Manufacturer's model No. and year of manufacture	
4.	Continuous sea level rating after allowing for ancillary equipment : a) In b.h.p. b) In kW	
5.	Percentage derating for site conditions, in accordance with BS 551.4 a) For altitude b) For temperature c) For humidity d) Total derating	
6.	Nett output on site in kW	
7.	Nominal speed in r.p.m.	
8.	Number of cylinders	
9.	Strokes per working cycle	
10.	Stroke in mm	
11.	Cylinder bore in mm	
12.	Swept volume in cm^3	
13.	Mean piston speed in m/min	
14.	Compression ratio	
15.	Cyclic irregularity	
16.	Fuel consumption of the complete generating set on site in l/h of alternator output at : a) Full load b) ¾ load c) ½ load NOTE : A tolerance of 5% shall be allowed above the stated value of fuel consumption.	
17.	Make of fuel injection system.	
18.	Capacity of fuel tank in litres	
19.	Is gauge glass fitted to tank ?	

20.	Is electric pump for filling the fuel tank included?	
21.	Method of starting	
22.	Voltage of starting system	
23.	Method of cooling	
24.	Type of radiator if water-cooled	
25.	Type of heater for warming cylinder heads	
26.	Capacity of heater in kW	
27.	Method of protection against high temperature	
28.	Method of protection against low oil pressure	
29.	Type of governor	
30.	Speed variation in % a. Temporary b. Permanent	
31.	Minimum time required for as assumption of full load in seconds	
32.	Recommended interval in running hours for : a. Lubricating oil change b. Oil filter element change c. Decarbonising	
33.	Type of base	
34.	Can plant be placed on solid concrete floor?	
35.	Are all accessories and ducts included?	
36.	Is engine naturally aspirated/	
37.	Are performance curves attached?	
38.	Diameter of exhaust pipe	
39.	Noise level in plant room in dBA	N/A
40.	Noise level at tail of exhaust pipe in dBA	
41.	BMEP (4 stroke) at continuous rating (kPA)	
42.	% Load acceptance to BS 5514, Part 4, with 10% transient speed droop	

B: ALTERNATOR

NO	ITEM	REMARKS
1.	Maker's name and model no.	
2.	Country of Origin and year of manufacture	
3.	Type of enclosure	
4.	Nominal speed in r.p.m.	
5.	Number of bearings	
6.	Terminal voltage	
7.	Sea level rating kVA at 0.866 power factor	
8.	Derating for site conditions	
9.	Input required in kW	
10.	Method of excitation	
11.	Efficiency at 0,8 power factor and : a) Full load b) ¾ load c) ½ load	
12.	Maximum permanent voltage variation in %	
13.	Transient voltage dip on full load	
14.	Voltage recovery on full load application in milli-seconds	
15.	Is alternator brush less?	
16.	Class of insulation of windings	
17.	Is alternator tropicalised?	
18.	Symmetrical short circuit current at terminals n Ampere	
19.	Type of Coupling	

C: SWITCHBOARD

NO	ITEM	REMARKS
1.	Maker's Name	
2.	Country of Origin	
3.	Is board floor mounted?	
4.	Finish of board	
5.	Make of volt, amp, and frequency meters	
6.	Dial size of meters in mm	
7.	Scale range of voltmeter	
8.	Scale range of ammeters	
9.	Ration of current transformers	
10.	Make of hour meter	
11.	Range of cyclometer counter	
12.	Smallest unit shown on counter (Item 11)	
13.	Make of circuit breaker	
14.	Type of circuit breaker	
15.	Rating of circuit breaker in Amp and fault level in kA	
16.	Setting range of overload trips	
17.	Setting range of instantaneous trips	
18.	Make of change-over equipment	
19.	Make of voltage relay	
20.	Is control and protection equipment mounted on a small removable panel?	
21.	Type of control equipment	
22.	Make of mains isolator	
23.	Type of indicators for protective devices	
24.	Make of rectifier	
25.	Type of rectifier	
26.	Is battery charging	
27.	Are volt- and ammeters provided for charging circuit?	
28.	Is the alarm hooter of the continuous duty type?	
29.	Rating in Amps of : a. Circuit breaker to outgoing feed	

D: BATTERY

NO	ITEM	REMARKS
1.	Maker's Name	
2.	Country of Origin	
3.	Type of battery	
4.	Voltage of battery	
5.	Number of cells	
6.	Capacity in cold crank amp	

E: DIMENSIONS

NO	ITEM	REMARKS
	Overall dimensions of set in mm	
	Overall mass	
	Is the generator room adequate for the installation of the set	

F: DEVIATION FROM THE SPECIFICATION (State briefly)

NO	DESCRIPTION

G: GUARANTEE

NO	ITEM	REMARKS
1.	Guarantee period in months	
2.	State conditions of guarantee	

H: SPARE PARTS AND MAINTENANCE FACILITIES

NO	ITEM	REMARKS
1.	Approximate value of spares carried in stock for this particular diesel engine and alternator	
2.	Where are these spares held in stock	
3.	What facilities exist for the servicing of the equipment offered	
4.	Where are these facilities available	

I: SWITCHBOARD

NO	ITEM	REMARKS
1.	Is manufacture of switchboard/control panel to be sub-let?	
2.	If yes, state name and address of specialist	

	manufacturer	

ITEM 3 – UNINTERRUPTED POWER SUPPLY INSTALLATION

SCHEDULE OF INFORMATION

A. SYSTEM PARAMETERS

1	Net output power of inverter system	.....kVA
2	Power factor for which the system is rated	...Lagging
3	Nominal input voltage	.....Volts
4	Maximum input voltage tolerated	.....Volts
5	Minimum input voltage tolerated	.....Volts
6	Maximum input frequency deviation tolerated	.....Hz
7	Maximum and minimum input power factor at rated KVA	.....kVA
8	Maximum harmonic input tolerated for successful operation	.....%
9	Nominal output voltage	.....Volts
10	Steady state output voltage regulation	.....Volts
11	Dynamic output voltage regulation:	
	1. Step load of 25% between 10% and 100% of full load	.....%
	2. 150% overload for 1 sec	.....%
	3. Input voltage step variation of ± 15%	.....%
11	Time for voltage recovery to steady state:	
	1. 25% step load	.....mS
	2. 100% step load	.....mS
3.	150% step load for 1 sec and then returned to 100%	.....mS

13. Relative output phase angles at 100% unbalanced load (in degrees) ...Degrees

14. Maximum harmonic content of output voltage .....%

15. Overload capacity

1. One hour .....%
One minute .....%
3. Ten seconds .....%
4. One second .....%
5. Five msec .....%
6. One msec .....%

16. Total input required with batteries charged for rated full load .....kVA

17. Total input required at full load and and battery discharged .....kVA

8. Allowable temperature rise across equipment at input air temperature of:

1. 25 C C
2. 30 C C
3. 32 C C
4. 35 C C
5 40 C C

19. Heat dissipation under normal full load running conditions:

1. Converter .....kW
2. Battery .....kW

20. Efficiency of the complete UPS system

		1,0p.f.	0.8p.f
1.	Full load	.....%	.....%
2.	80% load	.....%	.....%
3.	75% load	.....%	.....%
4.	65% load	.....%	.....%
5.	50% load	.....%	.....%
6.	40% load	.....%	.....%

21. R.M.S. value of the A.C. **current** component through the batteries for:

1. Discharged battery .....Amp
2. Charged battery .....Amp

22. R.M.S. value of the A.C. **voltage** component through the batteries for:

1. Discharged battery .....Volts
2. Charged battery .....Volts

3. Total number of cubicles .....

24. Total floor space required .....m^2

25. Dimensions of cubicle in mm .....W.....H.....L

B. BATTERY CHARGER

1. Type.....

2. Output voltage for trickle charge .....Volts

3. Steady state regulation of output voltage trickle to full load ±.....%

4. Output voltage for input voltage fluctuation

1. ± 10% .....%
2. ± 15% .....%

5. Ripple content (%) .....%

6. Current limit value .....Ampere

7. Input voltage at which battery charger switches off

   1. Maximum .....Volts

   2. Minimum .....Volts

8. Maximum switch on inrush current .....Ampere

9. Battery charger overload protection (type) .....

10. Efficiency .....%

11. How is the effect of harmonics on input voltage minimised ?

C. OSCILLATOR

1. Type of oscillator (RC, crystal, etc.) .....

2. Stability:
   1. With oscillator supply fluctuation ±.....%

   2. Temperature variation ±..... C

   3. Number of power supplies in parallel redundancy .....

3. Number of batteries from which oscillator is fed

4. Minimum time synchronise to mains frequency .....sec

D. INVERTER

1. Maximum continuous power output (kVA) .....kVA

2. Nominal output voltage .....Volts

3. Maximum harmonic content .....%

4. Nominal input voltage:

   1. Maximum .....Volts

   2. Nominal .....Volts

   3. Minimum .....Volts

5. Input current at full load .....Ampere

6. Input power factor at full load .....Lagging

7. Efficiency at full load .....%

8. Overload protection .....
.....

E. STATIC SWITCH

Does switch comply to clause 3.2.2.12 .....

1. Describe electronic switch
.....

2. Minimum power factor at which switches will operate satisfactorily .....

3. How does switch derive operating signal ?
.....

4. Maximum break time for switchover .....mS

F. BATTERIES

1. Manufacturer .....

2. Country of origin .....

3. Type .....

4. Type No .....

. Total number of cells .....

6. Number of cells per inverter .....

7. Battery voltage (float conditions) .....Volts

8. Battery voltage (Boost charge) .....Volts

9. Capacity (rated for time required) ....Ah at...hrs

10. Battery time offered under load conditions specified in Clause 2.17 (Part 2) and

	Clause 3.2.2.5 (Part 3)	.....Minutes
11.	Maximum output current	.....Ampere
12.	Cell voltage under float conditions	.....Volts
13.	Cell conditions under boost conditions	.....Volts
14.	Cell voltage at start of discharge and full inverter load	.....Volts
15.	Cell voltage at end of discharge period	.....Volts
16.	Expected lifetime of batteries	.....Years
17.	Time to charge to 90% capacity	.....Hrs
18.	Total time to charge to 100% capacity	.....Hrs
19.	Material of supporting framework	.....

7

20.	Finish of framework	.....
21.	Dimensions of each cell	W....H....L....
22.	Design of positive plate of cell	.....
23.	Rating of fused isolator	.....Ampere
24.	Cell configuration	

SYSTEMS ABOVE 200kVA

1.	No of shelves	.....
2.	No of rows/shelves	.....
3.	No of tiers/shelves	.....
4.	Shelf length	.....
5.	Shelf height (incl. batteries)	.....

NOTE : ALL BATTERY CALCULATIONS INCLUDING CURVES SHALL BE INCLUDED IN THE TENDER

G. DETAILS OF MANUFACTURE OF UPS

1. Manufacturer .....
2. Address.....
3. Country of origin .....
4. Make or trade name of equipment .....
5. Manufacture's type no. .....
6. Is tenderer an accredited agent ? ....YES/NO.....
7. Furnish details of maintenance and repair service facilities which can be rendered.
   .....

ITEM 4: FIRE DETECTION SYSTEM

SCHEDULE OF INFORMATION

ITEM	PARTICULARS	INFORMATION FROM TENDERER
1	**MAIN FIRE CONTROL PANEL**	
	Manufacturer	
	Country of origin	
	Type and model	
	Is the equipment acceptable to the Department of Public Work?	Yes/No
	Has the equipment previously been installed for the Department of Public Works?	Yes/No
	State where	a) b)
	Are there any deviations from the specification?	Yes/No
	Furnish particulars	
2	**ALARM AND EVACUATION PANEL**	
	Manufacturer	
	Country of origin	
	Type and model	
	Is the equipment acceptable to the Department of Public Works?	Yes/No
	Has the equipment previously been installed for the Department of Public Works?	Yes/No
	State where	a) b)
	Are there any deviations from the specification?	Yes/No
	Furnish particulars	
3	**LOG PRINTER**	
	Manufacturer	
	Country of origin	
	Type and model	
	Is the printer compatible with the MFCP.	Yes/No
	Is the equipment acceptable to the Department of Public Works?	Yes/No
	has the equipment previously been installed for the Department of Public Works?	Yes/No
	State where	a) b)
	Are there any deviations from the specification?	Yes/No
	Furnish particulars	

4	**LIGHTNING AND SURGE ELECTRONIC PROTECTION**	
	Manufacturer	
	Country of origin	
	Sound output at 1 metre	dB
	Is the equipment acceptable to the Department of Public Works?	Yes/No
	Has the equipment previously been installed for the Department of Public Works?	Yes/No
	State where	a) b)
5	**SOUNDERS**	
	Manufacturer	
	Country of origin	
6	**BREAK GLASS UNITS**	
	Manufacturer	
	Country of origin	
	Method of resetting	
	Is the equipment acceptable to the Department of Public Works?	Yes/No
	Has the equipment previously been installed for the Department of Public Works?	Yes/No
	State where	a) b)
	Are there any deviations from the specification?	Yes/No
	Furnish particulars	
7	**BATTERY CHARGERS**	
	Make	
	Country or origin	
	Type of charger offered	
	Maximum charging capacity	amps
	Recharging time for batteries supplied	hours
	Have all the specified meters been provided?	Yes/No
	Is the equipment acceptable to the Department of Public Works?	Yes/No
	Has the equipment previously been installed for the Department of Public Works?	Yes/No
	State where	a) b)
	Are there any deviations from the specification?	Yes/No
	Furnish particulars	
	(The recharging should reach approximately 80% of battery capacity within 8 hours. Tenderers are reminded that the chargers should be of the constant potential type design to limit the charging current to meet the specification of the battery supplier).	

8	**BATTERIES**	
	Make	
	Battery type	
	Country of origin	
	Guarantee period	years
	Number of batteries	
	Total capacity	amp hours
9	**CIRCUIT WIRING**	
	Manufacturer	
	Country of origin	
	Type	
	Does it bear the SABS mark?	Yes/No
	Does it bear the BS mark?	Yes/No
10	**STEEL CONDUITS**	
	Manufacturer	
	Country of origin	
	Type	

TENDERER DETAILS

A. SCHEDULE OF HISTORY AND EXPERIENCE OF TENDERER

ITEM	PARTICULARS	INFORMATION FROM TENDERER
1	**Company Details:**	
	Name:	
	Address:	
	Type of Company:	
	Directors/Owners:	
	Established:	
	Staff Skilled	
	Staff Labour:	
	Staff Professional:	
	Bank:	
	Bank Manager:	
	Bank Manager Phone No:	
	Credit Rating:	
2	**Experience with this type of work over the last 12 months:**	
	Fire contracts: and size:	
	Security contracts and size:	
	Current contracts and their value:	
3	**List of contracts completed and reference contact person**	
	1	
	2	
	4	
	5	
	6	
4	**List of experienced skilled personnel proposed for this contract:**	
	1 Name and phone No	
	2 Name and phone No	
	3 Name and phone No	

SUB-CONTRACTOR WITNESS

DATE

B. SPECIALIST SUB-CONTRACTORS

Tenderers shall list all specialist Sub-Contractors that are proposed for this project:

ITEM	SERVICE PROVIDED	NAME OF FIRM
1.	Fire Detection	
2.	DA set	
3.	UPS sytems.....	

CONTRACTOR **WITNESS**

DATE

C. MAJOR RATES FOR COSTING VARIATIONS

The following rates may be applicable for costing alterations by the issue of revised drawings and instructions

1. **Labour Rates**

Day work rates (including profit, overheads, design and drawing office time, etc)

Artisan and two assistants : R...../h

Labourer : R...../h

Multiplier factor for: weekend rates .....
night rates .....

2. **Vehicle Rates**

i) Mileage rate for vehicles not exceeding 1 tonne capacity R...../km

ii) Mileage rate for vehicles exceeding 1 tonne capacity R...../km

The above are to include all profit, overheads etc. but excluding VAT

3. **Bought-Out Items** (including all costs and profit etc)

Nett cost plus .....% (excl. VAT)

SUB-CONTRACTOR WITNESS

DATE

D. DEVIATIONS FROM SPECIFICATION

Any proposed deviations from the specification or drawings shall be outlined below giving full details of any such proposals. Unless items are specified below, then it is assumed that Tenderer's offers are fully conforming with the tender documents.

Paragraph No	Deviation

SUB-CONTRACTOR WITNESS

DATE

NATIONAL DEPARTMENT OF PUBLIC WORKS

PROPERTY AND FACILITIES MANAGEMENT

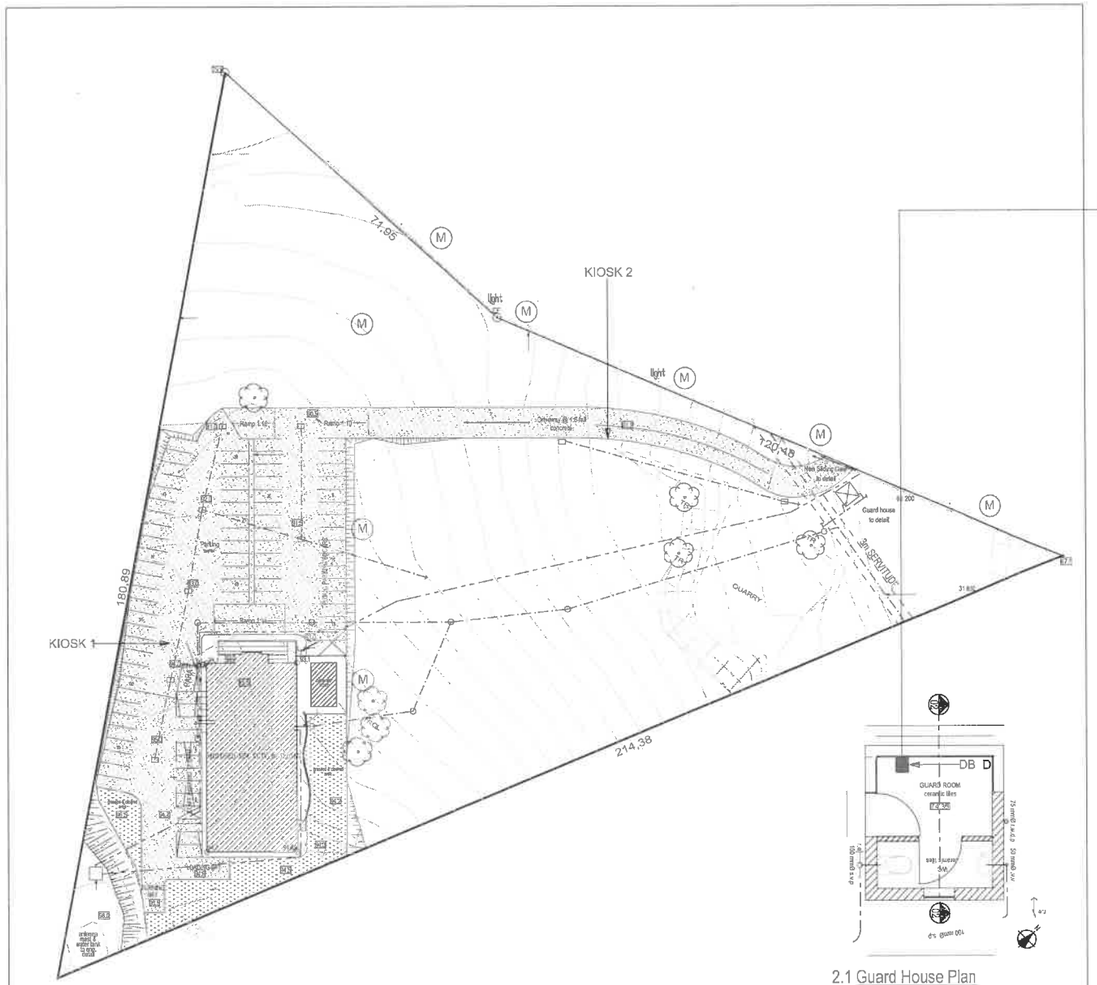
NTUZUMA SAPS
NEW CCTV BUILDING

PART 5

ELECTRICAL DRAWINGS

WCS 046725

AUGUST 2022



2.1 Guard House Plan
SCALE 1:50

3. CCTV Room & Generator Room Floor Plan
SCALE 1:100

LEGEND

◢	**Low Voltage Panel**
■	**Electrical Distribution Board**
⬓	**UPS Distribution Board**
Ⓜ	**Electrical Manhole**
⧗	**Change Over Panel**
M	**Telkom Manhole**
⬢	**Telephone Distribution Board**

Director - General:
(NS Malebye)

REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF PUBLIC WORKS

55 Road 718
Chatsworth, 4092
Tel No: 031 404 3810
Fax No: 086 571 9374

Service:

Ntuzuma SAPS : Site and Floor Plan
New CCTV Building

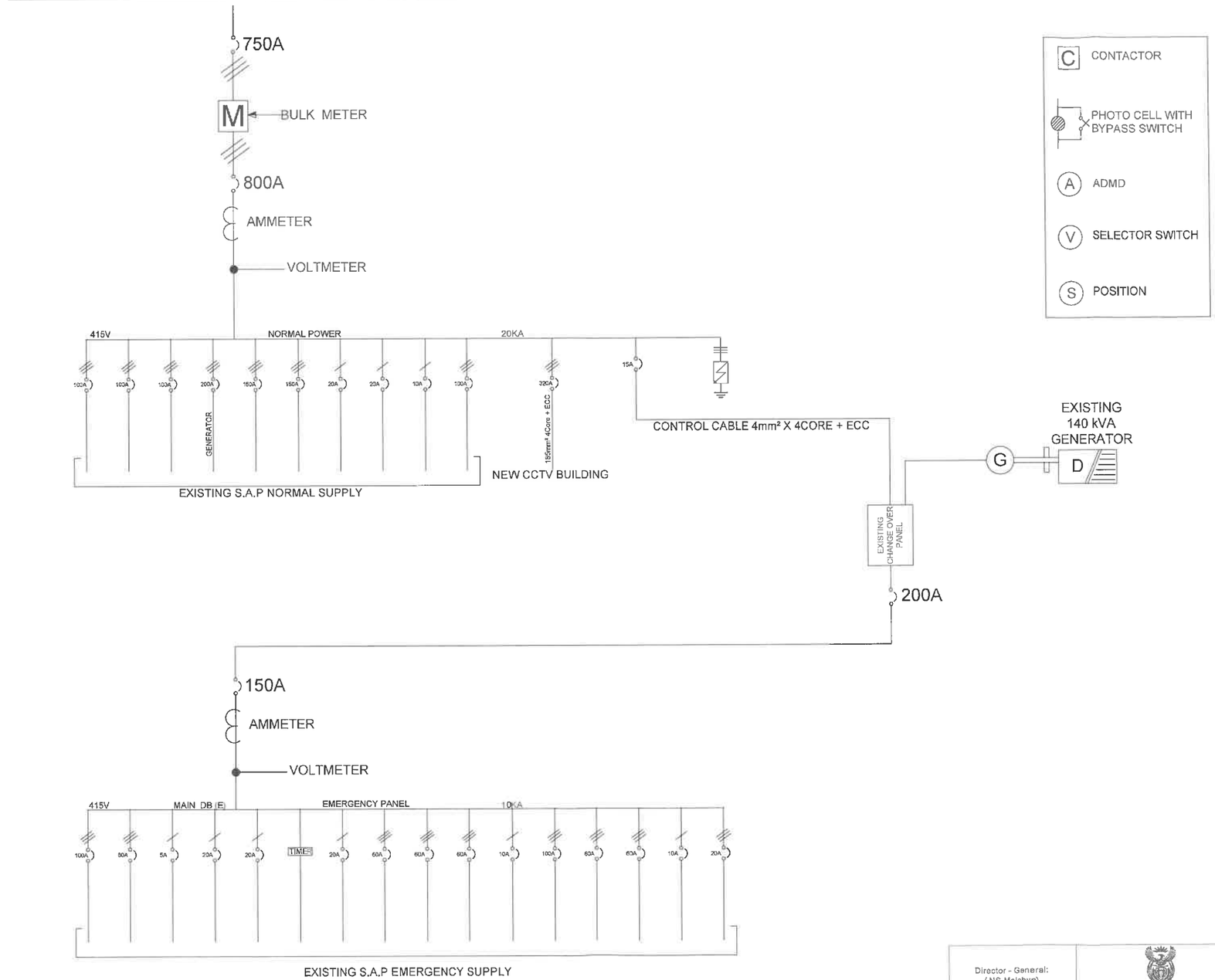
Title:

Distribution Board Layout

DATE: 28/01/2014
DWG NO: EE/046725/DB/01
WCS NO: 046725.
REV NO: 6
SCALE 1:100

EXISTING S.A.P PANEL & CIRCUIT BREAKER LAYOUT

FED FROM MUNICIPAL SUBSTATION 500 kVA

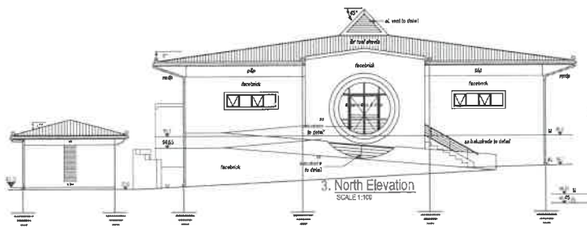


NOTES
SCHEMATIC DIAGRAM FOR MAIN SUPPLY & DISTRIBUTION
TO EXISTING S.A.P AND NEW C.C.T.V BUILDING.
ENTIRE DB LAYOUT ELECTRICAL DISTRIBUTION.

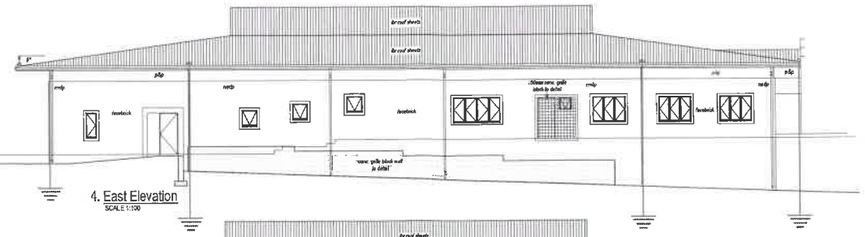
Director - General: (NS Malebye)	REPUBLIC OF SOUTH AFRICA DEPARTMENT OF PUBLIC WORKS
DAMPOWER	55 Road 718 Chatsworth, 4092 Tel No: 031 404 3810 Fax No: 086 571 9374
Service: Ntuzuma SAPS : Site and Floor Plan New CCTV Building	
Title: Schematic Layout Of Existing S. A. P Building	
DATE: 24/08/2011	DWG NO: EE/046725/DBSC2/02
WCS NO: 046725	REV NO: 1

C.C.T.V BUILDING

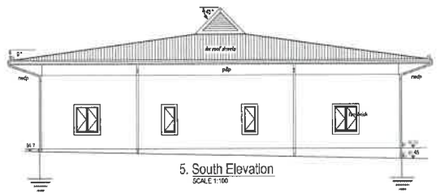
2. Section
SCALE 1:50



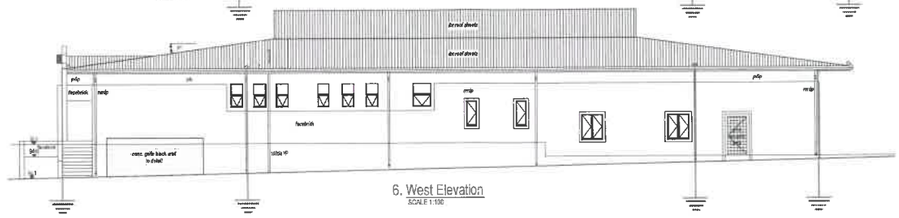
3. North Elevation
SCALE 1:100



4. East Elevation
SCALE 1:100



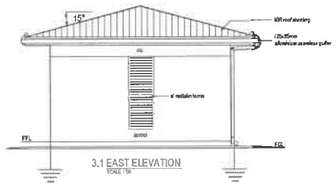
5. South Elevation
SCALE 1:100



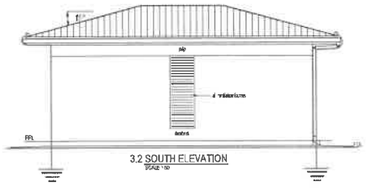
6. West Elevation
SCALE 1:100

GENERATOR ROOM

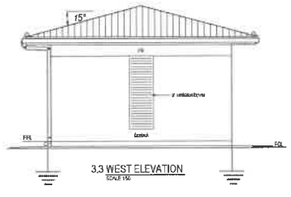
3.1 SECTION
SCALE 1:50



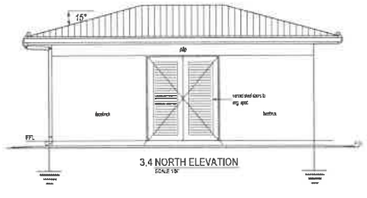
3.1 EAST ELEVATION
SCALE 1:50



3.2 SOUTH ELEVATION
SCALE 1:50

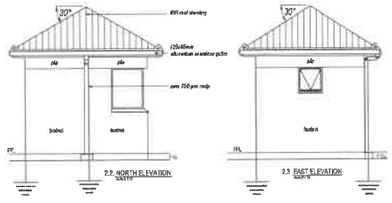


3.3 WEST ELEVATION
SCALE 1:50



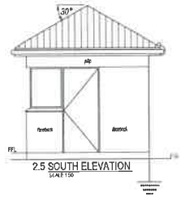
3.4 NORTH ELEVATION
SCALE 1:50

GUARD HOUSE

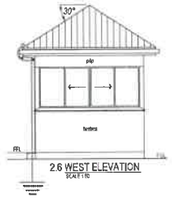


2.2 NORTH ELEVATION
SCALE 1:50

2.3 EAST ELEVATION
SCALE 1:50

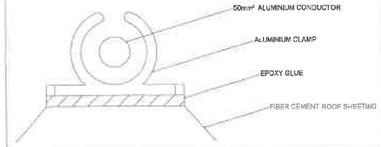


2.5 SOUTH ELEVATION
SCALE 1:50

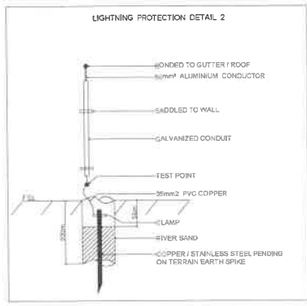


2.6 WEST ELEVATION
SCALE 1:50

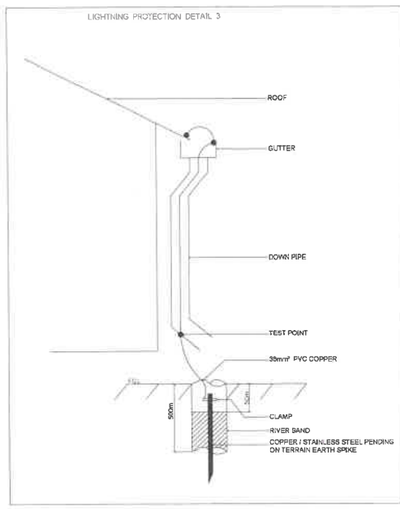
LIGHTNING PROTECTION DETAIL 1



LIGHTNING PROTECTION DETAIL 2



LIGHTNING PROTECTION DETAIL 3



LIGHTNING PROTECTION LEGEND

EARTH ELECTRODE WITH DOWN CONDUCTOR INSTALLED IN DOWN PIPE

EARTH ELECTRODE WITH DOWN CONDUCTOR INSTALLED IN GALVANIZED CONDUIT

50mm² ROUND ALUMINIUM ROOF CONDUCTOR

Director - General:
(NS Malebye)

REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF PUBLIC WORKS

55 Road 718
Chatsworth, 4092
Tel No: 031 404 3810
Fax No: 086 571 9374

Service:

Ntuzuma SAPS : Site and Floor Plan
New CCTV Building

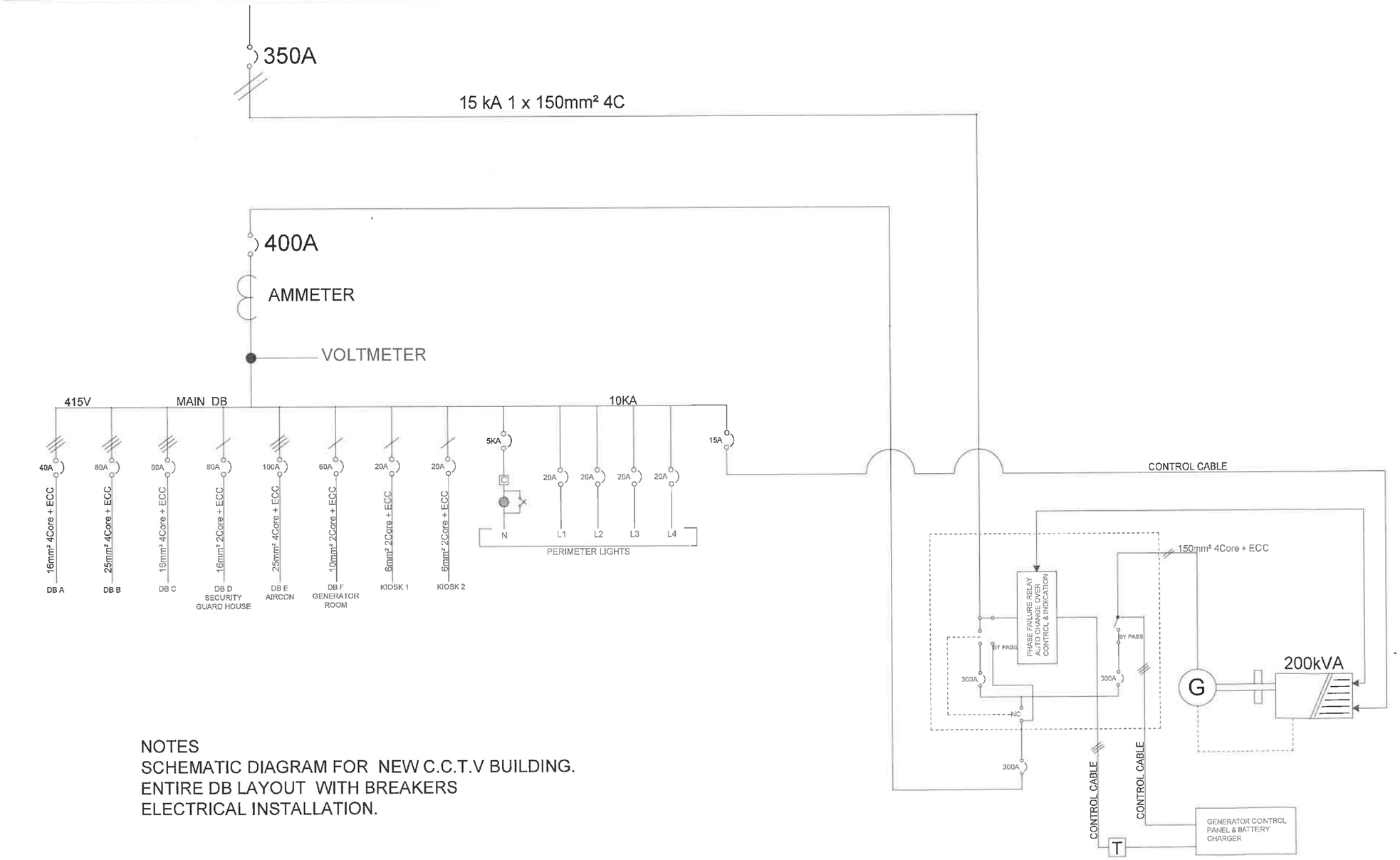
Title:

Lightning Protection And Earthing Layout

DATE: 24/08/2011	DWG NO: EE/046725/LPE/01	
WCS NO: 046725	REV NO: 1	AS INDICATED

MAIN CCTV PANEL & CIRCUIT BREAKER LAYOUT

FED FROM KIOSK 3 MAIN PANEL



C CONTACTOR

PHOTO CELL WITH BYPASS SWITCH

A ADMD

V SELECTOR SWITCH

NOTES
SCHEMATIC DIAGRAM FOR NEW C.C.T.V BUILDING.
ENTIRE DB LAYOUT WITH BREAKERS
ELECTRICAL INSTALLATION.

Director - General:
(NS Malebye)

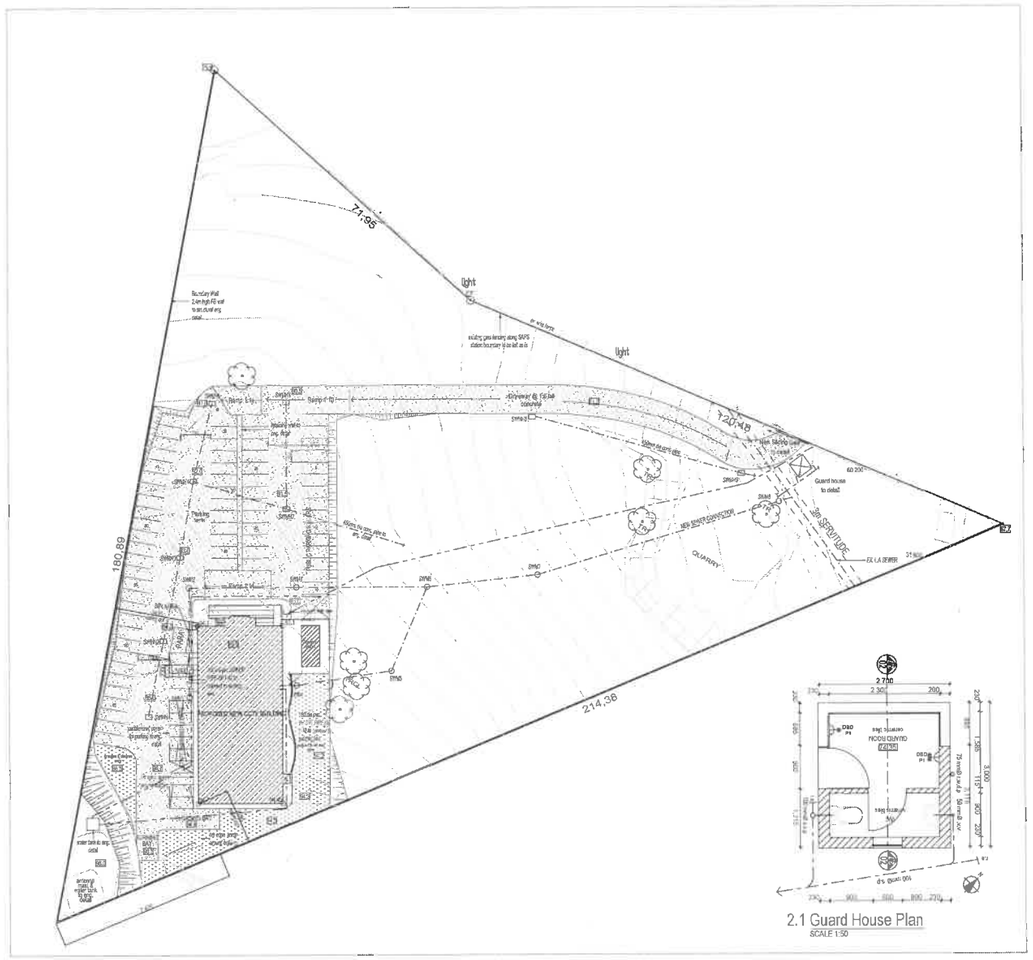
REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF PUBLIC WORKS

55 Road 718
Chatsworth, 4092
Tel No: 031 404 3810
Fax No: 086 571 9374

Service:
Ntuzuma SAPS : Site and Floor Plan
New CCTV Building

Title:
Schematic Layout Of C.C.T.V Building

DATE: 23/05/2017	DWG NO: EE/046725/DBSC1/01
WCS NO: 046725	REV NO: 3



2.1 Guard House Plan
SCALE 1:50

3. CCTV Room & Generator Room Floor Plan
SCALE 1:100

Revision 5 Notes (21 / 06 / 2014):
1. Added access controls
2. Added trucking as per clients request
3. Removed doorway from electron equipment room leading to CCTV monitoring room.
4. Added doorway only between IT core room and electron equipment room.
5. Added doorway on left side of sceen panels
6. All double doorways need a power source

Revision 6 Notes (6 / 08 / 2014):
7. Added Access Control At Front Entrance
8. Added Access Control Entrance Of Records Room
9. Added Access Control To I.T Core Room
10. Added 3x 3ϕ 4 Wire UPS Sockets In IT Core Room
11. Added 1 x 3ϕ 4 Wire UPS Sockets In Electron
Equipment Room.

Revision 7 Notes (25/08/2016
8. Re-labled Power Socket Plug Points In Commander, Kitchen & Parade Room

▨ UPS CIRCUIT
▨ ESSENTIAL CIRCUIT
▨ AIR-CONDITION CIRCUIT

LEGEND

A Power Sockets Installed In Powerskirting Under Desk With 1x16A Dedicated Socket, 1xRJ11 Telephone Point, 1xUPS Socket And 1xData Socket

16A Double Socket Outlet

16A Single Socket Outlet

16A Dedicated Socket Outlet

16A 3 ϕ 4 Wire UPS Socket Outlet

16A UPS Socket Outlet

Data Connection Point

Telkom Connection Point

G Geyser Isolator

5A 5A Single Phase Socket Outlet for Air Conditioner In Ceiling Void Or Wall

3PH 20A 3 Phase Isolator Complete With Cover

AC 20A Air Conditioner Isolator

5A 5A Single Phase Socket For Air Conditioner Water Tight On the Outside Wall

ACCESS CONTROL Access Control Conduit

3 Tier Trucking

Director - General:
(NS Malebye)

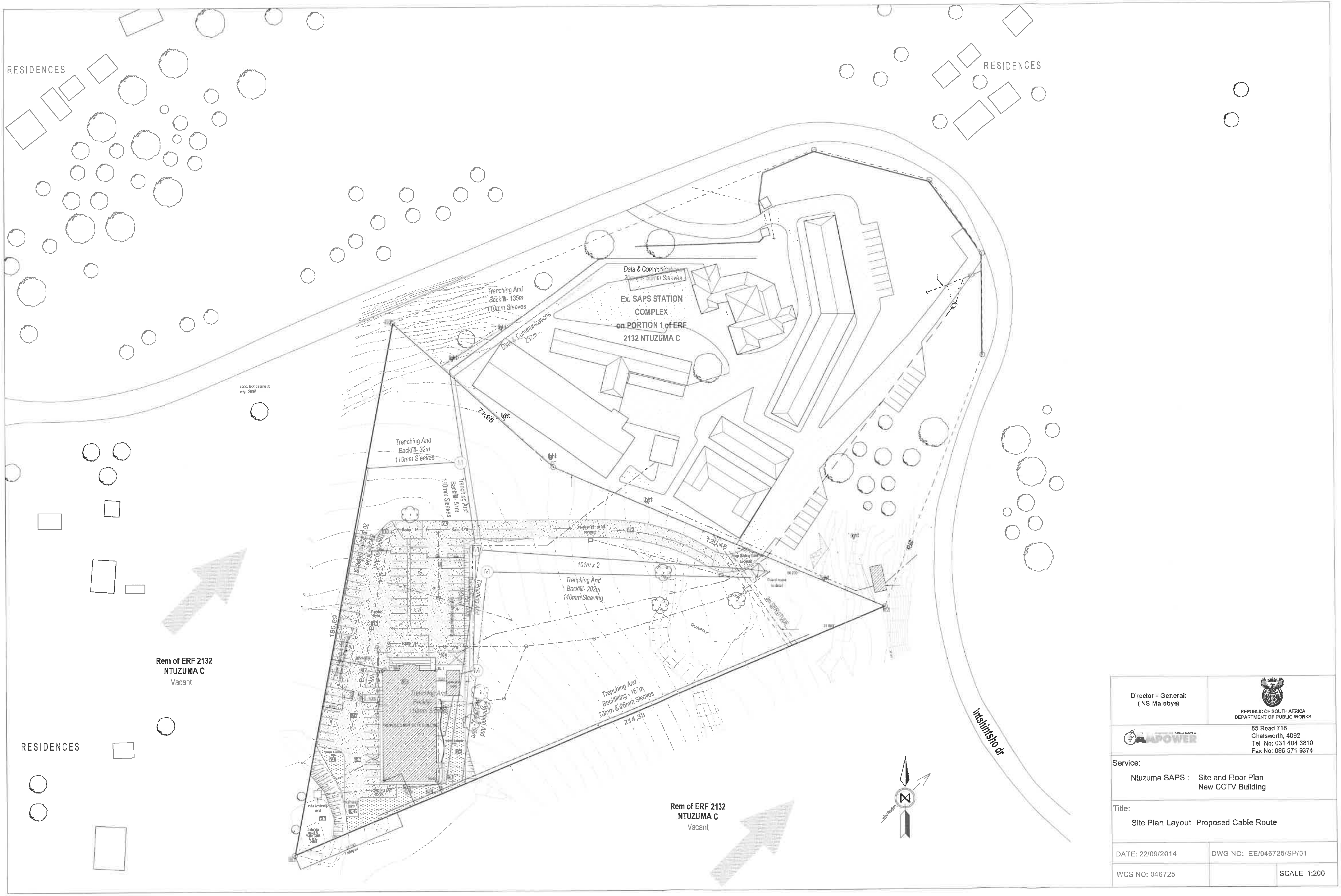
REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF PUBLIC WORKS

55 Road 718
Chatsworth, 4092
Tel No: 031 404 3810
Fax No: 086 571 9374

Service:
Ntuzuma SAPS : Site and Floor Plan
New CCTV Building

Title:
Main Power Layout

DATE: 28/08/2016
DWG NO: EE/046725/MP/01
WCS NO: 046725
REV NO: 7
SCALE 1:100



RESIDENCES
RESIDENCES
Trenching And Backfill- 135m 110mm Sleeves
Data & Communications
Ex. SAPS STATION COMPLEX on PORTION 1 of ERF 2132 NTUZUMA C
Data & Communications 232m
71.95
light
Trenching And Backfill- 32m 110mm Sleeves
Trenching And Backfill- 57m 110mm Sleeves
101m x 2
Trenching And Backfill- 202m 110mm Sleeving
120.48
180.89
Trenching And Backfilling - 167m 20mm & 25mm Sleeves
214.38
QUARRY
Rem of ERF 2132 NTUZUMA C Vacant
RESIDENCES
Rem of ERF 2132 NTUZUMA C Vacant
intshintsho dr

Director - General: (NS Malebye)	REPUBLIC OF SOUTH AFRICA DEPARTMENT OF PUBLIC WORKS
AMPOWER	55 Road 718 Chatsworth, 4092 Tel No: 031 404 3810 Fax No: 086 571 9374

Service:

Ntuzuma SAPS : Site and Floor Plan New CCTV Building

Title:

Site Plan Layout Proposed Cable Route

DATE: 22/09/2014	DWG NO: EE/046725/SP/01	
WCS NO: 046725		SCALE 1:200

Legend	
▨	Main Power Manhole
▨	Telecoms Manhole

Manholes

1.	Main Power Manholes	- 21
2.	Telecoms Manholes	- 14
	Total	- 35

Director - General:
(NS Malebye)

REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF PUBLIC WORKS

55 Road 718
Chatsworth, 4092
Tel No: 031 404 3810
Fax No: 086 571 9374

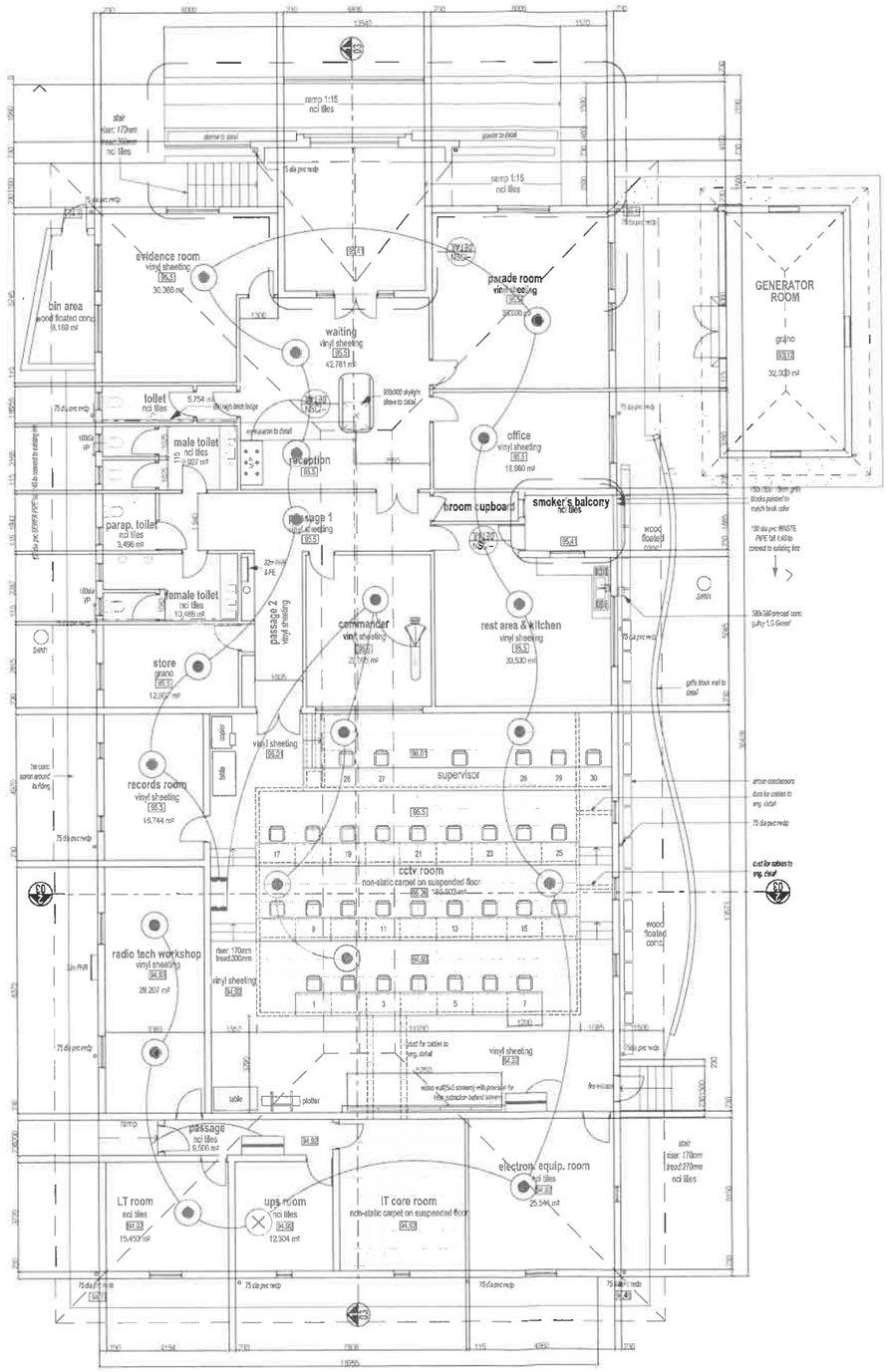
Service:

Ntuzuma SAPS : Site and Floor Plan
New CCTV Building

Title:

Manhole Site Plan Layout For
Main Power & Telecommunications

DATE: 22/10/2017
DWG NO: EE/046725/SP/01
WCS NO: 046725



3. CCTV Room & Generator Room Floor Plan

SCALE 1:100

LEGEND

- Main Control Panel
- Conduit Housing Cables From Floor
- Siren - In Ceiling Void
- Break Glass
- Ionisation Detector Ceiling Mounted
- 60°C Heat Detector
- Gas System

Director - General:
(NS Malebye)

REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF PUBLIC WORKS

55 Road 718
Chatsworth, 4092
Tel No: 031 404 3810
Fax No: 086 571 9374

Service:

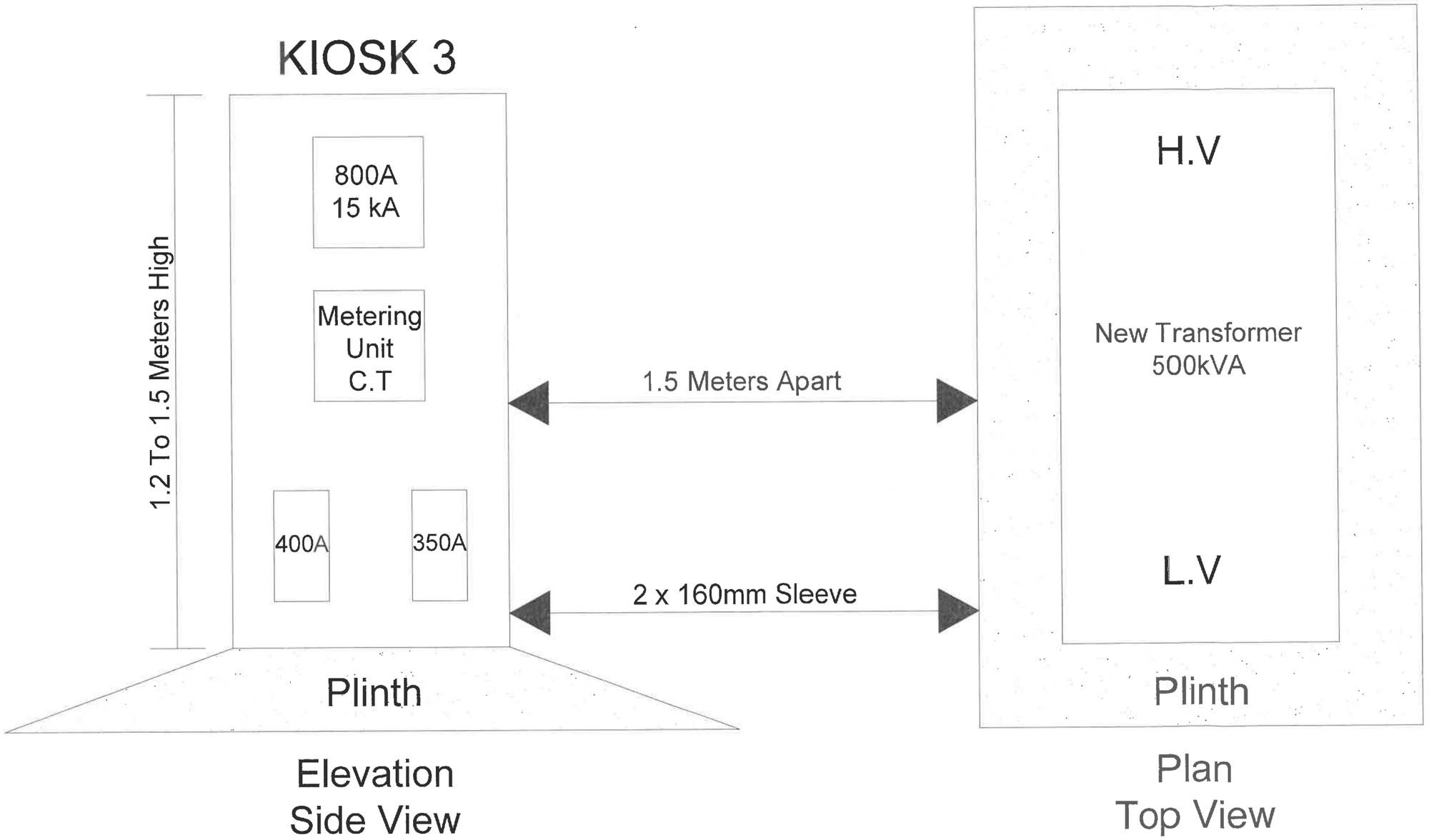
Ntuzuma SAPS : Site and Floor Plan
New CCTV Building

Title:

Smoke Alarms And Detection

DATE: 24/08/2011	DWG NO: EE/046725/SMK/01	
WCS NO: 046725	REV NO: 4	SCALE 1:100

NTUZUMA CCTV
TRANSFORMER AND KIOSK 3 LAYOUT

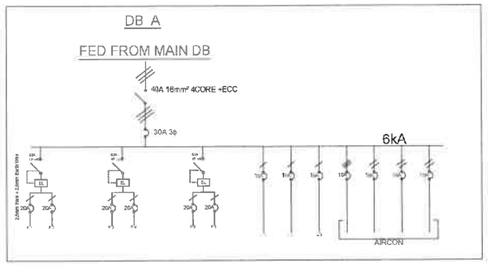


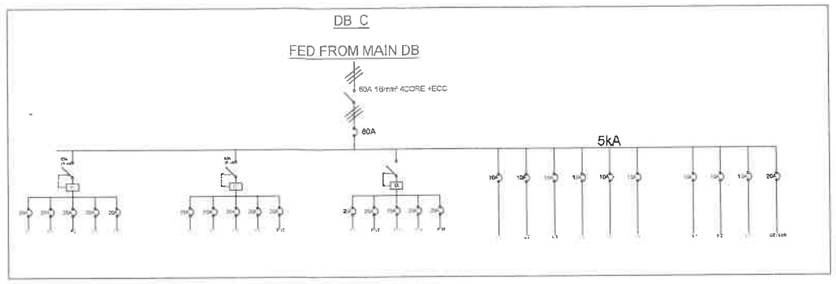
Elevation
Side View

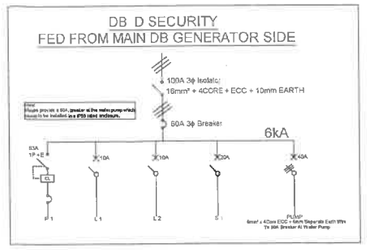
Plan
Top View

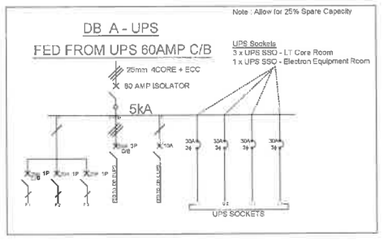
N.B : Dig And Expose Existing Cable

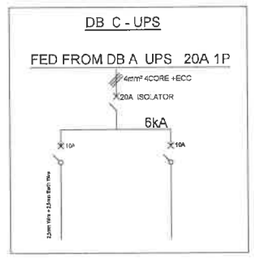
COMPLETE DISTRIBUTION LAYOUT C.C.T.V ROOM

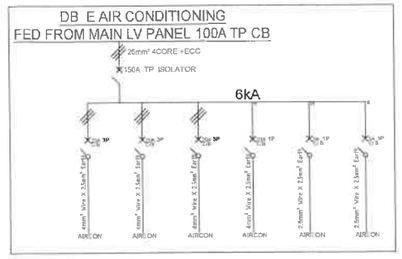


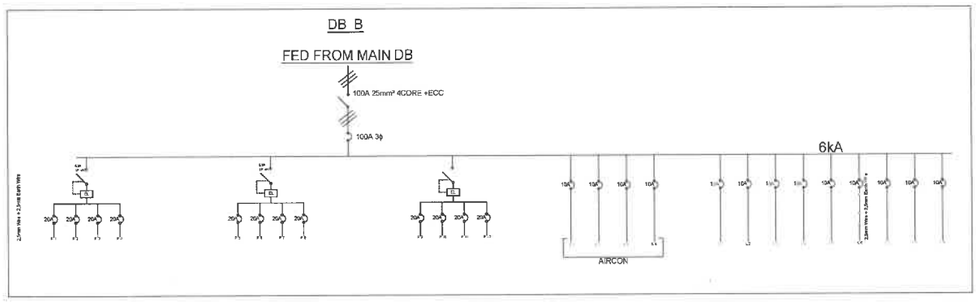


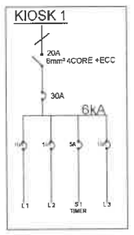


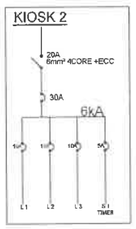


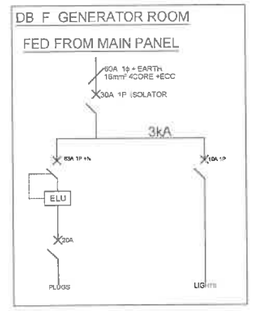


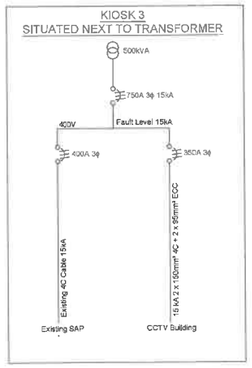


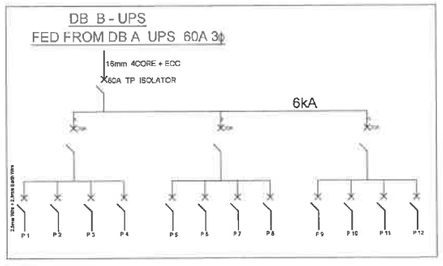




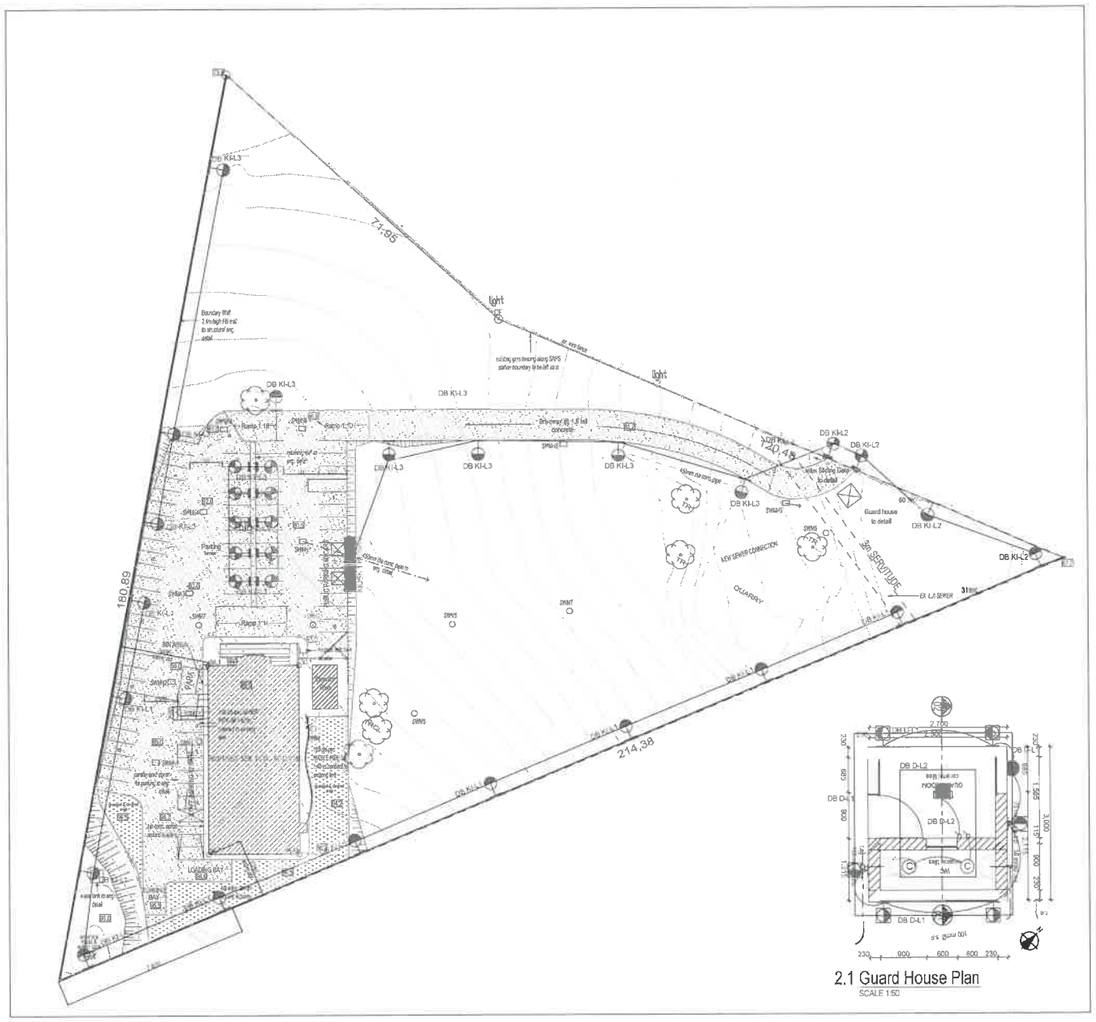








Director - General: (NS Melubyé)	REPUBLIC OF SOUTH AFRICA DEPARTMENT OF PUBLIC WORKS
ESKOM HOLDINGS SOC LIMITED INANPOWER	55 Read 718 Chatsworth, 4092 Tel No: 031 404 3810 Fax No: 086 571 9374
Service: Ntuzuma SAPS : Site and Floor Plan New CCTV Building	
Title: Complete Distribution Layout C.C.T.V Room	
DATE: 28/06/2016	DWG NO: EE/046725/DBSC3/03
WCS NO: 046725	REV NO: 3



2.1 Guard House Plan
SCALE 1:50

3. CCTV Room & Generator Room Floor Plan
SCALE 1:100

LEGEND

■	**Type A: LED Panel 600x600mm 36w**
■ D	**Type AD: LED Panel 600x600mm 36w Dimmable Located In Control Room**
▭	**Type B 1500mm 2x58W**
Ⓒ	**Type C 9W LED Downlight**
●	**Type D LED 29W LED Downlight**
◐	**Type E 16W Bulkhead 6500K Round PVC Bulkhead Black Trim**
◑	**Type F 24W LED Bollard**
◒	**Type G 42W LED Post Top**
◗	**Photocell**
○	**16A One Lever One Way Light Switch**
●	**16A Double Lever One Way Light Switch**
2 WAY ●	**16A One Level Two Way Light Switch**
☒	**Kiosk With Plinth**

Director - General:
(NS Malebye)

REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF PUBLIC WORKS

55 Road 718
Chatsworth, 4092
Tel No: 031 404 3810
Fax No: 086 571 9374

Service:

Ntuzuma SAPS : Site and Floor Plan
New CCTV Building

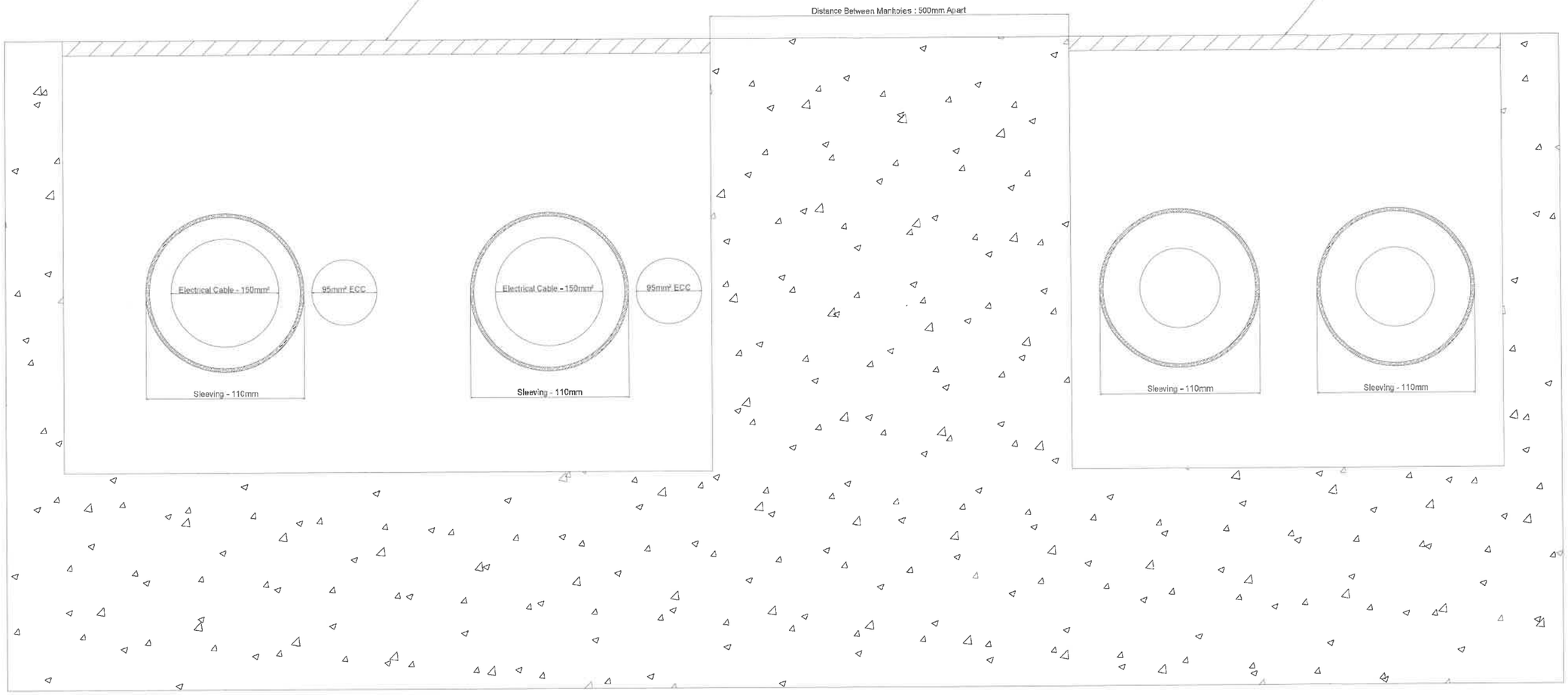
Title:

Lighting Layout

DATE: 08/09/2016	DWG NO: EE/046725/L/01	
WCS NO: 046725	REV NO: 6	SCALE 1:100

Electrical Manhole
Dimensions : 900mm (W) x 900mm (L)
Lid Type : Stainless Steel

Telkom And Network Manhole
Dimensions : 600mm (W) x 600mm (L)
Lid Type : Stainless Steel



Notes

1. In Trenches: Trenches located on embankments and across driveways need to be encased in concrete.
2. Telkom / Data manhole must be staggered from Electrical manholes
2. Danger tape denoting power cables 300mm below ground level shown throughout the entire length of cable and sleeving.
3. Draw wire is to be provided in telecommunications and fibre optic sleeving.
4. Costing to be finalized with Quantity Surveyor for encasement and concrete.

Director - General: (NS Malebye)	REPUBLIC OF SOUTH AFRICA DEPARTMENT OF PUBLIC WORKS
	55 Road 718 Chatsworth, 4092 Tel No: 031 404 3810 Fax No: 086 571 9374
Service: Ntuzuma SAPS : Site and Floor Plan New CCTV Building	
Title: Manhole Detail	
DATE: 22/09/2014	DWG NO: EE/046725/MD/01
WCS NO: 046725	REV NO: 1